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Design Management as A Driver for Innovation in Small and Medium Sized Enterprises

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Declaration:
Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for doctoral or equivalent academic degree.

Laima Gerlitz

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TALLINNA TEHNIKAÜLIKOOL
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Disainijuhtimine kui innovatsiooni liikumapanev jõud väike- ja keskmise suurusega ettevõtetes

LAIMA GERLITZ

Contents

List of Publications

The work of this thesis is based on the following publications:

I Gerlitz, L.; Hack, A; Prause, G. (2016). An Integrated Design Management Concept: Creating Innovative Space for Emergent SMEs and Value for Knowledge Absorbers. Journal of Entrepreneurship and Innovation in Emerging Economies, 2 (1), 1-18. (**ETIS 1.2 classification**).

II Gerlitz, L. (2016). Design management as a domain of smart and sustainable enterprise: business modelling for innovation and smart growth in Industry 4.0. Entrepreneurship and Sustainability Issues, 3 (3), 244-268, 10.9770/jesi.2016.3.3(3), (**ETIS 1.1 classification**).

III Gerlitz, L. (2016). Developing a Design Management Model for Innovating SMEs in the Context of Regional Smart Specialisation. Research in Economics and Business: Central and Eastern Europe, 8 (2), 26-57, (**ETIS 1.2 classification**).

IV Gerlitz, L. (2017). Design-driven innovation in SMEs: smart and sustainable organisation within industrial transformation. International Journal of Environmental Policy and Decision Making, 2 (2), 98-124, (**ETIS 1.2 classification**).

V Gerlitz, L.; Prause, G. (2017). Design Management as a Driver for Innovation in SMEs. Kindai Management Review, 5, 41-58, (**ETIS 1.2 classification**).

Other related publications

- Laima Gerlitz (2015). Design for Product and Service Innovation in industry 4.0 and emerging smart society. Journal of Security and Sustainability Issues, 5 (2), 181-198, 10.9770/jssi.2015.5.2(5), (**ETIS 1.1 classification**).
- Hack, A., Prause, G., & Maknytė, L. (2012). Design Management and Branding for SMEs: Experiences from the DesignSHIP Project. In: Muravska, T., & Prause, G. (Eds.). European Integration and Baltic Sea Region Studies: University-Business Partnership through the Triple Helix Approach (131−150). Berlin: Berliner Wissenschaftsverlag. (Regional Business and Socio-Economic Development), (**ETIS 3.2 classification**).

The results of this thesis were presented, assessed and validated to the research and peer community in the frame of the following scientific and business conferences that underpin credibility, validity and transfer of knowledge:

- Gerlitz. L. (2016). Design Management for Smart Entrepreneurship - A Training Tool Crossing Sector and Discipline Boundaries. 20th Academic Design Management Conference - Inflection Point: Design Research Meets Design Practice, 22-29 July 2016, Boston, MA, USA. Boston, MA, USA: Design Management Institute, 176-194.
- Gerlitz, L., & Prause, G. (2016). Integrating Creativity into Regional Entrepreneurial Practices: Perspectives for Innovation and Growth. 2016 International Conference on Design Creativity (ICDC), Georgia Tech Global Learning Center, Georgia Institute of Technology, 84 5th St NW Atlanta, Georgia 30308-1031 United States. Georgia: Georgia Institute of Technology, 1-12.3.

- Gerlitz, L., Prause, G., & Hack, A. (2016). Creativity-driven Entrepreneurship through Design Management: A Case Study from the South Baltic Sea Region. Knowledge, Innovation and Technology Across Borders: Developing the Research Agenda, June 27-28 2016, Tallinn, Estonia. Tallinna Tehnikaülikool.
- Gerlitz. L. (2016). Design Management for Small and Medium-Sized SMEs: The Way SMEs Can Innovate and Accelerate Their Business. EIRD2016 – Entrepreneurship, Innovation and Regional Development, June 28-29 2016, Tallinn, Estonia. Tallinna Tehnikaülikool.
- Gerlitz, L. (2016). Integrating Design Management Concept in Entrepreneurial Practices: Evidence from the Cross-Border Project. "9th International Scientific Conference "Business and Management 2016", Vilnius Gediminas Technical University May 12, 2016 - May 13, 2016. (Eds.) J. Stankeviciene, & T. Lankauskiene. VGTU Press "Technika", 1-10.
- Hack, A., Maknytė, L., & Prause, G. (2013). Design Management and Entrepreneurship: Current Practices, Progress in Conceptualisation and Advanced Integration within A Network of Design Management Absorbers in the South Baltic Sea Region. 12th International Entrepreneurship Forum on "Social Sustainability and Economic Security: The Agenda for Entrepreneurship in the 21st Century", Vilnius, Lithuania, 4-6 September.
- Prause, G., Hack, A., & Maknytė, L. (2012). How to Integrate Design Management Concepts into SME? – Experiences from the South Baltic Sea Region. In: 11th International Entrepreneurship Forum (IEF) Conference. (2012): "Entrepreneurship and Sustainability: From Lifestyles to Innovative Enterprises in Creative and Sustainable Environments", Kuala Lumpur (KL) Malaysia on 3-6 September 2012: Conference Proceedings (429-457). University of Essex.

Author's Contribution to the Publications

The contribution of the researcher to the **publications I–V** is the following:

I An Integrated Design Management Concept: Creating Innovative Space for Emergent SMEs and Value for Knowledge Absorbers

The author of this thesis was the leading author. The theoretical contribution research design and the proposed processual model were developed by the researcher. The co-authors supported the researcher with key theoretical insights and experiences sharing gathered from the participation in the applicable project – action research domain.

II Design management as a domain of smart and sustainable enterprise: business modelling for innovation and smart growth in Industry 4.0

The researcher is the sole author of this paper. As a result, the research carried out the entire research journey regarding this publication on her own. Starting from merging design, strategy and domain of digitalisation and transformation, the author conducted an in-depth ethnography based on the observed, analysed and assessed patterns of DM within the emerging economic and social paradigm.

III Developing a Design Management Model for Innovating SMEs in the Context of Regional Smart Specialisation

Based on the preceding grassroots and conceptual perception on DM and design integration within the SMEs and entrepreneurial practices (publication I), the author consolidated the integration of DM within the SME context, in particular closing the gaps, which address the marginalised scrutiny of DM from processual and framework perspective within the regional development paradigms. The researcher is the sole author of this publication.

IV Design-driven innovation in SMEs: smart and sustainable organisation within industrial transformation

The present publication is a continuation of the research done in the domain of smart specialisations, digitalisation and transformation, as explored in publication II. This publication, the researcher thereof being the sole author of this scientific output, enhances the contribution of DM within this new economic and social landscape and rounds off the research pillar that relates to DM potential and implications for smart and sustainable growth.

V Design Management as a Driver for Innovation in SMEs

This final publication rounds out the research portfolio. The researcher was the leading author of this thesis having the co-writer – the supervisor. The researcher undertook the analysis and evaluation of the overall research carried out and DM impact on SMEs performance and prospects for innovation, competitiveness and growth, whilst the co-author supported the researcher by positioning DM implications for SMEs within the nexus of related research streams and associated concepts that contribute to innovation generation and exploitation. The researcher is the principal compiler of the graphs and figures used in the publication.

The orchestration of the research articles into the sequence publication I–V is claimed to have followed a specific logic. First, the researcher argues that in order to answer the research questions, it is necessary to undertake an in-depth analysis supported by empirical observations. Yet, a coherent and feasible understanding of the phenomenon in-depth presupposes understanding, implementation and validation. Testing, validation and transferability can be confirmed once studied both from the longitudinal perspective as well as consolidating the research focus and providing specific insights to the same phenomenon. This is clearly supported by the research gap.

As a result, **publication I** is a stepping-stone research done in the domain of understanding DM in SMEs within the regional context, which, in turn, was consolidated and underpinned by a deepened view provided with the **publications III** and **publication V**, respectively. Whilst the publication I mainly yields conceptual and theoretical foundations on a grassroots level, **publication III** builds upon the preceding results and implications from the previous research and drills down to the very particulars of DM conceptualisation and application within the regional SME nexus. As a result of this complex and comprehensive scrutiny and observation, research results are reconfirmed, additional framework conditions, bottlenecks and potentials of DM utilisation are revealed. The **publication V** rounds out the DM perception within the given SME context and agglomerates the research results. Here, collation is undertaken on DM embeddedness and impact within different entrepreneurial scale, thus revealing the highest DM potential and its contributions.

In a similar fashion, there was the research done in case of DM within the changing landscape – in face of the increasing uncertainty, volatility, complexity, digitalisation and transformation. Here, the research commenced by understanding and merging theoretical tenets in the context of digital industrialisation and arriving new combinations of theoretical considerations for DM integration in this context (**publication II)**. Following this publication, which itself precedes the additional related research publication (Gerlitz, 2015, 1.1 classification), the researcher undertakes a thorough and sound research on how SMEs in this pace of change are able to respond to challenges and problems and what implications DM might have on organisational level and affect performance on the market (**publication IV**).

Therefore, bearing this mind, the research can be looped into one coherent and consecutive research portrait consisting of individual research units that when combined build up a comprehensive understanding on DM within regional SME context and in an amalgamated form enables to increase the positioning of DM for SMEs on both the science and business management scoreboards and reference maps.

In aggregate, the research portfolio can be referred to as consolidated and balanced one. First, the researcher of this thesis started the research journey with the support of experienced colleagues and integrated the valuable insights of the supervisor. Second, consequently, being equipped with the research tools, knowledge and practiced skills, the researcher demonstrated the command of scientific research and novelty achieved in the frame of sole authorship. Finally, the last publication is a recall to the co-working in the frame of this doctoral research journey, acknowledging the insights, critical evaluation and sound support of the supervisor and co-author in accumulating the research results into the coherent research contribution.

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Firstly, I would like to express my sincere gratitude to my supervisor Prof. Dr. Gunnar Prause for his guidance and continuous support of my PhD studies and related research as well as valuable hints for the future research avenues in pursuing my further academic and research way. I am thankful for his assistance, patience and motivation, suggestions and immense knowledge in writing this thesis. I could not have imaged having better advisor and mentor for my PhD studies.

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In this line, my thanks also go to the opponents for their willingness to supervise my research done as external reviewers, critical remarks, future suggestions and time.

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Talent, not capital, will be the key factor linking innovation, competitiveness and growth in the 21st century, and we must each understand better the global talent value chain.

World Economic Forum, Human Capital Report, 2015

Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less

Marie Curie

Abbreviations

Add.	Additional
CCIs	Creative and Cultural Industries
CRQ	Central Research Question
CTCC	Creative Traditional Companies Cooperation
DC	Dynamic Capabilities
DM	Design Management
DT	Digital Transformation
EC	European Commission
Etc.	et cetera
EU	European Union
I 4.0	Industry 4.0
i.e.	id est, that is
ibid.	ibidem, in the same place
ICT	Information and Communication Technologies
IoT	Internet of Things
MBV	Market-Based View
OC	Organisational Culture
OI	Open Innovation
R&D	Research and Development
RBV	Resource-Based View
RIS	Regional Innovation Systems
RO	Research Output
RQ	Research Question
RT	Research Task
SD	Service Design
SMEs	Small and Medium-Sized Enterprises
TUT	Tallinn University of Technology
UCD	User-Centred Design

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Introduction

The core of this paper and the overall research journey is Design Management (DM) and its conceptualisation within the entrepreneurial performance and management of Small and Medium-Sized Enterprises (SMEs). The research conveys a regional account of DM in the regional integration and innovation domain. The research was undertaken between 2014 and 2017.

DM can be understood as an efficient and feasible collaboration between design and business in the SME context, which leads to innovation (Cawood, 1997; Norman and Verganti, 2014). Innovation is key to both competitiveness and growth (Borja de Mozota, 2011; McGrath and MacMillan, 2009). Therefore, the research is allocated to the strategic management province. Here, the phenomena of network and integration play a crucial role. Dimensions that affect SMEs performance in the regional context are connected and intertwined. In particular, organisational, social, managerial, technological and environmental domains connected through design drive innovation, accelerate new knowledge and generate new experience. This, in turn, enables to better adopt to the changing environmental in a more efficient way. It also facilitates finding solutions in a rapid transformation pace (Atkinson, 2017; Best, 2015; Borja de Mozota et al., 2016; Lockwood, 2010).

Globalisation and emergence of global networks as well as new social and environmental challenges have jeopardised innovation and growth opportunities. This is especially true for the SME sector and performance of individual regions in the EU. Certain EU regions located outside the core of industrial activity or that are remote from metropolitan areas face a fiercer competition from other economically strong regions or global players. SMEs are regarded as a backbone and vehicle of regional and national economy. Thus, in order to strengthen regions that are exposed to competition more than the other, there is a need to take supportive action for SMEs. They play a crucial role in generating growth, attracting new investments and establishing businesses. They enable clusters to evolve and ensure employability of regional people (European Commission (EC), 2013a, Regional Policy for Smart Growth of SMEs; 2013c; European Innovation Scoreboard, 2017; Global Innovation Index, 2017).

In this sense, SMEs are increasingly forced to look for a new better environment, appropriate business framework conditions, new collaboration and networking perspectives. New solutions are demanded by enterprises, regions and global communities to meet the addressed challenges. This is especially true for the EU regions that are bound to stronger competition due to increased environmental pressure and globalisation. For instance, the Baltic Sea Region as one of the EU macro-regions records heavy negative environmental footprints induced by human activities, e.g. manufacturing, shipping. It has been also subject to harsh competition from overseas, e.g. in the shipbuilding sector. Given this background, traditional manufacturing SMEs are forced to search for new innovative and sustainable solutions in order to survive on the macro-regional or global scale. This bears a clear paradox. Innovativeness in certain region-based sectors, e.g. maritime transport, shipbuilding and green energy production are recorded as being zero or negative (JRC Technical Report on Blue Growth and Smart Specialisation, 2016). In addition, SMEs are generating less innovation (Innobarometer, 2016). Indeed, it might be argued here that local and regional needs and challenges should be addressed first. This would enable to better equip for the global competition. This must be done before proceeding to the global scale. Innovation generation and light

on the local and regional context needs to be brought back on the agenda. A stronger use of the "glocalisation" is needed. This implies focusing on local and regional needs as well as regional challenges rather than concentrating on global integration (Courchene, 1995; Wolfe, 2002).

From the ecosystem perspective, DM can help SMEs to drive innovation and to better adopt to globalisation. This can be achieved through development of new ways of making and selling products and services. This concerns also adoption of new organisational processes and implementation of visions that are in line with needs and challenges of the local and regional setting (Lockwood, 2009; 2011; Candi, 2006; Steffen, 2010). DM is integrated in the strategic management domain. It is based on a strategic logic and focuses on 'best' preparedness and responsiveness in a changing landscape. This can be realised through strategic thinking and acting. DM acts as a management culture in SMEs and performs inclusive networking function. This function enables to connect different SME performance domains into one ecosystem. It also allows achieving the vision, long-term goals and to better prepare for the future. Thus, the research adopts a holistic perception of design integration within management processes of SMEs. This is done by placing design as a communicator, constructor, implementer, collaborator, mediator, integrator and leader in transformation. In this particular sense, design integration and DM act as an inevitable prerequisite for better performance and organisational success of SMEs in the region context. This makes the doctoral research very **topical**.

The actuality of the research can be underpinned on policy and regional development agendas as well. Counting from 2009, a myriad of policy recommendations, roadmaps, strategies, actions and reports were published to strengthen focus on design-driven innovation, e.g. Action Plan for Design-Driven Innovation (2013b); Design for Europe (2014); Horizon 2020 call "Capabilities for Design-Driven Innovation in European SMEs" (2015). In the Council Conclusions on cultural and creative cross-over effects that aim at promotion of innovation, economic sustainability and social inclusion, design is one of the sub-sectors of Creative and Cultural Industries (CCIs). Here, it is stressed that industry needs new approaches. The so-called silo thinking has to be broken:

> *(...) there is a lack of awareness of the potential of combining arts, culture and creativity with technology, science and business, as well as insufficient exchange of good practices. In particular, the catalytic effect of culture and the arts on innovation in all sectors is still underestimated and thereby underused; (...) sectors and policies are still often organised in silos, thus limiting the scope for synergies and the emergence of innovative solutions (...)." (2015 / C 172/04, p. 13).*

The doctoral research is driven by the two-fold **research problem**. Despite growing trends of DM utilisation on the global scale and in large organisations, the map of DM theoretical contributions and practical applications in the SME context is scarce (Acklin, 2013a, 2013b; Niedworok et al., 2015; Ward, 2013). On the one hand, *scarce research* is existing on DM conceptualisation and application in SMEs and regional context (Erichsen, 2014; Gulari, 2014). This is evident from the DM concept emergence onwards (Gorb, 1976). Screening the worldwide databases, in 2016-2017 DM conceptualisation and application in the SME context yield just a few entries (Nunes, 2016; Ford and Terris, 2017; Townson et al., 2016). In the TUT and Estonia, no PhD theses were located on DM

in the SME and regional context. On the other hand, *DM is marginally utilised* in SMEs and entrepreneurial *management practices*.

The researcher herself felt confused on DM application concepts for SMEs in the regional context. This resulted from the practices and experiences gained from participation in projects related to DM application to SMEs in the home region. Applicable concepts appeared to be either absent or far away from their feasibility to the SME domain (European Commission, 2009a; 2009b; 2013b). They were rather driven by transfer of best practices from large multinational companies (Gemser and Lenders, 2001; Hertenstein et al., 2005; Fernandez-Mesa et al., 2013). Existing approaches and models made them less feasible for SMEs. They were detached from taking into account the environmental ecosystem of SMEs. Less focus was given on SMEs' specific needs and challenges, their performance practices and networking interactions (Gardien et al, 2014a; 2014b; Mortati and Cruickshank, 2011; Whicher et al., 2016).

Driven by this impetus and taking into account the research problem, this doctoral thesis aims at reducing the following **research gap**. The interplay among the domains of DM, SMEs and innovation is scattered in the regional level of governance (Bucolo and Mattews, 2011b; Cooke and Eriksson, 2011; Salminen et al., 2015; Ward et al., 2009, Whicher and Walters, 2017). The research gap lies in the missing conceptualisation of DM. Here, DM is driven by design integration and DM application for SMEs innovation in the regional context. DM addresses the ecosystem perspective and ability to adopt to transformation and rapid pace of change (Buchanan, 2015; Gardien and Gilsing, 2013). First, there is missing conceptual DM approach and modelling to innovation in SMEs from the processual perspective. We need to explore how to employ tools. We need to know what challenges and opportunities related to DM embeddedness as a process.

Finally, exploration is needed on how the management of design integration takes place (Bucolo and Matthews, 2011a, p. 5; Yström and Karlsson, 2010, p. 3). Knowledge on organisational changes is to a large extent missing. This concern opportunity recognition, innovation, organisational strategy and culture (Matthews and Bucolo, 2011a, p. 999). Second, we are coping with non-utilised potential of DM – design integration and utilisation – in the SME context. Therefore, policy and governance measures are foreseen to enable a decrease of the gap in knowledge and research. The gap concerns missing processes and frameworks used by enterprises to assist them in becoming design-oriented (Bucolo and Mattews, 2011b, pp. 4-5; Ward et al., 2009, p. 78). As noted by Whicher and Walters (2014), only a few regions in Europe have design integrated into innovation policy on regional and local policy levels (p. 4). There is a demand for display of practical application of DM concepts through research projects Acklin et al., 2006).

In this sense, the **overall objective** of the doctoral is to develop a synthesised and consolidated transdisciplinary conceptual DM approach and processual model for SMEs in the regional context. This is done through practical policy measures, i.e. research projects. They should contribute to better theoretical understanding as well as managerial feasibility of DM, design integration and utilisation. They serve for innovation, performance and organisational development of SMEs. The ecosystem perspective and future strategic orientation are incorporated into the developed tools to enable a better preparation for the future.

In this light, the research places a **Central Research Question (CRQ)**: *how to deploy DM for innovation in SMEs in the regional ecosystem addressing change and transformation process?*

The following **Research Questions** (**RQ**) constitute the research scope:

(1) How to conceptually integrate design into management of SMEs in innovation development?

(2) In which way could DM be utilised for SMEs innovation in the digital transformation age?

(3) What would be conceptual mechanisms to integrate DM in SMEs innovation development as a process model?

(4) How to unlock innovation potential by DM for the entire ecosystem of SMEs in a changing economic paradigm?

(5) How could DM become an organisational management culture for different size SMEs in innovation development?

The present research delivers **contributions** to both science and management. The contribution to science and research communities lies in the *conceptualisation, application* and *validation* of the *conceptual approaches* and *models* developed. These are explored in two paradigms – DM application in the present economic nexus and DM projection and strategic future foresight in the digitalisation and transformation age. The fundamental practical contribution of the conducted research lies in the applicability and transferability of the developed DM concept and model to SMEs. They apply to SMEs business and entrepreneurial interactions both organisationally and on the market. The concept and model on DM were practically applied to SMEs within the regional development projects. The results confirmed positive multiple implications for small businesses. DM can be deployed for innovation generation, strengthening competitive edge and providing growth prospects.

In a nutshell, the individual five publications deliver both **science and management contributions.** They answer all five RQs that frame the CRQ. A processual perspective is proposed on design integration and DM conceptualisation for SMEs in innovation development. This is done through established and applied conceptual partnerships. In addition, value creation for stakeholders is projected. The conceptual approach on DM is a response to RQ1 (publication I). Starting from the grassroots conceptual level (publication I), the author drills into the processual DM modelling through the RQ3. She reveals possible process-based DM integration model for SMEs, which is based on the thorough analyses of two technology-driven regional SMEs (publication III). Linking up, DM conceptual approach and processual model for SMEs in the regional context are validated with publication V. This research response loops DM conceptualisation into a synoptic picture. Here, RQ5 is addressed and answered.

The researcher showcases a networked conceptual pattern. This applied pattern enables to establish and integrate DM as a social organisational construct and a management practice (publication V). The author explores and compares different evaluation and validation schemes. This is done against the background of the stated research gap and in line with the marginalised focus on DM integration and conceptualisation within the changing economic paradigm. Based on the empirical practices, the research proposes matrices for design integration and DM application. They can be used for innovation and business modelling in the digital transformation. This is targeted through RQ2 (publication II). Finally, a conceptual turnkey for SMEs innovation and value creation is discovered (publication IV) as a response to the marginalised ecosystem perception and changing socio-economic and technological paradigm. This change is characterised by digitalisation, changing environmental and

social responsibility and technological specialisation. Here, targeting RQ4, the author scrutinises the ways SMEs can utilise DM potential for their future pathways.

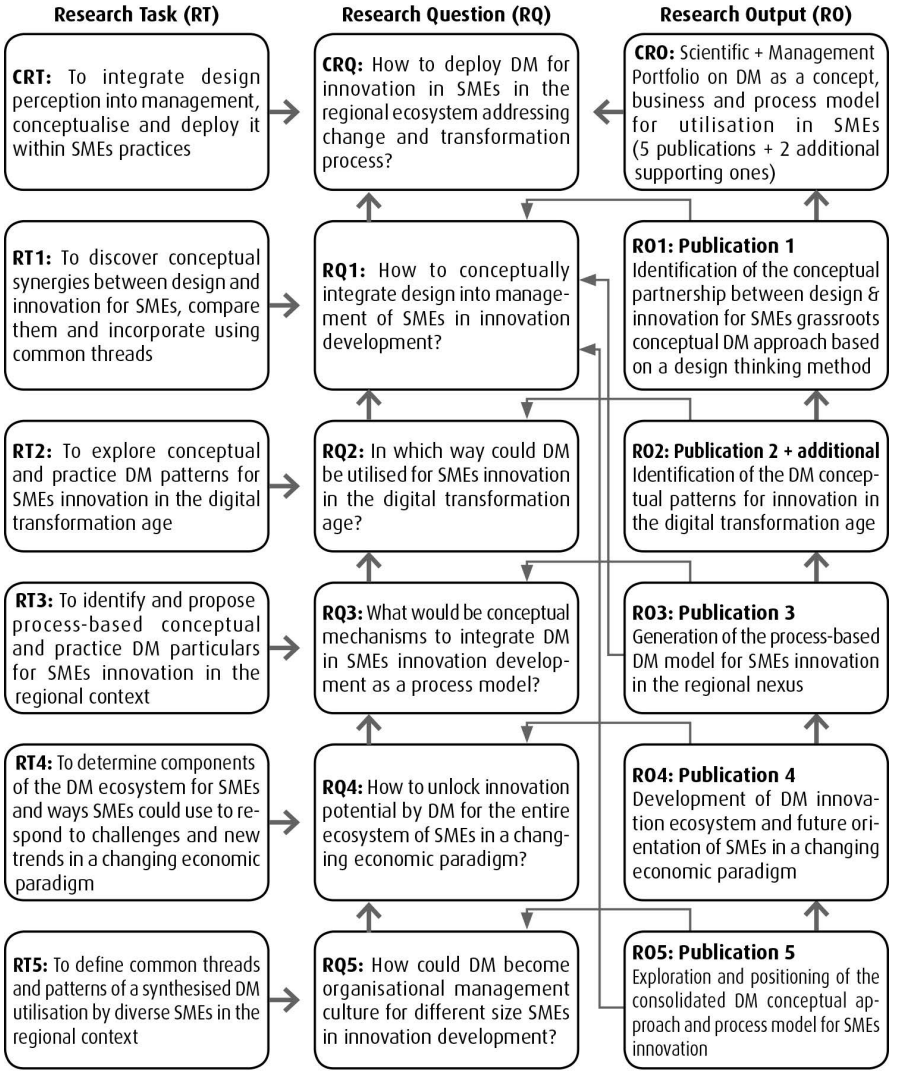

Figure 1: Doctoral research breakdown into pillars and components

Source: compiled by the author

To outline the overall doctoral research endeavour, **Chapter 1** provides a theoretical foundation, which serves for grounding the empirical research. Consequently, methodology including research design, paradigm, approach, methods, analysis and data are elaborated in **Chapter 2**. Within the next chapter, the results are discussed and critically assessed. **Chapter 3** provides segmented research contributions and implications in line with the research publications. The chapter is rounded off by the future oriented strategic foresight and positioning of DM within upcoming strategic and operational discourses. The next **Chapter 4** discusses research contributions and positions them within the topical research and management discourse.

1 CONCEPTUAL RATIONALE AND THEORETICAL MAINSTAY

Theory and concepts provide foundational knowledge. Yet, the challenging task for the young engaged and evolving researcher from the business discipline is to find and use an applicable theoretical and conceptual path. It is because of the vibrant nature of the phenomenon dealt with, ambiguity, ambidexterity and the pace of embeddedness in the social realm. The author lays down applicable and strong theoretical foundations that enable logically and legitimately to link design and business spheres of action for innovation. As a result, the researcher is able to arrive at a novel epistemic conceptual encounter, which is discussed here.

1.1 Setting the scene: rationale of DM research and its positioning

It is much easier to define DM than to reveal its rules, its organisation and application (Gorb, 1990, p. 7). In this light, the doctoral research aims at defining and establishing DM as a management and organisational practice. This practice shall integrate design into organisational culture. As a result, DM practices, skills, competencies and processes, once integrated might allow, in line with Chiva and Alegre (2009), to achieve good design (p. 425). Indeed, good design means good business (Watson, 1974, cited in Hertenstein et al., 2001, p. 11). Good business, again, requires a thorough management that integrates design and enables to achieve organisational success (Moultrie et al., 2007; Rothwell and Gardiner, 1984; Roy, 1994). It is predominantly agreed among scholars and practitioners that DM can provide organisational success (DMI, 2018). Success can be associated with specific factors that enable organisations to move forward (or to innovate). Entrepreneurial success is primarily linked to personal traits of entrepreneurs control, tolerance, risk taking and opportunity recognition. Success of an SME can be influenced in the short-term by the novelty of product / service, ambition and skill portfolio of the entrepreneur (Bianchi and Winch, 2012, p. 2; Burns, 2016). Long-term (i.e. strategic) success, however, cannot be guaranteed by these factors.

In this light, this research positions DM within the strategic management domain. Here, design is integrated in management practices and performs strategically pivotal functions. The author argues that design integration is the key to strategic thinking and acting. Design integration allows for becoming design oriented. Consequently, design orientation stands for organisation vision. It includes a set of ways to deliver products, services, improve organisational practices and to achieve better positioning (Calabretta et al., 2008; Beverland and Farrelly, 2007). Indeed, organisational vision and attributes do address the strategic management level. Design orientation requires strategic management and management culture support (Borja de Mozota, 2003b; 2013). All the ways generate value and enable social inclusion through different functions performed by design (Venkatesh et al., 2012, p. 291).

Overall, based on the identified research problem and research gap, the research has adopted the overall design function of “driver”. By this, the research has bridged conceptual approaches residing in 1) design related research streams; b) strategic management literature; 3) organisational culture scholarly body of knowledge (Figure 1). Yet, bearing the research gap, objectives and questions, the applicable concepts and approaches are filtered through three turnkey lenses: a) innovation domain; b) regional development and regional innovation ecosystems, and c) longitudinal view – paradigm

of socio-economic development. As a result, the scrutiny is given to industrial, over experience, knowledge and towards the transformation economic paradigm. Understanding the differences of single disciplines, combining the strengths of each other and balancing the needs through integration enables reducing risks, challenges and gaps. Transdisciplinarity yields a high potential once emerging from the interplay of interdisciplinary interactions.

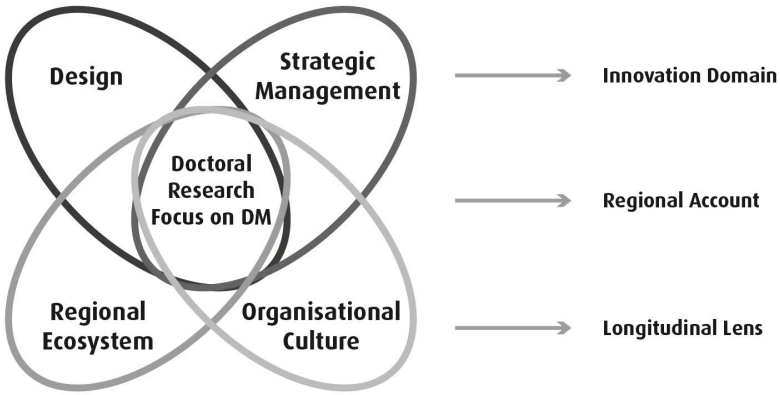

Figure 2: Doctoral research position and focus on DM

Source: compiled by the author

Indeed, success of design integration and DM is linked through design function that needs to be managed in an appropriate manner. This allows to achieve improvements (product, service, organisational) and generate value (Calabretta et al., 2008, p. 379). It is argued here that in order to manifest positive implications for business and entrepreneurial practices through design success, it is, first, necessary to show a conceptual ways and procedures. Second, it is needed to address how to generate this success based on integration of diverse research streams. Only with available concepts, procedures and models can a quantitative output portfolio of design success be delivered. This is very topical in the present research, which is placed within the European Policy context (based on EU projects implementation). By echoing scholars that researched design in the European context, the focus needs to be on challenges associated with evaluation of the design. In addition, conceptual models on design for success (here – innovation: competitiveness and growth) are also demanded (Whicher et al., 2011, p. 46). In her dissertation, Whicher (2016) confirms that the missing link to assess and benchmark design innovation in the European policy is usually qualitative research gaps, i.e. models and a qualitative perspective on the assessment (2016, p. 247).

In addition, it is not sufficient any longer to concentrate solely on investment in design in enterprises. Rather, skills, competencies, processual perspectives on DM and design integration into business processes are gaining importance (Bruce and Cooper, 1997, p. 3.; Chiva and Alegre, 2009, p. 436). Echoing Danish Design Vision 2020 based on the OECD statements (2011), innovation has become increasingly subject to immaterial rather than physical investments. It is rather born in the frame of collaboration among enterprises and different stakeholders, customers and users (p. 15). This, again, supports the doctoral research. The researcher has addressed this research problem. She aims at

reducing the topical research gap by providing a conceptualised way on DM for innovations in the regional context. The missing conceptual foundations also confirm the demand to start with the qualitative approach at this grassroots level of the topical and newly emerging DM domain. This particular theme, indeed, seems to gain a growing importance within the European policy and practical business discourses.

1.2 Delineating conceptual partnerships for DM research

The doctoral research adopts a perspective on design from a functional nature. Here, design acts as a "driver" incorporated in SMEs strategic management and organisational culture. Design being a driver for innovation serves as an overall umbrella function. In this sense, it is more feasible to integrate design into the management using the overall basket of design functions – communicator, integrator, constructor, enabler, innovator and leader. It is more pivotal than only concentrating on the design aesthetics and styling functions. This is because these functions are inevitable from the *strategic management perspective*.

Taking the given strategic management domain, the research applies particulars of the strategic DM. It *integrates* attributes and functions of the strategic design and enables to become strategically oriented on the entire corporate level (Borja de Mozota, 1998; Brookes et al., 2011; Calabretta et al., 2016; Hertenstein and Platt, 1997; Joziasse, 2000; Matthews et al., 2013; Noble, 2011; Stevens et al., 2008). Echoing Holland and Lam (2014), strategic design implies using DM to drive and implement corporate strategic goals. Both processual and strategic attributes of DM are herewith addressed. Strategic design creates vision, integrates and orchestrates collaboration across disciplines. As a result, real value can be provided to all stakeholders involved in creating solutions to business, social and environmental problems. It is about contribution to business performance management (p. 3). In this, strategic design drives organisations by learning, strategic planning, catalysing innovations and delivering on operational, tactical and strategic levels (ibid., pp. 116-117; Nusem et al., 2017).

The incorporation of strategic design enables to establish conceptual rationale for the doctoral research. It is based on the distinguished design functions it is performing in the management and culture domain of SMEs. For instance, when design is addressed as a resource, core competency, capability and capital from a strategic design perspective, design functions of differentiation, integration, etc. come to the light. Strategic design allows to perceive design a competitive advantage and strategic asset. As a result, design becomes driver for innovation, competitiveness and lead towards better positioning. Its role is therefore moving from just fitting to the industry towards becoming heart of the business model and value creation (Borja de Mozota, 1998, p. 26; Borja de Mozota & Kim, 2009, p. 67).

Furthermore, strategic design serves as an enabler for integration. The research itself claims importance of design integration into the management and organisational culture of SMEs. Design integration might turn organisations into design-driven ones using DM in management and organisational practices. In line with Manzini and Vezzoli (2003), strategic design is concerned with integration. In particular, it aims at integrating products, services and communication based on new forms of organisation. Roles and their reconfiguration among the involved stakeholders (companies, clients, users) is also objected. In addition, it targets new values and market opportunities. These are adopted to existing trends and long-term goals associated with economically feasible and socially appreciable sustainability (p. 856). In this regard, we might claim that the role of design

has moved from just fitting to the industry towards becoming heart of the business model and value creation (Borja de Mozota, 1998, p. 26; Borja de Mozota & Kim, 2009, p. 67).

Here, approaches and concepts are brought together, as they address and share the same conceptual partnership connected by a design function performed in management. This partnership is therefore reflected through the main umbrella function of DM, namely, DM acting as a driver for innovation in SMEs in the regional ecosystem. As a result, design is a driver for SMEs innovation in the regional context. It enables integration of conceptually similar approaches and theoretical models that share the same functional and impact (success meaning) perception. The Figure 2 above displays therefore the constructed conceptual partnership evolving into a sound theoretical mainstay. This was used throughout the entire research journey. It showcased how the start with the principal design function of "integration" or design being "inclusive" paves the way for organisations (here – SMEs) to become and act as design-oriented ones.

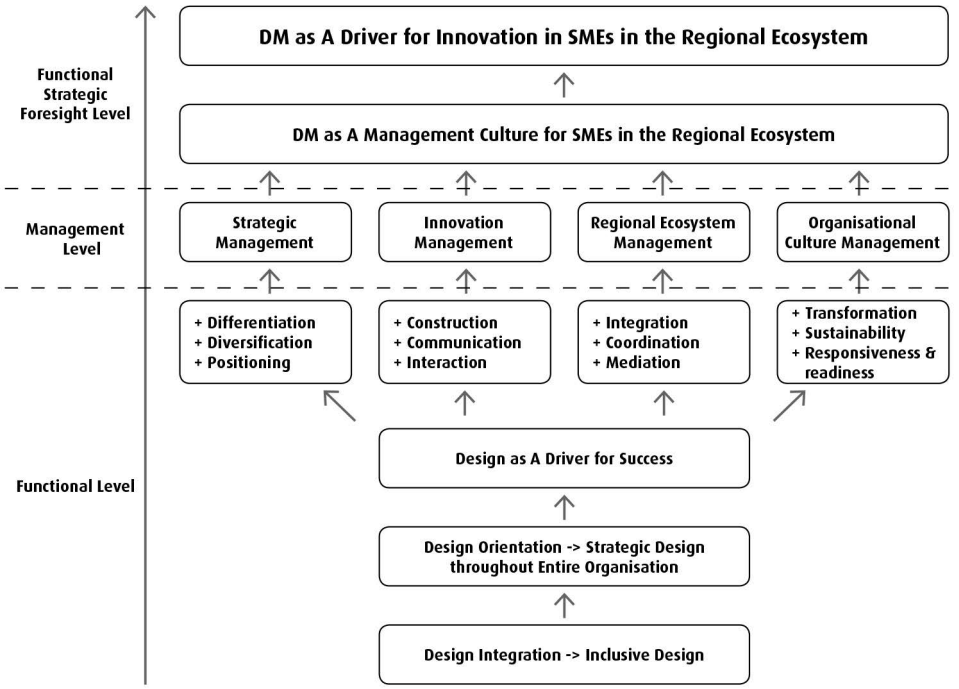

Figure 3: Conceptual mainstay of the doctoral research on DM
Source: compiled by the author

As a result, design acts as a driver for success (qualitative and conceptual focus) and provides in this manner a conceptual stepping stone. This, again, bears on the strategic thought, according to the discussed particulars of design orientation in section 1.1, and show in Figure 3. Thus, we might adopt the functions of strategic design that, in turn, can be allocated to a different domain or field of management literature: a) strategic management; b) innovation management; c) regional ecosystem management; and d) organisational culture management. From the functional level, when design and strategic design management functions are used as a common conceptual thread, we arrive at

management level. Subsequently, over it we transfer to the strategic foresight level that combines both functional and strategic attributes of design and DM. Here, DM acts as a driver for innovation in SMEs within the regional context in the present economic nexus and the rapid pace of changing economic paradigm – digital and socio-economic transformation.

The transformation value is of particular importance in this rapid pace of change and uncertainty. It is because design, when employed, does not manage projects, but rather leads to strategic strength. This occurs when it is utilised as a core strategic resource and organisational capability, activity, process or phenomenon inherent in the creative industry (Borja de Mozota and Kim, 2009, p. 69). DM acts as managerial competence, resource competence, economic competence and design with indecisive role on SMEs (Borja de Mozota, 2003a, pp. 96-98). DM as an approach focuses on business practices and organisations. It shows how design can streamline certain processes within them and bring the value. This can be achieved through design as a style, function, process, corporate resources or corporate strategic resource, organisational culture or a vision. Yet, some scholars link up corporate identity and DM. They pinpoint that design must be integrated and, in turn, managed in all four contexts of an organisation – product, environment, information and corporate identity (Olins, 1985a, 1985b, 1989). Indeed, DM has increasingly become perceived as a strategic tool creating and capturing value (Kotler and Rath, 1984; p. 16; Er, 1997, p. 293).

From the strategic design view, DM drives management practices and organisational culture and thus might propose the entire value model. By using design as a resource, externally enterprises may develop external, market-based advantage. This allow them to differentiate their products or services. Their value can be increased through branding and corporate image development. Enterprises are capable to develop internal competitive advantage. This is achieved internally by combining unique, invisible, difficult to imitate organisational processes and design resources (Borja de Mozota, 2006, pp. 45-57). Here, the design integration leads to an increased differentiation, diversification, integration and transformation. As a result, design performs strategic functions. It also has impact (success capability) throughout its “powers” on the entire organisational success and value creation (Borja de Mozota, 2006, p. 45). It also performs a function of a communicator (through aesthetics, styling and symbols). Design acts also as a constructor (for products and construction of other physical things). It has an interaction function too through connecting, intertwining and mediating activities, services and processes. Finally, acting as integrator it performs one of the pivotal functions enabling to adopt and perform in systems, organisations and environments (Buchanan, 2015, p. 14). Indeed, design needs to be strengthened as a core function within a company. This provides improvement in collaboration and transformation as well as enables exploitation of its potential. With this, new tools can be discovered to help SMEs to turn their creativity into a strategic choice (Gardien and Gilsing, 2013, p. 54; Westcott et al., 2013, p. 10ff).

1.3 Orchestrating theoretical foundations for DM research

Building upon the conceptual partnership (Figure 3), DM domain postulates a thorough architecture of key management conceptual approaches and theories. This architecture is enabled by bringing in the turnkey design function, where it acts as a driver for innovation. Thus, DM opens up new ways for further functions that yield success for management and organisation culture of SMEs. In order to provide a strategic foresight

in a rapidly changing economic and social environment, the research has adopted a two-strand theoretical mainstay. This mainstay embraces two paradigms – DM application in the present economic nexus and DM projection and strategic future foresight in the digitalisation and transformation age. Therefore, the research delivers a longitudinal perspective on DM conceptualisation and deployment, where approaches and theories are marshalled for DM from the following domains: a) strategic management; b) innovation management; c) regional ecosystem and d) organisational culture. These are respectively positioned along the entire socio-economic and technological development paradigm. This is then divided into key four economic development patterns (Figure 4).

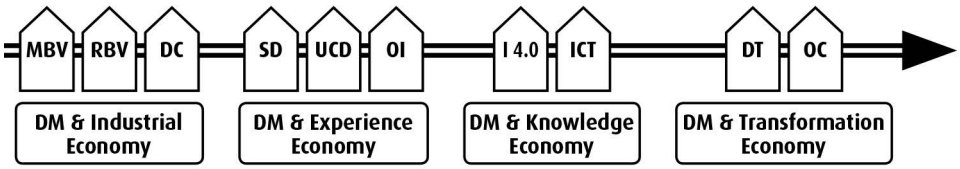

Figure 4: Orchestration of theoretical foundations in a change paradigm
Source: compiled by the author

As a result, each of the paradigms are reflected through applicable conceptual approaches and theories. These were applied throughout the entire research (rf. Publications I-V) in the following way:

(1) Industrial (market paradigm) – Market-Based-View (MBV), Resource-Based-View (RBV) and Dynamic Capabilities (DC). –> Design and DM are perceived as strategic resources internally and externally to the organisation; capability, competency and asset.

(2) Experience paradigm – Service Design (SD), User-Centred-Design (SCD) and Open Innovation (OI). –> DM from the methodological design thinking perspective, design perceived through the customer and user lens (Cooper et al., 2009a).

(3) Knowledge paradigm – Industry 4.0 (I 4.0), Internet of Things (IoT), Information and Communication Technologies (ICT). –> DM as a new tool to respond and use in the digital transformation. In particular, here DM role is *unexploited* (rf. Publications II and Gerlitz (2015) (add. publication).

(4) Transformation paradigm – Digital Transformation (DT) and Organisational Culture (OC). –> DM as a new corporate function in management and culture. In particular, here DM role is *unexploited too* (rf. Publication IV), in line with Buchanan, 2015; Gardien et al., 2014a, 2014b; Lockwood, 2009, etc.)

In brief, taking *into account the strategic management domain (a)*, two key research streams are governing perception of DM from a strategic intent. These are: a) market-based view (Porter, 1980, 1985) and b) resource-based view (Barney, 1991; Penrose, 1996; Peteraf, 1993; Wernerfelt, 1984). The former argues that industry in which organisations are acting define the firm's strategy and performance. The latter calls for resource understanding. Strategic DM research frequently addresses resources as intangible assets, such as reputation, information management system or trust and similar. Intangible assets of an organisation are being also referred to as core

competences or dynamic capabilities (Borja de Mozota and Kim, 2009, p. 67; Hoopes et al., 2003, p. 890; Prahalad and Hamel, 1990, p. 4; Porter, 1996, p. 70; Teece et al., 1997). Internal strengths resulting from design integration have also become the focus of researchers like Brown (2008); Verganti (2008); Martin (2009).

From the *innovation management perspective (b)*, design as well as design integration and thus DM can be conceptually linked with innovation. The researcher argues that design and innovation can be brought together through the following common threads: a) conceptual meanings of design and innovation (Brown and Wyatt, 2010; Candi, 2005; Jahnke, 2012); b) conceptual meanings of design thinking and DM (Borja de Mozota, 2011; Brown, 2008; Carlgren, 2013); c) conceptual meaning and application of creativity (Schumpeter, 1911; von Stamm, 2004; O'Sullivan and Dooley, 2009); d) conceptual meaning of opportunities (Acklin, 2013a; Casson and Wadeson, 2007; Nielsen et al., 2013), and e) dimensions of innovation (Tidd and Bessant, 2013, Verganti, 2008). In overall, innovation and design share conceptual foundations linked through value creation (bringing us again in the strategic design domain). Innovation leads to solutions that can be exploited on the market. They deliver social and economic value. This is a shared value (Dorst and Hendriks, 2007; Fraser, 2012; Norman and Verganti, 2014). Design, the same applies for innovation, can be used as a noun or verb. Design as an activity and process lead towards strategic and competitive advantage and innovation (Whyte et al., 2015, p. 2).

DM can be perceived as applied innovation i.e. capturing the talent and resources available inside and outside an organisation to create new products, environments and new user perspectives. Strategic initiatives are applied by using design to foster culture of innovation (Borja de Mozota, 2011, p. 19; Bachman et al., 1998, p. 17). Design coordinates all factors contributing to a product, from its consumption (functional, symbolic and cultural factors) to its production and distribution (Verganti, 2008, p. 440). Candi (2005) even proposes design as an element of innovation. It encompasses activities that enhance the value inherent in products and services. This is achieved by combining design with technology and commercialising the result. In this case, both functionality and aesthetics of the final result can be achieved (p. 3). Design is a tangible outcome, i.e. end product of the process or intangible (e.g. service or process, solution (von Stamm, 2004, 11). Notwithstanding, this research stream is still new. More studies are needed based on empirical observations in order to consolidate the relationship between design and innovation.

Coming to the *regional ecosystem (c),* the research deploys the concepts of glocalisation, integration and ecosystem approach. Based on the challenged regional development and innovation patterns of SMEs as well as taking into account SMEs needs to respond to these challenges, we must start at the local level to build local resilience and local communities (Cooper et al., 2009b, pp. 16-29). Local focus or "glocalisation" as opposed to "globalisation" needs to be undertaken. Two facets of this learning process include adjusting products to local markets and identifying local solutions, which can meet a global market (Bitard and Basset, 2008, p. 25). This is because "glocalisation" rather than "globalisation" drives enterprises today, which are engaged in international markets and develop "mass-glocal" rather than "mass-global" products and services (Cooper et al., 2009b; Wolfe, 2002; Holbrook and Salazar, 2004, pp. 50-52). Parallels can be also drawn with the concept of regional integration (Mattli, 1999; Mattli and Stone Sweet, 2012).

Here, the relevance of integration is evident through regions virtually now exposed to new arrangements or reformation of existing regimes and economic globalisation, which is channelled through regions (p. 3). Integration merges external and internal perception. It also combines different dimensions of economic, environmental, social, policy and culture sphere into a multidimensional process (De Lombaerde and Van Langenhove, 2005, p. 2). Similarly, ecosystems are treated as dynamic, goal-driven communities, characterised by complexity, dynamism, adaption and emergence perspective (Gooble, 2014). They show a strong interplay of relations that presuppose collaboration, trust and co-creation of value, which are shared by complementary technologies and competencies (Durst and Poutanen, 2013). Integration success depends on two conditions. Namely, a) creation of demand for the regional markets, which results from cost advantages through liberalised trade investments, and b) engagement in international interactions (Krapohl, 2017, p. 35). It can be therefore argued that design integration may spur innovation, strengthen competitiveness and enhance growth perspectives. As confirmed by Raulik et al. (2008), more advanced economies do exploit design as a strategic asset for the economic advantage and social development (pp. 119-120).

In line with the research problem and gap, regional account is somewhat missing in DM application in the SMEs domain (Cooke and Eriksson, 2011; Sleuwaegen & Boiardi, 2014; Lee et al., 2004; Whicher and Walters, 2017). There is too little synthesis of design integration in regional innovation development processes. Lovering (1995) contends that design might support regional economy and its development. Design might accelerate developing countries within innovation process (Guimarges et al., 1996). Yet, the ultimate focus is to be placed on DM integration as addressed in sections 1.1-1.3, both internally and externally. This enables consistent and sustainable development of SMEs while generating and exploiting innovations. This is in line with the current research aiming at providing tools and approaches to respond to the rapid pace of change. The systemic view is of particular importance. It brings all affected agents together for the interaction that leads to goal achievement. It involves economic, technological, social, policy, environmental and cultural domain peculiarities. The linking concept between the ecosystem of design and entrepreneurship is innovation, which enables emergence of creative ecosystem (Mortati and and Cruickshank, 2012, p. 5).

Finally, looping the entire picture into an *organisational culture (d)* perspective, a strategic design delves into this discourse through innovation and growth. This is true when perceiving organisational culture. It is an organisation that has to be designed (Peters, 2014; Holland and Lam, 2014). The same applies for organisations in digital transformation (Cole, 2015). Drucker (1985) and Senge (1991) have recognised design as an important driver of organisational and cultural change and transformation. Design orientation is a result of an organisational culture that promotes key tenets for appropriate DM. It leads to optimal exploitation of innovations. Potential of design for innovation can be perceived via organisational ability and capabilities to learn use of design in all managerial and organisation issues. It is not only new product development techniques and activities that drive innovation in innovation development. Rather, it is an organisational culture itself (Calabretta et al., 2008, p. 380), which enables design orientation of organisations. It promotes design integration leading to both internal and external success. The success is expressed by better product and service design and performance on the market (Ravasi and Schultz, 2006, p. 434).

Design is a corporate asset. Given both, globalisation and the rapid advance of technology, organisations need to search for leaders or tools to embrace transformational change. Indeed, design is a strong demand for strategic value of design upfront and throughout the organisation. It might lead towards better business strategy. Design can also imply responsive leadership and bring all parts together along the organisational chains (Solomon, 2014, p. 43). Design is bound to the value system of an organisation itself. Yet, approaches on smart, sustainable business models and innovation strategies have overwhelmed the research communities. This is evident in comparison with discourses of design potential and its integration in face of digital transformation. Thus, the design centred research within this nexus appears to have substantial research gap (Clegg, 2000; Hermann et al., 2015; Walter, 2015).

The proposed theoretical mainstay conveys DM positioning in four paradigms. It shows a logical rigour of their application to the DM domain. The author argues that the longitudinal perspective and postulation of DM, which mirrors a paradigm change, is a necessity. The theme of DM for SMEs innovation has not been positioned from the longitudinal angle yet. In particular, this is a case within the digitalisation and industrial transformation age (second strand of the research, rf. publication II and IV). To add, this bears an inevitable obligation for the researcher to manifest and embed DM as a mind-set and practice for SMEs innovation with a future outlook. As a result, applicable considerations and foundations from the aforementioned theoretical and management domains have been deployed for DM exploration and valorisation. They are presented here in a synoptic way, pointing to the core of the conceptual partnerships.

2 RESEARCH PARADIGM, DESIGN AND METHODOLOGY

The chapter in hand displays key methodological research tenets and hallmarks. Methodology strategy and methodological choices play a crucial role for the research and its projection. Methodological orchestration demonstrates personal capabilities and gathered knowledge in strategic discovery process. Looping these processual steps to the methodological account is a key bridging theory and practice. The methodological trajectory embracing these steps is presented in the following.

2.1 Research strategy and objective discourse

The driving research impetus is an anticipated social construction of DM concepts and models. They propose new insights, ways, conceptualisation and new inputs to theoretical foundations. This social endeavour requires methodological interaction. Interaction has arrived into the research philosophy discourse by attempting to loosen the strict competing camps among the traditional research philosophies, in particular of that of positivism vs. constructivism. This emerging approach is called an interactive research approach (Elström, 2008; Svensson et al., 2008).

Bearing the social lens in mind, the present research follows the *constructivist philosophical stance*. Yet, the research aims at avoiding any isolation and silo building. Thus, it adopts the tenets of an interactive participatory research. It is because the present research a) addresses both science and management complex problems; b) it aims at creating new concepts and models demanded; and c) given the real-life projects aims at solving real-life problems of SMEs in certain regions (rf. challenges and problems addressed in Introduction) (Figure 5). In this regard, the research postulates a complexity of the phenomenon and therefore is subject to a thorough analysis. Next to the social interaction perspective, the research complexity calls for a holistic collaborative action (Coughlan and Coghlan, 2002; Coghlan, 2011). Here, holistically, the research philosophy is regarded as a collaborative and interactive one integrating tenets and methodological particulars into the main adopted constructivist research stance.

Drilling into the research project, the dominating approach within the adopted philosophical stance is an *actors approach* that is clearly linked to constructivist thinking. The reality is socially constructed including and integrating stakeholders, participating and constructing sense-making and understanding (Creswell, 2013; Lincoln et al., 2011). This reality is constructed by a number of meanings that are shared by a larger and small number of people (Arbnor and Bjerke, 2008, p. 66). Indeed, understanding of the observed and analysed reality as a social construct lends a strength to the present research. First, it is because the research is located in organisational studies addressing social constructs. DM is also a social construct. Moreover, the research aims at not defining in a direct sense, but rather tracing and constructing meanings of DM potential and success within the SME province. Here, meanings encapsulate scanning, understanding, interpretation and action. There is a need to conceptualise and provide new understanding. Second, the research aims at understanding DM patterns within SMEs, the organisational context and construct conceptual approaches and models. Third, advantage is also associated with the fact that DM breaks the boundaries of a single discipline. It connects research domains, namely, that of management, technology and design within organisational culture.

In this regard, employing the actor approach is argue to be feasible and beneficial both to science and management practice. The research aims at explaining activities,

processes and outcomes involved in DM innovation for SMEs. The research shows that DM within SMEs and its potential for innovation in SMEs are also bound to relationships and interdependencies of actors and stakeholders involved in the process from the management, technological and design domains. Then again, individual meanings and multiple meanings occur, which needs to be recognised and acknowledged as sources of information and value. Afterwards, they need to be integrated in order to trace accumulated understanding, values and perspectives of the involved stakeholders as well as a shared value. In this light, the actors' view enables to perceive the whole through the lens of finite domains (provinces) of meaning of actors (Arbnor and Bjerke, 2008, p. 55).

In aggregate, this dialectical reciprocity among the involved vests the researcher with the research guiding mind-set. This aims at comparing different points of view and arriving at solutions or proposals that are likely to be truth through the ultimate use of the argued reasoning.

2.2 Selection and rationale of research paradigm

The research has adopted a research paradigm that enables to justify research methodology. It is also bound to respective ontological, epistemological and methodological assumptions and related actions. Finally, from axiology viewpoint, ethical considerations are reflected too (Creswell, 2013, p. 36; Crotty, 1998; Lincoln et al., 2011, p. 99; Mertens, 2010, p. 8). Using a structured way and coming from the overall towards specific, i.e. from the rough to the detail, the researcher has used the so-called "research onion" (Figure 5), as developed by Saunders et al. (2003). This approach is recently enjoying an increasing interest, as the latest scholarly entries show within the business management research, e.g. Davis (2014); Schmiedel et al. (2013); Venable (2011). It is valuable means, as the research targets the business management research – SME sector – and challenges related to their innovative development.

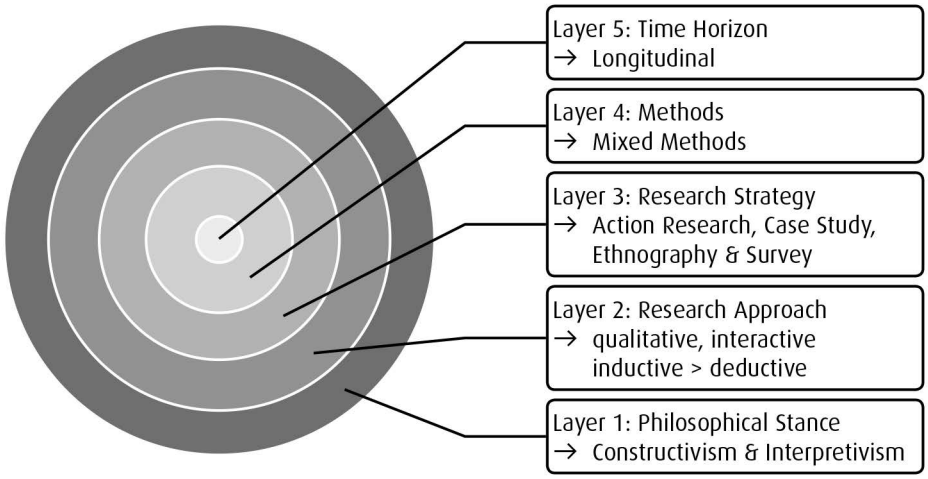

Figure 5: Research onion for the doctoral research

Source: compiled by the author

Further, the research onion seems to be valuable in terms of complexity, as it provides a detailed view, a step-by-step approach in the frame of the research process. As noticed by Bryman (2012), the advantage of the research onion might be associated with the fact that it provides a progressive perspective. It is a way through which it is possible to design a research methodology, adapt to any context of research methodology and use in myriad of context (p. 10ff).

Research philosophy encapsulates the ontological and epistemological considerations. With this regard, research has built upon a consolidated view bridging conceptual meaning of constructivism and interpretivism. Constructivism stresses instrumental and practical function of theory construction (Crotty, 1998). Further, since light is shed within the research on local and regional scale, i.e. SMEs embedded in the governance by specific local and regional policies, the perception of the given reality plays an important role. Constructivism holds on multiple realities, and the researcher is integrated within the object of the study, which shapes the investigation (Guba & Lincoln, 1994, p. 107; Lincoln et al., 2011, p. 99). Furthermore, in terms of interpretative manner, it is important to gather the holistic and interdisciplinary view on processes, interactions and relationships of all involved stakeholders and actors. It is pivotal grasp the interdisciplinary clout that opens up new transdisciplinary meanings and forms (Malone et al. 2003; Brown et al. 2010). Interpretivism is also important in the face of complex phenomenon. DM is claimed to possess this attribute. In addition, it enables to comprehend the complexity of DM on internal and external performance levels of SMEs. It also embraces SMEs interactions in the complex and networked regional ecosystems. It is also important bearing in mind the search for the meanings (Krauss, 2005, p. 761).

2.3 Research design: approach, methods and data

According to Creswell (2014), research design refers to types of inquiry within qualitative, quantitative and mixed methods approaches. They provide with specific direction how to proceed within a research project (p. 296). It is a strategic decision on how the topic will be dealt with and the research problem addressed (de Vaus, 2001, p. 8). Any research design requires a particular research method for data collection to be used. It ensures that the evidence obtained enables answering the initial question as unambiguously as possible (de Vaus 2001, p. 9) and deals with logical, but not logistical problems aiming to answer the research question (Yin, 1989, p. 29). Since the research paradigm during the research trajectory was constructivist mainly but integrating and combining mutual benefits of the above discussed, the research approach is also argued to be ambiguous. The umbrella research approach might be referred to as a hybrid research approach (Fereday & Muir-Cochrane, 2006, p. 80) combining deductive and inductive perspectives in the face of exploration.

Against this rationale, the research approach is of qualitative nature, dominated by a qualitative paradigm, combined with quantitative research patterns. The research pinpoints the social construct's domain and calls for identification of factors, barriers and drivers that influence the outcomes, i.e. DM use and success for innovation in SMEs in the regional paradigm. Little is known on how DM acts within the regional development paradigm (Acklin et al., 2006), what is the potential of DM and how it can be deployed within SMEs in a successful way (Whicher and Walters, 2014). Taking this research gap under scrutiny, we might build upon the justification of Creswell (2014). He contends that if a *concept or phenomenon needs to be explored and comprehended, since only scant research on that has been done, then qualitative approach appears to be feasible*.

Qualitative research is especially useful when the researcher does not know the important variables to examine (p. 50). Indeed, this type of approach is valuable, bearing in mind the marginalised focus in the previous research. Further, existing theoretical approaches and concepts do not any longer meet the needs of the changing landscape characterised by high complexity and networks of ecosystems, uncertainty and ambiguity.

Nevertheless, although the qualitative approach is dominating over the present research, there was used a deductive reasoning. This was done in order to trace DM, its attributes and peculiarities that are needed to conceptualise DM in the regional SME setting. The research incorporates quantitative data, which contributed to build up generalisations and findings and systemise the way. Use of quantitative data refer to perception of DM and its impact potential among the respondents of the research project "Design EntrepreneurSHIP". As a result, we might refer to a mixed research approach, although predominated by the qualitative way of proceeding, which is reasoned.

The impetus of inductive reasoning and thus aimed conceptualisation supports the use of the overall methodological approach, which also integrates other ones (Figure 5). Yet, *action research approach* (Figure 6) acts here as the main research driving approach (Eden and Huxham, 2006; Fendt and Kaminska-Labbe, 2012; Foss and Moldenæs, 2007; Maestrini et al., 2016; Mohrman & Lawler, 2011; Radaelli et al., 2014; Susman and Evered, 1978). It is a suitable approach for the present research, since it is able to act in a holistic and complex way. It supports a dualistic and dialectic view employed here and discussed above and opens up opportunities to bridge both science and practice. It enables to intertwine different research methodology categories (Zhang et al., 2015, p. 151). This is also the case here. Having its roots with the work of Lewin, action research has turned to an important research methodology in organisational sciences and entrepreneurship. It enables to arrive at pioneering results. It is applicable, since the researcher herself was directly involved in the ongoing projects (regional development projects). She undertook an observation and assessment of real-time phenomena. Learning cycles were integrated in the upcoming research activities and constituted an important research component (Gustavsen, 2005, p. 281).

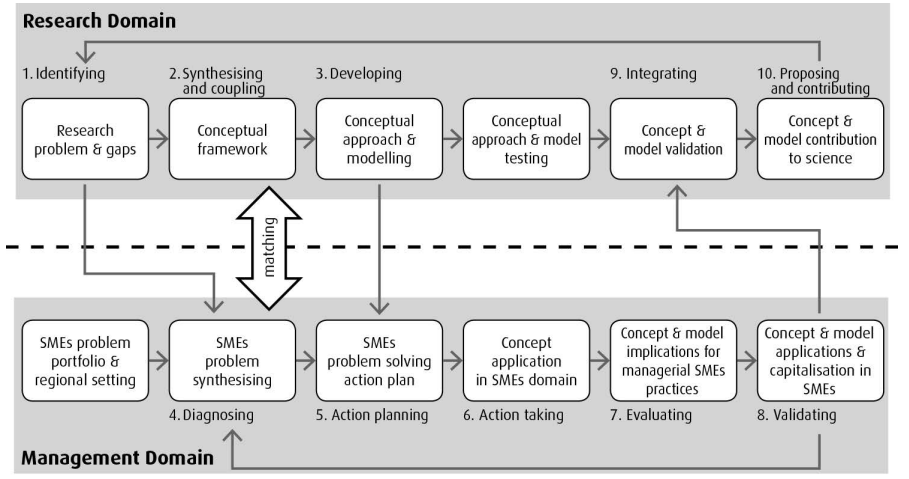

Figure 6: Action research approach in DM domain for SMEs

Source: compiled by the author

Indeed, the action research related to design integration and DM in firms and design-led innovation is highly marginalised (Andriessen, 2006; Pozzey et al., 2013; Townson et al., 2016), in spite of the fact that there can be established conceptual partnerships between the design thinking approach and action research. The focus is on a consequent problem solving and structured way. By echoing Townson et al. (2016), there is a scant research that investigates the use of designers, who undertake action research projects. these projects focus on innovation catalysts embedded in manufacturing sector SMEs (p. 49). This contention, indeed, is notably supporting the current research as well as the need to shift the focus on DM within SMEs sector. Important in this sense remains the endeavour on how SMEs might benefit not only from the external design consultants but build up capabilities and capacity by themselves. The action research approach deployed here adopts longitudinal and cross-sectoral (addressing different industry sectors) approaches (Figure 6). It is because the researcher participated from the beginning till the end within the research projects concerned.

With regard to methods and data employed, the present research utilised a mixed body of methods. The body of empirical evidence was completed by thematic analysis method (Braun and Clarke, 2006), filtering and using funnel method (Benkenstein, 1998, p. 700). Field notes, diagrams, memos as well as social network analysis were used. Overall, the methodological body constitutes a solid element that regulates the research and enables to arriving at decisions and solutions. Despite the research camps on either qualitative or quantitative approach, important issue still remains for SMEs innovation. By doing this, the researcher is relying on Berger:

> *When it comes to questions that have some measure of controversy surrounding them, our field's active researchers generally seem to be occupied chronically with arguing about the relative merits of various methodological approaches...These continuing methodological debates involve such polarities as qualitative versus quantitative, self-report versus observations, structured versus unstructured, laboratory versus field, cross-sectional versus longitudinal, and so on. In general, these debates have done little to advance the study of ...[education]... because they have taken place within a substantive theoretical vacuum." (1994, p. 11).*

In an emergent field of DM for SMEs innovation in the regional scale, we are dealing with the so-called "wicked problems" (Rittel and Webber, 1973, Buchanan, 1992). Indeed, these wicked problems, also referred to as complex ones, emerge and exist with high penetration of uncertainty attributed with multiple potential solutions. As a result, decisions are likely to produce unforeseeable consequences partly due to feedback loops with other parts of the system (Hobday et al., 2012, p. 278). In this light, strong research foundation is a key to success, once intertwined with the theoretical concept. This overall research journey from the methodological point of view has complied with the fundamental ethical tenets that are applicable in the research community. The clearance was done. Involved participants agreed on taking part in the research projects and acknowledgement was gathered. The researcher ensured throughout respect of participants' rights, values and took into account individual and group needs. Private, confidential and anonymous treatment of the issues was also secured.

3 RESEARCH RESULTS AND CONTRIBUTIONS

> *"(…) while high-level theory and concepts provide foundational knowledge, leadership abilities will only be tested and honed through their application to real-life situations. Top talent needs to be assigned a range of tasks which provide new experiences (…)*[1]
>
> *Jeff Welton, Managing Director at Verity International Limited, 2015*

The chapter in hand provides a consolidated overview of the research results achieved during the research journey. The comprehensive, multi-dimensional and longitudinal research results can be retrieved in the annexed individual publications. The following narration conveys a coherent synopsis of the results. These loop the research outputs by recalling specific research questions to a bigger interconnected and harmonised exposition of DM. Emergence, perception integration and exploitation of DM for SMEs success within the regional and smart specialisation context (Figure 7) are highlighted.

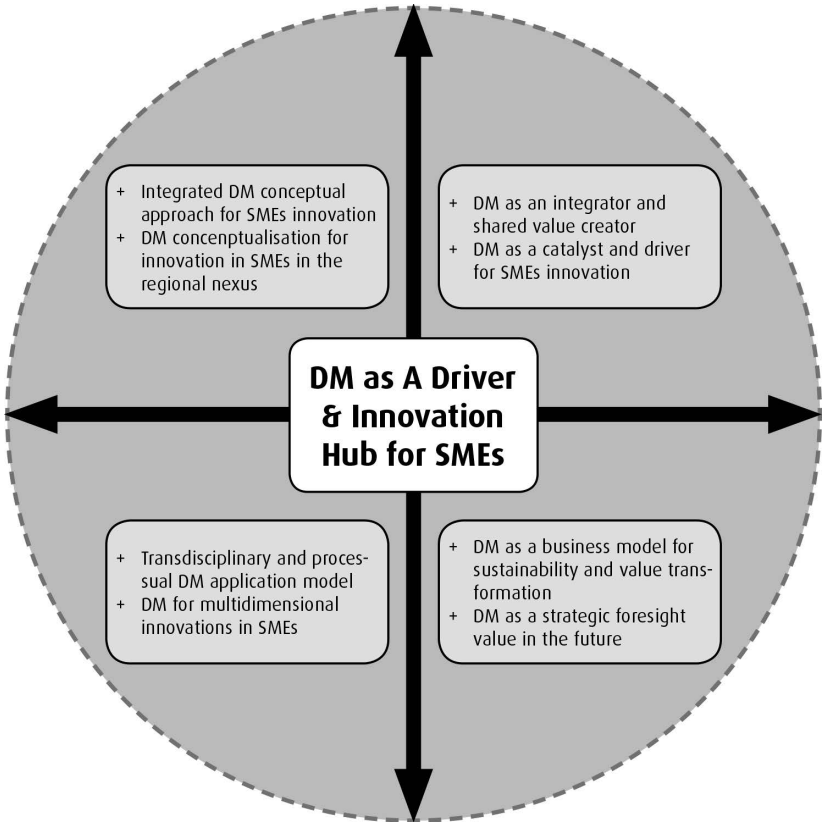

Figure 7: Consolidated doctoral research results map

Source: compiled by the author

[1] Adopted from http://www.verityintlblog.com/5-leadership-development-tactics-of-top-companies/, accessed on 15th May 2017.

The exhibition of the results is structured in a way to reveal the change achieved by this research measured against the state of play before undertaking this research path. In addition, synergies and mediating effects are displayed and discussed.

The **overall contribution** of the research can be accumulated under the umbrella term *DM as Driver and Innovation Hub for SMEs and province for regional innovation and specialisation* (Figure 7). Here, the **CRQ** is answered: *how to deploy DM for innovation in SMEs in the regional ecosystem addressing change and transformation process?*

Design can be integrated. DM can be conceptualised and modelled for innovation development and value creation. This is achieved by understanding, exploring and delivering DM as an innovation driver and a hub of activity on a regional scale. The response to this CRQ has delivered DM understanding, conceptualisation and modelling for SMEs innovation within the regional paradigm (top + bottom left plots, Figure 7). In addition, discovery and proposition of practical application scenarios and accounts for SMEs innovation are also unveiled (top + bottom right plots, Figure 7). Here, science and management contributions, on left and right side, respectively, coincide into the one domain called “hub”. The hub itself holds, connects and cross-fertilises each of the four individual plots under one roof.

DM as a driver can be conceptually understood as an ecosystem. DM is a platform for interactions, activities and collaborations among stakeholders involved in innovation development for SMEs in the given regional setting. The networking and integration functions are in this concept crucial ones. They were also addressed in the research problem and stated in the research gaps. Focusing on and positioning ecosystem approach within research and practice becomes inevitable in the transformation age. Thus, by providing this ecosystem perspective on DM, the present research enhances the marginalised field DM. DM is positioned as an ecosystem that leads to functional and strategic goals, as already echoed by respective scholars (Buchanan, 2015; Gardien et al., 2014a, 2014b; Walsh, 2000). In particular, the research results are therefore marshalled in two strands, thus mirroring contributions and implications both for science and business:

Consolidated conceptual results and implications:

(1) Synthesised and consolidated DM conceptualisation for innovation in SMEs business domain and entrepreneurial development path within regional scale.

(2) Transdisciplinary DM conceptual approach and model for better understanding of design driving functions and roles of design integration and utilisation within SMEs applications for exploitation of innovations.

Consolidated managerial results and implications:

(3) Practice-centred DM processual application model for start-ups and practices of SMEs in integrating design and creating shared values.

(4) DM as a business model to apply in ecosystems and contribute to a shared value creation enabling sustainable innovations in face of uncertainty, volatility and transformation.

3.1 DM conception in the nexus of SMEs and regional account

Addressing **RQ1** (*How to conceptually integrate design into management of SMEs in innovation development?*), DM integration within the SME and regional context requires clear and holistic understanding of DM. In particular, this implies a clear notion and definition of DM in the given setting. Further, DM can be conceptualised and integrated using step-by-step process during project development processes.

Within the research carried out it is argued that today the definition and thus conception of DM is highly multifaceted. Within the SME context, there is no explicitly existing DM definition that is not deducted and narrowed down from the large organisational scale applications. There is a missing definition that targets the SME sector, including start-ups, micro and small businesses that do act under different framework conditions compared to those of larger organisations. In addition, several existing DM definitions and conceptions are argued to be outdated. This is especially true taking into account the rapid pace of change in business and social ecosystems, increasing globalisation, digitalisation as well as market volatility and degree of uncertainty. It is because new areas of application entered the scientific and practice-oriented discourses and affected DM application in the business setting. Thus, the definitional background for DM is *an interdisciplinary, process-based approach. It links peculiarities of design process*, *where design is a driver for act and outcome and leads to success in entrepreneurial innovation and thus competitiveness and growth* **(publication I, III** and **V**).

By building upon this, the research yields that DM is perceived within SME nexus as a development process. Here, all the strategically essential methods, tools and resources are accumulated and deployed from the three domains: technology, business and design **(publication I)**. Furthermore, DM is an open process. It addresses enterprise issues related to all operational (product), tactical (business planning) and strategic (innovation development and growth oriented) settings. It facilitates and accelerates the achievement of the given task (**publication V**). It provides new development directions for enterprise from a strategic perspective. It acts as a key catalyst, driver and stepping stone for developing a new approach for the marketing strategy. It is based on a complex product and diverse internal and external stakeholders **(publication III)**. DM conception is driven by strategic and entrepreneurial intentions.

In line with Malone et al. (2003) and Brown et al. (2010), the researcher concludes that interdisciplinary approaches facilitate transdisciplinary actions, interactions and solutions. They combine knowledge, methods, tools and approaches from technology, business and design provinces. As a result, holistically, the researcher *defines DM as a management approach and tool based on interdisciplinary interactions that integrate action arrays of technology, business and design. Here, new ideas, forms, outputs and transformations – would it be product, service, organisational or marketing solution – are created through an aggregated processual approach going beyond interdisciplinary boundaries. This is followed by implementation and exploitation on the market. This, in turn, provides success and positive effects for organisations on operational, tactical and strategic corporate levels that account to economic, environmental, social, policy and cultural dimensions of evolving (eco)systems*.

The proposed definition clearly integrates with and accomplishes the existing notions of DM in the strategic thought (Brookes et al., 2011; Joziasse, 2000; 2013; Noble, 2011). It has found its application throughout the research of the author. The researcher underpins that the domain of DM implies a need for the integration of the strategic

thought inside organisations. DM is increasingly emerging and demanded. However, it is used to be edged away by design thinking approach. This is essential in face of rapid change, that, in turn, affects organisational culture and organisational responses to the change. Indeed, the DM conception goes beyond the design thinking concepts **(publication I)**. These are currently in fashion but are used more as a method. Here, the ideation process does not unveil how design integrates and operates during the implementation and exploitation on the market (Dorst and Hendriks, 2007; Price, 2016). DM definition is ignited and driven by design as a notion and construct. Design can propose any tangible and intangible value, because it serves as a tangible / intangible source and connector between creativity, i.e. generating new ideas and innovation and placing them on the market. Creativity is applied to all activities necessary to bring these ideas into use either as product, service or process innovations. This creates a value and enables organisations to differentiate and position of the market. Indeed, DM can be regarded as enabler, collaborator and leader within innovation.

3.2 DM Ecosystem for cross-sectoral exploitation

Taking into account **RQ2** (*In which way could DM be utilised for SMEs innovation in the digital transformation age?*) and **RQ4** (*How to unlock innovation potential by DM for the entire ecosystem of SMEs in a changing economic paradigm?*), design integration and DM potential utilisation on organisational interactions is expressed through the value attributes, as revealed by the research.

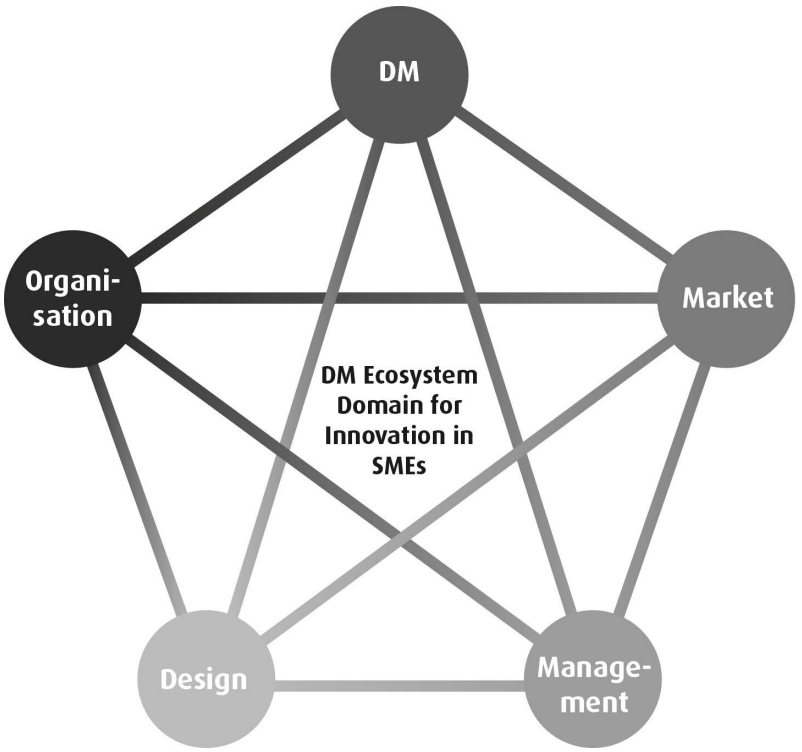

Figure 8: DM Ecosystem for Innovation in SMEs

Source: compiled by the author

Having scrutinised DM applications from the transdisciplinary and cross-sectoral knowledge absorbers and stakeholders' perspective **(publication I),** managerial **(publication III)** and longitudinal perception nexus **(publication V),** intensifying digitalisation (**publication II)** and transformation **(publication IV),** the conceptualisation of DM ecosystem is expressed through the following influence domains: (1) Entrepreneurial clout and (2) Regional clout.

As shown in the figure above (Figure 8), perception and integration of DM postulates an ecosystem which intertwines the following platforms or domains, namely:

(1) Design – creative attributes, capabilities, resources, methods and tools.

(2) Management – innovation, competitiveness and growth perspectives and strategic positioning through application of key management tenets to design.

(3) Organisational – inside-out perspective, DM absorption on organisation level (enterprise).

(4) Market – outside-in perspective, DM absorption and valorisation outside the organisation (enterprise).

In this regard, the platforms, as depicted in the Figure 8, are displayed as opposed to each other. They imply the opposition of the central meanings, e.g. design vs. management or organisation vs. market. DM enables to connect these platforms. This is done by design, which acts as an integrator and driver. Here, the link also emerges through conceptual design partnerships from the functional perspective with the domains mentioned above. The result thereof is a DM ecosystem and its domain available for actions, undertakings and other interactions.

In particular*,* within the *Entrepreneurial clout of DM*, the research expands the DM notion and clearly places it within the strategic management literature **(publications I–V)**. Next to this, the researcher underpins and redefines the conceptual partnerships coupled in a holistic domain of DM that drive SMEs and entrepreneurship. In particular, these concern a success on entrepreneurial scale leading to innovation, competitiveness and growth. For this, it is necessary to couple certain ingredients. The research concludes that entrepreneurial drivers, such as *opportunity recognition, uncertainty reduction, collaboration* and *integration*, need to be merged and embodied with the strategic impact determinants, which are *innovation* and *location, competitiveness* and *growth*. This implies also placing focus on complexity and increasing interactions that spur or might hamper innovations within a more enhanced scale – ecosystem perspective. Specifically, the researcher demonstrates that opportunity recognition and discovery should find their embeddedness in the domain of DM for SMEs.

As a result, a new opportunity or vision for SMEs can emerge **(publication I)**. With this insight, the research demonstrates and supports the arguing that opportunity recognition plays a crucial role for SMEs development path. Yet, much more important are the results in a sense that the research provides a processual or methodological tool how to discover and recognise opportunities. Namely, this was done through a step-by-step approach, which was utilised in an initial DM process concept **(publication I)**. Subsequently, methodological and opportunity benefits were confirmed within succeeding research **(publication III)**.

In terms of the *Regional clout of DM*, the first **(publication I)**, comprehensive **(publication III)** and aggregated **(publication V)** research results demonstrate that DM conception and its integration within the regional SME nexus is likely to be promising.

The applied DM processes in regional SMEs open up SMEs innovation and thus competitiveness and growth opportunities. As has been confirmed by the research **(publication III** and **V)**, all involved SMEs were capable to increase their innovation penetration. This resulted from the implemented DM application and embeddedness of DM concept within operational and strategic interactions.

The research yields that DM utilisation and potential are likely to be more necessitated in the strategic management field. It is because problems or challenges do concern the management province of the SMEs scrutinised during the research journey (**publication III)**. This also supports the claim that DM has been so far less used within the strategic domain, but rather was utilised within functional applications, i.e. to be used to improve aesthetics, form or appearance. This insight, in turn, supports the research output **(publication V)** that when utilised, DM is capable to contribute to strategic orientation of SMEs on the regional level.

By addressing operational, tactical and strategic levels of involved SMEs in an aggregate manner, DM is capable to equip with innovation potential. DM opens up ways to perceive and utilise innovation potential as well as to generate and capture innovation. As a result, SMEs get strong strategic support and new opportunities to differentiate and to diversify. This is a result of embodied DM conception and application. In this context, innovation emerges in the area of strategic positioning, customer value and experience-oriented innovation **(publication V)**. Indeed, this is in line with the scholarly insights (Holbrook and Salazar, 2004; Andersen, 2011). Innovation is key to competitiveness and growth.

3.3 Transdisciplinary, processual and integrated DM model

Next to the demanded DM conceptualisation, application and capitalisation in the regional SMEs context, the succeeding contribution touches upon the **RQ3** (*What would be conceptual mechanisms to integrate DM in SMEs innovation development as a process model?*). The response unlocks mechanisms and tools for DM integration into SME practices. It also traces different application patterns within micro, small enterprises or start-ups, thus also addressing **RQ5** (*How could DM become organisational management culture for different size SMEs in innovation development?*).

The pivotal contribution of the undertaken research lies in the following provision:

(1) Grassroots level DM conceptual approach for SMEs innovation (**publication V**)

(2) Comprehensive DM process model for SMEs innovations (**publication III**).

Both allow decomposition of SME performance areas, finding roots of value and tracing value creation. As a result, they can be transferred into the DM model earning twin-fold contributions and benefits to manifold stakeholders. The twin benefits are associated on the one hand with the DM concept that contributes to the current topical science and research. On the one hand, the developed grassroots level approach **(publication V)** and comprehensive model **(publication III)** enrich the highly marginalised DM research on DM application within SME performance domain (theoretical and science contribution). They also strengthen the importance of governance and policy participation in DM conceptualisation and application (dirigiste level). On the other hand, the developed DM comprehensive **(publication III)** model can be applied within the regional SME nexus as a tool. It is an efficient and effective means projected towards

developing innovations, increasing competitiveness and prospecting the growth (in-depth networked perspective).

In a transdisciplinary interplay of technology, management and design in an organisational nexus, DM plays different *functions* that can be ascribed both to design and management fields. Here, DM conceptualisation and applications come into light. DM acts as enabler, collaborator and leader within innovation (**publication II** and **IV)**. It also performs functions of mediation, driving forces, ignition, strategic positioning (**publication I** and **III)** as well as specific operational functions. These concern product and service scale or organisational and marketing (positioning) process related functions (**publication V**). It is a contributor to value generation (**publication II)**, a connector and a partner in innovation development process. It opens up horizons for innovation, competitiveness and growth. In this sense, design and management can be merged in a functional manner. Indeed, management is rather driven by the functionalist paradigm placing emphasis on objective views and structuration (Burrel and Morgan, 2017). Both can be also intertwined. Both analyse a socially constructed world with subjectivist assumptions of individuals and stakeholders involved in economic and social interactions. Further, both aim at explaining the social construction also by integrating the viewpoint of the directly involved.

In short, we can distinguish between three key attributes of the concept and models, namely:

(1) Transdisciplinarity pattern of DM developed concept and models.

(2) Processual pattern of developed DM concept and models.

(3) Integration pattern of developed DM concept and models.

With regard to the *transdisciplinary pattern*, the conducted research has merged the domains of technology, business and design into one. Because of this, it enables to grasp and benefit from the interdisciplinary as well as transdisciplinary opportunities. The research results do confirm the necessity to take into account and emphasise the transdisciplinarity issue. It can be argued that combination and integration of critical capabilities do promise a critical pace for innovation. These are inherent to specific organisational practices and activities and must be integrated with other crucial tools. They can be employed within different practices underpinning innovation emergence. Integration of heterogeneous capabilities and DM knowledge may therefore constitute a key to smart specialisation within diverse entrepreneurial practices and business development processes. This concern is especially topical in industry or business sectors, which are more technology-driven. They are likely to underestimate the potential of heterogeneous or interdisciplinary capabilities and skills.

Scrutinising the *processual pattern*, the research provides a step-by-step DM processual approach **(publication I)** concerning the DM process and its deployment from the problem towards a solution. Further, it delivers a consolidated DM processual application model. Both can be applied within SME nexus despite their allocation to any specific industry or business sector **(publication III)**. Finally, addressing the *integration pattern*, DM applications are coupled with the regional perspective of integration. Integration guides development of regional economic and social ecosystem.

The proposed models imply an amalgamated DM process. This integrates both inside-out (enterprise internal) and outside-in (performance on the market and externalities) perceptions. They provide a merged perspective for understanding ecosystems. They

imply recognition of opportunities for technology-led micro and small enterprises that usually do not possess the specific design knowledge, skills and competencies. Without them, they are not able to undertake DM application and its integration within organisational patterns.

3.4 Smart DM managerial application scenarios

Addressing **RQ4** (*How to unlock innovation potential by DM for the entire ecosystem of SMEs in a changing economic paradigm?*), the research conducted confirms that DM is changing its application perspective (**publication II** and **IV**). The research carried out reveals how design integration and thus DM can be deployed for strategic strength, i.e. as a business model for shared value creation. The following DM application scenarios were identified:

(1) DM as a shared value creator, which emerges once DM is perceived and used as a processual transdisciplinary and integrative tool (**publication II)**.

(2) DM as a catalyst for innovations, acting as communicator, connector, mediator, integrator and contributor to innovations **(publication IV).**

(3) DM as a business model in Industry 4.0 applications enabling adaptation of DM and its integration within the given ecosystem setting **(publication II)**.

(4) DM as a strategic foresight value in changing economic paradigm **(publication II** and **IV)**.

Both publications yield value design and design integration can create for smart manufacturing, smart products and services or other smart solutions for customers and consumers. Value creation through design within Industry 4.0 practices can be linked through design attributes. Design acts as a source of competitive advantage, knowledge, information, resource, capability, innovative and creative process. Design can be strategically deployed and exploited for product / service innovation. Strategic action of design within the business array can be delineated as a critical dynamic collaboration.

This occurs across operational and management practices of organisations or companies successfully utilising design capabilities. Indeed, design integration and its potential for value creation needs cross-cutting perspective. Establishing cross-linkage between design and business domain to innovation in Industry 4.0 landscape allows forging design-driven strategic orientation of enterprise. It also proposes a background to generate business models for enterprises aiming to catch up with Industry 4.0. This linkage also facilitates compliance with key tenets, such as operational efficiency, competitive excellence, smart and sustainable growth.

Finally, design integration and DM practices might affect not only the innovation dimension of entrepreneurship, but also concern the entire enterprise ecosystem (**publication IV**), where value creation emanates from design integration. It is not enough to rely on service design as a business model. There is needed integrated perspective on design perception within Industry 4.0 and smart enterprise in order to remain sustainable, resource-efficient and smart. Internal and external perspectives need to be combined, as the proposed business model implies (**publication II**).

3.5 DM as a business model for sustainability in ecosystems

DM is a valuable and sustainable business model in digitalisation and transformation. This issue was addressed in **RQ4** and **RQ5** and answered in **publication IV**. Multidimensionality of innovation and multidimensional innovations are key success factor in today's changing economic and social environment. This is also supported in the literature (e.g. Eckert, 2016). Multidimensionality enables organisations, in particular, SMEs to respond to the rapid pace of change, uncertainty, volatility and complexity.

Impact of design integration and DM is presented through four key enterprise layers: operational, financial, strategic and socio-cultural (environmental). They are considered within enterprise and eco-system (customer, users and network engagement). SMEs are not sustainable themselves, and the business growth is not sustainable because of aimed contribution towards sustainable acting and thinking.

Sustainability is expressed through tangible and intangible business outputs and is embodied within product, service or process domain of an enterprise. Innovation emerges from applied, new, modified or absorbed design knowledge, resources deployed, knowledge and capabilities utilised. Then, it is directly linked to development of the demanded product or service, which is exploited on the market by customers and end-users. In this light, innovation generation (conceptualisation) and its exploitation on the market are linked through key creative (design) innovation technologies. These directly refer to design, drawing, prototyping, visualisation and simulation. Key enabling technologies are also integrate. These link innovation generation and exploitation (production) via design.

The researcher argues that smart and sustainable growth can evolve and sustain when assuring balanced product, service or process development process. Being competitive does not automatically imply being smart and growing in a sustainable way. In fact, sustainability evolves through value creation and ensuring consistent value chain performance, i.e. value proposition for all involved actors. Sustainability embraces aspects of labour, environmental standards, etc. In this regard, values are affected in terms of social, environmental or labour-related settings and through two key functions within the value chain, i.e. rule-making and rule-keeping.

Design for innovation and growth unveils the key flagship words that share common recipients, such as stakeholders, customers, and users. Features, such as incremental process, need response, challenges and problems are also commonly shared. SMEs seem to have entered the success path in unlocking potential of design and its connection to innovation. Design aims at consumer satisfaction and company profitability through the creative use of major design elements, such as performance, quality, durability, appearance and cost. This is combined with products, environments, information and corporate identities. In a product, service or process development, design shall be intertwined with technology to ensure efficient and effective innovations.

4 DISCUSSING AND POSITIONING RESEARCH FOOTPRINTS

Design has been crucial and played major role during the human civilisation development and evolution of culture. This is marked by technological advancement and social evolutionism. Paradoxically, business, strategic innovation and organisational literature have neglected conceptual and meaning "partnerships" between design and business for innovation. This is evident during the last decades in practical business interactions. As a result, different "camps" emerged advocating for innovation on one or another side. In recent years, however, cross-sectorial discussions on innovation are gaining importance. In particular, an integral innovation approach of design and technology is considered as a key-driving factor for the economic grow and competitive advantage (Lüttgens and Piller, 2010). Design and DM are becoming a highly fashionable phenomenon and a must use tool. Nevertheless, this is mostly a case within the larger organisational scale. In addition, design and DM became more popular rather in global regions that show strong economic performance.

Shifting the perception on design integration and DM from the global towards regional scale, exploitation of DM shows diverse development patterns. Differences on DM usage also prevail by scrutinising the companies landscape, from large, over medium-sized and very small, mostly start-up enterprises. This is especially true in Europe, which is a word economic region and a macro-region. It is comprised of smaller regions merged by social, culture, economic or common development proximity. Some newly constructed or emerging macro-regions, like the Baltic Sea Region, are facing uneven development patterns based on a path dependency. This is especially true in innovation and utilisation of design, as well as for the SME sector – the backbone of the EU and thus regional economy.

Building upon crucial innovation policy accounts worldwide and in Europe, e.g. Global Competitiveness Report (2017-2018), Global Innovation Barometer (2018), EU EU Innobarometer (2016); Innovation Scoreboard (2017); Innovation Pillar 12th of Global Competitiveness Report 2017-2018, Global Innovation Index (2017) or Regional Ecosystem Scoreboard (2017), there is one common trend mushrooming here. Namely, in the addressed region along the Baltic Sea, innovation performance and innovativeness are changing. This happens despite the fact that the region is referred to as a flagship region in terms of innovation. In some countries as part of this region, innovativeness is decreasing or stagnating. When it comes to design integration and DM perception on the enterprise level in the region concerned, the reports send a rather negative signal. In sum, design is not integrated and especially utilised in smaller companies in contrast to their larger counterparts.

In order to change this development paradigm, a myriad of policy recommendations, roadmaps, strategies, actions and reports were published. These are concerned with the focus to strengthen design-driven innovation and thus DM (e.g. Action Plan for Design-Driven Innovation (2013), Design for Europe (2014), European Design Innovation Initiative, Design for Growth and Prosperity (2012), Horizon 2020 call "Capabilities for Design- Driven Innovation in European SMEs" (2015). All of them have called for stronger design integration and DM utilisation in the SME sector in order to improve innovation landscape on individual regions and in Europe.

In this light, the present doctoral thesis might be viewed as a blueprint contribution to the call and expressed demand on design and DM utilisation. This is noted within the European Innovation Policy that acknowledges design potential for innovations. The

thesis can be valorised in the DM development paradigm on the EU and regional level. It addresses and delivers ways on how to grasp innovation opportunities for SMEs on the regional scale. It can be regarded as a grassroots approach, which deals with the change of the current rather than of negative or stagnating pattern of DM utilisation in the SME sector in regions and in Europe. If not too late, this thesis provides models and frameworks at the right time. They can be deployed and fertilised for SMEs practices and SMEs that develop innovations. This can be ensured by using a simple integration logic coming from the regional integration literature.

In 2018, the European Union will take the stock of the Council Conclusions on cultural governance and implementation of design and creativity driven approaches. These concern the increase of innovation in the European Union, in particular, the utilisation of creative and design potential for other than creative industries (Council Conclusions, 2015/C 172/04, p. 13). In this, this thesis aims at breaking the silos and camps existing between traditional and creative design industries. They should rather integrate and utilise synergies for developing innovation driven by design. Design has been proved as a source of competitiveness. Now, it is about to show ways, tools and framework conditions on how this is possible to be realised.

From the scholarly perspective, the doctoral research takes a stronger positioning of DM within the research domain. The theme of DM for SMEs has been recently marginalised in research and research outputs. The theme was rather edged by overwhelming use of Design Thinking. Design Thinking conquered the science and management community as being good method to utilise design. Yet, in line with other scholars, the author claims that it is vital to focus on the management culture and establish DM as a practice within SMEs management. This is essential in order to integrate design and efficiently utilise DM. It is stressed that what is likely to be seen is to show how DM will be perceived within organisation in any given context (Cooper et al., 2009a, p. 51).

The research decreases the knowledge gap on design integration and utilisation of DM potential in the SME and regional context. This is done by positioning the research within the EU policy and governance paradigm (Bucolo and Mattews, 2011a, 2011b; Ward et al., 2009). Here, the policy and governance province are touched and integrated through real-life project implementation and evaluation of design integration and DM account. Only a few regions in Europe have design integrated into innovation policy on regional and local policy levels (Whicher and Walters, 2014). Furthermore, it diminishes the knowledge gap on providing framework and processual perspective, i.e. showing how and with which conditions and frameworks can design be integrated and DM exploited by SMEs (Dorst and Hendriks, 2007; Price, 2016). Portraying practical application of DM concepts through research projects is demanded (Acklin et al., 2006).

Since DM concerns the management side, it appears much more essential to continue this research stream. The context in which organisations will undertake management and utilise DM is likely to change, especially taking into account the current rapid pace of change through digitalisation, social and technological transformation. The research explored a marginalised ecosystem perspective. The light was also shed on the need to respond to the changing socio-economic and technological paradigm. This paradigm is characterised by digitalisation, changing environmental and social responsibility as well as technological specialisation. Here, design integration and DM in an ecosystem perspective are discovered as a conceptual turnkey for SMEs innovation and value creation. The nature of DM is interdisciplinary and crosses boundaries of different camps.

DM aims at integrating approaches from, on the one hand, design and creativity domain, and, on the other hand, management, innovation and organisational culture provinces. DM is perceived as a management culture of SMEs ecosystems, where design is integrated within SMEs management practices and organisational culture for the purpose of innovation generation.

The research bridges different development perspectives of DM. It also marshals DM within the longitudinal paradigm of socio-economic development – from industrial, over experience, knowledge and towards the transformation economic paradigm. In line with corresponding scholars (Buchanan, 2015; Gardien and Gilsing, 2013), this is an inevitable task for the researcher. We are faced with the rapid pace of change, increasing competition from overseas and among the regions. DM is placed within the future scenarios. The crucial question is and remains in the next future on how DM can drive innovations and propose functional and strategic qualities in and for transformation.

Taking this into account, the need remains to address intrinsic activities and processes. These are accelerated by learning and shared organisational values within organisational setting. These go in line with the external performance of organisations on the market. They concern especially tools, methods, activities, processes and frameworks. When integrated, they might lead to design orientation in organisations and drive organisational development and progression. In this sense, the light should be shed much more on constituting factors rather just using static statistical data. The same applies to general business assumptions that allow design-led value measuring. This can be associated with different business activities, performance, or even be generalised based on diverse development paths. This gives the floor for diverse interpretations. Despite the fact that scholars emphasise possible use of DM in three key patterns (service, catalyst for organisational change and strategic design thinking resource), little is known on what processes are to be followed. In addition, marginalised knowledge exist on what are environmental ecosystem framework conditions and enablers to be in place as well as processes to kick-start and accelerate that would lead towards value creation in internal and external nexus of organisational perception.

The research is in demand of a guiding tool that would open up a horizon of opportunities instead of narrowing down the success opportunities. By now, these come from general questioning and application of large organisational pattern to the SMEs context. Concentration on metrics does shed the light only on the one side of the coin of organisational performance. They are likely to be generated as a result of measured external performance (on the market). In addition, in order to advance entrepreneurship development and success in innovation, it is much more reasoned to provide these key success guidelines rather than metrics. It is believed and argued by the researcher that this enables to strengthen positioning in competitiveness and to enhance growth prospects. The researcher argues that the current value generation approach in the nexus of DM discourses constitute rather an ex poste evaluation instead of anticipated ex ante strategic projection pertaining to SMEs peculiarities and practices.

Indeed, DM conception and model developed presuppose the overall holistic coupling of internal and external perceptions and developments. They are looped into one DM application and exploitation domain. DM as it was shown, enables crossing the boundaries of the segmented performance patterns. Further, it allows gathering together business dimensions on internal and external organisational levels into a hub of interactions. When these are shared, they accumulate experiences of all involved stakeholders, activities and processes concerning product, service, organisational or

positioning patterns. The sharing of these experiences is enabled and held by DM, which acts as connector, communicator, mediator, contributor, value generator and integrator. It is a catalyst and a hub of SMEs future business and a strategic foresight in the face of increasing complexity, uncertainty, ambiguity, volatility and evolvability of new paradigms, mind-set and action space of (eco)systems.

Under the scrutiny of the above described ecosystem volatility, use of strategic thought and topical tools are therefore likely to exhibit a rationale and common thread for theory and practice. We must learn from and for the future, in order to better respond (Fahey and Randall, 1998). This bears a pivotal impetus for the researcher in her future research paths, that based on this present research deliverables, have been already projected.

CONCLUSIONS

The present research conducted claims to have both ***theoretical*** and ***managerial contributions***. The contribution to science and research communities lies in the *conceptualisation, application* and *validation* of the *conceptual approaches* and *processual models*. These are applicable in two paradigms – DM application in the present economic nexus and DM projection and strategic future foresight in the digitalisation and transformation age.

From the **science and theory contribution** perspective, the doctoral research explores an aggregated and consolidated DM conception (publication I). It discovers processual models (grassroots and consolidated) in strategic SMEs and entrepreneurial provinces (publication III and V). The provided tools are based on a novel coupling of the existing theoretical approaches and concepts pertaining to design, management and organisational domains. By linking up the conceptual attributes that are shared between design, management and organisational culture, the researcher constructs a feasible understanding, application and capitalisation of DM within the SME and entrepreneurial setting. This is done using the driving factor – innovation – as a common denominator and functional attributes of design. It is an essential contribution of the researcher, especially at this stage. During the last years of 2012-2017, there can be observed decreasing research interests on DM conceptualisation and application orientated to small business and entrepreneurial discoveries.

Indeed, the highest record of successes using DM can be traced back to large organisations – design-centric organisations, such as Apple, Coca-Cola, Ford, Nike, IBM, Herman-Miller, Procter & Gamble, etc. From the managerial side, design and DM have been notably utilised so far promising higher revenues, higher market penetration and overall better performance on the market. This is applicable to large organisations. Little is known on processes, tools or mechanisms that allow to achieve better performance, also internally. In particular, in the EU and on the European regional level, DM has been so far displaced by other theories and concepts aimed at innovation development or generation of innovation dichotomies. Yet, through shared practices and successes in large organisations and overseas, e.g. in Australia and the US, there has emerged a consciously increasing call to adopt DM practices also in the EU, in particular, within the SME sector. SMEs stand for the backbone of our regional and the EU economy. Nevertheless, in this context, we face the missing knowledge base on how SMEs can utilise DM tools and practices. However, tools and practices of large organisations cannot be easily transferred and adopted to SMEs.

In particular, the tools developed by the researcher have key strengths. They are associated with tenets that characterise the concept, such as transdisciplinary, processual and integrative perception. This perception, indeed, is highly demanded today and will be needed in the next future (Bucolo and Matthews, 2011a; Ward et al., 2009). With this, the doctoral research enhances the existing DM literature on SMEs. It provides with the concept and model that go beyond single discipline boundaries. They also address design integration and thus DM use from a processual perspective. Here, DM explores and shows the way on how design is used not only for the ideation phase, but throughout the entire development process. As a result, solutions are proposed for their exploitation in two paradigms – DM application in the present economic nexus and DM projection and strategic future foresight in the digitalisation and transformation age. Further, DM explores needs and challenges associated with evaluation of design and DM

in form of conceptual models. It shows how design could lead to success from a marginalised qualitative perspective in the European innovation policy and governance nexus, in line with Acklin et al., 2006; Whicher and Walters, 2014.

In overall, from the scientific point of view, the research is claimed to fill in the highly marginalised knowledge gaps in the DM literature. Here, DM is perceived as a concept, process model and framework. DM provides tools and checklists on how it can be embodied within business practices in the regional policy perspective. In addition, the current research contributes also by employing and strengthening the use of action research in the context of design integration and DM implications. The application of action research with direct participation of the researcher has been recently marginalised, as showed by topical scholars (Bucolo and Matthews, 2011b; Townson *et al.*, 2016). Action research is a practice-driven research approach. Furthermore, the DM conceptual approach and model integrate the logic of geographic location. This is novel in the given context. The research streams on regional development, regional integration and innovation as well as smart specialisation can be enhanced by and benefit through integration of DM logic into business interactions. These interactions take place in a certain geographical location or are bounded by geographic proximity (regions).

Moving to the pillar of **managerial contributions**, the fundamental practical contribution lies in the applicability and transferability of the developed DM concept and model. These concern SMEs, their business and entrepreneurial interactions both organisationally and on the market. These were practically applied to SMEs within the regional development projects. The results confirmed positive multiple implications for small businesses. DM can be deployed for innovation generation, strengthen competitive edge and provide with growth prospects. The applied DM concept and model were recognised and acknowledged by involved SMEs and entrepreneurs. They took part in the frame of the conducted action research, which served as a valuable tool to unveil any success potential. Managerial contributions are also linked to the policy implications. The developed concept and model in the frame of regional development projects found its application within the policy recommendations for regional stakeholders, regional SMEs and entrepreneurs. Opportunities and implications of the developed DM tools and their potential use within future business applications and development projects were brought to the light.

Indeed, DM concept and model can be deployed as a methodological tool for businesses of different size (micro, small and medium). It can be also used by individual entrepreneurs during their own development projects. It can serve as a means to arrive at a feasible solution by adopting a structured and segmented step-by-step approach ignited by a challenge, problem or opportunity identification. Managerial application scenarios of the developed tools can be diversified in the frame of this research. They can be transferred to other business, sectorial or regional setting that do face challenges or are on the opportunity discovery path. From the managerial perspective, DM concept and model provide with business modelling tool. During the research, the impact of DM as a shared value creator was confirmed. Value was proposed, which emerges, once DM is perceived and used as a processual transdisciplinary and integrative tool. In management of small business or entrepreneurial activities, DM can be employed as a catalyst for innovations. DM acts as communicator, connector, mediator, integrator and contributor to innovations. The recognition of the catalyst function, i.e. DM being a driving force and igniting development and innovation process, can be a crucial strength for business in competitive environment.

The argument for managers on DM strengths deriving from the developed tools lies in a practice-centred DM processual application and exploitation. Here, managers are a) unfamiliar with DM; b) managers are partly familiar; and c) managers are fully familiar with DM. The strength derives from provision with framework conditions, processual guidelines, checklists and tools to exploit design potential and its integration. These, in turn, can be adopted to the given business or environment setting. Positive implications of the proposed tools are also associated with the growing management need to respond to the changing technological, economic and social challenges. In the face of increasing digitalisation and intensifying transformation, DM can become a strategic tool. It enables to connect organisational and customer values and to arrive at smart and sustainable solutions that provide a shared value. Therefore, the suggested value map and key framework conditions that lead to success (publications II and IV) can be practically employed within business practices.

In aggregate, the present research enhances the existing body of science and management knowledge by introducing DM conceptualisation and modelling schemes for innovating SMEs. In addition, the conducted research amplifies the existing innovation theories by putting DM not only in the R&D basket but introducing it from the very first point of departure. It claims that design-driven innovation is a result of consolidated and interdisciplinary interaction along the entire innovation development process. From the managerial perspective, the research underpins the integration and utilisation of DM within the RBV and dynamic capabilities theory. Further, through this research, regional integration and innovation theories are supported with regard to the aim to increase innovation potential and utilisation in the regions. This is done by integrating DM, combining its key tenets and placing it as an essential driver at the core of performance. Finally, from the strategic management and future foresight scholarly perspective, the present research facilitates SMEs management and innovation development. Indeed, the research offers a novel view by combining strategic functional attributes of design and DM that can lend SMEs. Therefore, by establishing the key shared meaning and conceptual partnerships, DM is capable to bridge management and organisational perspectives within innovation on a regional scale.

Research limitations

The researcher was aware of her subjectivity and avoided false separations. The neutrality of the researcher was assured, since the researcher was not working for or involved in any SME that was part of the research journey.

In order to overcome the subjectivity, the researcher acknowledged this from the very beginning of the research rather than neglecting it. This was kept in mind, recalled and addressed in each step of the research. Furthermore, the observed DM practices and validation of design impact for innovation, competitiveness and growth is not free from limitations. The main limitation remains, however, with the sectorial concentration. When dealing with SMEs, the research focused on design practices within high technology driven or manufacturing SMEs. For this, it is necessary to continue the research in this field. This can be done, for instance, by undertaking sectorial comparative studies on how design is being integrated and exploited within different sector SMEs.

The research imprints are the most crucial step to successfully complete the research journey. They need to be fully integrated within the research community. The research imprints are also an input to progression, giving driving force and motivation to drill down to new unleashed observations that need further research account in the future.

FUTURE RESEARCH AVENUES

Forthcoming future research should support DM conceptual and model applications. This shall be realised by measuring design value and employing a higher number of SMEs cases. A quantified validation and development of Key Performance Indicators (KPIs) for DM models are then projected. Comparative and impact analyses should be done. They should unveil stronger sustainability perception after a certain time lapse on how the provided DM solutions work in SMEs. In this regard, the proposed DM model yields a practical contribution to the DM literature that shall be enhanced. DM can be efficiently implemented by means of different DM dedicated problems. In the future, there seems to be an increasing need to enhance this model. This is essential in other technology sectors, and especially with different size of enterprises. This is in line with the mentioned drawbacks in the SMEs sector in Europe, which constitutes the backbone of our economy. Indeed, this action could turn into flagship strength in innovation development and rational utilisation of resources, capabilities and competencies.

The enhancement of DM utilisation within the SME context from the regional nexus remains an essential research task. The objective is to increase the scope and scale of DM interactions within the DM regional maps. The researcher believes that generation of regional DM maps, comparative analysis on DM applications and implications would strengthen DM perception and penetration. This is applicable to both economic, policy, environmental, social and cultural organisational provinces. This would also contribute to and support implementation of the EU, national and regional DM related policy recommendations and actions. Once DM integration or multiplication of DM practices is ensured, a further step could be made towards DM clustering and DM applications. This would enable benchmarking against other clusters and multiplication of positive effects. In this potential proceeding research, Porter's five Forces theory and model could serve as a sound theoretical foundation.

In addition, the future research is partially projected. Recently, the researcher was approved as key leading author and researcher of the international team. The aim of this team is to implement an international project on cooperation between Creative and Cultural Industries (CCIs) sectoral stakeholders and traditional maritime and green sector businesses. The cooperation should facilitate a more intensive blue and green growth on regional as well as European level. Here, integration of creativity and design as well as DM conception and application models will be very valuable. They serve as a tool for interdisciplinary interactions emerging in the frame of joint development projects. As a result, the future research might underpin feasibility and long-term sustainability of the developed DM conceptual approach. It also might increase its application potential and thus expand the DM exploitation domain.

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Abstract
Design Management as A Driver for Innovation in Small and Medium Sized Enterprises

The nature of DM is interdisciplinary and crosses boundaries of different camps. They aim at integrating different approaches. On the one hand, these concern design and creativity domain. On the other hand, they refer to management, innovation and organisational culture provinces. In this doctoral research, DM is perceived as a management culture of SMEs ecosystems. Here, design is integrated within SMEs management practices and organisational culture for the purpose of innovation generation. Here, DM goes further than focusing on design support, design promotion or design intervention. These are mainly driven by the external design service providers, e.g. consultancies and government support. In contrast, proactive design approach is applied here that addresses exploration of design as a new paradigm and improvement of management with design knowledge.

In this light, the purpose of the present doctoral research is to provide an integrative approach. Here, design is integrated into the SMEs domain for innovation development on a regional scale. DM becomes an integrated management and cultural organisation practice leading towards innovation, competitiveness and growth. In addition, the research aims at reducing the addressed research gaps and positioning this DM research within the marginalised body of knowledge on DM for SMEs.

The originality of the doctoral research on DM lies in the fact that it combines DM perception, conceptualisation and exploration within two economic development paradigms. The former one refers to the current economic nexus and DM projection. The latter targets strategic future foresight in the digitalisation and transformation age. Further, the doctoral research is positioned within the highly prioritised European Innovation Policy domain. It links innovation for SMEs through design and its contributing qualities and functions. Design acts here as a driver, communicator, constructor, integrator value generator, integrator and leader. It is a catalyst and a hub of SMEs future business and their strategic foresight. The originality can also be linked with the real-life research site. It makes the research outputs more feasible and applicable. The research was conducted in the frame of real-life cross-border and international regional development projects.

Having set the aim and projected research tasks, research outputs and contributions were achieved using a thorough interactive research mainstay. Conceptual approaches and theories from the strategic and innovation management, regional ecosystem and innovation as well as culture organisational research streams were merged. This was done by using the common denominator – innovation. This was enabled due to shared conceptual partnerships between innovation and design. Then, design was deployed by integrating it from the functional side. Its contributions to innovation and its qualities were also taken into account. These concern differentiation, positioning, integration, mediation, coordination, transformation, sustainability and ability to respond and be proactive. The overall key and umbrella function of design served as a common ground, namely, design being catalyst and driver for innovation. Building on the strong established conceptual partnerships, the research was driven by the driven by the constructivist philosophical stance. The research addressed both science and management complex problems. It aimed at creating new concepts and models demanded and projected to solve real-life problems of SMEs in certain regions. There

was integrated an actors approach and research was driven by the action research, where the researcher herself participated in the real-life projects.

The DM conception, the grassroots and comprehensive DM processual models were delivered for both economic contexts through addressed and responded five research questions. Taking into account the research questions and the research gap addressed, the research was driven by a qualitative approach. The research response is a reduced number of missing conceptual and theoretical contributions in the field of SMEs and the regional context. This lack was addressed by both scientists and practitioners. Indeed, marginalised conceptual foundations justify the impetus to start with the qualitative approach, given the DM landscape and SMEs performance. This need is also reasoned within the European policy and practical business discourses.

The body of empirical data is characterised by a variation of methods and data sources. Using it, research not only delivers DM concept and process model for innovation in SMEs. The research also explores an empirical validation and practical verification of the developed tools. This was enabled in the frame of the real-life regional development projects. The developed tools showcase a high level of practical orientation, transferability, credibility and validity. The developed conceptual approaches and models have been tested, implemented and validated within SMEs management practices on the regional scale.

Overall, the research makes contributions to both science and management. The research explores and delivers an extensive state-of-the-art conception of DM. It takes into account the interdisciplinary, regional and entrepreneurial context. Further, conceptual approaches and models are delivered. From the management perspective, a practice-based and application-ready concept and model is proposed for SMEs, start-ups and entrepreneurs. They should streamline SMEs strategic, tactical and operational interactions. The researcher also proposes a business model and some matrices for SMEs. These might facilitate complicate innovation development processes or accelerate SME position and performance within the new provinces of digitalisation and transformation.

Keywords: Design Management, design integration, SMEs, regional ecosystem, organisational culture, innovation policy

Lühikokkuvõte
Disainijuhtimine kui innovatsiooni liikumapanev jõud väike- ja keskmise suurusega ettevõtetes

Disainijuhtimise (DJ) iseloom on interdistsiplinaarne ja ületab mitme valdkonna piire. Selle eesmärgiks on erinevate lähenemisviiside integreerimine, ühest küljest kätkeb see disaini ja loovuse valdkonda, teisest küljest juhtimist, innovatsiooni ja organisatsioonikultuuri. Selles doktoritöös vaadeldakse DJ kui VKE-de (väike- ja keskmiste ettevõtete) ökosüsteemi juhtimiskultuuri, kus disain on innovatsiooni soodustamiseks integreeritud juhtimispraktikate ja organisatsioonikultuuriga. DJ läheb siinkohal kaugemale disaini toetamisest, edendamisest ja sekkumisest, millega tegelevad peamiselt välised disainiteenuse pakkujad nagu konsultatsioonifirmad ja riiklikud tugistruktuurid. Vastupidiselt neile rakendatakse siin proaktiivse disaini lähenemist, mis käsitleb disaini uurimist uue paradigmana ja juhtimise rikastamisena disainialaste teadmistega.

Selles valguses on käesoleva doktoritöö eesmärk pakkuda integreeritud lahendust, kust disain on lülitatud VKE-de innovatsiooni arendamise haldusalasse regionaalsel tasemel. DJ saab juhtimis- ja organisatsioonikultuuri praktikaks, mis viib innovatsiooni, konkurentsivõime ja majanduskasvuni. Lisaks on doktoritöö eesmärk täita lünki teadusuuringutes ja paigutada see uurimus VKE-sid puudutavate DJ uuringute hõredale maastikule.

Doktoritöö originaalsus seisneb asjaolus, et see ühendab DJ tajumist, kontseptualiseerimist ja uurimist kahes majandusarengu paradigmas, millest üks on seotud praeguse valdava majanduskorra ja DJ rolliga ning teine strateegilise tulevikuprognoosiga digiajastul. Lisaks puudutab doktoritöö kõrge prioriteetsusega Euroopa Innovatsioonipoliitika valdkonda. See seob VKE-de innovatsiooni läbi disaini ning selle omaduste ja funktsioonide. Disaini roll on olla eestvedaja, suhtluse vahendaja, ehitaja, integraator, väärtuse tekitaja ja juht. See on VKEde tuleviku äritegevuse ja strateegilise prognoosi katalüsaator. Töö originaalsus on seotud ka praktilise uurimistööga, mille raames viidi läbi piiriüleseid regionaalse arengu projekte ja mille tõttu on uuringu väljundid lihtsamini elluviidavad.

Lähtudes püstitatud eesmärgist ja kavandatud uurimisülesannetest, saavutati uurimistöö väljundid läbi põhjaliku interaktiivse raamistiku. Kontseptuaalsed lähenemised ning strateegilise ja innovatsiooni juhtimise ja regionaalse olustiku teooriad ning innovatsiooni- ja organisatsioonikultuuri uurimissuunad koondati kasutades ühist nimetajat – innovatsioon. Selle tegi võimalikuks innovatsiooni ja disaini kontseptuaalne partnerlus. Seejärel kasutati disaini, integreerides selle funktsionaalset külge ja panust innovatsiooni ja selle omadustesse. Viimased puudutavad eristumist, positsioneeringut, integratsiooni, vahendamist, koordineerimist, transformatsiooni, jätkusuutlikkust, reageerimisvõimet ja proaktiivsust. Disaini võtmeroll oli ühendavaks jõuks, käitudes katalüsaatori ja innovatsiooni eestvedajana. Toetudes olemasolevatele tugevatele kontseptuaalsetele partnerlussuhetele, on uurimistöö ajendatud konstruktivistlikust lähenemisest. Uurimus käsitles nii teaduse kui juhtimise keerukaid probleeme ja püüdis luua uusi kontseptioone ja mudeleid, et lahendada teatud piirkondade VKE-de tegelikke probleeme. Uurimusse oli integreeritud osapoolte vaatenurgad ja see oli läbiviidud kui tegevusuuring, millest uurimuse teostaja ka ise osa võttis.

DJ kontseptsioon, põhialused ja üldised mudelid toodi välja mõlema majandusliku konteksti jaoks, kasutades viit esitatud ja ka vastuse saanud uurimisküsimust. Uurimistöö

oli ajendatud kvalitatiivsest lähenemisviisist, võttes arvesse uurimisküsimusi ja täidetavaid teadusuuringute lünki. Uurimistöö tulemiks on kontseptuaalsete ja teoreetiliste tööde lünkade täitmine VKE vallas ja regionaalses kontekstis, millesse panustasid nii teadlased kui praktikud. Puuduvad kontseptuaalsed alused tingisid otsuse alustada kvalitatiivsest lähenemisest, arvestades DJ valdkonda ja VKE toimimist. Selle vajadus on põhjendatud ka Euroopa poliitika ja praktilise ettevõtluse võtmes.

Empiirilist andmestikku iseloomustab meetodite ja andmeallikate paljusus, mida kasutades pakub uurimus välja nii DJ kontseptsiooni kui ka VKE innovatsiooni protsessi mudeli. Samuti tegeldakse välja arendatud vahendite empiirilise valideerimise ja praktilise tõendamisega, mis sai võimalikuks regionaalse arengu projektide raames. Välja arendatud vahendid on kõrge praktilise suunitlusega, ülekantavad, usaldusväärsed ja valiidsed. Kontseptuaalseid lähenemisviise ja mudeleid on testitud, rakendatud ja valideeritud VKE juhtimispraktikates regionaalsel tasemel.

Kokkuvõttes panustab uurimistöö nii teadusesse kui juhtimispraktikasse. Töö uurib ja pakub välja ulatusliku ja kaasaegse DJ kontseptsiooni, mis võtab arvesse interdistsiplinaarset, regionaalset ja ettevõtluse konteksti. Lisaks on esitatud kontseptuaalseid lähenemisviise ja mudeleid. Juhtimise seisukohalt on välja pakutud praktiline ja rakendatav kontseptsioon ja mudel VKEdele, idufirmadele ja ettevõtjatele, kes peaksid lihtsustama VKE-de strateegilist, taktikalist ja tegevuslikku suhtlust. Samuti pakutakse välja ärimudel ja mõned maatriksid VKEdele, mis võiksid soodustada innovatsiooni arenguprotsesse või kiirendada VKE-de digitaliseerimist.

Märksõnad: disainijuhtimine, disaini integreerimine, VKEd, piirkondlik ökosüsteem, organisatsioonikultuur, innovatsioonipoliitika.

Appendix 1: PUBLICATION I

Gerlitz, L.; Hack, A., & Prause, G. (2016). An Integrated Design Management Concept: Creating Innovative Space for Emergent SMEs and Value for Knowledge Absorbers. Journal of Entrepreneurship and Innovation in Emerging Economies, 2 (1), 1−18, (**ETIS 1.2 classification).**

Article

An Integrated Design Management Concept: Creating Innovative Space for Emergent SMEs and Value for Knowledge Absorbers

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Abstract

This article endeavours to place the integrated and trans-disciplinary theme of design management in the research domains of small- and medium-sized enterprises (SMEs). It contributes to our understanding of the value of the design-management-driven processes in SMEs, based on current cross-border practices observed across the emerging South Baltic Sea Region. Matching mature concepts of the research-based view of firms, innovation management and organisation culture with the emergent and increasingly advocated notions of knowledge, innovation and learning, absorptive capacity, competence-based view, strategic planning, entrepreneurial learning and training, this study covers various aspects of design management orientation in the domain of small business and enterprise development. The focus is on design management practices among small businesses and other design management absorbers and practitioners (students, graduates and start-ups) observed and investigated as part of the 'Design EntrepreneurSHIP' project carried out under the South Baltic Programme 2007–2013. This article validates an effective application of the conceptual approach to the design management conceptual approach to SMEs business practices and proposes deployment of this trans-disciplinary approach for individual and organisational learning and training as well as for organisational strategy development and operational decision making. This research article is of interest to various stakeholders interested in design management—students, academics, trainers and coaches and SMEs. The revised conceptual design management integration roadmap is likely to facilitate and streamline understanding construct of design management and its increasing recognition for business performance and strategy.

Keywords

SMEs, design management, design thinking, resource-based view, strategy, design management training

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Introduction

Emerging discourses on the influence of design, design management and design thinking for organisational performance, particularly for small- and medium-sized enterprises (SMEs), have found integration in various academic and research areas. There has been a dramatic development of configurations and approaches to trace key drivers and criteria for successful design integration in management processes. Causal links of design with business performance, innovation and strategy have recently seen an increasing interest in fields of marketing, strategic and innovation management, and organisational and entrepreneurial studies (Borja de Mozota, 2006; Buchanan, 1992; Kotler and Rath, 1993; Verganti, 2008).

Most research studies share the objective of scrutinising the impact of design management on enterprises and their markets, products and consumer orientation alongside their performance on the market and in terms of marketing strategy (Brown, 2008; Chiva & Alegre, 2009; Meier-Kortwig, 1997). Debates related to the implications on internal operational and business processes appear to have been marginalised in topical discourses. As a study by the German Design Council in 2010 shows, these process-based issues have considerable significance for enterprises. The study notes that design affects the return on investment positively through increased sale volumes, the launch of new products and a growth in the market share of a business. The study also indicates that the impact of design on cost saving, business process improvements and on sustainability is broadly underestimated by companies (German Design Council, 2010).

This article examines how an appropriately targeted strategic orientation of an SME, based on the development of three distinct capabilities and competences, can generate intrinsic and extrinsic values for it. The key objectives of the research are to demonstrate how design management processes in practice affect SMEs' organisational behaviour, business performance and strategy; why these processes are vital today in educational, training and business contexts; and what implications design management processes have on design management absorbers and practitioners, especially on learning and innovation across the emerging South Baltic Sea Region (SBSR).

The remainder of the article includes a literature review of design management research and the design-management-process-based perspective. This is followed in the second section by a detailed description of the methodology applied for the research. While the third section discusses the results of the cross-case analysis, the following presents the main implications of design management processes for small businesses from the organisational, business and strategic perspective as well as in terms of individual and organisational learning. The fifth section suggests a modification of the original design management concept for simultaneous business and educational/training purposes, as developed by Prause, Hack, and Maknyte in 2012. The article ends with concluding observations about the application of the design management process to SMEs and makes recommendations for research and design management practices in the future.

Literature Review

Design management is perceived as a development process, wherein all the strategically essential methods, tools and resources are accumulated and deployed from the three domains: design, business and technology (Prause et al., 2012, p. 441). Overall, design management embraces the development processes of an organisation or enterprise. This construct is likely to be referred to as a process involving diverse stages or transitions from one level to another, thus implying incremental steps forward or the

improvement of current practices. These transitions or gradual developments can generate innovations, and the processes themselves can be innovation-oriented ones.

The importance of a development process itself has been recognised in design-related discourses on *design thinking, innovation management* and *knowledge funnel* (Benkenstein, 1998; Brown, 2008; Brown & Wyatt, 2010; Martin, 2009; Schmitt-Grohe, 1972; Thoring & Müller, 2011a). Echoing Buchanan (1992), Rittel thought of new design methodology as a step-by-step model for design process being explored by many designers and design theorists, whereby the design process is divided into two distinctive stages, namely, problem definition and problem solution. Problem definition and problem solution embrace steps, phases or sequences that need to be undertaken in any process (Buchanan, 1992, p. 15).

Evolutionary, design thinking emerged to offer a new perspective on (design) management in 2000 and is referred to today in terms of a new business model for creative organisations. This concept stands for design processes encapsulating both project management tools and organisational capabilities (Borja de Mozota & Kim, 2009, p. 68). These tools, capabilities and techniques help to control and manage an organisation (Boland & Collopy, 2004, p. 17) or imply project-based work flow and mental processes in which design objects, services or systems, as distinct from the end result of products, are used by designers (Dunne & Martin, 2006, p. 517). The methods and insights of designers are employed 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, 2008, p. 86). Thus, design thinking is associated with processes, methods and diverse tools. It can be a discipline, a concept (Martin, 2009, p. 62) or a method itself (Best, 2011, p. 17; Plattner, Meinel, & Leifer, 2011, p. v; Thoring & Müller, 2011a, p. 1). Since 2000 onwards the steady growth of research on design thinking induced emergence of a research domain for scholars pursuing the role of design for organisations, such as business performance and projects (Borja de Mozota, 2009; Borja de Mozota & Kim, 2009; Brown, 2008; Brown & Wyatt, 2010; Dunne & Martin, 2006; Martin, 2009; Thoring & Müller, 2011a).

Conceptually, design thinking implies a process, a system of interfaces or intertwined processes. Scholars suggest that there are different steps within the design-thinking processes. As introduced by Brown (2008), design thinking encompasses (a) inspiration, (b) ideation, and (c) implementation stages (Brown, 2008, p. 4; Brown & Wyatt, 2010, p. 33). These stages cover all methods, behaviours and activities, which are necessary to define, and later, solve the problem (Best, 2011, p. 17; Boland & Collopy, 2004, p. 17; Brown, 2004, p. 22; Dunne and Martin, 2006, p. 512; Martin, 2005, p. 6). With an increasing reasoning of design thinking, researchers have made attempts to enhance the threefold conceptual structure. Dunne and Martin propose four steps within the design-thinking cycle: (a) generation of new ideas or abduction; (b) prediction of consequences or deduction; (c) testing of the ideas in practice; and (d) generalisation from the results or induction (Dunne & Martin, 2006, p. 518). Meinel and Leifer have introduced five stages of the design-thinking method, which are iterative: (a) (re)define the problem; (b) need finding and benchmarking; (c) body storm (ideation); (d) prototype; and (e) test (Meinel & Leifer, 2011, p. xiv). Thoring and Müller (2011a) plead for the adaptation of design-thinking concept, as employed at the School of Design Thinking in Potsdam (HPI D-School), and even go further in deconstructing it (Thoring & Müller, 2011a, pp. 2–3). Herein, initial stages of inspiration, ideation and implementation are divided into six steps demonstrating how best to (a) understand; (b) observe; (c) express points of view; (d) ideate; (e) prototype; and (f) and test. It is apparent, that this constellation of design-thinking ideas correlates highly with the original concept, as introduced by Brown.

A clear correlation with the process is also evident with concepts of innovation management, which entails processes and stages leading to innovations. As coined by Schmitt-Grohe, innovation emerges

from and can be traced by the following processes: (a) idea generation, (b) idea analysis and (c) idea implementation (Schmitt-Grohe, 1972, p. 52). Benkenstein has enhanced this observation by the so-called innovation funnel, which includes stages of (a) idea generation, (b) research, development and conception, (c) product and market test and (d) implementation (Benkenstein, 1998, p. 700). A conceptually similar model is that of the 'knowledge funnel' introduced by Martin (2009), who uses this concept in the context of design and design thinking. The knowledge funnel includes a process with three different stages—(a) mystery, (b) heuristic and (c) algorithm—which capture the movement of knowledge through the funnel. While 'mystery' conveys exploration of a problem by means of knowledge, the knowledge is transferred to a 'heuristic' stage, where it serves to narrow work and enable better management and decision making. Finally, in the algorithm stage, the knowledge is transformed into a fixed formula, and a complex problem becomes a simpler proposition (Martin, 2009, pp. 7–9).

Taking into account design thinking and innovation management approaches, it is evident that they share similar conceptual reference points. Indeed, they are more likely to differ in terms of terminology depending on the culture or context in which they have been applied.

In order to initiate organisational processes, it is essential to use knowledge and resources for the solution of problems ('wicked' ones, as referred to by Buchanan (1992, p. 15)). Such processes are not deployed only for problem solving. Indeed, in the past decade, methods, tools and processes addressed directly the construct of competitive advantage (Martin, 2009, p. 26; Borja de Mozota and Kim, 2009, p. 67) and/or innovation generation (Brown & Wyatt, 2010, p. 32; Buchanan, 1992, p. 10). All the three concepts are powerful tools contributing to strategy development and organisational changes too.

Going beyond these concepts, strategic planning and organisational development commence when certain resources, capabilities and knowledge have been applied. Recalling strategic and design management discourses, at the core of reasoning, is the application of resources and skills (innovation management) and knowledge including design thinking, innovation management and the knowledge funnel. In the context of strategic design management, two modes have been considered in elucidating the construction of competitive edge, strategy or innovations. The first was highly shaped by strategic management scholars, especially by the treatises on strategic planning, positioning and sustained competitive advantage, as developed by Porter (1991, 1996). The second mode evolved from the work of researchers on the concept of resource-based view (RBV) of the firm, which serves as a plausible point of departure for identification of strategic resources of an organisation.

Following Porter, competitive advantage derives from an organisation's activities in the external environment or in the market. How an organisation's activities fit strategically into the external environment or the market constitutes the creation of economic and customer value. Although Porter distinguishes between activities, skills and resources, which directly produce, market and deliver products or services and those that are required internally for planning or management, and are deployed to create value through the value chain, the focus remains on the external competitive environment (Porter, 1985, p. 35; 1991, p. 103). As a result, an enterprise gains a competitive advantage through fitting, for instance, its products, technology or marketing approach to the external setting (Porter, 1996, p. 70). Moreover, sustained performance is a result of relevant competitive advantages gained due to industry structure and appropriate positioning of an enterprise in an appropriate industry setting (Porter, 1991, pp. 99–100). Following Meffert and Burmann, the performance of an organisation is determined by the industry structure in which it is operating, and strategic behaviour within this industry (Meffert & Burmann, 2002, p. 38). Competitive advantage is, thus, shaped by external factors.

Despite attempts to adapt to external factors or to obtain a strategic fit to the external environment and the market, organisations have found it difficult to sustain their competitive advantage. As a reaction to such developments, scholars have made further attempts to define organisational success, performance

and the competitive advantage of organisations (Barney, 1991, p. 102; Peteraf, 1993, p. 187; Wernerfelt, 1984, p. 172). It was no longer enough to adapt to the external competitive environment and let the market decide what resources are economically relevant and a source of competitive advantage (Meffert, 2004, p. 297). Rather, it was necessary for organisations to recall the duality between the external environment or the market and the enterprise's internal resources, such as human, physical capital and respective capabilities (Wernerfelt, 1995, p. 172). The generation of those advantages is underpinned by the strategic use of crucial resources that are valuable, rare, imperfectly imitable and non-substitutable (Barney, 1991, pp. 105–106; Boxall, 1996, p. 65). By building upon the work of Penrose, Wernerfelt brought a new conceptual perspective into strategic management research on organisations' competitive advantage, thus laying a foundation for development and nurturing of the RBV framework. Penrose views a resource as a bundle of possible services, whereby a resource has to be acquired in order to obtain a service. Productive services or inputs derive from existing resources, and it is never a resource that is input in the production process, but only a service that the resources can render (Penrose, 1996, pp. 24–25). Following Wernerfelt, a resource can be anything that can contribute to a strength or weakness of a given organisation (Wernerfelt, 1984, p. 172). Strictly speaking, in the RBV resources are all tangible and intangible assets, capabilities, organisational processes, attributes, information and knowledge, which allow an enterprise to recognise and implement strategies that lead to organisational efficiency and efficacy (Barney, 1991, p. 101; Crook, Ketchen, Combs, & Todd, 2008, p. 1150–1152). More specifically, a resource is a tangible or an intangible asset and an input to production that an organisation owns, controls or has access to in the external environment (Helfat & Peteraf, 2003, p. 999). A resource can be categorised into many respects, depending on its level of observability or functionality (Grant, 1991, p. 119). An enterprise is perceived as a broader set of resources (Penrose, 1996, p. 77; Wernerfelt, 1984, p. 172) or as a bundle of heterogeneous resources (Peteraf, 1993, pp. 187–188). To underpin strengths through resources, an enterprise needs capabilities or the capacity to deploy resources. It gains capabilities within the organisational processes and uses them to provide enhanced productivity of its resources as well as strategic flexibility and protection for its final product or service (Amit & Schoemaker, 1993, p. 35), or as an ability to perform or coordinate a set of tasks (Helfat & Peteraf, 2003, p. 999).

Strategic design management research frequently addresses resources as intangible assets, such as reputation, information management system or trust and similar. Recently, intangible assets of an organisation are being also referred to as core competences or capabilities (Borja de Mozota & Kim, 2009, p. 67; Hoopes, Madsen, & Walker, 2003, p. 890; Porter, 1996, p. 70; Prahalad & Hamel, 1990, p. 4).

The design-thinking approach enables us to identify and effectively employ resources residing in the fields of design, business and technology. Indeed, within the boundaries of thematic research, we can find some attempts to conceive design as a resource. Borja de Mozota defines four characteristics to conceive design as a resource: (a) design as differentiator; (b) integrator; (c) transformer; and (d) a good business (Borja de Mozota, 2006, p. 45). By using design as an external resource, enterprises may develop external, market-based advantage to differentiate their products or services as well as to increase their value through branding and corporate image development. On the other hand by combining unique, invisible, difficult to imitate organisational processes and resources derived from design work internally, enterprises are capable of developing internal competitive advantage (Borja de Mozota, 2006, p. 46).

Design is a valuable resource, since it facilitates the creation of value by understanding a company's environment. Furthermore, it acts on the value chain of a sector by creating a new vision and reinforcing external coordination (Borja de Mozota, 2003, p. 94). Design may influence products offered by a firm giving them sense. Taking it as a source of making sense of things, design implies the conveyance of messages to the user, about the styling or form, the functionality of a product, service or process, and its emotional and symbolic value, or meaning. Meaning proposes to users a system of values by using

a specific language, such as signs, symbols and icons that deliver the message (Verganti, 2008, p. 440). As a result, design can be used as a resource in several ways: as a strategy, as a method, as a form of creation or styling, as an internal enterprise resource, or as a valuable knowledge and as a process applied in enterprises.

Methodology

This article follows a consolidated qualitative research approach encompassing empirical case study research enhanced by qualitative techniques based on experts' interviews and focus groups analyses. The case study approach or a case study method entails a set of procedures that are needed to do case study research. These refer to such activities as design of a case study, collection of data, analysis, presentation and reporting of the results (Yin, 2012, p. 3). The case study method is recognised as being appropriate for examining design management practices and their role for small businesses and other design management practitioners (students, graduates and start-ups), because case studies clearly illustrate the design-thinking practices, why and how design management practitioners cooperate in practice. Furthermore, case studies help to reveal key strengths and bottlenecks of design management processes in order to improve business performance in the future and to streamline design management application in organisational and business practices. This article sets out to examine the core research questions of how design management processes in practice affect SMEs organisational behaviour, business performance and strategy, why those processes are vital for business education and training programmes, and the implications of design management processes for design management practitioners across the SBSR.

The research objectives correlate with what is encapsulated in the notion of the case study research. Drawing on Yin (2009), the focus of the case study research is on contemporary phenomena rather than on historical events. Besides, it usually addresses questions of how and why and the researchers have little room to control events (Yin, 2009, p. 2). Furthermore, the case study enables the researcher to catch the particularity and complexity of a single case (Stake, 1995, p. xi). This research uses both single and multiple cases in order to reveal the complexity of design management practices. Stake calls this technique of research a collective case study (Stake, 1995, pp. 4–6).

The single case in this research is the EU cross-border project 'Design EntrepreneurSHIP—Integration and Education of Students, Graduates and SME's in terms of Industrial Design Management' as launched in 2011 under the South Baltic Program 2007–2013. The project implementation is divided in three milestone stages, one in 2012 and two in 2013. Due to the educational nature of the project, those three milestone stages are referred to as three training cycles. Each milestone stage or training cycle consists of three events: two training sessions and one creative mix meeting. The target group of all training events are students, graduates, young start-ups and SMEs. However, while students, graduates and young start-ups make up the participant groups in each training session implementing cases of SMEs, the SMEs benefit from the training sessions because the case-related problems are solved for them. For the purpose of the research, emphasis is placed on two milestone stages 2012 and 2013, with each stage involving two training sessions. The implications for design management practices in the SBSR from the first cases were the focus of the first research exercise (Prause et al., 2012). However, the first investigation was limited because only the initial results were available from July 2012. This is because the cases were completed within the third milestone stage event in September 2012. This turn out of events hampered an in-depth exploration. As a result, the first paper (Prause et al. 2012, p. 453) could reveal only basic implications for design management practices.

This research takes a step further and is based on a full set of cases implemented in 2012 and 2013 within the overall framework for the project. Therefore, this research constitutes work on collective case studies, since a number of cases are examined in order to trace and evaluate a particular phenomenon (Stake, 1995, p. 4), including design management practices as undertaken in SMEs and by other practitioners or knowledge absorbers. Drawing on Yin, those single cases from 2012 and 2013 constitute a multiple-case study approach within the same context (Yin, 2009, pp. 46–52). The cases employed are exploratory and explanatory ones, since they serve to elucidate the questions of 'how' and 'what' (Yin, 2009, pp. 8–9). To avoid possible confusion with regard to a multiple-case study approach, single cases (provided by SMEs) are called as SME cases, whereas the training session itself is recognised as a training case. A respective project milestone stage (training cycle) is interpreted as a collective case. A comprehensive outline is presented in Table 1 below.

Table 1. Body of empirical evidence

Collective Case	No.	Training Case	No.	SME Case	No.	SME Scope
Training cycle	1	Wismar, 2012	1	Propose a marketing strategy for technology-intensive SME	1	SME 1
		Gdynia-Stockholm, 2012	2	Redesign the blades in a product line	2	SME 2
				Technology change in the heat recovery system	3	
				Enlargement of air conditioner and ventilation power	4	
				Re-launch of communication strategy of the product on the market	5	
				Development of new markets for the product	6	
Training cycle	2	Rostock, 2013	3	Developing a canopy concept for an office building	7	SME 3
				Design of detached front entrance of an office building	8	
				Design of external lift staircase outside an office building	9	
		Gdynia, 2013	4	Design of a paddling with seat as bathroom equipment	10	SME 4
				Design of sink as bathroom equipment	11	
				Design a set of exhibition stands	12	
				Design of a set of sunbed and terrace table	13	
				Design of hanger for clothes	14	

Source: Design EntrepreneurSHIP project.

We provide brief case descriptions, as they are discussed in the results and implications sections. Since the project itself and the implementation of the design management concept (Prause et al., 2012, p. 442) is more experimental in scope, the number of SME cases deployed in the respective training sessions varies. This is especially obvious in the Wismar and Gdynia-Stockholm training cases, as scheduled in 2012.

All training cases from 2012 and 2013 are practice-oriented. They are built upon real-life cases from four SMEs, each of whom participated in a single training session. These real-life SME cases are recognised as very important in the educational and training context, since they allow for better observations of real, instinctive processes undertaken by both participants and SMEs including the exploration of organisational and participatory behaviour. Beyond this the SME cases represent a broad spectrum, both in terms of operational fields of SMEs, problem complexity and scope. It is worth mentioning that despite the varying specification of SME cases and the diverse sectors they represent, nearly all cases elucidate similar design management patterns, problems and observations.

Our research rests upon the depicted set of cases and accompanying data sources that were analyzed by independent researchers. One researcher acted as an expert and a coach within the single training cases and counselled participants' groups within the design management processes to ensure the realisation of SME cases. The other two undertook more work by way of observations. Hence, contentions, perceptions and claims in the article at hand combine internal and external views, and the direct insights gathered through participation in participant teams' work together with indirect perceptions derived from observation of SME cases' implementation activities and the behaviour of design management practitioners. The results from the SME cases and multiple data sources are showcased according to the processes or stages, in accordance with the applied concepts of design thinking, innovation management and the knowledge funnel.

Results from the Cross-Case Analysis

From the consolidated point of view, all the explored 14 SME cases manifest design management processes, although the scope and manner of these processes vary from one case to another. The design management processes are disaggregated to sub-processes or stages for an extensive form of presentation. The analysis rests upon the stages as introduced by Plattner, Meinel and Weinberg (2009, p. 113) on approaches to design thinking. The additional reasoning behind this choice is that the educational context in which these stages have been applied are similar to this research case study and the setting of the projects.

Stage 1: Understand. This stage differs across the SMEs and SME cases. Whereas SME case 1 is very complex and implies extensive understanding, communication bargaining and consensus finding by participants, a more structured way of understanding is evident in the cases of SME 2–4. This is a natural outcome of the different scope of design management premises. While the SME case 1 stands for the whole SME with its organisational, strategic and operational structures, the rest of the SME cases are based on a certain SME structure. In the former, the preconditions for understanding to take place subsume the more complex tasks of the case. The task of analyzing this SME, its organisational structure and performance in the fields of design, management and technology seems to be too complex for participants and requires intensive new knowledge to solve this specific task. Since SME 1 is a specific technology-led enterprise, participants need knowledge on specific technology-intensive resources of this SME, even more because most of the participants are from design and management disciplines. In

this regard, a comprehensive analysis of the SME is subject to the high individual absorptive capacity of participants and their ability to recognise the valuable resources of the SME. This helps to redefine the existing ones or define the new ones and apply them for the purpose (task), namely, the development of a concept for an interdisciplinary marketing and brand strategy with a focus on product and its quality. The participants need to absorb new information from the three fields, which on internalisation are capable of generating commercial profits (Cohen & Levinthal, 1990, p. 128). This information refers to such physical and invisible assets as product, management structure, customer value, internal information and external communication management system. Thus, the task given to solve the case becomes very challenging for participants. It is what Martin calls a 'mystery' of phenomena and comprehensive information that the participants have to deal with (Martin, 2010, p. 39) as part of the exercise.

When we compare SME case 1 with the SME cases 2–4, it is clear that the understanding processes are less confusing. In these cases, first-level understanding is available for the participants in the form of the perception of an SME itself (case 1) or familiarisation with the SME cases (SME 2–4). In this case, no desk or field research was conducted.

SMEs 2–4 provided participants with the clear cases they want to be realised. Therefore, the briefings of cases were offered to the participants as guidelines, and the understanding process was more structured. Furthermore, the absorption of the knowledge on cases and the key resources of those SMEs were managed effectively, as the SMEs pinpointed these themselves. They include physical resources such as products (SME 2, e.g., heating products, SME 3—steel buildings and SME 4—bathroom polymer manufacturing technology) or organisational capabilities such as strategic planning (e.g., SME case 6) or organisational culture (SME case 5).

Stage 2: Observe. The design management processes in SME case 1 leave extensive room for the case approach by participants, in the observation stage. Consequently, a form of iterative questioning of the SME 1 on the technology used and its relationship with product, customers and marketing strategy was developed. Very complex tasks that have to be actually understood at stage 1 are redirected again to both the SME representatives and the coaches of participants. In turn, this results in redundant discussion of the resources and capabilities in the fields of design, business and technology. Paradoxically, and at the same time, it raises issues about the necessity for intensive and individual counselling of participants in terms of solving case-related problems (interim feedback sessions).

Similar observations were made in the Training Case 4 (Gdynia, 2013). Participants require more in-depth information on the material used by SME 4. This results in the repeated interviews of the SME representatives to clarify the material itself and its processing methods. In this case, tacit knowledge from the SME is needed to increase knowledge absorption by the participants, and instrumental knowledge from the coaches is necessary to show how to deal with the new knowledge and to decompose it. Since SME 4 has been utilising a new solid surface material, Corian, to produce interior design products, there is a need to particularise this issue more intensively. We find cases 12–14 in which the SME targeted solutions by participants for the development of exhibition stands set, sunbed and terrace table and hanger for cloths, to be particularly obstructive.

Stage 3: Analysis. In order to move forward with the analysis of the cases, all the participants from 14 cases had to consult diverse data sources to comprehend the tacit knowledge assimilated in the understanding stage. Participants conducted in-depth analysis based on sources from books, articles or websites. This step is especially time consuming for SME case 1 and the SME cases 2–4, 7–9 and 10–14 because of missing technological knowledge of the participants. Most of these participants were from design and management disciplines. Due to the absence of engineers in the groups they are limited in their ability to overcome technological problems, especially the identification of the technologically

valuable and rare resources of all the four SMEs. Besides the resources themselves, the participants focused also on the organisational capabilities and considered ways in which the SMEs could employ their resources (Helfat and Peteraf, 2003, p. 999). This is possible through, for example, marketing strategy, changing of customers' target group (SME case 1) or, for instance, organisational culture, corporate design (SME case 5) and managerial skills (SME case 6). These are regarded as core competences, as identified by the participants, since, they open up the potential for accessing a variety of markets (Prahalad & Hamel, 1990, p. 7).

In addition to the internal perspective, which includes identifying SME resources residing in the design, business and the technological realm, the participants explored the external factors of influence, and the environment in which the products or services of the SMEs have been marketed (SME case 1), valued by customers (SME case 1) or were ready to be launched (rest of the SME cases).

Stage 4: Point of view. In exploring SME cases, a certain dichotomy showed up. As elaborated by Plattner et al. (2009), this stage implies a certain problem. However, depending on the point of departure, which could be a given initial situation, it is not necessary for a problem to be derived from the understanding, observation and analysis steps. In the SME case 1, it is an opportunity, a way or idea formulated by the participants rather than a problem or a target as formulated by SMEs 2–4. It is 'something' formulated by the participants based on what they have reacted to (Brown, 2008, p. 4). The participants make their formulations resting upon key statements of SME 1, which imply core competences of this SME. For instance, a core statement of the SME 'fire prevention' was understood, assimilated, analyzed and transformed into 'fire control' in the subsequent stage. An opportunity was transformed through recognising the core statement of the SME 1 'safety and control' measures, interpreting it and redesigning the target customer group, thus providing a new opportunity or vision for the SME to target specific customers first. Other solutions of the SME case 1 elucidate problem formulation and solution through communication channels. This is what Martin calls a 'heuristic' way of proceeding or guiding towards a solution by way of organised exploration of the possibilities available (Martin, 2010, p. 38). Again, an organised exploration of those possibilities can be considered by taking an SME as a bundle of resources, capabilities and competences. This bundle can then be analyzed and evaluated according to their economic value and for the efficiency of the SME, choosing the attractive ones, which by virtue of their preferential status, help to generate profits (Hoskisson, Hitt, Wan, & Yiu, 1999, p. 438). Participants are able to synthesise the analyzed information and apply new knowledge absorbed through filtering and rearranging the resources, core capabilities or competences. Hence, the participants in these three cases of SME 1 are able to filter the most valuable, rare and heterogeneous assets (Priem & Butler, 2001, pp. 24–25) and to build upon them their ideas (solutions). In this particular case, they are the intangible assets or core technological or informational competences, such as control, safety or communication means of the SME. In contrast to the SME case 1, the *point of the view* stage was less distinctive in the cases of SME 2–4, mainly, due to the pre-defined nature of the cases, where the SME targeted a new product development, product change (Gdynia-Stockholm 2012 SME case 4 and Gdynia 2013) or a design-immanent solutions in accordance with the prevailing technology (steel) (Rostock 2013). Thus, here the point-of-view stage does not occur, as the problems and targets are given by the SMEs, with no reflections on user's (SMEs') needs being required to be formulated.

Stage 5: Ideation. This stage merges with the prototyping stage. All the potential ideas are already distilled, and multiple options and alternative visions are rejected based on the collective tacit and interdisciplinary knowledge, as in the brainstorming sessions of participants. Here, at the core is the maturing process of the idea, and the definition and specification of a problem solution or opportunity or target. In this particular stage, an idea, problem, opportunity or target is embedded into the respective context and fleshed out explicitly, enabling the search for a solution and the simplification, structuring,

contextualisation and codification of that solution (Martin, 2010, p. 38). In this case, this process is dependent on the degree of the SMEs access through, for instance, visualisation means, and corporate culture metrics. This stage might refer to a stage of prototype building.

It is evident that depending on the individual inputs to the solutions by the participants, namely their individual human capital resources (knowledge), the solution to the problem or the identification of opportunity, participants come up with a variety of solutions. We find this in the case of SME 1. No clear structure is adopted and there is no balance between the design, business and technology fields within the SME. A targeted output is design-led solutions with the implementation concepts within the pre-defined financial range. As a result, this transforms design management processes into design marketing. By contrast, with respect to SME case 1, participants develop five independent solutions, even though the solution process was difficult, and time and resource-intensive. An important consideration in this particular case is the set of iterative feedback sessions, especially, as participants' groups have developed multiple or alternative ideas, and had to be directed to or counselled in simplifying and distilling them or redeploying them to obtain a clear focus. Since there are no given parameters by the SME 1 (targets, cases pre-defined, etc.), a high level of freedom within the design management process yields unexpected results. The SME case 1 overstretched the participants due to the missing skills in the field concerned. This problem results in the quality of the design management processes aimed to deliver plausible solutions, ideas or opportunities, being compromised.

In contrast, the SME cases from the training case 2 (Gdynia-Stockholm, 2012) indicate that extremely structured tasks, such as the provision of the participants with the cases to be solved by indicating a clear problem, target and financial limits, can facilitate timely design management process itself. The participants are able to finish their search for findings in a given time frame. Although such a structured setting, as in the training cases 2–4, facilitates the absorptive capacity of the participants in proceeding to the development of a solution, it reduces a potential of the solution. To exemplify, due to their unfamiliarity with the physical tangible resources in the training case 4 (Corian as a solid surface material) as well as limited financial resources (given price range), the participants fail to arrive at a plausible solution. As a result, developed solutions in the frame of the design management processes are likely to be new or innovative ones. Moreover, due to the very precise structure to be followed and the given setting (SME targets and problems), the participants do not manage to step out from this setting. They come up with more problems than solutions during the design management processes that, in turn, exacerbate the problem of finding the solution. Ideation results are, however, very extensive and differ across the single training cases.

Stage 6: Test. In this design management process step, the developed solution is taken back to the users to gather their feedback (Thoring and Müller, 2011b, p. 2). In the present context, outlined solutions (product, strategy or brand) were presented to the respective SME to obtain their feedback and points of view. This step was conducted in the form of a final presentation given to the SME. After the testing of respective solutions, some of them were very positively perceived by the SME representatives and shown to have scope beyond the project and the context of the training case. Within the SME case 1, the SME managers decided to build up their target group, as proposed in the participants' group presentation. The rest of the SMEs also mentioned a great potential for some of the ideas or solutions and their possible application in practice. Moreover, in the training case Gdynia 2013, the SME representatives articulated their interest in hiring some of the participants—designers. This shows clearly that the SME case 4 acknowledged the important role of designers within the whole design management process, especially their human capital or the individual capabilities for deploying design skills. This suggests that the design management processes do affect SMEs behaviour and, potentially, their future strategic, organisational and operational decisions, which can be processed with design management tools

(interdisciplinary methods, step-by-step analysis and the incremental mode of development). In this way, management processes become iterative and can affect path dependence in the entrepreneurial context, if applied regularly. This is a promising deductive clue.

Discussion

In this section, we discuss the implications of the design management processes in the context of business practice and education and training.

We contend that design management processes influence SME behaviour, individual learning and training capabilities. It is argued here that the design management application as a process facilitates, first, the way of building up capabilities and competences in the field in which it is performing, perhaps less effectively. This field could be a design, business or technology field. As is evident from the cases, where the SMEs are technology-intensive manufacturing enterprises, the most developed structures, or the sphere of activities, reside in the management domain. Owners are frequently managers (especially in SME 1 with few employees) and do possess mostly management and business skills and competences. Owner-managers' skills are, however, not efficient enough to accelerate organisational development (internal capabilities, competences) or external perception and positioning (customers, brand and behaviour on the market). In this sense, all the four SMEs involved have an unbalanced distribution of competences in the fields of design, business and technology. The most flourishing domain still remains business or management with the exception of the Training Case 3 Rostock 2013. In the SME case 1, the solutions as developed by the participants address design-immanent constructs, methods and tools, such as building a brand by creative corporate culture or new communication means. Solutions also cover strategic management structures of the SME and tackle managerial activities and competences that are needed for better SME marketing and position or branding. The other three SMEs have a different challenge in the deficit in capabilities and competences in the design field. This can be justified by the fact that SME 2–4 formulated for the participants such SME cases that pertain solely to the design domain. This implies that those SMEs view their competence deficits in the design fields, such as in the 'redesigning of the product' (SME case 2), or 'designing bathroom equipment' (SME case 10 and 11), and other related or similar competences. Large enterprises usually possess independent design management and technology structures such as design departments, and a management board. SMEs, and especially the small ones, rarely have a structured organisation. It is rational to assume that when established, small enterprises are likely to gain economic value from sales and distribution of products or services requiring technological inputs, they do not demonstrate competences in the field of design. Subsequently, the focus usually shifts to the design field. For the strategy of the SME, it is necessary to develop all the three fields (design, business and technology) and the capabilities or competences to deploy the resources residing in those fields.

Second, design management processes are likely to increase SMEs organisational, operational and strategic performance. In exploring the SME cases, we observed that the operational design management process reduces production costs. For instance, in questioning, finding and identifying resources and core competences of the SME 2 in the fields of design, business and technology, participants came up with a surprising solution. They did not follow the way the SME wanted to be pursued, namely to redesign the airflow blades in a product line (SME case 2). On the contrary, they changed the problem formulation: removal of the blades from the product was a result that was actually needed. Thus, a new product impressed with its simplicity and rectilinearity. In this case, the design management process

enabled the firm to rethink the product and its perception from the design (appearance and use value), business (marketing and customer view) and technology (back to the traditional form) perspectives and to arrive at a solution, which enables the SME to save costs in removing the airflow blades from the air conditioner. Taking those examples, it becomes evident that at the core of the new innovative solutions for an SME are open process-based design management processes integrating all the three domains of design, business and technology. Strictly speaking, a less controlled process leads to more innovation. In the training cases 2–4 what resulted from the processes is that too much control leads frequently to the rearrangement of the initial problem.

Strategically, the design management processes as implemented in this project demonstrated to the SMEs where there is a potential for market penetration or a new niche through, for instance, new definition of the target groups and the respective individualisation of the product.

Organisationally, as the SME case 1 demonstrates, due to rethinking of the SMEs design, management and technology structures, SMEs owner-managers become aware of the problems they face. Hence, changes in the SMEs organisational culture, streamlining management capabilities and optimising the product itself and its positioning, are high on the agenda of emerging businesses. Additionally, a constant and integrative process-based scrutiny of design, management and technology structures enables better organisational performance and paves the way for the emergence of a brand, which is based on an appropriate combination of resources (Meffert and Burmann, 2002, p. 39). Brand is a result of some attributes pointing to a particular product or service and implies creative, business and technological attributes (Hack, Prause and Maknyte, 2012, p. 145). Here, it is argued that from all three fields, embracing resources, capabilities and competences of an organisation can help to achieve the most promising result—a brand having multiplayer effects for SMEs positioning, differentiation, better business performance and increased market share (Prause et al., 2012, p. 442).

In terms of the participants, design management practices do correlate positively with the educational and training environment. The intensive interaction with the SMEs cases and different approaches applied in the training cases (either design-led process and design tools or a management-driven process and management instruments) open up the participants to a new environment where design management practices may evolve and result in feasible solutions. An important clue is that design management processes underlie an integrative approach combining the domains of design, business and technology, incorporating resources and capabilities of designers, managers and engineers. It is an interdisciplinary working approach and a unified working language. As SME case 3 shows, missing competences in engineering in dealing with a technology-intensive topic has generally led to failure in the entire problem-solving process. In other cases, however, although solutions were delivered, missing technology competences did hamper continuation of the design management processes. As a result, participants in the training cases 2012 and 2013 were able to recognise the importance of an interdisciplinary approach for a harmonised design management process.

In summary, this project-based experiment clearly demonstrates advantages for both SMEs and participants. For SMEs, the design management processes enable the establishment of an interdisciplinary strategy, reengineering of their structures and the expansion of their potential. For participants, processes are conducive to understanding the challenges of interdisciplinary work in SMEs, building up the capacity to work in an interdisciplinary setting and understanding the different language, tasks and methods of the designer, the manager and the engineer working in the same environment. The results are depicted in a more distinct way in Figure 1.

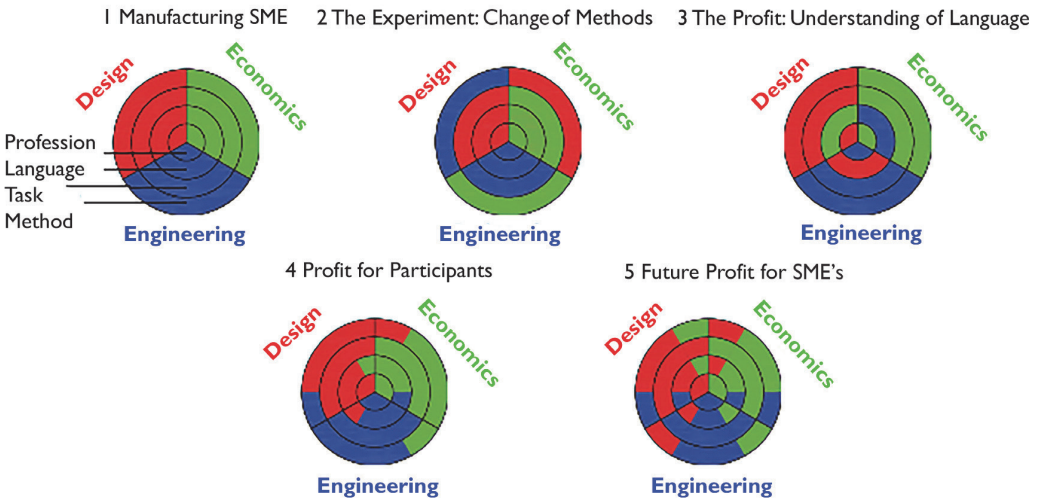

Figure 1. Design-management Process as an Experiment

Source: Authors' own.

Concluding Observations and Implications

Although the design-thinking concept with its six stages (Plattner et al., 2009, p. 113) enables decomposition of the design management processes in most explicit ways, it is argued that this concept works well from a theoretical and conceptual point of view. In practice, some of the stages do occur simultaneously or are combined. In some cases, no separate processes were identified. Therefore, activities typical for the ideation stage, such as questioning SMEs (customers) of the solutions to be developed by the participants, or interpreting results, were accumulated already in the preceding step of observation, where all potential analyses of knowledge were conducted. This is evident also in the cross-case analysis. Based on the empirical inquiry, the article contends that for practical purposes (for both SMEs and participants) the design management concept as applied in the training cases is the most suitable way of developing process or project-oriented activities. A comprehensive empirical body (14 SME cases) enabled us to undertake a more in-depth analysis and to propose some slight modifications to the design management concept, which are presented in a consolidated form in Figure 2.

First, (as apparent from the available results), in contrast to previous research, we claim that a design management process starts not only at a stage of problem identification or targeted opportunity formulation, but rather through an initial understanding of the SMEs organisational structures. This can occur either internally (for SMEs) or externally (by participants). What follows the first stage of understanding is the comprehensive analysis of the SMEs resources, their deployment (capabilities), competences and external perceptions by customers. Participatory observation can be made, for instance, in the business environment by external contractors or internally by means of questionnaires, observations and interviews. In the training context, SMEs take part in the analyses or deliver information material to participants. Alternatively, participants themselves approach SMEs for information or recommendations (interim feedback sessions). The principal issue is to refer to all the three fields of design, business and

technology (analyzing SME performance and coherence in design, business and technology, stage 2). In the next step, the information acquired or new knowledge gathered, helps to formulate a target, address problem, or identify an opportunity (stage 3). SMEs usually formulate closed problems or targets to be solved and, mainly, in the fields in which they encounter deficits. Once all potential ideas are distilled, the design management process proceeds to stage 4, when the selected idea, target or problem is 'matured' by proposing a solution for its implementation. It is a guideline, a way of arriving at a solution or, in some cases, it is a matured or sustained idea, target or problem for which a solution is found. From an organisational, strategic or operational perspective, this stage can result in a brand, a new or reengineered vision and strategy, a new product or service, and costs reductions or saving of resources through streamlining processes. After having arrived at a solution, an iterative process may start. When a new solution is developed, the SME may set a new target, formulate a new problem or obtain a new insight—all possible options, which then require a new understanding, and a fresh set of observations (second-level understanding). This process originates from the preceding developed solution 1. In this sense, a new design management process evolves.

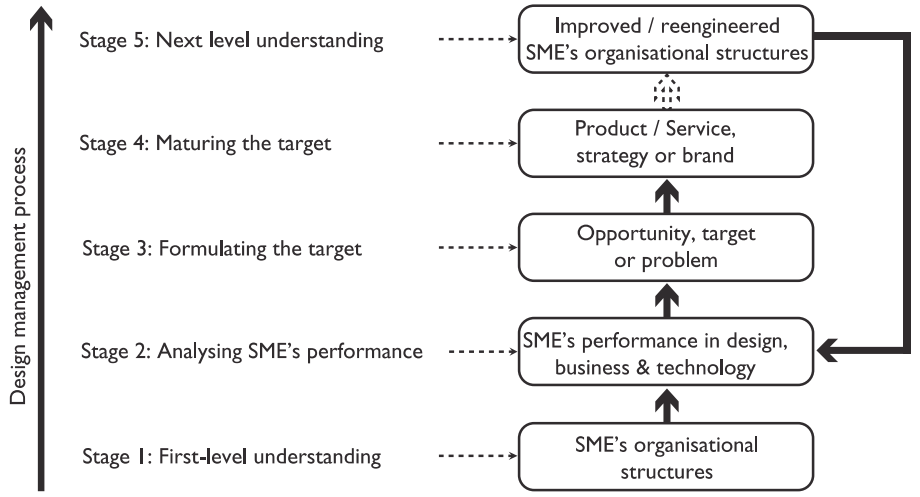

Figure 2. Revised Design Management Concept

Source: Authors' own.

The inductive approach applied in this research project yields certain modifications to the design management project that result from the collective case study. First, from the observations made on the basis of SME cases, it might be stated that a revised design management concept is deemed suitable for both business and education and training purposes. It is a business model for SMEs and a design management training tool for related stakeholders (students, graduates or start-ups).The proposed model facilitates the integration of design management stakeholders and practitioners under one design management process. Given the diverse group of stakeholders involved, a network of design management practitioners—both SMEs (from the business and entrepreneurial learning perspective) and participants (from the individual learning and training perspective)—is emerging in a context where dramatic organisational changes have occurred since the advent of the market-based economy.

Second, it is obvious that design management enables a better level of efficiency when it is not controlled, as in pre-ordained structures, concrete cases or targets (as provided by the SMEs 2–4). The controlled development of products or their reengineering and redesign, constrains the freedom of interdisciplinary teams and reduces innovation potential. It is a rather reactive view to market changes or competition within the design management process. It is similar to a more project-based method, whereby a certain project (design, product etc.) has to be implemented and which is aimed at increasing market share, or obtaining higher economic value, due to a more specific focus being placed on resources contributing to external positioning (market). A more internal perspective based on the RBV theory at the core of a dynamic SME is a proactive way of thinking and doing. It is an uncontrolled design management process enabling the definition and employment of organisational capabilities and the strengthening of core competences. In this sense, the internal resources of SMEs, especially managerial skills, information, knowledge, technology, culture, image in a customer (user) environment—all invisible assets—when deployed lead to more innovative and promising results and solutions. This contention corresponds with the findings of important research papers. Echoing Borja de Mozota and Kim (2009), the principal problem with the educational and training programmes on design management is the limitation derived from the processes aimed at developing new products rather than at improving skills or creativity (p. 73). This has been a critical issue for the design management process and the validity of concepts as applied within the project context.

As the call for a greater focus on processes (process-based design management) is growing in the design management discourses, this article argues that a more intensive exploration of this method within the practical design management processes should be done and underpinned by further empirical evidence. A clear research focus on the polarisation of those two perspectives would facilitate the implications for the design management process in different types of businesses. Further research is also needed in identifying alternative process-based methods for design management practices, either through a combination of unstructured and structured ways or a consolidated combination of techniques from the design, business and technology domains. This requires finding a common denominator, which is shared by all disciplinary process.

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Appendix 2: PUBLICATION II

Gerlitz, L. (2016). Design management as a domain of smart and sustainable enterprise: business modelling for innovation and smart growth in Industry 4.0. Entrepreneurship and Sustainability Issues, 3(3), 244−268, 10.9770/jesi.2016.3.3(3), (**ETIS 1.1 classification).**

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DESIGN MANAGEMENT AS A DOMAIN OF SMART AND SUSTAINABLE ENTERPRISE: BUSINESS MODELLING FOR INNOVATION AND SMART GROWTH IN INDUSTRY 4.0

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Abstract. The prior research has scrutinised the extent and scope of design integration for smart production and services innovation and value generation for smart society including enterprises, customers and end-users in the context of Industry 4.0. A conceptual approach has been proposed for practical business applications in developing and exploiting new innovative products or services. The present paper underpins the earlier research in methodological terms and is an affiliated research endeavour. The research traces successful performance of small and medium-sized enterprises (SMEs) within the context of Industry 4.0 in correlation with design as a source, resource and strategic tool for value generation and its capitalisation on the market. Building upon the integrated design as a tool and process for innovation capacity in the current industrial development paradigm, the present paper contributes to the previously anticipated research objective to reveal how design integration and design management manifest within small business practices and to what extent creates value. The key research focus is placed here on the strategic business orientation – business modelling and value creation for SMEs driven by impact factors from design, innovation management and strategic management field in the context of entrepreneurship. The present research is a result of qualitative research activity based on the case study methodological approach. Empirical data suggest how small enterprises within the Industry 4.0 domain can accelerate their growth targets and become more innovative, innovation being the move towards sustainable competitiveness and smart growth.

Keywords: design-driven business model, design value, design impact, design measuring, industry 4.0, small and medium-sized enterprises

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1. Introduction

In the Communication of the European Commission COM (2012) "Entrepreneurship 2020 Action Plan – Reigniting the Entrepreneurial Spirit in Europe", it is stated that future growth and competitiveness needs to be smart, sustainable and inclusive addressing our principal societal challenges. Europe is depending on entrepreneurs in order to bring Europe back to growth and higher levels of employment (COM(2010) 2020 final; COM/2014/014 final; SWD(2014) 14 final). In the landscape of industrial (r)evolution ('Industry 4.0' or 'Internet of Things'), entrepreneurship is particularly important to accelerate development of the six emerging industrial and social growth sectors according to the Communication from the Commission (COM(2012) 582 final, p. 4). Smart and sustainable growth for 2014-2020 milestone necessitates innovation and research, digital agenda, support for and SMEs and low-carbon economy (SWD (2014) 120 final, p. 7). All of the four focus fields already reveal the linkage with Industry 4.0.

Linking up with the prior research, the author believes that what is highly missing in the context of Industry 4.0 and smart entrepreneurship growth is not a business model based digital and information technologies, strategic management and firm research solely (Inglewood & Youngs, 2014; Burmeister *et al.*, 2015; Westerlund *et al.*, 2014; Blythe, 2014; Fleisch *et al.*, 2014; Dujin *et al.*, 2014; Kagermann, 2015), but rather one evolving from design integration into business for innovations supported by strategic orientation. It is about thinking and acting in a smart way and becoming a part of smart society (SWD(2013) 380 final; SEC(2009) 501 final). Impact and value of design for innovations – competitiveness and smart growth – should not be marginalised any longer also in this field, as it happened with other business domains, where design has been acknowledged as a source, resource, tool or approach within the strategic management, product development and innovation management arrays (McNabola, 2013; UK Design Council, 2013; Micheli, 2013, 2015; Mortati, 2015; Borja de Mozota, 1998, 2003; Kortesoja, 2013; Maroni *et al.*, 2013; Gerlitz, 2015).

Design integration must go beyond design thinking approach emerged as a new business model within the design management evolutionary paradigm (Boland and Colopy, 2004; Borja de Mozota & Kim, 2009; Brown, 2008; Brown & Whyte, 2010; Martin, 2009; Meinel & Leifer, 2011; Plattner *et al.*, 2011). In this industrial era, design should become the core of design-driven business model for SMEs, and design management – take a step forward – leaving aside obsolete tenets and taking the move towards smart tool, process and approach for innovations, competitiveness and growth of SMEs in this high-tech and digitised industrial paradigm. Indeed, Industry 4.0 related research have already emphasised the need to rethink existing business models as a result of pervasiveness of digital and new information technologies, increasing virtual communication and open communities (Turber *et al.*, 2014; Burmeister *et al.*, 2014). Thus, this research reconsiders the time as being appropriate one not to miss design integration into business in Industry 4.0 and avoid any possible challenges in entrepreneurship, which, as the real business practices show, can be solved by bringing in design in operational, strategic or social-environmental business dimension to create value. As a result, the research endeavour complements the prior research from the Industry 4.0 perspective and, structured in a similar way, advocates design integration in SMEs practices using a case study approach.

2. Literature review

In the strategy management, organisation and innovation related literature, smart, sustainable and inclusive growth has been often linked with Industry 4.0 and discussed through the business modelling and information technology perspective (Sun *et al.*, 2012; Eckert, 2014; Brettel & Uckelmann 2014; Rivard *et al.*, 2006; Kemp, 2014), competitive advantage or business strategy perspective (Bucherer *et al.*, 2012; Porter & Heppelmann, 2014; Veit *et al.*, 2014). A series of responses has been proposed in order to integrate industry 4.0 tenets within

industrial and entrepreneurial practices to advance business performance and growth. As a result, numerical research outputs forecasting the future potential of Industry 4.0 have entered academic and practice-oriented landscape, e.g. proposing business models for Industry 4.0 and within it (Fan & Zhou, 2011; Leminen *et al.*, 2012; Ueckelmann *et al.*, 2014; Hui, 2014; Chan; 2015). A new rethought business model adapted to digital technologies and digitisation, advanced manufacturing technologies, merging virtual and real worlds, increasing automation and intensifying information flows, which enable to acquire competitive advantage (Porter & Miller, 1985; Porter, 1996; Moody & Walsh, 1999; Porter & Kramer, 2006; Porter, 2008; Li *et al.*, 2012; Tvaronavičienė, Černevičiūtė, 2015), including openness and open innovation sources as well as Internet importance among socio-economic stakeholders (industries, businesses, costumers and user communities) and emerging role of communities (Jawecki et al., 2011; Füller & Matzler, 2007; Füller *et al.*, 2011, 2012; Gault, 2012; Dell'Era & Landoni, 2014; Baldwin & von Hippel, 2009; von Hippel *et al.*, 2011, 2012) has been put on the demand list of scholars and researchers.

From the conceptual point of view, the adopted concepts and design can be linked via their objective boundaries and content meanings, as they are likely to share similar common content threads. Industry 4.0 aims at assuring high-tech manufacturing location, jobs and welfare to people in a certain region to generate the competitive advantage (Ramsauer, 2013, p. 6; Avigdor *et al.*, 2014, p. 2; Krückhans and Meier, 2013, p. 31) and concerns design, manufacture, operation and service dimension of the manufacturing industry, thus including product, services and enterprise dimension as well as operational, strategic and environmental level. Smart specialisation is linked with competitive advantage and strategy, since it is a strategic approach aiming at developing a vision and identifying a competitive advantage setting strategic proprieties and making use of smart policies to maximise the knowledge-based development potential (David *et al.*, 2009, p. 1; SWD (2014) 120 final, p. 17). It also sets out to generate knowledge about the future economic value of a possible structural change and to discover the best suitable domains of specialisation by entrepreneurs (Foray *et al.*, 2011, p. 8). Innovation dimension can be added as additional needed capacity to smart specialisation and thus smart growth. It finds the roots in the innovation systems literature, the entrepreneurship and growth (OECD, 2013). As a result, three key tenets are associated with the concept: it recognises economic potential and growth via entrepreneurial search processes during which (1) distribution of potential opportunities for technological improvements in a specific sector, activity or profession is identified; (2) exploitation of the innovation results is ensured and (3) learning from outcomes regarding opportunities and scope of innovations is applied (McCann and Ortega-Argiles, 2015, pp. 1292-1293; Foray and Goenega, 2013, p. 1). In fact, smart specialisation strategies forge competitive advantage by obtaining the most efficient innovation results by means of effective prioritising scarce resources or concentrating resources on certain domains of expertise, e.g. industry, education and innovation (Ortega-Argiles, 2012, p. 2). Adding to this resource-efficient, greener thinking and competitive acting, Europe might arrive and not only smart, but also sustainable growth by 2020 (COM (2010) 2020 final, p. 5).

Sustainable growth, the same as smart growth, is dependent on entrepreneurship growth (Voss, 1998; Vossen, 1999; Delgado *et al.*, 2014; Mettler & Williams, 2011, Ayyagari et. al, 2011; Fraser, 2010; O'Gordman, 2001). Sustainable entrepreneurship is subject to efficiency and effectiveness, sufficiency and consistence (Young & Tilley, 2006, p. 402, Gerlach, 2003, p. 101), it aims to deliver profit and improve environmental sustainability and social conditions, i.e. setting long-term economic and business outputs deriving from entrepreneurial opportunities (Cohen & Winn, 2007, p. 35). In entrepreneurship, it requires a more specific focus by SMEs on social responsibility, environmental awareness, i.e. intertwining of all three dimensions of sustainability, i.e. economic, environmental and social ones (Cliberti *et al.*, 2008, p. 1580). Sustainability issues encompass such indicators as product-based green supply, environmentally friendly decision-making, cost reducing. In fact, sustainability might refer to issues, whether environmental, ethical or social ones (Seuring and Müller, 2008, p. 456).

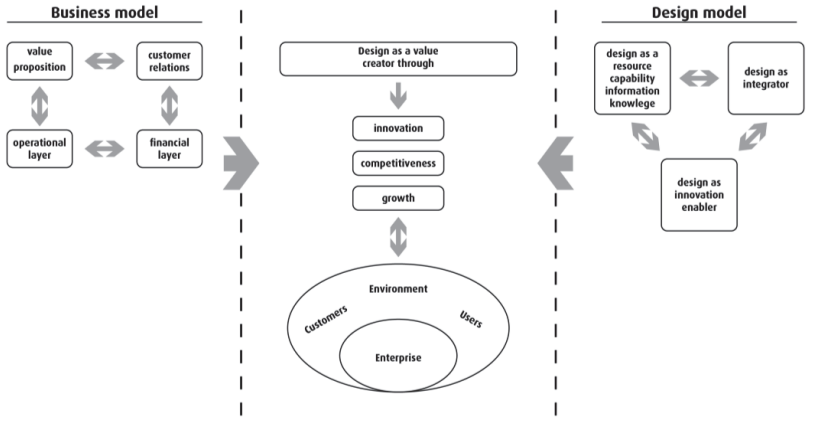
3. Framework for analysis and measurement

Being important vehicle of regional and national economy, SMEs have become a topical issue. Innovation, competitiveness and growth are key business success variables articulated by science and practice. According to the EU Policy Paper "Regional Policy for Smart Growth of SMEs", the key aim is therefore to increase the strategic focus of SMEs by making them more innovative, thus contributing to competitiveness and growth, as innovation is the key to both (p. 1). To envisage such a business success – smart and sustainable growth, business and design domains have been leveraged and merged as a result of sharing common grounds for creating and exploiting value for SMEs:

(1) Design domain integrating tenets of value creation and exploitation – design for innovation, competitiveness and growth.
(2) Business domain embracing value creation and capturing residing in strategy and competition, innovation and business modelling.

The stated below underpins the conceptual inter-linkage of perception of innovations, competitiveness and growth from cross-disciplinary perspective. As a result, the author hypothesises that existing similarities support design integration in business interactions and proposition of design-driven model application for enterprises, contributing towards the anticipated key success factors, a business model, which answers essential questions of archetypal business model who, what, how and why (Gassmann *et al.*, 2014, p. 90ff).

Fig. 1. Merging Design and Business Domains in Industry 4.0



Source: compiled by the author

3.1. Design domain to innovation

Strategic role of design and inter-linkage of design and innovation is used to be the research objective in the context of service design. Strategic role of design has been also frequently revealed through the lens of the 'customer value' (Schmiedgen, 2011, p. 1; Wetter Edman 2011, p. 41; Chiva & Alegre, 2009; Meier-Kortwig, 1997; Brown, 2008). Design innovation modelling and thus business modelling has been linked through service design approaches (mostly, design thinking). Nevertheless, the role of other driving parameters and factors for business model and strategy from the design management related literature seem to be underestimated (Borja de

Mozota, 2013, p. 296). In fact, is an important to link all the actors in the innovation process, both inside and outside of the firm and to establish and maintain the role of designer as a 'gatekeeper' facilitating such linkages (Walsh, 2000, p. 88).

Starting from 1990s, there can be observed a trend of 'advocacy' of design in the management field and demystification of design among managers (Gorb and Dumas, 1987; Oakley, 1990; Walker, 1990). Design management should be employed within management in form of design resources available to an organisation aiming to achieve its corporate objectives. The issue of design leadership and its role for corporate identity get at increasing attention among scholars and practitioners, e.g. Koppelmann, 1993; Blaich and Blaich, 1993; Davies, 1993; Gorb, 1990; Topalian, 2002; Turner, 2013, etc. from 1990 onwards. Placement of design within an organisation, identification of design resources and related issues for solving key management issues and trainings of managers to effectively use design (Gorb, 1990, p. 2). Similarly, however, with a stronger view on long-term corporate mission and vision, Blaich and Blaich (1993) conceive design management as a programme of corporation activity focused on communication of design relevance to achieve long-term goals of an organisation and coordinate design resources on all applicable organisational activity levels, thus enabling to achieve corporate objectives (pp. 13-15). Similarly, Turner (2013) links design management with corporate strategy and vision. It is as a tool enabling to achieve this, and design leadership – a means to define the future, i.e. vision. Both are critical sources to value achievement and its maximisation. Fundamentally, Turner conceives design management and its role in delivering successful design solutions in an efficient and cost effective way (ibid., 72). In this, it can be stressed, here, the focus clearly shifts from design management as being solely employed on functional and operational levels towards its embeddedness within the corporate strategic level.

Today, strategic design management research frequently addresses design as a resource, core competency, capability and capital. Its role moved from just fitting to the industry towards becoming heart of the business model and value creation (Borja de Mozota, 1998, p. 26; Borja de Mozota & Kim, 2009, p. 67). It is a competitive advantage and strategy. It is a process and styling leading towards strategic competitive advantage (Borja de Mozota, 2006, p. 45ff). Design has increasingly become perceived as a strategic tool, whereby information and knowledge about a product from which it can be materialised and positioned on the market, thus creating and capturing value (Kotler and Rath, 1984; p. 16; Er, 1997, p. 293). As a result, design integrates all the strategically essential methods, tools, capabilities and resources accumulated and deployed from the three domains: design, business and technology (Prause *et al.*, 2012, p. 441; Hack *et al.*, 2012, pp. 140-141). Design became differentiator (1), integrator (2), transformer (3) and a good business (4) (Borja de Mozota, 2006, p. 45). Design may influence products offered by a firm giving them sense. Being design as a source of making sense of things, design implies messages to the user, within the styling (e.g. form), functionality of a product, service or process, emotional and symbolic value, i.e. meaning. Meaning proposes to users a system of values by using a specific language, e.g. signs, symbols and icons that deliver the message (Verganti, 2008, p. 440). As a result, design can be used as a resource in several ways: as a strategy, as a method, as a styling, as internal enterprise resource, as valuable knowledge and as a process applied in enterprises.

3.2. Business approach to innovation

Value creation has been heart of business modelling, innovation, business strategy and organisation discourses (Hui, 2014, p. 2; Magretta, 2002, p. 87, etc.). Already Porter & Miller (1985) by proposing the value chain highlighted the importance of information for competition as well as that of information technology. Value emerges along the entire value chain and is at the end confirmed by the customer via mutual transactions (usage of product or service) (p. 154). Later, big data and data management were considered as changing value proposition and value chain (Nagle & Sammon, 2014, p. 397). Similarly, change in service logic implied value creation with goods as value supporting resources and services as value supporting processes (Grönroos, 2006, p.

325) or change in producer-customer paradigm, where value embedded in an physical artefact is exchanged with customer and customers are part of a service seen as a resource or integrating resources (Lusch *et al.*, 2008, p. 10; Vargo *et al.*, 2008, p. 145; Prahalad & Ramaswamay, 2004, p. 5).

Beyond the 'classical' manufacturing enterprise's and supply and value chain perspective on value creation (Porter & Miller, 1985; Porter, 1995; 1996) and perception of value creation through the lens of 'service logic' (Lusch *et al.*, 2004; Vargo & Lusch, 2004, 2008), recently research community has started to focus on value from the angle of strategy as basis for value creation (Osterwalder & Pigneur, 2010; George & Bock, 2011; Zott *et al.*, 2011; Osterwalder *et al.*, 2014; Gassmann *et al.*, 2014) or innovation (business innovation model) (Chesbrough & Rosenbloom, 2002; Chesbrough, 2010; Teece, 2010; Bucherer *et al.*, 2012; Amit & Zott, 2012; Andries & Debackere, 2013; Foss & Saebi, 2015; Ignatavičius *et al.* 2015). In fact, a business model finding its roots in 1957 (Bellmann *et al.*) should allow a holistic view on an enterprise by combining factors located inside and outside the firm (Turber & Smiela, 2014, p. 4). This is a clear link towards the two sides of the coin, i.e. internal and external organisational perspective – external environment approaches as shaped by Porter fitting strategy to the external environment, and internal scrutinising enterprise, deconstructing the competitiveness and innovation within the domain of key resources, capabilities, competencies (Wernerfelt, 1984; Barney, 1991; Amit & Shoemaker, 1993; Peteraf, 1993; Prahaland & Hamel, 1990; Hoopes *et al.*, 2003; Helfat & Peteraf, 2003; Crook *et al.*, 2008; Foss, 2011, etc.; Rezk *et al.*, 2015).

Enterprise and innovation as intertwined construct have been perceived already by Drucker (1985), Zhao (2005) and frequently discussed within business model innovation discourses (e.g. Amit & Zott, 2012; Teece, 2010, etc.). Here, again, the heart of the business innovation model is innovation process and the ability to identify a good idea including capacity transforming such idea into a business model that adds value and generates revenue (Andries & Debackere, 2003, p. 337). There is a need to integrate all interdependencies and to combine them into one consolidated approach, an integrated structure of products, services and information flows including the involved actors and roles as well as the potential value created for all participants and the source of revenue (Sun *et al.* 2012, p. 3). It is business pattern of components, linkages between them and dynamics. It is a systematic approach implying construction of certain 'success elements'. There are nine elements comprising four building blocks within business models: value proposition, operational and financial model and customer relations (Osterwalder & Pigneur, 2010, p. 252; Chesbrough & Rosenbloom, 2002, p. 551; Kindström, 2012, p. 483; Zott *et al.*, 2011, p. 1020ff; Tikkanen *et al.*, 2005, p. 790). These building blocks are also referred to as balanced systemic approach consisting of financial, internal business process, customer and learning and growth (innovation) dimensions, which make up a balanced system towards strategy – balanced scorecard (Kaplan & Norton, 1996, p. 56; Kaplan & Norton, 2005, p. 5), as strategy maps (2006, p. 105) or even activity system maps enabling to achieve competitive positioning and implement strategy (Porter, 1996, p. 60ff). As frequently emphasised, value proposition of a business innovation model is heavily subject to products and services offered by an enterprise and its operational model, and therefore products and services innovation can lead to business model innovations. Nevertheless, the innovation is not limited to dominant product or service process innovations (Bucherer *et al.*, 2012, p. 184). In fact, a broad variety of 'ingredients' are needed to achieve value.

4. Methodology

The present research applied a hybrid research approach (Fereday & Muir-Cochrane, 2006, p. 80) combining inductive and deductive perspectives, analysing and interpreting raw data and identifying key tenets that enable to capture the key phenomenon – design integration and its value for SMEs. Starting from thematic analysis, locating the applicable thematic research streams, developing a framework for analysis and measurement, the research aims at answering two fundamental research questions:

(1) How can design be integrated within entrepreneurial strategic orientation and accelerate business model?
(2) To what extent can design integration and design value be traced within SMEs in Industry 4.0 context?

A following research path characterises the methodological research approach. First, the paper builds upon design perception as integrated design management approach for innovations (using deductive reasoning) and traces smart ideation and exploitation patterns in a given enterprise (case study) on operational, strategic and social-environmental dimension based on the accumulated evidence gathered. Subsequently, potential business model integrating design, innovation and firm management perspective is developed and validated by manifold field research activities (inductive reasoning) proposing how value can be generated and exploited for smart entrepreneurial growth (inductive). As emphasised by Kelley (1998), within design related discourses, an inductive approach to innovation is dominating (p. 32). Although the research combines the mix of deductive and inductive intentions, when using a qualitative case study to build the design-driven business model for Industry 4.0, it relies, however, on integration of theoretical reflections (the framework). It serves as a foundation and common ground for the analysis and results' synthesis, although the theoretical reflections usually are not employed within the analysis phase. Here, using a specific structured approach by means of the developed outline (Fereday & Muir-Cochrane, 2006, p. 80; Crabtree and Miller, 1992, pp. 93-109), the research adopts a framework for analysis and measurement as a certain template with specific applying indicators (Fig. 1) and uses it for the phenomenon observation purposes and data validation. In fact, employment of the framework underpins credibility of the research by providing a specific approach towards dealing with evidence and facilitates transparency. Consequently, observations made allow articulating a new conceptual perspective on design integration and its role within Industry 4.0 discourses – a model, which can be employed within SMEs businesses.

The choice and adaptation of qualitative research approach has been justified taking into account applicable research streams (Neergaard & Ulhøi, 2007, p. 1; Fossey *et al.*, 2002, p. 717), where qualitative research approach has been dominating. In the last decades, increasing role has been ascribed to the case study as being very crucial in making conceptual models (Eisenhardt, 1989; Miles and Huberman, 1994, p. 101; Stake, 1995, pp. 4-6; Yin, 2009, p. 2; 2012, p. 3). Further, as has been observed, whereas surveys were usually employed in the context measuring the business performance in a particular industry SMEs, case studies dominated research focusing on linkage of design and innovation, new product development as well as in research contributions related to the strategic management and the business strategy, i.e. emerging, developing and growing SMEs, e.g. Borja de Mozota, 1998, 2002.

The research process implies the following steps of the qualitative study, such as case selection, data collection, data preparation, data analysis, data interpretation and validation as well as data utilisation for theoretical and managerial contributions. The qualitative research applies such research methods as case study method (Yin, 2009, 2013), thematic analysis method (Braun & Clarke, 2006), interviews with enterprise representatives, field notes, diagrams and memos as well as social network analysis. They are recognised as being appropriate for examining design management practices and their role for small businesses and design management networks, as they enable to trace the links and to investigate relationships of interacting structures and units, in this particular case of that within a given enterprise (Wassermann & Faust, 1994, p. 8; Scott, 2003, p. 38ff; Corbin & Strauss, 2008, p. 123ff). In fact, the case study enables to catch the particularity and complexity of a single case (Stake, 1995, p. xi). The research type is therefore exploratory, interpretative, integrative and practice-oriented. It is also reflective showing how the research was produced, described and justified. The research scale is rather small, as it involves a single case study – a perception of design integration within strategic orientation and business modelling in one given enterprise. Nevertheless, the conceptual implications imply generalisation potential, i.e. a piloted design-driven model, which can be tested within an increased number of further observations of this phenomenon.

5. Case of Merging Design and Business Domains: A Design-Driven Smart and Sustainable Enterprise

Building upon the previous topical research within Industry 4.0 context, this research attempt showcases design performance, i.e. its integration and implication patterns on the enterprise level. Design is likely to be the driving force on operational, strategic, and socio-environmental level of the enterprise (its external performance on the market and linkage with customers). It implies a common thread embedded in all enterprise interactions, from the manufactured goods, over service proposition and customer management related to produced goods or services towards self-supporting value networks. Within Industry 4.0, design is a networked activity, source, resource, competency and capability. It enables and facilitates connectivity of an enterprise from internal and external perception. A new network is emerging that supports value creation for enterprise (revenue generation) and value proposition for its customers and end-users.

The case company is the small enterprise from Berlin, Germany. The SME offers planning, production and implementation of ideas – products and services. Through the three key business areas – product development, related knowledge accumulation and transfer and working drawing including workshop, the enterprise has established strong horizontal links with potential customers and users from different sectorial affiliations – science, research, business, service providers, network users, etc. Value creation occurs simultaneously, is manifold source-driven and connected with design being at the heart of the enterprise. For confidential purpose, the name of the enterprise is not disclosed, especially taking into account its size and therefore potential negative exposure on its growth. This, however, does not affect the reliability and validity of the research results.

The justification of this case study builds upon self-supporting evidence. First, the motivation to canvas the design impact for entrepreneurial practices, especially of those being very small or start-ups is clearly supported by the research evidence. There is to less attention have been paid towards revealing design impact, design practices and implications within smaller SMEs (Gemser and Lenders, 2001; Hertenstein *et al.*, 2005; Moultrie *et al.*, 2007; Fernandez-Mesa *et al.*, 2013, Erichsen, 2014; Kortesoja, 2013; Maroni *et al.*, 2015). As a result, there is an increasing research impetus to provide smaller enterprises with potential guides on how to harvest design for operational efficiency and effectiveness, strategic orientation and acknowledgement by customers and users. Second, the case study suits well the given landscape. Instead of selling products or services solely on the market through design-driven innovation, where innovation is usually associated with the operational readiness needed for products and services development and implementation on the market, the given enterprise adopts a different view. It sells a mixed commodity, a value proposition for different customers groups, varying from those of using products to those using a particular service attached to this enterprise. It proposes therefore a value, which does not solely belong to the upstream (production) or downstream (activities). By contrast, it encompasses the entire enterprise and its ecosystem (Leminen *et al.*, 2012). Third, the selected case shows the context proximity, i.e. the enterprise has been chosen from Germany as being birthplace of Industry 4.0 trend (Gerlitz, 2015). By contrast to the ample cases on Industry 4.0 and business models, this research scrutinise how Industry 4.0 is perceived and employed within small business practices in relation to design. Fifth, the research claims that design integration supports not only smart, but also sustainable performance of enterprise on operational, strategic, social and environmental (external) level. Indeed, the enterprise was chosen for the case study, as it envisages the vision of sustainable development and proposition of sustainable solutions to its customers. Particularly, the SME adopted within its business practices the environmental tenets calling for the sustainable development owing to the proceedings of the UN Environment Conference and World Summits on Sustainable Development. As a result, the SME contends developing smart, ecologically and environmentally friendly solutions intertwining ecology, economy and social dimension into one ecosystem.

In what sense is then this enterprise being smart and sustainable in the context of Industry 4.0? Along the three key aspects delimitated in the framework, the integration of design is scrutinised from the value creation perspective being the heart of the business model. Accumulated identified patterns of design 'performance'

along the entrepreneurial practices are presented, which are needed to match them to the construct of design-driven strategic orientation of SME and therefore integrate into the research setting. Subsequently, the author shortly elaborates on findings, articulates analytical statements and illustrates them by using the examples and data from the case. The succeeding research will require for generalisation of the 'distilled' patterns of design integration and its value creation potential.

Design as A Domain for Innovation

As the empirical data from the case study demonstrate, design is a core activity and stepping stone within certain projects. In a given enterprise, designer is at the core of the firm. Design enables to deliver innovations through the incremental process, from the idea to the developed product or service. As contended within personal interviews and observations, design ranks the highest position when it comes to its perception as a source of innovation. Design, the same applies for innovation, introduces a new meaning and value for its consumers, i.e. a new or significantly improved good or service, process or new marketing method, new organisational methods in business practice, workplace organisation or external relations (OECD/ EC, 2005, p. 46). As contended by the CEO and top managers of the enterprise, design enables to 'design', i.e. develop solutions, which match the needs and demand of the society – customers and end-users. The developed solutions, however, showcase clear linkage of functional, aesthetical, meaning and visual match expressed through a form (product) or solution (service or process). In fact, the developed solutions must clearly underpin functional dimension. Furthermore, for this specific enterprise, design enables product development from the idea towards the maturity phase. Particularly, different number of developed solutions and prototypes in the field of sustainable design enables diversification – application of solutions to a range of options, thus enabling quantification of design-driven innovation solutions. Innovation implies a process during which all the necessary activities such as problem resolving and /or idea generation, development, manufacturing and marketing of a new construct (would it be product, service, or process itself) are effectively and efficiently managed and commercially and practically exploited to the market (Trott, 2012, pp. 12-15). Innovation is to be viewed as a process of turning opportunity into new ideas, ensuring its practical application in the reality (Tidd & Bessant, 2013, pp. 18-22) and bringing value through its availability and access to it for its users via the market and/or other channels or distributed peer-to-peer and / or by the market (Gault, 2012, p. 122). Design is a tangible outcome, i.e. end product of the process or intangible, e.g. service or process, solution, etc. (von Stamm, 2004, p. 11).

Thus, design being key innovation source and designer as key enabler to innovate allows developing smart and sustainable products. As the case data show, design stands for a basic requirement for all sustainable and smart solutions' development. In Industry 4.0 context, such innovative solutions can be developed faster, particularly using prototyping devices – software such as computer-aided design (CAD), 3D printer or other rapid prototyping methods. It is interestingly, however, that everybody, who has infrastructural, financial and internal capabilities and capacities to develop solutions, can use today such tools and methods. Indeed, technological advancement, increasing interconnectedness of machines and people, better possibilities to respond to customers needs and recognition by end-users facilitates faster innovation potential. However, the research results imply that technological and managerial capabilities are not enough. It contends that design and related capabilities residing in design, when combined with technology and business dimension, can lead towards mature innovations – smart and sustainable ones. Particularly, design-driven innovation is underpinned, it is argued here, through internal design capabilities and competencies, i.e. designer being at the heart of the enterprise or designers, who are working within the enterprise. It is far less evident that smart and sustainable solutions emerge when outsourcing design related services. In fact, design needs to meet enterprise culture, shared values, thinking and acting expressed through operational and strategic setting. According to the data, enterprise perception of design impact on innovation is the following. Using the seven-point scaling, the author has measured the potential of design for innovation in the enterprise. For this, the researcher has constructed three

impact layers, which showcase the magnitude of the particular parameter for innovations: essential (+++), average (++) and marginal to absent (+ / 0) and clearly underpin the analytical statements above.

Table 1. Design Domain and Innovation

Design is a source of innovation within the enterprise	+++
Design implies important development process of SME	+++
Design improves production and / or service provision development and provision processes	+++
Design improves products, services and process in SME	+++
Design enables achievement of the required product, service or process quality	++
Design supports development of new technologies, methods and tools in SME	+++
Design Domain's Magnitude	**Essential**

Source: compiled by the author

Design as A Domain for Competitiveness

Innovation is key towards business success, processes, products, services and other internal and external optimisation patterns. Innovation might be regarded as a key for SMEs to develop, grow and mature on the market. Becoming innovative forges also the level of competitiveness and affects the pace of growth. Taking into account the evidence from the given enterprise, it can be argued that the competitive edge derives from smart combination of resources, capabilities and competencies. It is also based upon external perception and customer relationships. The principal competitiveness might lay in the fact that the enterprise, also being very small, builds upon the tenet of providing a complete solution package, including both product and service attached to this product. Further, a certain perception towards social and environmental setting outside the company can be considered also as a potential source of competitiveness. The enterprise claims on complying with environmental friendly principles, emphasises the coexistence with and recognition of resources scarcity. Developed solutions do not stand just for a specific artefact. By contrast, it can be asserted that they implicate a combined approach in a smart way proposing a commodity integrating creative, managerial and social perspectives. Finding customers, which do acknowledge such solutions calling for a more sustainable thinking and acting complements the competiveness. The enterprise has specialised in terms of offering sustainable solutions, which save energy, reduced maintenance and waste generation and enables cost saving in terms of operational, social and environmental parameters. Key customers are being integrated into the product or service delivering process at an early stage. Designer acts as service provider showing the benefits of the final commodity – functional excellence, positive ecological footprint and social recognition. It is move towards sense making for customers and end-users. Indeed, design is a powerful source of the enterprise competitiveness that, however, needs to be generated, smartly intertwined and exploited. The enterprise's top management perception towards potential of design to facilitate enterprise competitiveness in the parameters below (i.e. correlation between design capability to support and thus strengthen the competitiveness) are displayed as follows:

The empirical evidence showcase that design as a source alone cannot provide enterprise with differentiation strength yet, thus being able as enterprise to differentiate itself from the competitors. Design facilitates improvement of external performance of the enterprise on the market through, e.g. marketing activities or supports enterprise corporate identity and positive image building. This means that despite the fact that design role for competitiveness is evident and moving towards increasing one, design cannot be treated alone as a source of competitiveness. As it is apparent, it requires a combination of certain parameters and criteria. However, especially from the external perspective, where relationships with customers, network engagement and management of customers come into play, design impact on them is less traceable than that on internal product, service or process peculiarities and related activities, such as development and exploitation (innovation).

Table 2. Design Domain and Competitiveness

Uniqueness of your product	+++
Production / servicing process in SME	++
Marketing activities and outputs	++
Branding activities and brand	+++
Design is treated as important source for competitiveness of SME	+++
Innovation process	+++
Capacity for innovation	+++
Cooperation and links with customers / clients	++
Links with supplies	+
Networking and internationalisation	++
Design Domain's Magnitude	**Average moving towards Essential**

Source: compiled by the author

Design as A Domain for Smart and Sustainable Growth

It is clear that design role as enabler for innovation, competitiveness can be underpinned on entrepreneurial level, where design is driving force for all applicable interactions and transactions. The author argues that smart and sustainable growth can evolve and be sustained when assuring balanced product, service or process development process. Being competitive does not automatically implies being smart and growing in a sustainable way. Sustainability is a very broad concept that can be delineated through intertwining economic, environmental and social layers of performance (Cliberti *et al.*, 2008, p. 1580; Seuring and Müller, 2008, p. 456). Sustainable enterprise, as the case enterprise from Germany shows, should comply with tenets, such as social responsibility, environmental awareness, etc. The aspects of sustainability are gaining more attention as a response to the current economic challenges, increasing negative footprint on environment and social setting, globalisation and demographic trends, etc. In fact, sustainability evolves through value creation and ensuring consistent value chain performance, i.e. value proposition for all involved actors. In addition, sustainability embraces aspects of labour, environmental standards, etc. In this regard, values are affected in terms of social, environmental or labour-related settings and through two key functions within the value chain, i.e. rule making and rule keeping.

Sustainable thinking and acting, however, are not ultimate preconditions for smart growth. The researcher claims that sustainable and smart growth emerges from smart combination. As the enterprise evidence suggest, design can influence sustainable enterprise growth, however, to a different extent. In the particular case study, design role is likely to vary when all the key parameters are measured in the same paradigm – impact of design for the enterprise, as the Table 3 below reveals.

Table 3. Design Domain and Smart and Sustainable Growth

Business performance	+
Integration of internal organisational resources and capabilities and their use	++
SME's competitiveness	+++
Level of innovativeness and innovation generation	+++
SME's business growth	+
Design Domain's Magnitude	**Average moving towards Essential**

Source: compiled by the author

With regard to the data displayed it may be argued that understanding design role for SMEs growth is not well revealed yet both on the research and practice level in the context of Industry 4.0. Paradoxically, although the enterprises highly recognises the role of design for innovation, which is seen the heart for competitiveness and

growth, the impact of design for growth remains underestimated. The reasoning behind this might also lay in the fact that small enterprises have not clearly linked innovation to competitive business strategy yet or do not possess necessary command how to do this. The decisions are taken less deliberate, it might be argued. Another reason refers to the bare fact that small enterprises are just developing and might have not established business growth perspective yet. Business performance indicator can be interpreted in a similar way, which principally yields internal and external business performance expressed through the costs and revenue structures, all enterprise building blocks, such as operational, financial model, customer and process perspective.

Taking the future perspective of the given enterprise into account, the evaluation pattern looks similar. Design enjoys the highest rank in terms of its potential for future enterprise business within the parameters of innovation and competitiveness. Essentially important in the context of Industry 4.0 becomes efficient resource employment and their utilisation, which share the same position for the given enterprise with the prior ones. For the given enterprise, design will also be crucially important in the future in the array of employees, industrial manufacturing and servicing, whereas economic competitiveness and business growth will be placed far down the business agenda and strategic enterprise orientation modelling.

6. Discussion

Industry 4.0 related discourses are saturated with 'smartness', which should help in achieving this goal, particularly, boosting productivity and value added of industries and stimulating economic growth, for instance, through smart products and services (Schmidt *et al.*, 2015; Porter & Heppelmann; 2014), smart objects (Atzori *et al.*, 2014), smart machines and factories (Kagermann *et al.*, 2013), smart manufacturing and industry (Dais, 2014; Davis *et al.*, 2012), smart spaces (Leminen *et al.*, 2012) or smart cities (Letaifa, 2015). It is a smart way of thinking and acting that can be expressed in the ecosystem via smart economy, smart people, smart governance, smart mobility, smart environment and smart living (Giffinger *et al.*, 2007; Mačiulis, Tvaronavičienė 2013). Further six principles can be applied to implement 'smartness': interoperability, virtualization, decentralization, real-time capability, service orientation and modularity (Hermann *et al.*, 2015, p. 3). Smart growth implies creation of internal, aligned, self-reinforcement system, which integrates effective leaders, engaged employees, continuous-improvement enterprise culture, experimental learning process including measurement systems and reward policies that drive growth (Downs, 2005; p. 368; Hess, 2010, p. 75).

The principal value of Industry 4.0 lies in providing industries and thus enterprises with specific value implying innovation, competitiveness and growth within the entire ecosystem – operational, strategic and socio-environmental (external) dimension, e.g. through increased flexibility, mass customisation, speed in product / service design and manufacturing, improved product quality, increased productivity, integrated customers and higher customer satisfaction or proximity of location to customers (Davies, 2015, p. 2ff; Mejtoft, 2011, p. 672). This, in turn, facilitates not only smart, but also sustainable thinking and acting. In sum, all these principles are encompassed within a business model providing a smart value, where industry and enterprises gain competitive advantage and are able to grow based on their innovativeness, capabilities for product, services or process designs that meet customers' needs and assure quality and satisfaction thereof.

In Industry 4.0, there is a shift in the paradigm of value creation and value capturing. It is not anymore enough to create value by identifying customer needs and producing state-of-the-art products. It is usually a web-based services that users access through a product (Ferber, 2013, p. 2) and generate income (Carruthers, 2014, p. 5). Instead, the focus shifts towards value creation based on customer experiences and value capturing, i.e. monetisation of customer value in the digitised connected spaces, including value-added services. Indeed, there is a growing concern that the classical generating strategy model as developed by Porter building upon differentiation, cost leadership and focus is not sufficient any longer, as these indicators can be supplement, but not solely used as exclusive ones. It is more that they can reinforce value creation and capturing (Hui, 2014, pp.

4-5; Porter, 1985, pp.12ff). However, the combination of both is needed – strengthening products, their differentiation, supply chains, human resources, brands as well as related services. As a result, value creation and capturing should be scrutinised from both manufacturer and customer / consumer perspective. Indeed, this is a special endeavour to be kept in mind when dealing with Industry 4.0, highly digitalised world and intensive interactions inside and outside the enterprise.

Table 4. Design as a Strategic Domain for Value Creation

Design integration through strategic value proposition		
Σ **Design as an integrator and innovation enabler**	**Design deployed and exploited on corporate operational and strategic level**	
Form of design integration	**Operational indicators**	**Strategic indicators**
DESIGN AS: Resource Knowledge Information Meaning Source of competitive advantage Competence Resourcing, organisational coordinative, protective and innovative capability Coordinative capability Networking capability	⊕ Aesthetic appearance (form)	⊕ Differentiation
	⊕ Functionality in the value chain (e.g. manufacturing specific product/service) to be validated (e.g. through technology, cost, etc.)	⊕ Productivity ⊕ Strategic flexibility
	⊕ Manufacturability (product/service as a result of design /creativity process from problem/idea to commercialisation on the market)	⊕ Positioning ⊕ Resource efficiency ⊕ Efficient productivity
	⊕ Integrity (using design to intertwine aesthetic, technological, business, social, environmental resources and capabilities)	⊕ Differentiation ⊕ Strategic flexibility ⊕ Customer/user satisfaction
	⊕ Durability (product/service effectively and efficiently used over longer time)	⊕ Positioning ⊕ Customer/user satisfaction ⊕ Differentiation
	⊕ Quality (product/service excellence in use and recognition by customers/users)	⊕ Positioning ⊕ Differentiation ⊕ Customer/user satisfaction
	⊕ Sustainability (product/service functionally reusable, recyclable, material-saving, ecological, clean)	⊕ Resource-efficiency ⊕ Differentiation ⊕ Positioning ⊕ Strategic flexibility ⊕ Societal critical mass
	⊕ Usability (user-friendly, safe, reliable, individually customised, etc. product/service)	⊕ Customer/user loyalty and satisfaction ⊕ Positioning ⊕ Differentiation

Source: compiled by the author

Design can create extensive value – would it be smart manufacturing, smart products and services or other smart solutions for customers and consumers. Impact of design within industry 4.0 practices can be clearly linked through perceiving design as a source of competitive advantage, knowledge, information, resource, capability and innovative and creative process. As a common thread serves value proposition, activities of value creation and processes of value capturing and exploitation. Indeed, the value creation includes resources, dynamic capabilities and processes required to deliver the offering – starting from partner/supplier relationships to sales channels. Value capture comprises the underlying cost structure and revenue formula, which decide about profitability and economical sustainability (Burmeister *et al.*, 2015, p. 5). Design, which has been perceived as knowledge, can be strategically deployed and exploited for product/service innovation. Strategic acting of design within the business array can be delineated as a critical dynamic collaboration across operational and management practices of organisations or companies successfully utilising design capabilities. For this, design integration for innovations resulting in value proposition on corporate level might be showcased as in Table 4.

Table 5. Design as A Strategic Domain for Value Creation in Industry 4.0

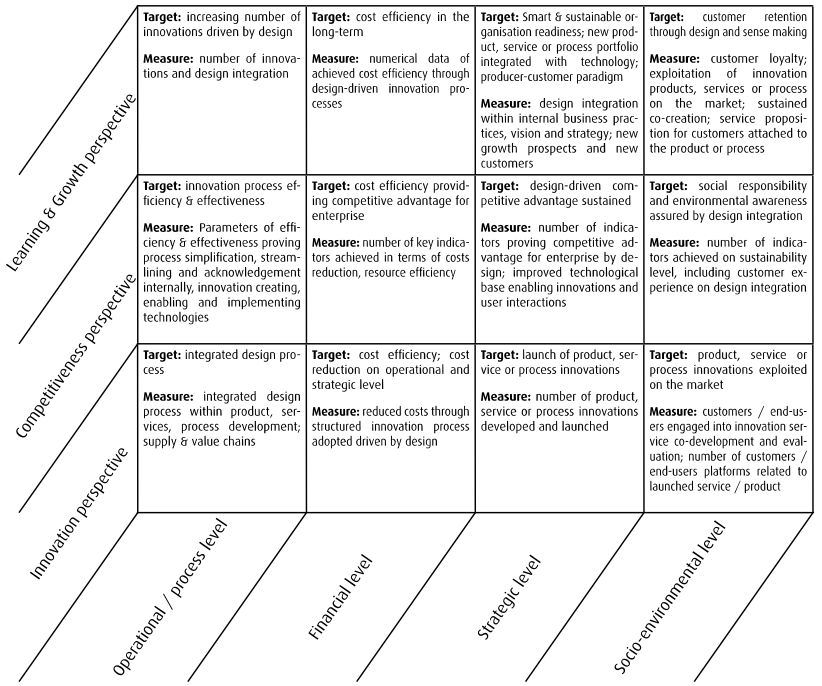
Design integration in industry 4.0					
Integration domains industry 4.0	**Manifestation / dimension**	**Performance impact**	**Operational indicators**	**Strategic indicators**	**Enabling, creating and implementing technologies**
Industrial manufacturing Healthcare Sustainable mobility and transport Energy efficiency Clean technologies Service sector Customer/user engagement	Industrial design (product) Service design (services) Design as a innovation process Design as an integrated creative process	Operational efficiency Economic efficiency Environmental efficiency –e.g. travel/carbon footprint / source / energy reduction Social efficiency – individual customisation, user acceptance, liberalisation / democratisation	Aesthetic appearance Functionality Manufacturability Integrity Durability Quality Sustainability Usability Reliability	Differentiation Positioning Strategic flexibility Resource efficiency Customer/user satisfaction Value creation Competitive advantage Predictability	ICT – computers, servers, software, Internet, WiFi, EDI, etc. IvT – modelling, simulation, visualisation, rapid prototyping, 3D printing OMT – design and production & coordination and networking technologies (e.g. computer-aided design tools, CNC, MRP, etc.

Source: compiled by the author

In the context of industry 4.0, such strategic indicators of design enable clear strategic opportunities advocated by scholars and practitioners: competitive strength, flexible manufacturing, individual customised products and services, innovative business models, new working and collaboration ways, resource-efficiency (production on demand), production at a place of use or in the market and user engineering through his integration in development process (Bartevyan, 2015, p. 2). Indeed, innovation, and thus design, as showcased above, can beat on the market with same value enablers (Francis and Bessant, 2005, p. 172ff). When it comes to design integration areas in the course of Industry 4.0, there exist different classifications and specifications of key technologies and domains of their application (Dujin *et al.*, 2014; Bechtold *et al.*, 2014; Blythe, 2014; etc.). Areas of application can be distinguished based on such criteria as networked systems; intelligent products/services; smart solutions, users; key enabling technologies; key economy sectors (transport/logistics, energy, mobility, maritime, environment, healthcare, business, insurance and finances, creative industries); industrial applications (e.g. advanced manufacturing); social and virtual networks and culture and social interactions.

Yet, within industry 4.0, design integration and exploitation for value creation is considered impossible without key enabling technologies. These are likely to be essential for innovation, and thus for design integration creating strategic value. Key enabling technologies allows design integration and exploitation within product/service innovation processes through integrating all key stakeholders – companies, suppliers/partners, customers, users and policy decision makers (Whyte *et al.*, 2015, p. 13). Within innovation processes, such technologies play crucial role for innovations, as they make innovation and thus design process more accurate, efficient, provides more activity/action room, time saving and cost efficiency, result-orientation (product/service innovation), resource efficiency, experimentation and sophistication (Dodgson *et al.*, 2008; p. 5; Thomke, 2001, Schrage, 2013; p. 211ff; Debackere and Looy, 2003). They also make sharing between and coordination of stakeholders and coordination of actors in innovation process simpler. Such design enabling technologies are used both internally and externally – corporate and market (community) level as well as in the economic and social context, characterised by shift away from manufacturing industries to services in developed economies. This, in turn, is stimulating innovations leading towards improved value, quality and experience in consumption. Economically, it is also increasing productivity and profitability in their supply (Dodgson *et al.*, 2008; pp. 5-6).

Fig. 1. Business Modelling for Design Integration within Industry 4.0 Landscape



Source: compiled by the author

Conclusions

Design integration and tracing its potential for value creation needs cross-cutting perspective. Establishing cross-linkage between design and business domain to innovation in Industry 4.0 landscape allows forging design-driven strategic orientation of enterprise as well as proposes background to generate business models for enterprises aiming to catch up with Industry 4.0 and to comply with its tenets – operational efficiency, competitive excellence, smart and sustainable growth. This research contribution yields that design is a sound source of value creation through innovation, competitiveness and growth. Creating value through design integration can become heart of businesses that set out not to be innovative, competitive and growing, but using design to move towards uniqueness and smart and sustainable competitive strength. Design as a driving force for value creation makes it hard for competitors to imitate business model and strategy. Design integration as key 'ingredient' in business model within Industry 4.0 comes up with new perspective crossing boundaries of business and technological array. The conceptual common thread needs to agglomerate concepts supporting this smart and sustainable growth. The author argues that interlinking profound concepts from the strategy, management and firm-based literature with that of the strategic design related concepts in the paradigm of European economic development could support business excellence in European SMEs. In fact, the present research, which is complementary to the first attempt to perceive and track design integration for innovations within Industry 4.0, reveals the positive link and provides a potential model for small enterprises to proceed.

Deepened observations of entrepreneurship practices within Industry 4.0 domain support the scholarly justification of positive design impact for innovations and extend the perspective. If design integration yields the power to develop and exploit innovations being a driver for competitiveness and growth, it is rather also the case that design will result in value creation. Achieving innovation, competitiveness and growth is smart strategic orientation of an enterprise. Design integration and design management practices might affect not only the innovation dimension of entrepreneurship but also the entire enterprise ecosystem and value creation emanating from design integration within business practices. It is not enough to rely on service design as a business model. There is needed integrated perspective on design perception within Industry 4.0 and smart enterprise in order to remain sustainable, resource-efficient and smart. Internal and external perspectives need to be combined, as the proposed business model implies. The empirical data justify this need and showcase the importance of design integration for enterprise innovation capacity, competitiveness and smart growth.

Nevertheless, the research results recognise affordance to quantify the positive design impact within the business model application in the subsequent research step. Particularly, this is evident in the case of design integration and its potential for small enterprise within the parameter of smart growth. The future research impetus is therefore driven by the fact to generalise the positive research implications with empirical observations. A number of enterprises should be analysed in this context from being very small to bigger ones. Further, empirical data need to showcase perspectives of different enterprises performance across the networks, particularly, focusing on the increased connectivity, intensified interactions and stronger focus on customer and end-user logic.

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Appendix 3: PUBLICATION III

Gerlitz, L. (2016). Developing a Design Management Model for Innovating SMEs in the Context of Regional Smart Specialisation. Research in Economics and Business: Central and Eastern Europe, 8 (2), 26−27, (**ETIS 1.2 classification).**

Developing a Design Management Model for Innovating SMEs in the Context of Regional Smart Specialisation

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Abstract

The research paper presents the development of a design management model for SMEs based on the implementation of a design intervention programme. Using two regional SME cases and applying a process-based design intervention, the challenges of the SMEs are addressed and reduced in a more efficient and effective way. Therefore, new strategic perspectives for organisational change, innovation and competitive strength can be recognised. The integration and comparison of two SMEs facilitates the inductive implications for the delineation of a design management model and reduces the potential for controversy. The proposed model implies both theoretical and practical contributions: contributing to design management literature on SMEs and suggesting a practice-based process model for SMEs in improving their performance. This model expands the potential of design integration in SMEs and may motivate SMEs to participate in design support programmes to improve performance. Sustainable aspects of the model are subject to future research.

JEL classification codes: O14
Keywords: design management, innovation, design function, entrepreneurship, micro and small enterprises, SMEs, regional development

1. Introduction

Design and design management, its effectiveness and efficiency, as a tool, process, style or way of thinking and acting had already been acknowledged for organisational change and strategic strength by scholars from different disciplines. Yet, design management integration within practice-oriented SMEs has been largely marginalised or not successfully accomplished compared to other types of organisations or business settings (Cawood, 1997; Bruce et al., 1999; Moultrie et al., 2007; Ward et al., 2009; Ystrom & Karlsson, 2010; Matthews & Bucolo, 2011; Bucolo & Matthews, 2011; Fernandez-Mesa et al., 2013, Barison, 2015). It is a paradox of missing competencies and a lack of practice-oriented processual models of dealing with design in small businesses (Bruce et al., 1999; Dickson et al., 1995; Walsh, 1985). The applicable research remains scattered in the case of using design management for SMEs.

Nevertheless, an increasing interest in design integration in government policies and business support programmes has recently been observed, which target the SME sector (Raulik et al., 2008; Moultrie & Livesey, 2009; World Design Survey Report 2010 SEOUL; Immonen, 2013; Global Design Watch 2010, etc.). Yet, most design-designated initiatives are concentrated in certain already creativity-driven geographic regions (e.g. New Zealand (Better by Design), United Kingdom (Design for Demand), Australia (Ulysses), and Denmark (Danish Design Ladder) (Bucolo & Matthews, 2011, p. 3; Straker & Wrigley, 2014, p. 2). In particular, these are usually regions of strong economic performance. Despite an increase in initiatives that support the role of design for innovation and the positive economic effects on business, most of these imply design monitoring or design auditing. Yet, a much greater need in solving specific enterprise-related barriers in design utilisation is seen, such as decreasing the gap in knowledge and research – by means of policy support and design intervention programmes – on what processes and frameworks may be adopted by enterprises to assist them in becoming design-oriented (Bucolo & Matthews, 2011, pp. 4–5; Ward et al., 2009, p. 78).

No single entrepreneurship innovation intervention from participation in design support programmes could be linked to organisational change. Most research has marginalised the issue of change at the organisational level induced by design intervention programmes. This bears a clear research gap. Although design intervention programmes for SMEs show significant economic growth in enterprises, little is known about how SMEs can develop capabilities in a sustainable way to become more design-led in developing innovations, and more competitive, even when using external support via such programmes. Crucial issues remain the process of how to employ tools, what challenges and opportunities are related to the design integration process and how the management of design integration takes place (Bucolo & Matthews, 2011, p. 5; Ystrom & Karlsson, 2010, p. 3). The literature clearly supports the idea that knowledge on organisational change occurring as a result of opportunity recognition, innovation, organisational strategy and organisational culture is to a large extent missing (Matthews & Bucolo, 2011, p. 999). An integrated approach to innovation involving design and technology is considered a key driving factor for economic growth and competitive advantage (Lüttgens & Piller, 2010; Wood et al., 2011). Yet, the expansion of design beyond the tactical entrepreneurial activities of SMEs at the regional level is not fully utilised. This is especially true in the face of pressure on enterprises that are forced to adapt to new circumstances of competition, social expectation and cultural understanding (Buchanan, 2015, p. 5; Deserti & Rizzo, 2014, p. 36; Lockwood, 2004, p. 37; European Commission 2014a, 2014b, 2015; Delgado et. al, 2012, Porter, 2000; Edinburgh Group, 2012; Ayyagari et. al, 2011; Fraser, 2010, etc.).

The challenging nature of this research field was at the heart of a cross-border research project aiming to improve innovation and competitiveness in regional SMEs from the South Baltic Sea Region. In this region, SMEs are recognised as being less competitive and performing worse than their counterparts. Within the framework of the South Baltic Programme 2007–2013 and the INTERREG IVA cross-border project Design EntrepreneurSHIP, including four partners from Poland, Germany and Sweden, the author acting as one of the project partners representing the research field addressed the research problem of the rather marginalised focus on innovation development in SMEs by integrating design management in operational and strategic arrays. The research target group included manufacturing (technology-driven) and non-creativity-driven, micro and small regional enterprises that needed support according to performance figures in regard to regional development and smart specialisation strategies. These SMEs have rather limited design competencies and capabilities.

Using design management practices implemented within the project, the researcher aims to develop a multidisciplinary design management process model for SMEs, which could serve our regional businesses as an integrating and orientation tool for deployment in entrepreneurial practices in technology-driven micro and small enterprises, which suffer from less design orientation. Therefore, the following research question is raised by the author: *How can a practice-oriented multidisciplinary design management process model be constructed for technology-driven micro and small enterprises leading towards increased design orientation and innovation as a result of a design intervention programme?*

In order to provide an answer to the research question, first, the researcher constructed a conceptual framework based on innovation, and strategic and organisational management literature. Then, this is used for a design management implementation scheme with regional SMEs. The author limits the research scope to two enterprises and design management implementation with them. Therefore, two regional SMEs are treated as separate enterprise case studies with 10 SME solution cases solved. Based on the given problem and objective related to each individual enterprise and its ecosystem, SME-tailored solutions are proposed facilitating innovation, competitiveness and growth potential. On this basis, the author proposes a practice-oriented design management model, and discusses implications for technology-driven SMEs related to innovation, increased competitiveness and growth.

2. Theoretical framework

2.1. Ecosystem perspective – design and management for innovation

Innovation is recognised as a key factor for increasing productivity, efficiency, competitiveness, business growth, employment and to achieve socio-environmental compliance within an entire ecosystem (Fagenberg and Nelson, 2005; Tejinder, 2010). By eliminating or reducing the negative external impact from the environment (i.e. the market) and improving internal operational and strategic interactions, enterprises enhance their capabilities in overcoming environmental challenges or reducing their negative impact (Damanpour et al., 2009; Damanpour & Aravind, 2012). Building upon the past and recent trends and the multifunctional deployment of design management within enterprises, design management has been perceived as both a very narrow and specific or very comprehensive phenomenon. Broadly, design management can be understood as all the methods, means and tools referring to planning,

realisation and controlling the effective use of design to achieve business objectives. Design management is perceived as a holistic process extending across all design fields aimed to create a homogeneous image of an enterprise (Meier-Kortwig, 1997, pp. 17-19). Definitions of design management in a similar fashion are found in numerous other writings, where it is conceived as a bundle of organisational and managerial skills and practices to optimise the design process (Chiva & Alegre, 2009, p. 426; Koostra et al., 2009, p. 9). Most research shares the objective of scrutinising the impact of design management on enterprises and their markets, products and consumer orientation alongside their performance on the market of their marketing strategy (Nevado et al., 2016, p. 74). Debates related to implications on internal operational and small business processes appear to have been marginalised in topical discourses (Borja de Mozota, 2003, p. 88). Nevertheless, design has been a research focus from the organisational perspective. It is recognised as a resource deployed by the management or an activity involving numerous interactions with other actors in the product, service or process development process (Walsh, 2000, p. 74). Yet, it might be argued here that design management, when applied within the entrepreneurial dimension, should cover three different levels of enterprise management – the strategic, tactical and operational level (Holland & Lam, 2014, p. 22).

In fact, it is essential to link all actors in the innovation process, both inside and outside the firm, to establish and maintain the role of designer as a "gatekeeper" that facilitates such linkages (Walsh, 2000, p. 88). Similarly, Gardien and Gilsing (2013) recall the need to integrate internal and external perspectives for innovation generation. This means it is necessary to create meaning beyond the technological improvement of a product. It is much more about creating an ecosystem and integrating different perspectives that enable a transformation and therefore innovation (p. 56). By acknowledging design's value for organisations, its power to differentiate, position on the market and improve the functionality of internal processes and the external appearance of organisations (products, services), it can be viewed as a strategic resource. Indeed, design management is understood as a development process leading towards the optimisation of organisational performance, which can be expressed in the form of products, services, organisational processes or positioning (brand) – 'the 4Ps of the innovation space' (Tidd & Bessant, 2013, pp. 24–29).

2.2. Design as a strategic partner within entrepreneurial discovery

Since innovation is regarded as key to competitiveness and growth, and design as a strategic resource, then the creativity and design that integrates entrepreneurial performance becomes the concern of the strategic domain. Indeed, the success of the strategic domain can be associated with key factors that define the enterprise's performance internally and externally on the market; in other words, resources, capabilities, competencies and used opportunities (Wernerfelt, 1984; Barney, 1991, 2001; Amit & Shoemaker, 1993; Peteraf, 1993; Prahalad & Hamel, 1990; Alvarez & Busenitz, 2001; Connor, 2002; Hoopes et al., 2003; Helfat & Peteraf, 2003; Casson & Wadeson, 2007; Teece, 2007; Crook et al., 2008; Naranjo-Valencia et al., 2011; Foss, 2011; Candi, 2016). It can be argued therefore that there is a clear conceptual linkage of design and management perspectives with regard to the domain of strategy. This is also supported by the longitudinal research outputs (Mintzberg, 1990; Liedtka, 2004; Liedtka & Mintzberg, 2007; Beverland & Farrelly, 2007; Brown, 2008; Martin, 2009; Malins & Gulari, 2016; Gulari & Fremantle, 2015). Design is a value creator and strategic tool to be deployed within entrepreneurial practices that strengthens the strategic performance of an enterprise

(Kotler & Rath, 1984; p. 16; Er, 1997, p. 293; Borja de Mozota, 1998, p. 26; Verganti, 2008, p. 440; Borja de Mozota & Kim, 2009, p. 67).

As a result, two key research streams related to design have viewed design through the strategic lens of strategic design and service design. The research on strategic design started around the 1980s and argued for the role of design in managing design projects as a reaction to the growing complexity of new product development processes (Holland & Lam, 2014, p. 5) Design is also a reaction to alter the resource domain or to improve corporate performance; therefore, leading towards a corporate transformation that affects strategy, structure, systems and the culture of enterprise (Ravasi & Lojacono, 2005, p. 52; Candi, 2016, p. 34). Indeed, design is being increasingly acknowledged as a strategic resource (Borja de Mozota, 2006, p. 46; Stevens 2010, p. 1; Westcott et al., 2013, p. 15; Hertenstein et al., 2013, p. 8; Holland & Lam, 2014, p. 154). With regard to service design, the strategic role of design has also been frequently revealed through the lens of 'customer value' (Schmiedgen, 2011, p. 1). Design innovation and therefore business modelling has been linked through service design approaches (mostly, design thinking). Nevertheless, the role of other driving parameters and factors for business model and strategy from the design management related literature seem to be underestimated (Borja de Mozota, 2013). It is not necessarily the design thinking approach that can be used as the best approach for innovation and business modelling purposes in enterprises, or value creation from the business model, as the literature showcases.

Having recognised the importance of resources, capabilities, capacities, competencies and opportunities for the strategic orientation of enterprises, advocates of design and creativity also started to integrate the strategic notion within design-related discourses. Building upon the Resource-Based View (RBV), design might be perceived as a resource, core competency, capability, capital, differentiator, integrator, transformer and good business practice (Borja de Mozota, 2006, p. 45). This is because RBV recognises organisational development and its strategic performance emerging from efficiently and effectively bundled and deployed resources, capabilities and knowledge internally (organisational level). Based on scholars that focus on resource impact (Helfat & Peteraf, 2003, p. 999; Bertola & Teixeira, 2002, p. 181), it might be argued that design could act as a resource, organisational competency and capability. In addition, it can be used as an intangible asset (e.g. creative capabilities and knowledge) or a tangible input (expressed through visualisation, form, performance and ergonomics) to production that an organisation owns, controls or has access to. With such a bundle of organisational strengths, an enterprise is able to generate a competitive advantage (Wernerfelt, 1984; Grant, 1991; Rasche, 1994) or sustainable competitive advantage. Resources (here also design) encapsulate sustainability peculiarities, since they are likely to be hardly duplicable, imperfectly imitable and non-substitutable (Barney, 1991, pp. 105-106; Boxall, 1996, p. 65). This can be done in the case of design through, for example, distinctive form, style, messages combined with performance and functionality that design possesses, or new meanings associated with products, services or organisations themselves (Verganti, 2008, p. 440; Jonas, 2011, p. 1). In this sense, RBV makes it possible to consider enterprises from the strategic perspective or strategic entrepreneurship (Foss, 2011, p. 1).

However, as recognised in many research sources, although RBV is a dominant theoretical concept in the strategic management literature, it suffers from several drawbacks. Principally, RBV has failed so far to integrate creative and entrepreneurial processes. This can be traced back to the observed linkage between theories of strategic advantage and theories of creativity and entrepreneurship (Barney, 2001, p. 53). Empirically, there is little known about how firms

differ in their resource bases and how resources are connected to sustained profitability (Armstrong & Shimizu, 2007; Newbert, 2007; Crook et al., 2008). In addition, RBV provides rather an ex-post facto analysis and assessment of successful firms. There is a need to know a priori where assets come from, how they are created and deployed, and whether they will prove to turn into strategic assets. A path-dependency aspect is needed for consideration when delivering success (Connor, 2002, p. 312; Priem & Butler, 2001, p. 22; Dutta et al., 2005, p. 277). According to Arend (2006), RBV is often used to establish context, since independent variables can be brought together and labelled as resources, (p. 412). Resources and performance need to be linked and measured. Measurement is a difficult issue when dealing with tacit and not intangible resources (Poppo & Weigelt, 2000, p. 586; Coff & Laverty, 2001, p. 1). RBV marginalises external market sources; for example, resource endowment coming also as a result of changes in the external environment and the need to adapt and reposition on the market. Time is a crucial factor in RBV, as entrepreneurial success and survival is bound through developed and sustained resources, which will make adapting to the changing conditions in the environment possible (Connor, 2002, p. 307).

3. Methodology

3.1. Research design

Given the research area of design management in micro and small enterprises, the present research design follows the principals of 'methodological fit' (Edmonson & McManus, 2007, p. 1155); that is, the research design complies with tenets ensuring internal consistency among elements of the research project – research questions, prior work, research design and theoretical contributions.

The research approach is exploratory. Exploratory research usually implies a qualitative research approach, since it is concerned with an underdeveloped topic (Shields & Rangarajan, 2013, pp. 26–27). Indeed, qualitative research facilitates the exploration of the phenomenon in-depth or the discovery of new phenomena (Borrego et al., 2009). The choice and adaptation of a qualitative research approach has been justified, carefully taking into account applicable research streams (Neergaard & Ulhøi, 2007, p. 1; Fossey et al., 2002, p. 717), where the qualitative research approach has dominated. The research approach is usually determined by the research question (Creswell, 2002). The present research question does demand an explanation and reasoning of the role of design and its patterns within the organisational context of SMEs. In other words, to provide answers to why, how, who and what are involved in design management. The research approach can also be called a hybrid one (Fereday & Muir-Cochrane, 2006, p. 80), since here the author combines both deductive and inductive streams of conducted research.

In order to explore the role and impact of design, it is necessary to understand the scope of design management and its role for innovations. For this, the researcher employs the design management concept from previous research (Hack et al., 2012), which was initially used to test the impact of design management. Using this basis, the author analyses design integration patterns and the effects the design management process might have on organisations of different sizes. As a result, inductively, a new combined design management model based on real-life practices (SMEs cases) is proposed. As emphasized by Kelley (1999), in the case of design-related discourses, an inductive approach to innovation is rather dominant (p. 32).

3.2. Research methods

The present research employs qualitative research methods, and since it is exploratory and oriented towards indicative reasoning, the case study method was chosen. Two enterprises are used as enterprise case studies, whereas 10 single solutions developed as a response to a specific enterprise-based problem, challenge or idea serve as an individual design-oriented solution for enterprises (further referred to as SME solution cases). The case study method makes analysing specific phenomena possible. It is also crucial in making conceptual models (Eisenhardt, 1989; Miles & Huberman, 1994, p. 101; Stake, 1995, pp. 4–6; Yin, 2009, p. 2; 2012, p. 3). Indeed, case studies dominate research focusing on links between design and innovation and new product development, and are also present in research contributions related to strategic management and business strategy (e.g. Borja de Mozota, 1998, 2003). The case study method, where a given enterprise is perceived as a case study, is linked with other qualitative methodological choices (Yin, 2009, 2013). It is argued to be an appropriate method when exploring design management practices and their role for small businesses and design management networks, as they make tracing links and investigating relationships between interacting structures and units possible; for example, in a given enterprise (Wassermann & Faust, 1994, p. 8; Scott, 2003, p. 38ff; Corbin and Strauss, 2008, p. 123ff). In fact, a case study method makes it possible to catch the particular quality and complexity of a single case (Stake, 1995, p. xi). Svengren recognised the importance of case studies in dealing with design management as opposed to action research (1993, p. 444). With a number of cases, a better comparison can be achieved. Different SME solution cases reduce the critical issue related to validity as well as confronting the model. Indeed, the exploration of several cases facilitates a holistic view of design integration and its impact. It also increases the potential of practical applications of the model and displays of best practices for SMEs outside the regional setting.

Next to case studies, semi-structured interviews were used. The interviews were needed to help verify the results achieved (developed SME solution cases) outside mentoring teams, who were responsible for the development of the solutions. As a result, interviews were made with two external groups: enterprise representatives, and external experts and coaches involved in solution development for SMEs, but being external to mentoring teams and acting rather as advisors to mentoring teams. The semi-structured interviews were undertaken with the enterprise representatives before the design management consultation, in the middle stage of developing the SME solution case, and then after the solution development stage. This enabled tracking the valuation and impact of design integration and its management before, during and after the design management consultation. This made it possible to perceive the design management process and its framework. In total, 15 semi-structured interviews were conducted with enterprise representatives using the developed interview matrix. This matrix addressed issues related to difficulties, challenges, impact and value added from the design management process and its integration within entrepreneurial practices both internally and externally on the market. In the case of the second group, external experts and coaches, 12 interviews were conducted. These interviewees included four renowned design management experts worldwide and eight experts from project partner organisations (two experts per partner from Germany, Poland and Sweden representing different fields of design, business and technology). Specifically, the researcher asked respondents to elaborate on the need for design management in terms of regional development and the SME sector, how experts understand design management, which critical stakeholders are involved in innovation

projects, how they assess SME design management project results (outputs) and inputs (knowledge utilised from the consultancy groups) as well as why we need the interplay of three arrays of design, business and technology.

Finally, in order to track the design management process from the internal perspective (i.e. mentoring teams, who were involved in the SME solution case development process), the researcher interviewed all members of the mentoring (consultancy) groups (n = 30) before and after the project with the particular SME. In total, 120 interviews were conducted from two mentoring sessions concerning two enterprises. These mentoring groups consisted of design, business and engineering students, graduates and start-ups from Germany, Poland and Sweden, who had no prior experience with design management, had already worked with design in enterprises or were already running their own individual design-related business, (e.g. freelancing), thereby providing a design consultancy or working as an external designer or expert within an enterprise. In this case, the hybrid mentoring capacity also facilitated the integration of experiences and perspectives from different levels, fields, and academic and practical as well as different cultural backgrounds. In total, 30 mentoring experts divided into five competing groups were assigned to solve a specific problem or develop a solid idea for the individual pilot enterprise (SME). Consultancy groups or innovation developers worked in close cooperation with the particular enterprise when implementing the project. As a result, during the research project, three key terms were introduced – knowledge developers (5 mentoring groups consisting of 6 individuals with different academic, cultural and practical backgrounds), knowledge absorbers (participating pilot SMEs, two enterprises in this particular case), and design management knowledge facilitators (auditors – internal and external experts and coaches).

3.3. Data analysis and management

With regard to data management, all interviews were recorded and transcribed. Together with the research peers, the author interviewed target stakeholder groups: knowledge developers, absorbers and facilitators. The data was analysed using qualitative data techniques, since the research gap concerns the process and framework related to design management in small enterprises that, in turn, primarily targets content. In particular, narrative and storytelling was used. The importance of storytelling is increasing, since it makes it possible to display the design process, and to capture its role and value. Firms have moved from solely offering products tō also offering experiences (Beckman & Barry, 2009, p. 152). Therefore, softer aspects as well hard factors within insights are taken into account to build up a successful design management strategy for the SMEs. To that end, it was important to track the processual aspects related to how design is integrated and managed within the enterprises and what potential results this might lead to.

The body of empirical evidence was subject to a thematic analysis method (Braun & Clarke, 2006). This method uses the design management checklist with key questions to be answered by the mentoring groups from each of the particular fields of design, business and technology. The checklist covers both operational and strategic organisational levels and entrepreneurial practices. In order to evaluate the impact of the implemented design management process (consultation), the author used field notes, diagrams, visualisations of the SMEs' solution cases, memos as well as social network analysis. The narrative results are better perceived by having them available (rf. Annex).

Two SMEs and their problems were dealt with in the project within the framework of the first two training sessions, which took place in 2012 (April and July). This means that during an individual training session, one enterprise and its related problems or challenges were subject to exploration. Therefore, the research findings in the next section present the design-oriented solutions for two different enterprises: one a micro enterprise (up to 5 employees), and the other a small enterprise (up to 50 employees). This exploration was conducted using the conceptual framework matrix (Table 1). Having different organisational scope, the enterprises under scrutiny also differed in their cultural and operational background. Yet, both of them are high-tech SMEs with limited design resources or acquiring external design knowledge.

The rationale behind limiting the study to two SMEs is as follows. The last training session of the one-year training cycle did not specifically involve an SME, but a public organisation (museum). For this purpose, to safeguard the variation and the same entrepreneurial common thread of having two SMEs, without any other discolouration regarding organisational structure (e.g. public organisation beyond the scope and principles of those shared by privately organised SMEs), the author focuses on displaying design management within two enterprises. Having this in mind as well as arguing that design integration is mainly challenged in two SMEs with a focus on technology or business fields, rather than issues of design, the research scrutinises design utilisation and design management in fields that are not governed primarily by graphic or industrial design; for example, the appearance, usability and aesthetics of products, services or systems. Therefore, business and technology fields are the primary challenged fields according to the enterprises themselves.

4. Findings

4.1. Delineation of processual perspective of design management implementation and its framework conceptualisation

The present research delivers a practice-oriented multidisciplinary design management process model for technology-driven micro and small enterprises leading towards increased design orientation and innovation as a result of a design intervention programme. To delineate the model, two SMEs and the implementation of design management consultations with them (i.e. a practical thorough analysis of enterprise performance in technology, business and design arrays), serve as an empirical basis to ground the following inductive reasoning. The feasibility of the model, its principal application and allocation of differing stages is therefore built upon solution cases (in total 10) for two SMEs, as delivered during the design management consultations. These solution cases serve as sources and examples supporting the reasoning of processual aspects of the delivered design management model. They also underpin the storytelling of the design integration process, which was claimed as demanded by topical research scholars, and facilitates capturing the delivered value expressed through design (visual form). For this reason, and taking into account the limited scope of this paper, only two visual examples, implying two different challenges for the two SMEs and the processual design-driven response by delivering two feasible SME-tailored solution cases, are discussed here. The value generation by delivering other SME-tailored solution cases as a result of the design management consultation is summarised by means of a brief narrative or storytelling expressed in matrix form (Appendix 1 and Appendix 2). This is done to safeguard a better balance between the visual and narrative reasoning.

The results of the contents of the design management consultations are presented in Table 1. The author defines this matrix as a conceptual framework, which serves as a design management consultation in order to solve a content-based problem or challenge for a given SME or to utilise the discovered idea or opportunity. It is a scheme that makes up the overall design management process (consultation) implementation. Principally, for future research and other design management consultations, it can be referred to as a principal conceptual framework matrix, which defines who are involved in the design management process, as well as how, why, when, to what extent, for which purpose and with what impact. The author constructs this matrix by adopting project management evaluation techniques and processes. It is believed that its tenets can also be employed within this context. This facilitates tracking the impact of design management within micro and small enterprises. The approach is also useful because purposes, processes, activities, and outputs are to be provided in this context. The incentive can be linked with design integration and contribution on an operational, tactical and strategic level (Holland & Lam, 2014, p. 9). It might also be used as a matrix of the impact of design according to the function that design adopts within the enterprise context (Moultrie & Livesey, 2014, p. 481; Valencia et al., 2013, p. 369), such as product-related and process-related roles. Yet, all agents involved internally and externally within the development of products or services in the enterprise, play a significant role and contribute to the fulfilment of one of the other functions of design for enterprise performance internally and externally.

The developed conceptual framework matrix includes both comparative and narrative forms of the deliverables as well as enabling weighting and the synthesis thereof. In order to arrive at a certain solution, which is by the end of the project accepted by the given SME (problem or challenge solving, feasible idea generation, product, service or innovation solution, opportunity transferred into a business model or similar), there is a need for a structured approach. For the research, a structural approach implies the application of a processual perspective on design management and its implementation within an SME. As a result, certain processes, steps or stages need to be undertaken in order to arrive at a feasible solution covering and addressing the entire ecosystem of the given SME. Specifically, these processes, steps or stages need to point to the three fields of an enterprise, namely, technology, business and design. It is argued here that in order to deliver a successful design management consultation, the following approach, as shown in Figure 1, should be employed.

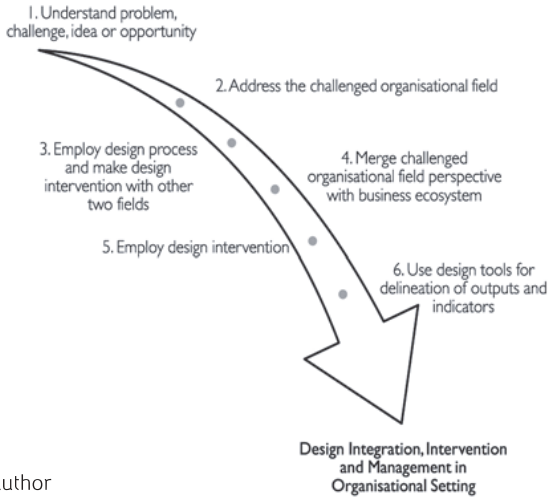
Table 1. Conceptual framework matrix for design management process implementation based on two enterprises

SME scope	SME problem / challenge addressed	Organisational field addressed	Process used	Activities and Tools employed	Outputs and Indicators achieved
SME 1 **Size:** Micro enterprise **Entrepreneurial scope:** Provider of a fuel cell, which gives heat, air conditioning and electricity through reduced oxygen generation, thus providing an ecological fire protection system.	• Attracting future customers, i.e. convincing them of advantages of the fuel cell system and gaining greater market penetration through new customers or engagement in new customer networks.	• Business problem: • Marketing and corporate problem • Tactical level: attracting new customers; diversifying customer groups • Strategic level: developing new marketing strategy and new business plan • Strategic level: improving organisational culture and organisational performance	• Merging internal (identifying key resources, capabilities and strengths) and external perspectives (identifying customer needs and target groups) • Combining technological output with business performance • Increasing the visibility of the product outside • Servitising product and enterprise	• Business problem as a point of departure • Integrating design tool on tactical and strategic level by means of: • Graphic design • Appearance • Aesthetics • Communication • Product promotion • Branding	• Strengthened corporate identity • Consolidated marketing strategy for product appearance, functionality and usability • *Design as a strategic resource and process at the strategic corporate level*
SME 2 **Size:** Small enterprise **Entrepreneurial scope:** Heating and ventilation unit producer and distributor	• Despite successful market performance, difficulties either with the entry of new products to the market or unsatisfactory sales figures after market entry. • Search for creative ideas to extend its product line, e.g. devices characterised by increased efficiency. • Overcoming minor functional problems with existing products.	• Operational problem: technology field (product appearance, efficiency, redesign, functionality and usability) • Operational level: product improvement • Tactical level: market entry with new products and streamlining product line • Tactical level: marginalised sales; diversifying customer groups • Strategic level: developing new communication strategy and new business plan	• Merging all agents involved in service provision process • Analysing step-by-step peculiarities of design, technology and business arrays that stick to a specific product	• Technological problem (operational level) as a point of departure • Integrating design tool on operational, tactical and strategic level by means of –> • Product functionality fit to appearance • Usability • Service ecosystem • Scenario building • Synthesising • Adopting	• New appearance of the product provided • New service package developed attached to the product • Changed product appearance implying the communication message • New market entry strategy based on relaunched product appearance • *Design as a tool at operational level improving product appearance, usability and commercialisation potential through differentiation and targeted customer communication*

Source: Compiled by the author

Taking the aforementioned into account, the presentation of the design management process is based on showcasing design management from a processual perspective; that is, deconstructing the design-driven process into specific steps or stages that yield design integration, intervention with other fields and multidisciplinary management. Consequently, the rationale and impact of each stage for the enterprise – improving the organisation's operational, tactical or strategic performance, providing new innovation incentives or similar – is underpinned by discussing applicable solution cases from the two concerned SMEs. The SME solution cases imply a reaction to the problem or challenge as formulated by the enterprise. In order to ensure consistent quality and balance of discussion throughout the entire paper, the presentation of design management from a processual perspective is based on passing through and demonstrating the stages attached to specific design management processes in the two SMEs. Sensitive data belonging to the enterprises are not disclosed. This does not yield any negative impact on the evaluation of the design integration, intervention, management and impact.

Figure 1. Processual perspective of design management consultation and intervention



Source: Compiled by the author

Step 1. Understand problem, challenge, idea or opportunity. This particular stage may differ depending on the given business ecosystem. The important issue here is the challenged organisational field, which is addressed by the enterprise. It becomes an essential and time-consuming interaction when an enterprise is a hi-tech driven business undertaking, the target groups of the enterprise are very specific, or the problem or challenge is not specifically defined by the SME itself. In the case of the regional hi-tech SME (Germany) (SME 1), which produces a fuel cell system combining different functions, the first stage appears to be resource-demanding; in other words, time and a thorough understanding is needed. SME1 proposes a very flexible solution for a range of customers. The system is an installation placed outside facilities (rooms) but connected with building installations (e.g. fire protection system). The key business proposal by the enterprise is to reduce the oxygen content within buildings. Since oxygen serves as one element for fire ignition, its reduction also diminishes the risk of fire ignition. In this, fire prevention is achieved. The system integrates heat, air conditioning and electricity functions through reduced oxygen generation, thereby providing an ecological fire

protection system. Preventing fires also contributes to the reduction of negative environmental footprints, as the additional functionality of electricity, heat production or cooling generation can be achieved based on the same input source in the system (low-content oxygen). The product represents a sustainable, smart and safe solution. The SME faces business growth problem. The key challenge is related to future customers.

SME 2 is a medium-sized enterprise (Poland). The SME operates as an expert on the economical heating and ventilation of industrial objects and utility service areas. It provides solutions, mainly, for medium and large enclosed spaces like warehouses, production halls, supermarkets, sports objects, churches, workshops and car salons. The enterprise's products stem from an established strategy, which steadily helps build the company's competitive advantage based on innovativeness, high quality and partner relations with customers. The key business proposal of the enterprise is the provision of innovative projects and implementing air heating and ventilation products with special attention to the application of progressive industrial design, energy efficiency and unique steering methods. The enterprise aims at being perceived as an expert when helping customers find a well-suited air heating system. However, despite a stable financial situation and continuous cooperation with designers in new product development and investment projects, challenges are faced on the market. SME 2 has difficulties entering new markets with new products or has unsatisfactory sales figures after market entry with new products. In addition, the enterprise sets out the idea of extending its product line, especially taking into account the technological and functional performance (usability) of the product itself. Increasing efficiency or overcoming functional drawbacks of existing products belongs to the objectives as well. Therefore, it might be said that the problem / challenge refers to both technological performance and marketing.

Step 2. Address the challenged organisational field. Taking into account the given problem or challenge, idea or opportunity, it is necessary to understand which specific field the recognised object (problem, challenge, etc.) addresses. This is a necessary precondition before employing the relevant design tools in the next steps. In both SME cases, the problems or challenges target the business field rather than technology or design. Both SMEs are referred to as technology-driven. The recognised needs target either marketing, market penetration or improvement of sales figures. They also have strategic issues, such as business planning, sustainable stakeholder management and similar. Operational drawbacks, such as changes in product appearance or the introduction of new features in the product group, do not dominate the problems and challenges portfolio of either SME. This might imply that from the technological side, the SMEs are employing their technological capabilities; however, the challenges addressed here mean that the technological side appears to be rather decoupled from the appearance (design) and business operational and strategic arrays.

Step 3. Employ the design process and make a design intervention with the other two fields. In this step, it is necessary to perceive and recognise design as an important operational and strategic resource. Acknowledging resources internally and externally from all three fields – technology, business and design – help 'track' product peculiarities – what it is, how it is perceived by the SME itself, externally, how does the product / service function or operate and what can be forecast. It is rather a typical failure made by SME planners or managers to decouple design from technology and business. As observed in SME 1, knowing and following the steps provided in the model above may result in a shortened innovation process cycle, a

better mutual understanding of different agents (designers, business people and engineers who need to work on an innovation project together), improved co-work and specific delivered value. Processual acting also fosters easier conflict resolution, which may arise due to different working languages, methods and the distinct operating cultures among designers, managers or engineers. Finally, it might improve the evaluation and recognition of the SME itself if the core of the SME's performance is decomposed into its individual parts, thus enabling tracking back to the root of the problem or challenge associated with a particular product, service, organisational or marketing issue. Similarly, bearing in mind the overall outcome of the real-life scenarios (solution cases) implemented for SME 2, it might be argued that a very precise predefinition of the challenges or problems by the enterprise makes a more efficient and effective implementation of the design management process possible. It is rather a project management approach that can be applied moving step by step from one point to another. Consequently, solutions are developed in a very structured way by narrowing down the search for the most optimal solution. Nevertheless, such an approach carries risk. The room for manoeuvring and design intervention remains rather restricted since the project management approach is used. As a result, the main focus related to the solution to the problem or challenge is placed on the business field and potential sources for solutions are associated with business. For this, the recommendation refers to finding a balanced way of handling the problem or challenge rather than being too precise and too narrow or giving broad operational boundaries.

Step 4. Merge the challenged organisational field perspective with the business ecosystem. In this step, the challenge or problem, idea or opportunity should be treated in the particular field. For instance, when there is a business (marketing related) problem, a marketing oriented process should be utilised and design tools integrated. In terms of the SME cases here, SME 1 needs to attract and convince future customers about the advantages of the fuel cell system and to gain greater market penetration through new customers or engagement in new customer networks and markets. This challenge clearly addresses their strategic corporate clout and requires strategic thinking, which appears to be the most extensive and challenging. It is design that is used as a strategic resource to be utilised within the innovation development processes. Taking the internal and external business performance of SME 1 into account, the consultancy groups needed to deconstruct the problem formulation provided by the SME. The key challenge lay in not having a clear understanding of the product itself. Yet, understanding design management as an open process that addresses enterprise issues related to all operational (product), tactical (business planning) and strategic (innovation development and growth oriented) settings, facilitated and accelerated the achievement of the given task. It provides new development directions for the enterprise from a strategic perspective and acts as a stepping stone for developing a new approach for the marketing strategy based on the complex product.

In the case of SME 2, the challenges address either the operational field or are associated with positioning drawbacks. In the first case, the approach requires a change of the form of the product (cases 1–3) or its visual appearance, which would lead to increased performance efficiency and streamlining the 'intrinsic' strength of the product. In the latter, the challenges target the 'external' perception of the product among customers and users, which implies better communication and promotion of products or their performance on the market (cases 4 and 5). Five challenges to be solved are presented in Appendix 2. When compared to SME 1 and its challenge, it is evident that the enterprise from Poland (SME 2) sets out merely to solve challenges related to the product itself (operational level). During the design management

consultation, it was apparent that the enterprise formulated a very precise brief (real-life scenarios) and provided mentoring groups with certain criteria and conditions to be met during the development phase. Indeed, in this regard the room the mentoring groups had to manoeuvre was more restricted than in the case of SME 1. Therefore, in contrast to SME 1, which aimed at developing a marketing and branding strategy based on a clear product idea and product communication, the case study of SME 2 more specifically targets the design field (product appearance, operational level) and aims at developing design solutions with design implementation concepts including cost projections for product design implementation.

Step 5. Employ design intervention. In this particular step, it is necessary to undertake an overall analysis and evaluation of the potential solution for the given enterprise. Here, it is essential to integrate not only design tools but to merge them with the technology and business tools (e.g. those that enable product functionality or exploitation on the market). The different working languages in the design, business and technology fields, as well as the different tools, approaches to processes and different perspectives need to be merged and treated together. It might be highlighted that this particular step is one of the most intensive and challenging ones: in terms of the multidisciplinary working environment, extensive working and implementation, intensive communication with SME representatives, the need to cover the entire business ecosystem when delivering SME suitable solutions as well as the other socio-economic factors to be taken into account. How quickly and to what extent a particular solution can be developed (final market-ready solution or prototype) depends on the complexity of the originally formulated challenge, problem, idea or opportunity, time pressure, heterogeneity of the team, co-work with enterprises, availability and interplay of technological, business and design resources, competencies and capabilities.

Step 6. Use design tools to delineate outputs and indicators. With this final step, as delineated during the research process, in order to resolve the specific challenge or problem, idea or opportunity, solutions are presented to the enterprises involved. Here it is essential to use design tools to visualise the content. The author believes, and this is in line with other research streams confirming, that it is crucial to use visualisation means when exploring design management case studies, analysing and evaluating the role of design for innovations, competitiveness and business growth. For this specific function and to better perceive the design management input, the selected SME solution cases are plotted in the Annex below. At this stage, it is indeed expected that visuals of the proposals are created for the SMEs that yield the overall business solution for the enterprise presenting the value creation, value proposition and value capturing actions.

In the case of SME 1 and the challenge or problem that targets the business, and in particular, the marketing field, the following results of the design intervention were achieved via the technology and design fields and the design management consultation. The author can distinguish two key building blocks in the findings, which can be agglomerated within the specific fields of design: corporate design, communication design, product design and environmental design. All aspects of these four forms of design have been touched upon during the design management process. Yet, it can again be emphasized that the holistic view of the SME can be achieved based on the model used. Particular findings refer to the optimisation of the external environment the SME is operating in as well as concerning internal business operations (i.e. the product and its development). It is argued here that only

by combining both perspectives, is an SME able to transform into a brand based on a sound strategic design approach, integrating the product dimension, which itself integrates the peculiarities of design, business and technology.

The author will now present the results in reference to selected SME solution cases. These were developed based on the same point of departure (Table 1) using different mentoring groups. Taking into account the limited scope of the article, only the most feasible solutions are discussed here. In sum, as is apparent from the results, which to a large extent confirm conclusions in the relevant literature (e.g. Bucolo and Mathews, 2011; Borja de Mozota, 2013, etc.), design might take over different functions and deliver multiple positive effects that in turn can be utilised for the further development of an enterprise.

When compared to other solutions that need further updates, one of the strongest solutions developed by the mentoring groups refers to the well-interconnected fields of technology, business and design. Here, we can see the clear impact of product alignment with technology and communication means, thus delivering a strong message to customers. The solution is based on having explicitly understood the technological peculiarities of the product. This, in turn, implies changes to the original perspective. It is fire prevention rather than fire control that should be put at the heart of the key communication message and marketing strategy. Furthermore, by understanding key technological advantages the product might deliver to customers, the mentoring group is able to enhance the number of target groups, and in this sense, pave the way to achieving multiplier effects that, in turn, generate increased value. As a result, the key message related to the product is supported, and the solution becomes more practice-oriented. Therefore, this specific solution was captured by the enterprise and integrated within its marketing strategy. Moving forward step-by-step, mentors were able to track key peculiarities related to the product, passing from the combination of the technology used from outside, through merging the technological strength with core internal enterprise strengths (key resources, capabilities and capabilities that enable to achieve key competitive advantage), towards integrating respective target groups that are subject to fire prevention. Finally, the solution case also integrates the perceived and embodied values, beliefs and perceptions of potential customers (target groups) attached to the product outside the company (i.e. on the market). Accordingly, it might be argued here that the marketing strategy is based on the coherent and reasonable outcome of the design management process, addressing all the necessary processes, tools, product interdependencies, technologies, as well as the appearance and perception of the product both internally in the enterprise and externally on the market.

As a result of solution case 3 developed for the company, the effect of the design management process is also clearly visible in time lapse. Three years beyond the project, the enterprise is still building its marketing strategy upon solution 3. The key message is the output delivered by using this technology – first, fire prevention, and second, other value add-ons that are delivered next to the fire prevention solution.

By echoing the CEOs of the company as a result of the interviews conducted after the solution was delivered, the achievement is in compliance with the values, brand and strategy the enterprise is pursuing:

We recognised two key issues: The first refers to how we need to communicate our company externally. Which direction does the company want to pursue? Who do we want to appeal to? Which message should be used to do this? Therefore, we understood that we should not address the end target group, but multiple groups (here, referring to planners of buildings, building / construction projects, etc.). The reasoning behind this is the following: they speak the same

language. Moreover, intensive building projects are associated with very precise marketing strategies and measures. After having recognised our target group we do want to take advantage of the network we have. We contacted a local company that has the contact details of the key planning offices. As a result, we can contact these directly, i.e. taking advantage of the value added chain, thus saving expenses and time. Otherwise, we need direct contact with potential customers. We started to address such questions as what should our message be about? What would we like to communicate? In what sense is the product subject to change based on the needs and demands of planners? In sum, the management process affects the design process. This is because based on the decisions taken by the management (new target group(s) identified), the product needs to be changed. Participation in the project led to conducting a professional target group analysis. Furthermore, we have reflected upon the product we sell. Consequently, we came to the conclusion that we sell fire protection with added-value, i.e. additional features. You are protected from fire and simultaneously can enjoy further advantages, such as having a source of energy.

In sum, the messages above imply design integration as a process and its impact on process-based solutions. Subsequently, SME 1 solution cases 1, 2, 4 and 5 and their results are summarised in Appendix 1. This is table bears in mind the page limit for the article. Nevertheless, all solutions were subject to a content analysis of design management and a synthesis of the results on the impact of design on the enterprise.

In the case of SME 2, and the tailored outputs and indicators that can be presented as a result of the design management consultation, showcasing the impact of the design intervention, it might be emphasized that within solution case 1, where the clear task was to redesign the blades of the air heater by changing the air directors, the need for a new design was seen by the enterprise as a result of adapting the blades to a different product (air heater) within one product line (LEO). Different lengths of blades are usually used in different products within the LEO product line. The current system with the option to fit the blades is based on springs that do not always work well. In addition, there is an essential need attached to the product design, more specifically, reducing production costs. As a result of this problem, the most challenging issue for the design management team was to comply with the enterprise brief – to develop a new blade concept that changes the air directors, includes a visualisation of the solution and cost calculations. After struggling with the brief and having recalled the real need during the design management process, in particular, linking product design with technology (i.e. performance and functionality) as well as taking into account the issue of the additional costs resulting from the new blade concept, the mentoring team decided not to prioritise the given brief by the enterprise, but to develop a product that meets the needs related to appearance, function, usability, performance and marketing (distribution on the market).

Therefore, after having explored the real problem behind the challenge, the mentoring group came to an innovative conclusion. It provided an air heater without any blades visible on the outside. The step-by-step exploration of the problem demonstrated that designing new blades would be a costly undertaking. The mentoring team recognised that, apart from directing the air, the blades had no real function. This provided the impetus to remove them and leave the air heater without blades. During brainstorming, the engineers from the mentoring team insisted on keeping the blades that fulfilled the role of directing the air. Based on input from the industrial designers, who felt responsible for the aesthetic function of the air heater, it was agreed to perform this function using simple aluminium blades hidden inside the air heater. In this respect, a positive outcome can be reflected through the new definition and

conceptualisation of the rather traditional and classical perception of the air heater. This implies a break from traditional discipline rules and the combination of design, technology and business perspectives concerning the product.

Next to the change within the product, the mentoring team proposed further solutions linked to the additional conditions of the brief set by the company – issues for solving the problem of product fittings as well as cost challenges related to the entire product line. In this respect, the mentoring team came up with a modular, flexible system that makes it possible to link frames together. In addition, this solution points out the challenge of the fittings, since the proposal creates more stability (than using springs) and saves additional costs. As described by the mentoring team:

The aesthetics of the visible part of the product could be inspired by the pictures given, bearing in mind creating a pattern, which could be effectively replicated and mass-produced in all the different sizes of the product range.

The external unit of the product should have one fixed shape / form, which should be easily manufactured for cost and transportation reasons (conclusion by mentoring team 1).

Taking into account the overview of the findings for SME 2, further solutions target integrating design into the business and technological fields, interactions within new product or service developments, or even redesigning products. In addition, marketing related problems are also solved. All solution cases 1–5 are summarised after the implemented content analysis in the results Appendix 2.

4.2. Delineation of design management model by merging content and process perspective

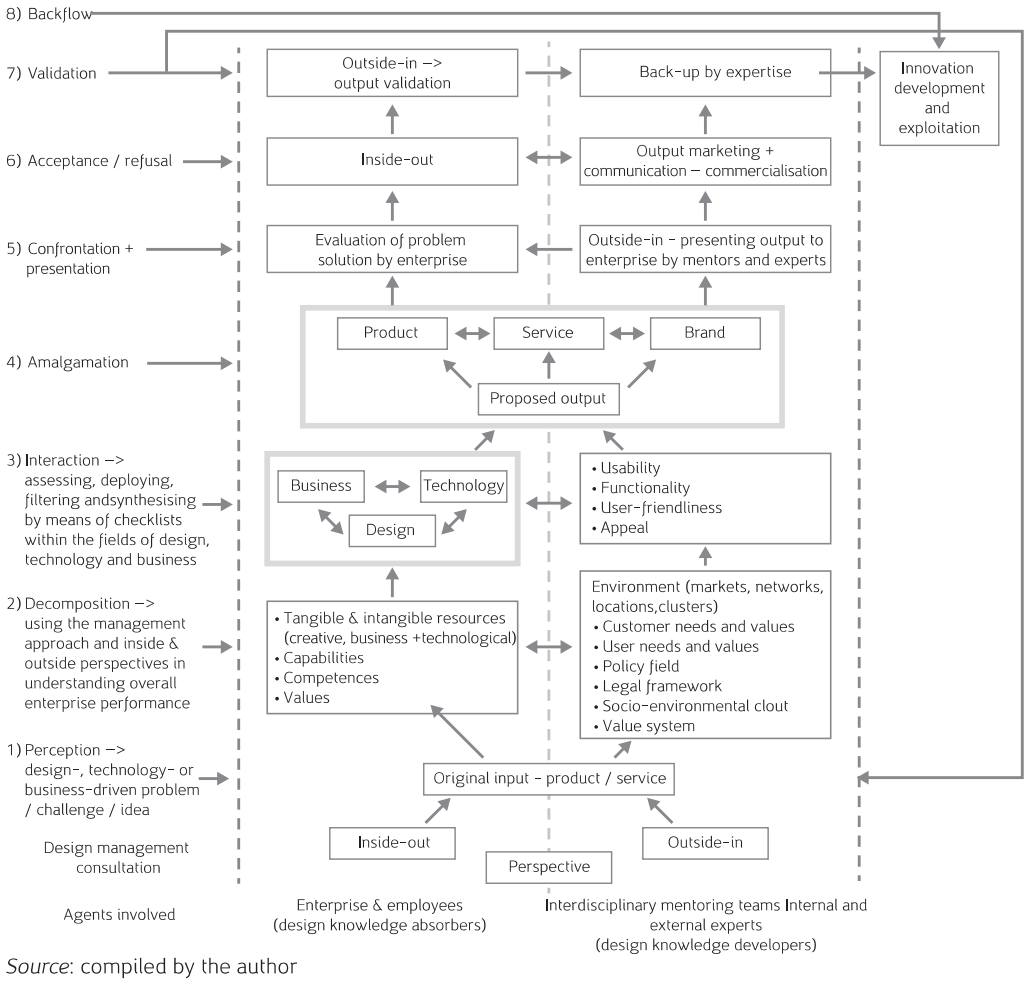
As a result of the design management consultations (processes) with two SMEs, the model proposed in Figure 2 (see below) is a result of thorough analysis and exploration based on two SME cases. Although the model is subject to sustainability issues (i.e. needs to be tested and adapted in forthcoming design management related projects or consultations given to enterprises), its contribution to the implementation of a small-scale short-term design management project (consultation) is evident.

The model implies an amalgamated design management process integrating both inside-out (enterprise internal) and outside-in (performance on the market and externalities) perceptions. Based on the processual perspective designed and implemented in two SME cases (Figure 1, section 4.1), the proposed model is referred to as a comprehensive framework, which includes not only specific steps or stages to be undertaken, but also integrates all stakeholders, actions, indicators and desired solution proposals that could be envisaged by enterprises and design management teams. This model provides a merged perspective for understanding eco-systems and implies the recognition of opportunities for technology-led micro and small enterprises that usually do not possess the specific design knowledge, skills and competencies to undertake a design management consultation. This is especially true when deploying external sources (e.g. designers and experts in design or innovation). Yet, it also applies to internal applications, where the enterprise has a designer involved in product or service development projects. Indeed, this model focuses on a rather marginalised issue. It addresses the step-by-step processes and frameworks involved in how to employ tools from the technology, business and design sectors, what challenges and opportunities are faced within

development processes and what impact these processes may have on organisations. It is argued that this model reduces the research gap recently acknowledged by Bucolo and Matthews (2011) and Yström and Karlsson (2010).

In order to undertake effective and efficient design management consultations using interdisciplinary mentoring teams, there is a need for a structured approach (Figure 2), which starts with stage 1 – perception. This is an especially crucial issue when implementing highly demanding design management consultation projects or projects at short notice when urgent demands from the enterprise can be expressed as a result of internal or external events (e.g. in the case of changed regulations and the need to promptly adapt the product to a new legal environment). Indeed, this change requires products to comply with new environmental regulations or similar. However, a certain room for manoeuvring should be left for mentoring teams. As it is apparent from the findings discussed above, enterprise problems, challenges or ideas that are too broadly defined may lead to rather vague results (products, services, organisational or positioning processes), which are hardly likely to be accepted by the enterprise as being very innovative.

Figure 2. Design management process model for innovations and growth



Source: compiled by the author

This was already pointed out by Kotler and Rath, who highlight that a common mistake in management is to bring designers into the development process too late or to bring the wrong type of designer (Kotler & Rath, 1984, p. 19). Bearing this tenet in mind, the author stresses that in stage 2 – decomposition, it is a necessity in today's development process to emphasize that neglecting the coherent, consistent and simultaneous interplay of the creative, business and technological realm may jeopardise business performance. This, in turn, impedes concrete performance gains. By not bringing the designer in at the first stage, when the idea generation process occurs, but when the product development process has already been carried out, can have severe implications. For example, it is extremely difficult to change the design-related attributes, such as logo, enterprise name or marketing activities, when an enterprise is already operating on the market.

Comparing the second training session with SME 2, which proposed very narrowly defined problems, the interdisciplinary mentoring teams faced much greater challenges than in the case of the solution cases from SME 1. This can be traced back to the fact that the mentoring teams struggled in order to meet the conditions and requirements set by SME 2 in each of the real-life scenarios. Yet, during stage 3 – interaction, which includes assessment, deployment of technological, business and design resources, competencies and capabilities, filtering, reasoning and synthesis, the mentoring teams faced either compliance with the enterprise brief or changing the brief itself. In cases where the brief is adapted or changed based on the 'actual' enterprise or market needs, mentoring teams are capable of delivering better and more solid solutions. These are therefore grounded on a reasonable and feasible linkage and amalgamation of the peculiarities of the design, technology and business fields, which form the delivered product, service, organisational or positioning related output. Therefore, tools that are commonly shared by designer, engineer and manager can be employed as a helpful measure for mentoring teams. The developed real-life checklist for the analyses in the design, technology and business fields serve here as a valuable tool for mentoring teams in moving forward during the design management consultation process. This appeared to be especially helpful when the mentoring team became stuck in the development process.

Understanding enterprise performance within all three fields – technology, business and design – enables the combination of key competitive product defining characteristics. This happens in stage 4 – amalgamation. Only when the form, aesthetics and appearance of the product (service) are combined with the technological performance (efficiency and engineering prolificacy) of the product, might a feasible product (output) result and be accepted by the enterprise at the end of the design management consultation project in stage 5 – confrontation + presentation. Here, product usability and functionality expressed in form (design) and adjusted to the internal and external business environment – cost efficiency, material utilisation and exploitation on the market – must be secured simultaneously. Although the point of departure – problem, challenge or idea – differs from field to field (i.e. one being business-led (SME 1), and the second design-led (SME 2)), the solutions appear to be feasible, and are therefore validated by the enterprises and can be exploited in the market through implementation at stage 7 – validation. This particularly applies to cases where the design field is efficiently and effectively merged with technology and business, thereby providing no room for critical argumentation or refusal by the enterprise or experts at stage 6 – acceptance or refusal.

Based on the above discussed design management process model, which is reflected through application with two SME cases, a generic (universal) model can be deduced, which is applicable in different businesses. In sum, using the problem, challenge or idea, design management

consultation passes eight stages (1–8). It starts with understanding the enterprise in the entire ecosystem, decomposing its key competitive strengths and its performance in the design, technology and business fields, moving forward towards understanding how customers and end-users perceive the enterprise and how it performs on the market. Afterwards, using the given tools and methods, mentoring teams aim at efficiently and effectively connecting different parts of the deconstructed enterprise. Here, again, three fields come into play: design, technology and business. Appearance, style, form and aesthetics (design) are merged with performance, functionality and engineering prolificacy (technology) and adapted to the customer, user and market needs. Compliance is necessary between usability, functionality, user-friendliness, environmental friendliness and appeal, which, in turn, are to be reflected in the product design, technology and business approach. After the interaction phase, where resources, capabilities and capacity are deployed, an amalgamation can be implemented. This is done by combining different parts into the proposed output – be it product, service, brand, organisational or positioning output. Subsequently, a presentation session takes place with the enterprise and external experts, and the final decision is made by the enterprise itself. To this end, an evaluation from outside the enterprise might be needed in order to validate the feasibility of the proposed solution. The output, when accepted, is subject to marketing and communication measures to be implemented on the market. When validated internally and having received external backing, the output can be commercialised and exploited. When exploited, it leads to innovation: either disruptive or incremental.

Indeed, this implies that within the product development, design cannot be detached from technology and business, even in small-scale development projects. This is a particular issue to be addressed in the organisational context. Since technology-led enterprises, particularly micro or small enterprises, usually do not have design competencies and tend to concentrate on their state-of-the-art technology and engineering prolificacy, the impact of design should not be neglected. As shown here by the empirical data, in neither solution developed for SME 1 or SME 2, did design play a marginal role. By contrast, it is rather design that plays a driving role in overtaking such functions within the project that concern both product and process fields. Design can be seen as a crucial strategic resource that enables differentiation from competitors. Design is also an entrepreneurial competency and capability. Where an enterprise does not possess design resources, it can acquire design knowledge and competencies through implementing the design management model (consultation). The consultation then passes through the stages as shown in Figure 2. Using an external consultancy through projects or financial support programmes, or even by designating the enterprise's own resources for such design management projects, the enterprise might absorb design-related knowledge and in time learn how to utilise this knowledge in combination with technology and business. As a result, the design orientation becomes visible. In all solution cases (n = 10), design played an important role and was not ignored during the design management process. In addition, design, when efficiently combined with technology and business, may spur innovation potential and serve as a stepping stone for innovation to emerge. In the majority of the cases covered, the design potential for innovation was evaluated ranging from medium to high. This implies that when developing a product or service, or conducting an organisational streamlining or positioning project, innovations, whether disruptive or incremental in nature, can be an effective outcome when exploited by the enterprise on the market. Innovations also emerge as a result of a common, linked, cooperative approach, where internal and external perceptions are merged and integrated into product or service development.

In addition to the universality of the design management model, it might be claimed that research results have found topical proponents among other researchers. The processual approach here merging content and process perspectives when integrating design, making design interventions with technology and business arrays and managing the intervention process, can be used to replace two prevailing research streams: a) understanding design management as a core of the design process and aiming to improve design within management tools, or b) designing the management process and integrated design tools, and language and methods into corporate management projects (Cooper and Junginger, 2011, p. 539; Borja de Mozota, 2006, pp. 45-46). The author claims it is rather a consolidated approach that helps to realise innovation potential, enables interdisciplinary communication, while learning and respecting the methods, knowledge and language utilised in different disciplines. Inputs from all are needed in product development. This is clearly in line with the research in this field. In his later research, Borja de Mozota (2013) highlights again the need to integrate more management tenets into the field of design management, as there already exists a variety of literature based on design theories: design project management, design strategy, managing a creative team, and others. By contrast, what is needed in interdisciplinary design management and thus research is to merge the design perspective with management using approaches from organisational management (p. 305). There is a need for a better partnership between design and management (Johansson & Woodilla, 2008, p. 1). This viewpoint is supported by the research results achieved here: in merging design, technology and business within enterprise development to achieve better performance. These endeavours, the same, as in the preceding research contributions, are justified via the integration, analysis and evaluation of case studies (Borja de Mozota, 2013, p. 305). Bringing the topical setting with environmental, social and economic challenges into the frame, Romme (2003) proposes organisations should develop in the manner of design. They need to establish communication links between design and science (management). In this, scholars will be capable of guiding human beings in the process of designing and developing their organisations towards more humane, participative and productive futures, thus making a difference to our current situation (p. 558).

6. Concluding observations and future implications

The proposed design management model delivers a multidisciplinary and processual perspective on integrating design into the organisational (technology-led SME) setting. By implementing the model, enterprises that lack design resources can increase their design orientation and innovation as a result of the design intervention programme. To this end, enterprises need to pass through stages that cover design integration, design intervention with technology and business realms and the management of multidisciplinary interactions. These interactions are needed in order to improve product or service, or organisational or positioning processes, and realise innovation potential to be exploited on the market. This model can also be utilised for those aiming to develop new products and services.

With the proposed model, the research contributes to topical research streams. It provides a model for SMEs waiting to build up, enhance and employ design resources and capabilities for innovation, competitiveness and growth. In terms of practical contributions, the research delivers a grassroots practice-oriented step-by-step model, which can be applied in various business settings. In this, the research enhances the design management contributions for

SMEs, since SME-oriented design management research has been referred to as marginalised. Design management can be reflected as a process-based approach and framework integrating different internal and external stakeholders. The structured approach is helpful when conducting short-term design management consultation projects on demand. Even if it provides a structured way of proceeding, certain room for manoeuvring is left. The key message remains the integration of design, technology and business and the assurance of consistent linkage of these arrays throughout the project. In this case, innovation potential is easier to grasp. Interdisciplinary work and merging of internal (enterprise) and external (market, customers and users) perspectives can help realise innovation potential.

This research contributes to reducing the research gap, as management science views are largely integrated within a design management model that does not solely build upon the design perspective. The model can be easily replicated in other design management projects or programmes. It is an efficient way of approaching a clear problem, challenge or idea and delivering a feasible output together within an interdisciplinary team on board. By providing this tool, agents are able to understand and benefit from each other by understanding different tools, methods, languages and techniques.

A practical contribution is evident through the findings achieved in the framework of the project as well during the showcasing of the findings of the first two training sessions. In the future, as a result of the drawbacks mentioned regarding SMEs as the backbone of our economy in Europe, this model should be tested in other technology sectors, and especially with different sizes of enterprises and numbers of enterprises. A clear research limitation is that this study is based solely on two SME cases. It is therefore recommended that the next step should test the construction of the model using a larger sample of SMEs in order to explore its feasibility, identify potential changes and ensure its sustainability. Continuing future research could reveal the real strength of this model in developing innovations and utilising resources, capabilities and competencies in a most efficient and effective way for SMEs, thus becoming an accepted management and organisational practice.

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Appendices

Appendix 1. Design integration and impact on organisational performance of SME 1

SME 1 – original setting	Design in Operational setting	Design in tactical setting	Design in strategic setting
Challenge – attract customers and increase market share			•
Objective – developing marketing strategy based on the complex product	•		•

Design impact after training session – result of design management consultation					
Solution	**Solution message**	**Design on organisation level**	**Design function**	**Innovation form**	**Innovation potential and realisation (adaptation) impact**
Solution (case) 1	• Changing the visual message in the enterprise promotional material – integrating 'bee concept' and 'cell concept' • Changing the marketing concept	• Strategic level • Marketing and brand	• Process-based – communication of information to external agents (customers and market) and among the product fields – merging appearance, functionality, technology and purpose of the product for the target groups, incl. marketing message	• Process-based • Positioning (branding)	• Medium • The concept of cells is rather disrupted from the technological and design (appearance) field • The use of honeycomb does not yield the full linkage of aesthetics, functionality and application within business
Solution (case) 2	• Changing the message – from fire control to fire prevention	• Strategic level • Marketing	• Process-based – marketing message; visualisation as a result of changed message (slogan); promotion of product and service; graphic design; language design and semiotics	• Positioning – marketing and communication	• Low • Changing of the communication strategy implied changing of the visual corporate identity • Too many changes on the corporate level associated
Solution (case) 3	• Enhancing customer (target groups) and changing the key message of the product and thus the marketing strategy	• Strategic level • Marketing and customer management incl. new market penetration opportunities	• Product-based – defining new values for potential customers (projecting experience) • Process-based – communication of product advantages to new target groups	• Organisational process – streamlining organisational development • Positioning – enhanced due to new customers and links addressed	• High • Linked product functionality to customer needs and adopted with the marketing strategy • SME has transformed components of the solution to its marketing strategy
Solution (case) 4	• Clarifying and presenting product advantages and visualising product groups incl. their utilisation areas	• Strategic level • Marketing and communication	• Product-based –> facilitating new product application fields • Process-based – communication of product advantages to the market and customer groups	• Product-based • Positioning	• Medium • Missing prioritisation of product advantages and application fields
Solution (case) 5	• Providing communication strategy aligned to the key product message	• Strategic level • Marketing and communication	• Process-based – communication of product key message	• Positioning (marketing)	• Low • Developed strategy limited to communication and visual presentation disruptive from the corporate identity and strategic orientation

Source: compiled by the author

Appendix 2. Design integration and impact on organisational performance of SME 2

SME 2 – original setting	Design in Operational setting	Design in tactical setting	Design in strategic setting
Challenge 1 – design a complex solution for new air directions of blades in air heater	•	.	
Challenge 2 – design new OxeN rotating heat recovery system instead of an existing cross-flow system	•		
Challenge 3 – develop a complex concept for a larger air conditioner	•	•	
Challenge 4 – solve a challenge of product innovativeness on the market			•
Challenge 5 – new market entry strategy incl. communication and marketing strategy			•

Design impact after training session – result of design management consultation					
Solution	Solution message	Design on organisation level	Design function	Innovation form	Innovation potential & realisation (adaptation) impact
Solution (case) 1	• Changing the product appearance attached to technology – no blades needed for air heater	• Operational level • Technical design –> design for performance and functionality	• Product-based – defining new product appearance as a result of technological performance	• Product-based • Service-based	• High • Appearance clearly linked to design and business approach – saving costs to introduction of modularity function and reduction of materials to be used
Solution (case) 2	• Proposing new target group for the product • Proposing new opportunities of servitisation through individualisation • New market niches	• Tactical level • Communication design • Marketing • Promotion of social and experience values	• Process-based – marketing message; visualisation of new target groups and servitisation; graphic and user-centred design	• Product-based – user involvement and communication of user experience (usability) • Positioning – market, communication of product values on the market	• Medium • Changing of the communication strategy implied changing of the visual corporate identity • Too many changes on the corporate level associated
Solution (case) 3	• Increasing airflow performance incl. changed design – switch to modular system	• Operational level • Technical design –> design for performance and functionality • Strategic level – new value proposition incl. service for customers	• Product-based – changed product aesthetics • Process-based – communication of product advantages to customers and value-oriented target group targeting	• Product-based – changed appearance • Positioning, marketing, communication of values	• High • Linked product functionality to technology and customer needs • Potential for efficiency improvement on design, technology and business field

Solution (case) 4	• Rethinking and redesigning communication strategy incl. optimisation for corporate identity and value proposition	• Strategic level • Marketing and communication Tactical level – new business planning • Operational level – changing product language and visualisation	• Product-based – facilitating new product appearance and language • Process-based – communication of product values, customisation; diversification of application areas and customer groups; differentiation of product	• Product-based • Service-based • Positioning, marketing	• High • Differentiation and diversification opportunities of the product yield spur innovation potential
Solution (case) 5	• Providing strategy for new market entry in China incl. discovery of market potential	• Strategic level – marketing, customisation and communication • Operational level – adapting product appearance to the existing culture and values	• Process-based – marketing and communication	• Product-based – changing aesthetics and style • Positioning (marketing) • Organisational – expansion opportunities	• Medium • Changing the perspective of product demand on the targeted market – rather cooling than heating

Source: compiled by the author

Appendix 4: PUBLICATION IV

Gerlitz, L. (2017). Design-driven innovation in SMEs: smart and sustainable organisation within industrial transformation. International Journal of Environmental Policy and Decision Making, 2 (2), 98−124, (**ETIS 1.2 classification)**.

Design-driven innovation in SMEs: smart and sustainable organisation within industrial transformation

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Abstract: The prior research has scrutinised the extent and scope of design integration for smart production and services innovation and value generation for smart society including enterprises, customers and end-users in the context of industry 4.0. The present paper underpins the earlier research. It traces tenets beyond successful performance of small and medium-sized enterprises (SMEs) within industry 4.0, considering design as enabler and integrator of innovations and driver of sustainable organisational development. Particularly, in a highly connected and intertwined ecosystem, as industry 4.0 society represents, where new industries and technologies are replacing the preceding ones, sustainable development has become one of the key agenda issues. Building upon the integrated design as a capacity and driver for innovations in the current industrial development paradigm (SME ecosystem), the present paper contributes to organisational culture research and demonstrates strategic potential of design and its integrated place within small business practices enabling to innovate and grow in a sustainable manner.

Keywords: design-driven innovation; transformation; sustainability; business strategy; business model; industry 4.0; digitalisation; organisational culture; small and medium-sized enterprises; SMEs.

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This paper is a revised and expanded version of a paper entitled 'Embedded creativity in entrepreneurial practices through design management: case study from the South Baltic Sea Region' presented at Cultural and Creative Industries: Economic Development and Urban Regeneration, Rome, Italy, 4–5 December 2015.

1 Introduction

Innovation is realised as a value for economic grow and social wealth (European Commission, 2012a, 2012b). In face of increasing competition, current dynamics of change in resource, environmental and social arrays as well as new infrastructural development, such as digital technologies used in industry and businesses (e.g. industry 4.0 or internet of things, enterprises have started to look for new tools and measures to utilise for their business strategies and run businesses in a sustainable way.

Paradoxically, in the last years policy makers in Europe have recalled the need for integration of creativity and design with innovation as a new tool embedding principals of delivering innovation, competitiveness and granting growth potential (tender of the EC 'Capabilities for design-driven innovation in European SMEs'; European Commission, 2013). In a similar manner, this has been also highlighted in the communication of the EC 'For a European industrial renaissance', 2014.

From the research perspective, strategic augmentation has been strongly warranted in the scientific literature pertaining to strategy (Porter, 1996, 2008; Porter and Kramer, 2006), business model (Magretta, 2002; Osterwalder and Pigneur, 2010; George and Bock, 2011; Zott et al., 2011), innovation (Drucker, 1985; Tidd and Bessant, 2013) or business model innovation (Chesbrough and Rosenbloom, 2002; Chesbrough, 2010; Teece, 2010; Bucherer et al., 2012; Amit and Zott, 2012; Andries and Debackere, 2013; Foss and Saebi, 2015).

Within the given digital transformation context, there were made attempts of adopting the strategic innovation and business growth mind-set to the recently emerged industrial phenomenon – industry 4.0, which stands for digital transformation in industry (Blackler and Brown, 1986; Kollmann and Schmidt, 2016) and advanced, smart and sustainable manufacturing (Lee and Seppelt, 2009; Brettel et al., 2014; Sendler, 2013; Kagermann et al., 2013; Bauernhansl et al., 2014; Kagermann, 2015; Burmeister et al., 2015). Yet, the discourse among researchers and practitioners has given rise to importance of industry 4.0 innovation and business models for large enterprises, e.g. in the automotive, aerospace and service sectors (Design Council, 2015a, 2015b, 2015c; Inglewood and Youngs, 2014). Most of scientific outputs display service and organisational innovations for smart factories and digitalisation systems of large enterprises, which are capable to drive industry 4.0 policies and favour further digital transformation (e.g. Lee et al., 2014).

Approaches towards smart, sustainable business models and innovation strategies in industry 4.0 have overwhelmed the research communities rather than discourses of design potential and its integration in face of digital transformation, thus claiming the design centred research within this nexus as having research gap (Clegg, 2000; Hermann et al., 2015; Walter, 2015). A clear notion of design and its value for product, service, social and organisational innovations, particularly of those being SMEs appears to be marginalised. SMEs have limited possibilities to become early movers in industry 4.0

eco-system. By their nature, they do rather react. In this particular light, design could become connector, integrator leading towards increasing SMEs participation in industry 4.0, especially those, who are emerging. Design, when integrated within entrepreneurial activities can lead towards sustainable development of an organisation itself (Hilton, 2001) or contribute towards sustainable ecosystem development built upon systematic innovations within organisations, as it bears capability to change methods, process and thinking (Liu, 2016).

In this respect, the present research aims at reducing the gap on strategic focus of design-driven innovation within the smaller organisational paradigm – small and medium-sized enterprises (SMEs) (Gemser and Leenders, 2001; Hertenstein et al., 2005; Moultrie et al., 2007; Fernandez-Mesa et al., 2013; Erichsen, 2014; Gerlitz, 2015) and in the context of digital transformation. The researcher endeavours to reveal the role of design for SMEs and their innovation potential using qualitative ethnographic research and investigating one case (emerging manufacturing SME). It is claimed here that SMEs also act as business partners and participate in innovation and digital transformation processes next to their large counterparts. In this discourse, creativity and design is likely to have enjoyed far less attention than other topics, such as technologies, networks, automation systems or machines (The Manufacturer, 2015).

2 Theoretical background

In the discourse of innovation, digital transformation is linked with organisational culture [Cole, (2015), p.16]. Recent recalls have been made towards changes needed both internal as well as external to organisations concerning leadership, decision-making processes, interactions with customers and users, planning and implementation of business models, etc. Contextualisation and networking inside and outside the organisation became key innovation and growth driving principles. Paradoxically, as recent studies in Germany show, cross-sectorial and interdisciplinary collaboration, digital business models and leadership, competence building, among them, also in design capability to increase usability of products and services still pose challenges that hamper faster transformation towards effective digitalisation along the supply and value chain, and thus innovation (Gausemeier and Klocke, 2016; Schmidt, 2016; Kollmann and Schmidt, 2016).

Bearing the organisational development landscape in mind, the author argues that exploration of organisations' innovation in face of digital transformation is subject to efficient and effective agglomeration of theoretical concepts and approaches from technology (industry 4.0 creating, enabling and implementing technologies), management (organisational culture), social-natural/environmental (learning, transformation and sustainability theory), policy (EU regulative framework and flagship strategies towards innovation) and design science (strategic design and design principles) perspective. In contrast to numerous scientific outputs on business modelling and innovation in industry 4.0 (Sun et al., 2012; Eckert, 2014; Uckelmann et al., 2014a; Rivard et al., 2006; Kemp, 2014; Bucherer et al., 2012; Veit et al., 2014; Fan and Zhou, 2011; Leminen et al., 2012; Uckelmann et al., 2014b; Hui, 2014; Chan, 2015), the researcher integrates within business innovation domain a design and social dimension, as the core of investigation is an organisation – small emerging enterprise sharing certain cultural values and operating within the social practices, among them from the cognitive perspective, i.e. learning and

absorbing knowledge on organisational and individual scale for building up innovation capacity (Cook and Yanow, 1993; Soken, 2016).

The rationale behind the cross-disciplinary approach can be also traced back to heterogeneous notion of organisation addressing managerial and socio-cultural peculiarities, e.g. collectively connected formal entrepreneurial entity, specific group or social category used by individuals [Coase, (1937), p.388; Alvesson, (2003), p.35; Douma and Schreuder, (2008), p.46] or acting as players [North, 1991; Scott, (2013), p.182]. It is a systematic understanding of organisations perceived through the lens of systems comprised of different elements addressing interactions, process and goals [Scott, (1961), p.16]. Indeed, it is a social realm and social system (Katz and Kahn, 1978).

In aggregate, key theoretical insights can be merged using the common thread bearing the 'sense' of change – transformation and the outcome of this change – incremental, radical or disruptive innovation exploited on the market [Kirzner, (1973), p.35; Schumpeter, (1911), pp.409–410, (1942), pp.82–83; Fagerberg et al., (2006), pp.7–8; Christensen, (1997), p.40ff]. Considerably, merging internal and external operational environment of organisations for innovation become increasingly important, as innovations do not any longer emerge internally. By contrast, their exploitation on the market is largely subject to networks, clusters, distribution, absorption and utilisation of knowledge among user's communities and networks [Arrow, (1962), p.623] or so-called open innovation [Chesbrough, (2003), p.43ff; von Hippel, (1988), 2005]. In this regard, SMEs participate in networks and are part of the innovation eco-systems.

From the technological perspective, industry 4.0 bears a promising phenomenon for industrial change leading towards smart, sustainable and user-friendly innovations. The principal strength lies in providing organisations with tools to develop specific value implying innovation, competitiveness and growth within the entire ecosystem – operational, strategic and socio- environmental (external) dimension, e.g. through increased flexibility, mass customisation, speed in product/service design and manufacturing, improved product quality, increased productivity, integrated customers and higher customer satisfaction or proximity of location to customers [Davies, (2015), p.2ff; Mejtoft, (2011), p.672]. This, in turn, facilitates not only smart, but also sustainable thinking and acting. Yet, sustainable value creation is impossible without key enabling technologies – information and communication technologies (ICT) as enabling indicators; operations and manufacturing technologies (OMT) as implementing technologies and innovation technologies (IvT) as creating innovation through creative (design) process [Whyte et al., (2015), p.13]. Within innovation processes, such technologies play crucial role for innovations, as they make innovation more accurate, efficient, provides more activity/action room, time saving and cost efficiency, result-orientation (product/service innovation), resource efficiency, experimentation and sophistication [Dodgson et al., (2008), p.5; Thomke, 2001; Schrage, (2013), p.211ff; Debackere and Looy, 2003]. This, in turn, facilitates not only smart, but also sustainable thinking and acting. In sum, these principles encompass the 'sense' of change, as the integrated technologies lead towards a change internal or external to the organisation itself.

As a result of technological imprint, innovation in SMEs as organisations, it can be argued here, is strongly affected by technology. Yet, currently, when the need to adopt to new changing environment incl. technologies gets faster, other aspects of eco-systems, such as organisational culture and system of values are desired to become ready for the

new digitalised era of industry 4.0. Indeed, organisational or corporate culture can facilitate decision making process, as it is strongly intertwined with the strategic dimension of an organisation, e.g. leadership [Trice and Beyer, (1991), p.149, 1993; Schein, (2010), p.16] or organisational learning capabilities as well as absorptive capacity. Learning processes are of paramount importance not only to bring forward organisational performance. Indeed, they can accumulate economic benefits. By drawing on Cohen and Levinthal, absorbing new information and knowledge and internalising it, organisations are better of to gain commercial profits. Collaborative activities of organisations within the networks (eco-system) are likely to be conducive to access to new resources, enhance financial and organisational flexibility and contribute to inter- and intra-organisational learning and fostering absorptive capacity [Cohen and Levinthal, (1990), p.128]. The notion of learning is of paramount importance in the present context, since learning may imply either individual learning pointing to the human cognition and behaviour understanding (Soken, 2016) or organisational learning (Cook and Yanow, 1993). This, in turn, underpins the integration of the social dimension in the current discussion of design role for innovations in industry 4.0.

A strategic design perspective delves into the subject within discourse of organisation development in terms of innovations and growth. Particularly, this is a true with perception of organisational culture. It is an organisation that has to be designed (Peters, 2014; Holland and Lam, 2014). Drucker (1985) and Senge (1991) have recognised design as important driver of organisational and cultural change, transformation and further development. According to Calabretta et al. (2008), design orientation is a result of an organisational culture promoting key tenets for appropriate design management, which lead to optimal exploitation of innovations. Potential of design for innovation can be perceived through organisational ability and capabilities to learn how to use design in all managerial and organisation issues. Within innovation development processes, it is not only new product development techniques and activities that drive innovation, but organisational culture itself (e.g. market performance, product design, etc., p.380). It is an organisational culture, which enables design orientation of organisations and promotes design integration leading towards both internal and external success – better product and service design and performance on the market [Ravasi and Schultz, (2006), p.434]. Design is a corporate asset, and given both globalisation and the rapid advance of technology, organisations need to search for leaders or tools to embrace transformational change. Indeed, design there is a strong demand for strategic value of design upfront and throughout the organisation leading towards achieved business strategy, thus implying responsive leadership loving change and bridging all the parts along the organisational chains [Solomon, (2014), p.43]. It is dependent on the value system of the organisation itself.

Indeed, sense of change is clearly traceable also in the context of design. This can be linked to the so-called process of ‘creative destruction’. The notion was introduced by Schumpeter, first presented in his last part of evolutionary trilogy ‘capitalism, socialism and democracy’ in 1942. By drawing on his work, innovation plays an important role for entrepreneurial activities by incessantly revolutionising economic structures in order to get new better or more effective processes and products. This is a process of ‘creative destruction’, which already stresses the close links between entrepreneurship, innovation and design. Innovation emerges according to Schumpeter from the new ways of using existing means. Something new can be created not from regular basis, but rather from something that is new to the existing value system of static economy. New is a new kind.

It is also using and/or employing something in a new manner, thus carrying out new combinations [Schumpeter, (1911), pp.409–410]. By echoing Schumpeter, the production of a new good originates from the existing ones. A new production method for one of the goods is understood as a 'new combination'. The same applies for new markets or enterprises (ibid, p. 410). Interlinking can be established with the Schumpeterian view when drawing on the considerations of Borja de Mozota (2011, p.19), i.e. to respond to certain situation, e.g. within the managerial practices by incorporating design tools. In his treatise in 1947 'The creative response in economic history', Schumpeter considers the concept of 'creative response'. It implies reaction to the economic change, e.g. on the market, by employing new resources, methods, etc. that have been so far not used in the practice of enterprises [Schumpeter, (1947), p.150]. Introducing design and design management into business processes may yield a potential 'something else' that is outside the entrepreneurial practices at the current stage. Nevertheless, by doing so, Schumpeter stresses the need to adapt to the historical perspective. This is also essential in terms of defining the strategy and patters of organisational innovations.

As a result, semantically, design and innovation are likely to go in line (Bruce and Bessant, 2002; von Stamm, 2004; Candi, 2006; Verganti, 2008; Steffen, 2010). Both, innovation and design embody transformation tenets. Transformation has recently entered also the discourse of industry 4.0 and organisations (Gorissen et al., 2016; Porter and Heppelmann, 2014). Transformation is needed in order to develop. Nevertheless, today, a sustainable way of transforming is highly requested, thus enabling to link organisational behaviour in terms of sustainable and smart development with social and natural sciences, particularly, conceptual approaches towards sustainability. One of the applicable concepts can be found in the social and natural sciences with transition theory highlighting the change on the individual level and adaptation of humans to transition, similar to that of individual learning and cognitive impact [Schlossberg, (1981), p.5; Anderson et al., (2011), p.65]. Similarly, but rather used in the economic context, transformation implies change of the system. This clearly underpin the phenomenon of industry 4.0 implying the change of the current eco-system towards the one characterised by the digitalisation, automation and increased networks of actors involved in social and economic interactions. Pertaining to the current research context, transformation has also entered the strategic management field incl. innovation and design intertwining, e.g. transformation design (Burns et al., 2006; Singh et al., 2007; Sangiorgi, 2011; Sangiorgi and Prendiville, 2014, etc.). Particularly, design is enabling transformation. Integrating design enables not only to develop new products and service innovations, but also, and much more important in terms of sustainability, to achieve cultural innovations that enable social transformation. In this, design is driving the entire organisation towards making business strategy, decision-making and innovation successful [Gardien and Gilsing, (2013), p.57]. Design supports organisations operating in a constant changing environment, what is applicable for, e.g. industry 4.0. Promising tenets of transformation design, according Burns et al. (2006) are multi-faceted roles, e.g. tools, methods, solutions, skills, organisational capacity. Yet, the way of designing means, which needs to adapt to constantly changing environment remains open [Sangiorgi and Prendiville, (2014), p.67]. In this particular context, the present research recognises even stronger support for intertwining social, environmental, technological and managerial dimensions with design, which might bear a promising solution, a smart and specialised solution.

Indeed, a smart solution integrating design must be today a sustainable one, especially taking into account the negative environmental footprints and limited availability of

resources. There is a high demand for sustainability, and taking into account the promising features of design for value creation, decision-making in the entire eco-system, as discussed in the strategic dimension of design for organisations, design is capable of contributing towards sustainable development in face of globalisation and rapid technological advance (European Commission, 2009, 2012a, 2013; Bitard and Basset, 2008; etc.).

Sustainability is a multi-faceted phenomenon. There is no uniform theory of sustainability. In fact, sustainability might refer to issues, whether environmental, ethical or social ones [Seuring and Müller, (2008), p.456]. However, in the economic context, sustainable growth, the same as smart growth, is dependent on entrepreneurship growth (Voss, 1998; Vossen, 1999; Delgado et al., 2014; Mettler and Williams, 2011, Ayyagari et al., 2011; Fraser, 2010; O'Gordman, 2001). Sustainable entrepreneurship is subject to efficiency and effectiveness, sufficiency and consistence [Young and Tilley, (2006), p.402; Gerlach, (2003), p.101], it aims to deliver profit and improve environmental sustainability and social conditions, i.e. setting long-term economic and business outputs deriving from entrepreneurial opportunities [Cohen and Winn, (2007), p.35]. In entrepreneurship, it requires a more specific focus by organisations on social responsibility, environmental awareness, i.e. intertwining of all three dimensions of sustainability, i.e. economic, environmental and social ones [Cliberti et al., (2008), p.1580]. Sustainability issues encompass such indicators as product-based green supply, environmentally friendly decision-making, cost reducing. Similarly, sustainable design (Heylighen, 2008; Novak, 2014; Nielsen et al., 2009; Fargnoli et al., 2014; Laszlo and Cooperrider, 2007) is addressing issues of sustainability, particularly, social sustainability, which should not neglect the role of human dimension (Chick and Micklethwaite, 2011; Fuad-Luke, 2009). In aggregate, design might become essential in addressing issues of sustainable development [Margolin, 1998; Thorpe, 2007, (2010), p.4; Fletcher and Giggin, 2001; Chick and Micklethwaite, (2011), pp.102–111]. It is because designs imply both positive and negative economic, environmental, social and cultural effects [Chick, (2012), p.54].

Taking into account the sense of change – transformation leading towards sustainability, the multi-faceted theoretical background based on the integrated approach using design and merging it within organisational performance in the context of industry 4.0 is likely to be promising when embodying social and natural-environmental dimensions into the business interactions of enterprises. To innovate, and, in turn, transform to another form of social and economic interaction necessitates also technological advancement enabling tangible generation of innovations. In this regard, design is able to ensure transformation validated in social, economic, policy and environmental realm, when adapted to current technological development.

3 Method

In the research phase, which sets out to forge the roadmap for design integration into organisational eco-system and to evaluate its contribution to the business performance within the advanced technological change – industry 4.0 trend, the paper has pursued a manifold research path, whereby diverse research methods have been combined with the respective research approach and research tool.

The present research applied a hybrid research approach [Fereday and Muir-Cochrane, (2006), p.80] combining inductive and deductive perspectives, analysing and interpreting raw data and identifying key tenets that enable to capture the key phenomenon – design integration and its value for SMEs. Starting from thematic analysis, locating the applicable thematic research streams, developing a framework for analysis and measurement, the research aims at answering two fundamental research questions:

1 How is design integrated and manifested within emergent organisational entrepreneurial business practices aiming at innovations, growth and sustainability in industry 4.0 discourses?

2 To what extent does design and design integration lead towards measurable desired innovations and sustainable growth for emergent SMEs in the industry 4.0 context?

The present paper accompanies the previous research done in the context of industry 4.0, where the developed integrated design process concept was developed based on the mapped SMEs practices and employed to generate innovations, business modelling and support organisational strategic orientation (Gerlitz, 2015, 2016). Respectively, the preceding research underpins the need to close the research gap on increasing knowledge on design role and its integration of smaller business organisations, which are also inevitable actors of industry 4.0 networks, next to their bigger counterparts – large organisations, which drive this trend (EU policy papers and strategies on necessity to support SME sector). The choice and adaptation of qualitative research approach has been justified taking into account applicable research streams [Neergaard and Ulhøi, (2007), p.1; Fossey et al., (2002), p.717], where qualitative research approach has been dominating.

Having the fuzzy, interconnected and very rapidly changing technological landscape and taking into account the multi-faceted roles of design, which is capable to link different parts of the organisational ecosystem and in this way to develop innovations and business performance in a sustainable way, a qualitative research approach is adopted. Qualitative research is currently enjoying growing interest in education and research (Patton, 2001; Case and Light, 2011). Next to the previous research, which has utilised also a qualitative approach and case study as a method, this paper employs a different qualitative approach. However, the focus remains on qualitative research, since, given the present context, it enables to better reveal the phenomenon in-depth or discover new phenomena (Borrego et al., 2009).

The research supports the previous research and provides with a holistic deeper view of organisational performance within industry 4.0 from the strategic perspective. From this perspective, it is argued here, ethnographic qualitative research may serve as a valuable approach. The ethnographic approach is used here, as it enables better to trace and perceive the entire culture (Richardson, 2000; Boeije, 2002; Brannick and Coghlan, 2007; Humphreys and Watson, 2009). This is especially applicable when having showed interdependent links of different concepts, as presented in the theoretical part underlying the needs to look at the phenomenon of design in the present context from the bigger social setting perspective. This confirms the need to examine the organisational phenomena as organisational culture and organisational eco-system (merging social and design dimension). Indeed, the present research focuses on the small enterprise operating in the industry 4.0 eco-system. Further to this arguing, it can be stated that ethnography

has been utilised in the context of design research, however, most of the research outputs focused on engineering design and design issues (Bucciarelli, 1998; Ball and Ormerod, 2000). This makes the application of ethnography to the organisational setting from the strategic management perspective more crucial in order to examine the usability and ensure the validity of this qualitative approach for the strategic management field and design-driven innovation. Principally, however, remains that the research questions determine the research approach (Creswell, 2002). And the questions do require to explain design role and its patterns within organisational context – to provide answers to why, how, what, etc. As underpinned by Shields and Rangarajan, exploration-driven research is likely to be qualitative. It aims at understanding the topic, which seems to be underdeveloped [Shields and Rangarajan, (2013), pp.26–27].

Taking into account the ethnographic research approach, it might use several or even one cases to be investigated in detail. In the present research, the unit of investigation is a micro organisation (enterprise with up to five employees) from Germany, driven by design and operating in the context of industry 4.0. For this, the enterprise is subject to analysis of the entire eco-system, which is involved in. This, in turn, allows adapting the integrative two-fold research approach – merging ethnography and case study research. Case study is important in terms of qualitative research – it enables to analyse specific phenomena, but also is crucial in making conceptual models [Eisenhardt, 1989; Miles and Huberman, (1994), p.101; Stake, (1995), pp.4–6; Yin, (2009), p.2, (2012), p.3]. Case studies dominate research focusing on linkage of design and innovation, new product development as well as in research contributions related to the strategic management and the business strategy, i.e. emerging, developing and growing enterprises, e.g. Borja de Mozota (1998, 2003a, 2003b). The case study method, where a given enterprise is perceived as a case study is linked together with other qualitative methodological choices listed above (Yin, 2009, 2013). Case study method is argued to be an appropriate one for examining design management practices and their role for small businesses and design management networks, as they enable to trace the links and to investigate relationships of interacting structures and units, in this particular case of that within a given enterprise [Wassermann and Faust, (1994), p.8; Scott, (2003), p.38ff; Corbin and Strauss, (2008), p.123ff]. In fact, the case study enables to catch the particularity and complexity of a single case [Stake, (1995), p.xi].

Taking data collection methods, there has been used a manifold approach. Data was collected from participant observation used as a method common for ethnographic studies. The researcher has got the opportunity to immerse with the micro enterprise (Trochim and Donnelly, 2001). The researcher undertook several visits to the enterprise under scrutiny and followed the organisational entrepreneurial interactions. During the participant observation the data was collected using the developed template with 17 points concerning design role, design integration for different segments of the eco-system the enterprise is involved in, e.g. environmental issues, social interactions, technologies used and similar. Afterwards, the descriptive field notes (Emerson et al., 2011) were synthesised, analysed and interpreted. Unstructured interviews also supported the participant observation. Further to this, the researcher conducted a semi-structured interview with the management of the enterprise based on the developed interview template. The template included both open questions as well as structured questions with provided possibility to weight and evaluates the phenomenon or statement, what allowed later giving some quantification to the statements made by enterprise management. In addition, such methods of data collection as analysis of artefacts (enterprise products),

interactions within the eco-system, supply and value chains, interactions with customers and employees were subject to analysis.

The collected data was analysed using the content analysis and comparative methods, synthesised, compared, smoothed and presented in a conceptual manner using the organisational setting (different corporate layers, such as operational, financial, strategic, socio-environmental) and unfolding the level of design integration and its role for strategic orientation and business performance. The approach can be expressed using the so-called 'knowledge funnel' [Benkenstein, (1998), p.700], considering specific processual steps undertaken, e.g. data acquisition, assessment, deployment, distilling, justifications, synthesis, amalgamation and presentation Particularly, material and information was combined concerned with the theme, pooled and compared. As a result, topical data was aggregated for the purpose of the analysis. It is also an interpretative attempt, since synthesis has been achieved through accumulating particular concepts in the research streams into higher-order conceptual approach [Dixon-Woods, (2005), p.46].

Taking into account the manifold research design approach and merging different methods, it might be argued that the research covered different aspects as highlighted by the meanings and purposes of research methods covered. In aggregate, the research approach facilitated the objective to showcase the holistic view and reduced research bias, as different methods were introduced. Further, it also increased reliability of the data.

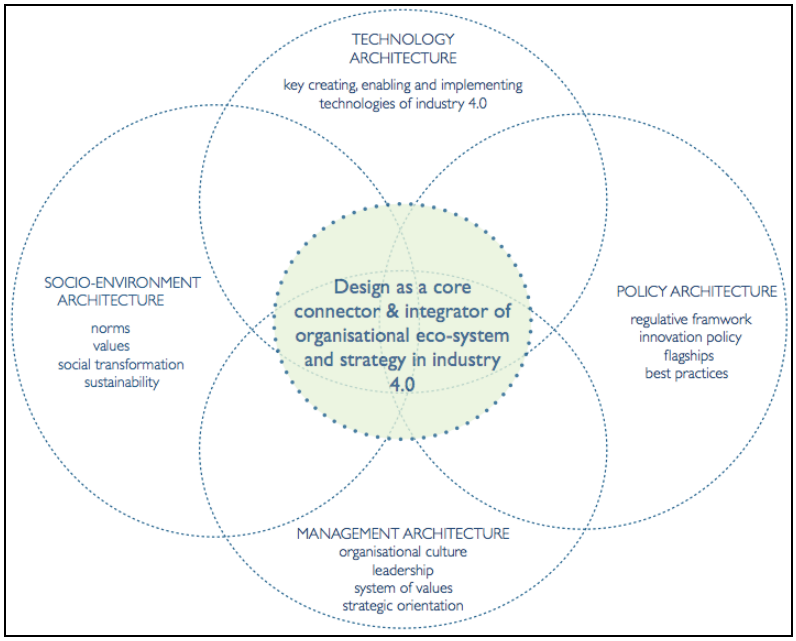
4 Results of embedded design in emergent SME – merging perspectives

The case company is a small enterprise from Berlin, Germany. The SME offers planning, production and implementation of ideas – products and services. Through the three key business areas – product development, related knowledge accumulation and transfer and working drawing including workshop, the enterprise has established strong horizontal links with potential customers and users from different sectorial affiliations – science, research, business, service providers, network users, etc. Value creation occurs simultaneously, is manifold source-driven and connected with design being at the heart of the enterprise. For confidential purpose, the name of the enterprise is not disclosed, especially taking into account its size and therefore potential negative exposure on its growth. This, however, does not affect the reliability and validity of the research results.

The research shows limited bias, as the authors do not heavy any affiliations with the enterprise concerned. The justification of this case study builds upon self-supporting evidence. First, the driving force to underpin design impact for entrepreneurial practices, especially of those being very small or start-ups is clearly supported by the research evidence. There is to less attention have been paid towards revealing design impact, design practices and implications within smaller SMEs (Gemser and Leenders, 2001; Hertenstein et al., 2005; Moultrie et al., 2007; Fernandez-Mesa et al., 2013, Erichsen, 2014; Kortesoja, 2013; Maroni et al., 2015). As a result, there is an increasing research impetus to provide smaller enterprises with potential guides on how to harvest design for operational efficiency and effectiveness, strategic orientation and acknowledgement by customers and users. Second, the selected case shows the context proximity, i.e. the enterprise has been chosen from Germany as being birthplace of industry 4.0 trend (Gerlitz, 2015). By contrast to the ample cases on industry 4.0, this research scrutinise

how Industry 4.0 is perceived and employed within small business practices in relation to design.

Figure 1 Design as integrating and connecting tool for organisations industry 4.0 (see online version for colours)



Source: Compiled by the author

Taking into account the created design tool based on the inductive reasoning in the previous research, the results gathered from the empirical data are presented such a way that they reveal innovation (1) and growth paths (2) of the given enterprises in a synthesised form. Impact of design integration on enterprise is presented through four key enterprise layers: operational, financial, strategic and socio-cultural (environmental), which are considered within enterprise and eco-system (customer, users and network engagement)

4.1 Inside-out perspective of enterprise innovation capacity through embedded design

As the empirical data reveals, design impact within innovation capacity domain in a given German enterprise is manifold. Driven by design, enterprise built up innovation capacity for developing, producing and exploiting innovative products and services, employing innovative process within organisational practices or implementing business strategy driven by design.

Operationally, creativity and design are utilised within product or services development processes as a source, resource and capability. Specifically, all developed enterprise products or services are forged by strong design integration. The SME produces creative products and provides with related services. The product portfolio encompasses bathroom fittings, office furniture (chairs, tables), kitchenware (tea warmer, egg cups) as well as modular product systems, e.g. shelve and shower modular systems, etc. Design is treated as a resource for product initiation, development, implementation and exploitation stage, i.e. from the idea to the market. Thus, design is an operational resource. Idea generator and developer is a designer possessing capabilities of application of design resources for delivering demanded products or services. Further, design can be treated as essential resource, since when combined with key creating, enabling and implementing technologies, it allows delivering products or services manufactured. Within the enterprise, usage of specific creative tools (design software) for modelling, simulation and combining it with rapid prototyping, 3D printing technology and ICT, such as software, computers, Internet, enables such a small enterprise to emerge by developing products and services. Indeed, the combination driven by design enables delivery of innovation expressed in the form of products, services or innovation solutions within the enterprise.

Financially, merging design with business and technological domains enables sound cost savings on both operational and strategic level. The enterprise has specialised in terms of offering sustainable solutions, which save energy, reduced maintenance and waste generation and enables cost saving in terms of operational, social and environmental parameters. As the enterprise practices show, by developing and producing products or services, SME demonstrates cost efficiency, increased productivity and production flexibility. This, in turn, should be traced back to the enabling and implementing technologies, such as 3D printing, which combined to design in a smart way, may lead to substantial financial advantages. Further, SME demonstrates savings in terms of time too. Earlier, design integration and validation required testing, prototyping and assessment stages in terms of technological feasibility. By contrast, today, such an enterprise can record specific valuable time saving, where time saved can be invested into other entrepreneurial activities, would they be internal or external to the company.

Strategically, It can be argued that design is utilised by this company as a business strategy, and, indeed, a successfully one. Taking a closer look, design is a strategic resource for the enterprise, as it contributes to innovation development, competitiveness, and business growth. Although the SME is emergent and does yield at a limited product or service portfolio, it is clearly demonstrating that smartly combined design capabilities may lead towards the desired business success. The key resource remains design, which needs to be input within all product, services or process development intentions and interactions. Indeed, design allows diversifying, differentiating and innovating. This is particularly evident perceiving the SME as a sustainable SME, which, indeed, claims this. Design and related capabilities residing in design, when combined with technology and business dimension, can lead towards mature innovations – smart and sustainable ones. Particularly, design-driven innovation is underpinned, it is argued here, through internal design capabilities and competencies, i.e. designer being at the heart of the enterprise or designers, who are working within the enterprise. It is far less evident that smart and sustainable solutions emerge when outsourcing design related services. In fact, design needs to meet enterprise culture, shared values, thinking and acting expressed through operational and strategic setting. Design acts as a form and symbolic value and is

matched via the design process to the existing technology, which enables production of innovation, which, in turn, encompasses tenets of design (form, functionality) and meaning to the customer and end-user. The spare part becomes innovation through combining design (form and shape) with technology in a new way, not yet exploited on the market, and valued by customers/end-users through its new meanings, i.e. the spare part becomes valuable innovation for end-users, as it is associated with such new meanings enabled through design, particularly – flexibility in terms of request, supply and delivery and functionality. Price, quality, durability, etc. are additional meanings or values ascribed to this innovation.

Socio-culturally (environmentally), it is evident from the empirical data that design may lead towards sustainability in terms of ecology, social responsibility and business itself. The enterprise claims on complying with environmental friendly principles, emphasises the coexistence with and recognition of resources scarcity. Developed solutions do not stand just for a specific artefact. By contrast, it can be asserted that they implicate a combined approach in a smart way proposing a commodity integrating creative, managerial and social perspectives. Finding customers, which do acknowledge such solutions calling for a more sustainable thinking and acting complements the competiveness. The enterprise has specialised in terms of offering sustainable solutions, which save energy, reduced maintenance and waste generation and enables cost saving in terms of operational, social and environmental parameters. It envisages the vision of sustainable development and proposition of sustainable solutions to its customers. Particularly, the SME adopted within its business practices the environmental tenets calling for the sustainable development owing to the proceedings of the UN Environment Conference and World Summits on Sustainable Development. As a result, the SME contends developing smart, ecologically and environmentally friendly solutions intertwining ecology, economy and social dimension into one ecosystem.

4.2 Outside-in perspective of enterprise innovation capacity through embedded design

With regard to the outside-in perspective, this one takes into account how does the enterprise manifest design integration and operates within external environment, which links it with its customers and users. Indeed, it is argued that external environment is important for competitiveness, growth and innovation (Porter, 1985, 1991, 1995; Porter and Millar, 1985). The same applies for customers' perspective, since they enable value creation and capturing for an enterprise through products, services or processes produced by enterprise but used by customers and end-users. It is essential to link all the actors in the innovation process, both inside and outside of the firm and to establish and maintain the role of designer as a 'gatekeeper' facilitating such linkages [Walsh, (2000), p.88].

Operationally, design integration for product, service or process development may arrive at a desired value. Value is viewed through the lens of customers and end-users. Indeed, industry 4.0 and related innovation enabling technologies when combined with ICT may speed up and underpin desired value creation. This is the case because customers and users can be integrated in the development, production and exploitation on the market process owing to the key tenets of industry 4.0 pointing to the connectivity of machines, technologies and people. In this, customers and end-users become co-creators of innovations in the product, service or process domain. SME can produce demanded products or services faster and on demand by its customers and end-users, since the

testing or prototyping phase are not such essential as they used to be before. Customers and end-users are today equipped with design generating and implementing tools. Customers and end-users can individually design the final stage and performance of their own products. Involvement of customers, users or end-users into innovation processes – open innovation processes – respectively, where customers and end-users do contribute towards increasing product, service or process efficiency with their inputs towards product and service, becomes essential. Design and integrated design processes serves as an approach for the given SME for capitalising from customers and end-users experiences and gathering contribution for further product or service development. Perception of design as coordinative, integrative and sharing activity within an organisation enables to involve customers and end-users [von Hippel, (2001), p.9]. Sharing the design as a tool, its conceptualisation and generation via key enabling technologies, customers and end-users can be effectively and efficiently involved in the innovation process today (von Hippel and Katz, 2002; von Hippel, 2001, 2005, etc.).

Financially, SMEs usually do not possess, especially those emerging, needed substantial financial resources to handle their business practices. In this, they rely usually on adapting to the external environment, the market. By contrast, as the SME case showcases, SME who have developed substantial resources, which are hardly to imitate, rare and hardly imitable – those residing in design – is able to perform better in terms of substantial resources, as design can be directly combined with innovation development and implementation technologies, such as rapid prototyping and 3D printing. Further, souring externally, acquiring new knowledge and sources, developing prototypes and testing becomes to a highly extent redundant. Design linked with technologies enables therefore lower costs for customers and end-users and therefore underpins the demand.

Strategically, design integration combined with the innovation enabling technologies and business affinity may positively influence external enterprise performance and perception on the market, and thus, competitiveness. Being competitive, again, supports growth. This is particularly the case for managing enterprise supply and value chains. Being very small and still emergent and having concentrated on its core resource utilisation, namely, design, SME has established links with other enterprises or engaged in networks, which allow her to extend business interactions based on design as a key resource. For instance, key customers of the given enterprise are usually family owned enterprises, who do not possess design and creative knowledge and are relying thus on the external design services. Further, strategically design integration enables to better meet the demand and requirements of customers and end-users. Using innovation creating and enabling technologies combined with design capabilities, SME is able to produce producers or deliver service on demand. Respectively, design can increase efficiency and effectiveness of supply chain performance (in terms of supply/delivery time) and value chain performance (streamline value creation and perception by customers and end-users through ascribing or granting new meanings, symbolic values, etc. to the products and services concerned. In this particular case, key creative (innovative technology) – 3D printing – transfers the value of design into a new, innovative and sustainable dimension.

Socio-culturally (environmentally), it is argued that SME reinforces its innovation capacity and business growth through further group of customers and users. These are those, who do support ecological and environmentally friendly business development. With this differentiation achieved, SME is able to establish links with the customers and end-users, which share similar values and do recognise the need to reduce environmental

imprints. Competitive advantage is supported through the 'clean vision', since number of customers or end-users are today switching towards environment protection, resources re-use, recovery and similar. Sustainable management successes underlie, however, an implementation of a holistic and dynamic model [Chetty and Cambell-Hunt, (2003), p.82].

5 Discussion

SMEs are not sustainable themselves, and the business growth is not sustainable because of aimed contribution towards sustainable acting and thinking. It is believed that sustainability is expressed through tangible and intangible business outputs, particularly, is embodied within product, service or process domain of an enterprise.

The author argues that smart and sustainable growth can evolve and be sustained when assuring balanced product, service or process development process. Being competitive does not automatically implies being smart and growing in a sustainable way. Sustainability is a very broad concept that can be delineated through intertwining economic, environmental and social layers of performance [Cliberti et al., (2008), p.1580; Seuring and Müller, (2008), p.456]. Sustainable enterprise, as the case enterprise from Germany shows, should comply with tenets, such as social responsibility, environmental awareness, etc. The aspects of sustainability are gaining more attention as a response to the current economic challenges, increasing negative footprint on environment and social setting, globalisation and demographic trends, etc. In fact, sustainability evolves through value creation and ensuring consistent value chain performance, i.e. value proposition for all involved actors. In addition, sustainability embraces aspects of labour, environmental standards, etc. In this regard, values are affected in terms of social, environmental or labour-related settings and through two key functions within the value chain, i.e. rule making and rule keeping.

Innovation generation emerges from applied, new, modified or absorbed design knowledge, resources deployed, knowledge and capabilities utilised. Then, it is directly linked to development of the demanded product or service, which is exploited on the market by customers and end-users. In this light, innovation generation (conceptualisation) and its exploitation on the market are linked through key creative (design) innovation technologies that directly refer to design, drawing, prototyping, visualisation and simulation) and key enabling technologies that link innovation generation and exploitation (production) via design.

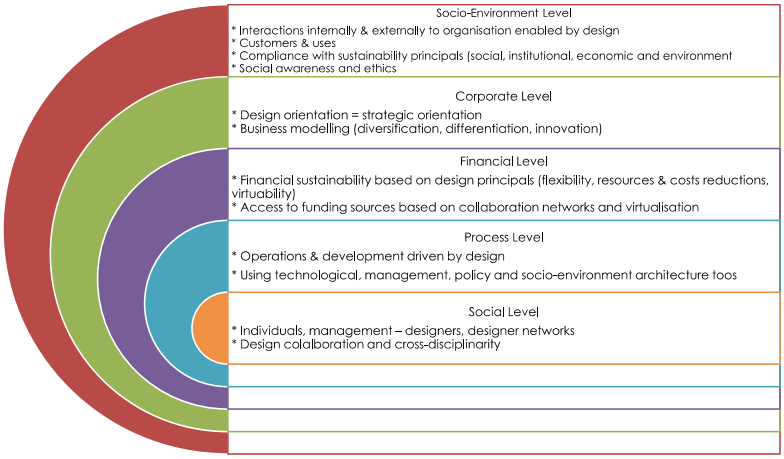
When utilised in the development process, such technologies tend to contribute to shorter development cycles – planning, research, testing and prototyping – and may become redundant for producing a new product / service and exploiting it on the market. Such technologies do already possess the validation of design (meaning and functional appearance) and thus ensures durability of a product/service over a longer time of use. In this sense, also manufacturability of products/generation of services may be streamlined in terms of time and resources employed. Supply, delivery or production time is reducing. Materials utilised are deployed in an efficient way and ensure flexibility in terms of resources acquisition and deployment. Enabling technologies ensure higher integrity of

design internal and external properties and peculiarities for product/service innovation. Quality of a product/service is a key result of integrated design, as it efficiently and effectively merges the symbolic representation of a product in form/shape with technology, thus achieving aesthetics and functionality of the final result (product/service) [Candi, (2006), p.3].

Instead of selling products or services solely on the market through design-driven innovation, where innovation is usually associated with the operational readiness needed for products and services development and implementation on the market, the given enterprise adopts a different view it sells a mixed commodity, a value proposition for different customers groups, varying from those of using products to those using a particular service attached to this enterprise. It proposes therefore a value, which does not solely belong to the upstream (production) or downstream (activities). By contrast, it encompasses the entire enterprise and its ecosystem (Leminen et al., 2012). Indeed, design becomes a crucial strategic resource for business strategic orientation and growth. The developed solutions, however, showcase clear linkage of functional, aesthetical, meaning and visual match expressed through a form (product) or solution (service or process). In fact, the developed solutions must clearly underpin functional dimension. Furthermore, for this specific enterprise, design enables product development from the idea towards the maturity phase. Particularly, different number of developed solutions and prototypes in the field of sustainable design enables diversification – application of solutions to a range of options, thus enabling quantification of design-driven innovation solutions.

Design for innovation and growth unveils key flagship words pointing to the common features: stakeholders, customers, users, incremental process, response to the needs, challenges and problems, etc. The given enterprise seems to have entered the success path in unlocking the potential of design and its connection to innovation, whereas design is seeking to optimise consumer satisfaction and company profitability through the creative use of major design elements, such as performance, quality, durability, appearance and cost, in connection with products, environments, information and corporate identities [Kotler and Rath, (1984), p.17]. In a product, service or process development, design must be combined with technology in order to ensure efficient and effective innovations. One important argument for combining design and technology activities in product development can be found in the fact that clients perceive products as a bundle of properties, where design emotionally attracts and influences the clients, whereas technology safeguard satisfaction during the later usage of the product. Already this approach explains that it is necessary to follow an integral concept of design and technology in innovation in order to raise customer satisfaction and to avoid customer disappointment, since the design-caused quick emotional effect of a product concept will be successful on the market only if the technology is able to affirm rationally the emotional expectations by positive experiences during the product life time. Designers and design tools can advance innovation solutions from mystery, exploration to experimentation. However, their tools are largely insulated within the design community. Integrating best tools of design into marketing, research, technology and business practices for innovation may help deliver those illusive, disruptive ideas that are perpetually searched for (Wood et al., 2011).

Figure 2 Design-driven organisational (enterprise) ecosystem in industry 4.0 (see online version for colours)



Source: Compiled by the author

6 Conclusions

Linking up with the prior research, the author believes that design integration into business canvas and its perception as equivalent component within innovation development and entrepreneurial development is missing in the context of industry 4.0 and smart entrepreneurship growth. There is an increasing need to display models and methods how innovation capacity, competitiveness and business growth can be built deriving not solely from digital and information technologies, supply chains literature, strategic management and firm-based research, but rather evolving as a result of design integration into business for innovations embedding innovation, strategy and design perspective within the industry 4.0 landscape – thinking and acting in a smart way and becoming a part of smart society.

The impact and value of design for innovations – competitiveness and smart growth – should not be marginalised any longer also in this field, as it happened with other business domains, where design has been acknowledged as a source, resource, tool or approach within the strategic management, product development and innovation management arrays. Indeed, in this industrial era affiliated with the umbrella term industry 4.0, design should become the core of design-driven innovation practices within SMEs. A step further is needed, i.e. to leave aside obsolete tenets and take the move towards smart tool, process and approach for innovations, competitiveness and growth of SMEs in this high-tech and digitised industrial manufacturing paradigm.

As the empirical case study demonstrates and the evidence suggest, design is crucial in today's industrial paradigm, particularly for small enterprises, which due to increased competition, globalisation and need to better respond to customers need are forced to

search for new ways in businesses. Design can be a potential answer, when combined with industrial technologies, information and communication measures may become source and resource of innovation in product, service or process domain. Within the SME, design has been employed as an organisational asset as well as information for competitive advantage. Through combination of new information flows, the SME gets ability to exploit new linkages between its activities internally and externally. Indeed, design has become a 'gatekeeper', which links both internal and external perspectives of an enterprise.

It is therefore clear that design can be integrated within small or emergent SME practices, as the pilot SME case demonstrates, by linking, again, as coined in Industry 4.0, machines, technologies and people. In this particular case, design needs to meet the innovation enabling and creating technologies, link then with ICT and involve customers and end-users into the innovation development processes, as the impact thereof on product, service or process competitive strength, flexibility, price, durability, efficiency, technological maturity, individual customisation, materials and functionality compliance, etc. is of vital importance.

Design provides meaning to products, services or processes. As a result, design can be integrated in all related product, services or process development process leading towards anticipated innovation, when succeeded on the market. Design can be integrated incrementally or radically. What is needed, it is smart combination of design with technological and managerial domains. Being design as a source of making sense of things, design implies messages to users, within the styling (e.g. form), functionality of a product, service or process (technology, cost), emotional and symbolic value, i.e. meaning.

Design becomes heart of the product, service or process development. Combined with industry 4.0 technologies, design becomes the most important competitive edge, as design is hardly imitable for competitors of SMEs. Indeed, design is not only a resource for innovations, but also a source and value creator for sustainable and smart growth. As the empirical data show, design integration may positively sustain business practices in terms of economic, social or environmental perspective. Becoming innovative, SMEs are able to compete and grow, as innovation is viewed as being source for both.

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Appendix 5: PUBLICATION V

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Design Management as a Driver for Innovation in SMEs

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Abstract

Innovation is the key-driving factor for economic growth and social wealth. Innovative products and services emerge more often as a result of cross-sectorial combination of technologies, design and business models. The European Union approved in summer 2011 the South Baltic project 'Design EntrepreneurSHIP' in order to develop and foster design management approaches and instruments for the SME sector. The project work was followed by an evolutionary approach supported by semi-structured interviews, qualitative and quantitative surveys and expert assessments. The paper presents accumulated results by highlighting expectations and needs of entrepreneurs concerning a SME-suitable design management model and a skilled design management, forging innovation and sustainable entrepreneurial growth.

Keywords: *design management, innovation, entrepreneurship, small and medium-sized enterprises, competitiveness, technology-driven SMEs.*

INTRODUCTION

In recent times, design gained growing attention in the context of entrepreneurship and innovation as a powerful tool for company development and business performance (Kotler & Rath, 1984). An empiric research study of the German Design Council (GDC, 2010) proved the influence of design on cost saving, business processes' improvements and sustainability but it also revealed that this role is broadly underestimated among companies, especially among SMEs. Indeed, traditionally design has been affiliated with products and their uses, their shapes, colours, etc. or just been treated as a matter of mere styling. Today, however, design has been 'repositioned' and new possibilities were opened up for design to play: within manufacturing, business development, industrial and social innovation and, recently, digital economy domains (Inglewood & Youngs, 2014; Hack *et al.*, 2013). Design is used not just for manufacturing anymore, but also for daily life, becoming a driving force on the entire manufacturing process and the entire lifecycle (Elsy, 2015). Design affects the entire ecosystem and leaves positive ecological, environmental and sustainable imprints, e.g. in the manufacturing sector, enables to generate technological innovations or achieve social inclusion through being heart within social innovation development process (Brown & Wyatt, 2010). Indeed, as the scholarly discourses showcase, design has become an important tool related to the business development, innovation and entrepreneurship (Borja de Mozota, 1998, 2003a, 2003b, 2006; Raulik *et al.*,

2008; Cooper & Press, 1995; Dumas & Mintzberg, 1989; Walsh *et al.*, 1992; Turner, 2013). Design as an approach and tool is notably multi-faceted and opens up new perspectives in all challenged societal and economic arrays, for instance, through inclusive design by integrating customers, end-users and information needs (Coleman *et al.*, 2007; Bound & Coleman, 2005). Other concepts refer to design as design for all, social design or eco-design (Ljunberg, 2007) as well as design for social responsibility (Persson *et al.*, 2015; Bochinska, 2011), collaborative design (Sebastian, 2004), green design (Adhikary, 2008) and sustainable design (Heylighen, 2008; Novak, 2014; Nielsen *et al.*, 2009; Fargnoli *et al.*, 2014; Laszlo & Cooperrider, 2007). As a result, different manifestations to design confirm the movement of design within the management practice from the form of design just being the heart of the operational and tactical practices to that of changing organisations and organisational culture. Although the role of design attitudes, skills, methods and techniques needed for product and service development, improvement of operational practices in organisation and issues related to strategic vision and positioning are still on the agenda, the focus shifts towards design aiming at cultural reform, and its best, seeking to bring innovations to organisations that have to adopt to new circumstances of economic competition, social expectation and cultural understanding (Buchanan, 2015, p. 5; Deserti & Rizzo, 2014, p. 36; Lockwood, 2004, p. 37).

Paradoxically, although effectiveness and efficiency of design as a tool, process, style, way of thinking and acting had been acknowledged already by scholars from different disciplines, design integration within practice-oriented small business interactions, particularly within the SMEs context has been largely marginalised (Moultrie *et al.*, 2007, p. 335) or failed successful utilisation when compared to other type of organisations or other business settings (Bruce *et al.*, 1999; Dickson *et al.*, 1995; Walsh & Roy, 1985; Cawood, 1997; Ward *et al.*, 2009; Yström & Karlsson, 2010; Matthews & Bucolo, 2011; Bucolo & Matthews, 2011; Fernandez-Mesa *et al.*, 2013; Barison, 2015). It is a paradox of missing competences, lack of practice-oriented concept of dealing with design in small businesses or lack of design integration within small business support programmes (Raulik *et al.*, 2008; Moultrie & Livesey, 2009; World Design Survey Report, 2010). Too less attention has been paid to reveal the pattern-related design impact, i.e. how does design process take place, what processes, frameworks, tools can be adopted by enterprises to assist them in using design and becoming more design-oriented by means of policy support and design intervention programmes (Bucolo & Matthews, 2011, pp. 4–5; Ward *et al.*, 2009, p. 78) as well as what challenges, opportunities and implications are related to design process within smaller enterprises (Gemser & Lenders, 2001; Hertenstein *et al.*, 2005; Moultrie *et al.*, 2007; Fernández-Mesa *et al.*, 2013; Erichsen, 2014; Kortesoja, 2013; Maroni *et al.*, 2015). Potential reasons related to missing or failed design integration in management practice, i.e. design management can be traced back also to the missing ability of design management to adopt to management function (Sun *et al.*, 2011); unawareness of design as strategic resource, limitations of human and financial resources related to design capacity building (Gorb & Dumas, 1987; Moultrie *et al.*, 2007) as well as non-existent and less formal product development and innovation process (Fueglistaller, 2004; Boult, 2006, etc.).

As a result, there is a missing practical answer to enterprises of how is then efficient and effective design process organised that leads to innovations, organisational culture reform, how it is implemented in the practice of management, i.e. how does design management take place. The missing answers to these raised questions serve as a scientific impetus for the researchers and thus constitute the research question. What implications for small business might be gained from the implemented design integration and its effective and efficient management frame the research gap formulated by the researchers. Similar concerns have been recently raised by contemporary scholars (Bucolo & Matthews, 2011; Yström & Karlsson, 2010; Barison, 2015). Therefore, the objective of this research is to provide practitioners (small enterprises) with specific design management framework, which can be used within entrepreneurial practices of technology-driven micro and small enterprises and clearly shows what and how processes, tools, methods, resources and techniques can be efficiently

interlinked.

Bearing this problematic nature and research gap in mind, the European Commission acknowledged the importance of the SME sector as the backbone of the EU economy and launched in 2012 the 'Entrepreneurship 2020 Action Plan – Reigniting the Entrepreneurial Spirit in Europe' stressing that future growth and competitiveness needs to be smart, sustainable and inclusive addressing their principal societal challenges (EC, 2012, p. 3). By following Candi (2005), the European Commission perceives design as part of the innovation process, which encompasses activities enhancing the value inherent in products and services by combining design with technology and commercialising the result, both functionality and aesthetics of the final result can be achieved. Similarly, in the Oslo Manual (OECD/EC, 2005) dedicated to the innovation policy and its measurement, design is seen as part of innovation, i.e. integral part of the development and implementation of product innovations. In this manual, design is linked to innovations through three dimensions: R&D, products / services and marketing. As a result, design is inherent throughout the entire development and innovation process, having its roots in the first ideation and understanding phase. It is not just a form, appearance of a product, service or marketing. It is a function, value and strategic resource along the entire value development chain.

In the frame of the EU-funded project 'Design EntrepreneurSHIP' a group of German, Polish and Swedish partners from the South Baltic Sea Region (SBSR) aimed at providing the regional SMEs with specific SME-oriented concepts and frameworks on how to integrate creativity and design into entrepreneurial practices and product development and to spur innovation and growth. The present paper builds therefore on key tenets relating to SMEs strategic orientation, innovation, competitiveness and growth in connection to design management and presents the design-driven approach, practice-oriented approach for SMEs based on the empirical inquiry – design management model. The authors argue that design integration within business interactions may lead towards business success expressed through variables such as increased innovation capacity, better competitiveness or growth potential.

THEORETICAL FRAMEWORK

Being important vehicle of regional and national economy, SMEs have become a major player in the economic world. According to the EU Policy Paper 'Regional Policy for Smart Growth of SMEs', the key aim is to increase the strategic focus of SMEs making them more innovative, thus contributing to competitiveness and growth, as innovation is the key to both (p. 1). To envisage such a business success from the entrepreneurial and managerial point of view, design integration within the business array is perceived through merging design perspective with theoretical approaches from organisation and innovation management literature. Empirical cases demonstrate the special role of an integral innovation approach merging design, business and technology and becoming a key driving force for innovation performance, economic growth and competitive advantage for SMEs (Prause *et al.*, 2012). One important argument for combining design, technology and business activities in product, service or organisational development arises from the fact that clients perceive products as a bundle of properties, where design emotionally attracts and influences clients, whereas technology generates satisfaction during the later usage of the product. This consideration underpins the advantage of an integral concept for design, technology and management in order to meet the customer expectations. A design-caused quick emotional effect of a product will be successful on the market if and only the technology is able to affirm rationally the emotional expectations by positive experiences during the product life time (Wood *et al.*, 2011).

Consequently, design integration becomes viable matching diverse approaches based on their common conceptual meanings or shared values and propositions and building upon complex and mixed conceptual framework. There is needed a better partnership between design and management (Johansson & Woodilla, 2008, p. 1). This viewpoint clearly underpins the research objectives and the identified research gap – to merge design, technology and business within enterprise development to achieve a better organisational performance

leading to innovation, growth and competitiveness. In fact, is an important to link all the actors in the innovation process, both inside and outside of the firm and to establish and maintain the role of designer as a 'gatekeeper' facilitating such linkages (Walsh, 2000, p. 88).

Against this background, design domain integrates principles of value creation and exploitation – design for innovation, competitiveness and growth, while business domain embraces value creation and its capturing residing in strategy, competition and innovation. As a result, taking into account the common conceptual thread of the affiliated approaches, design and management may result in design management perspective, a concept, which is still being highly debatable, depending on the scholarly or research array the angle therefore is placed on design. There are myriad of definitions proposed by scholars and practitioners on design management (Best, 2015). Already in 1998, the Design Management Journal counted more than 18 different views on the definition of design management (p. 14). Over the last 50 years, new areas of application entered the scientific and practice-oriented discourses, and new definitions were formulated. However, taking into account the research objectives, the best suitable definition of design management to be applied in the present research environment is that one that links the peculiarities of design process, design being an act and outcome with positive impact on entrepreneurial competitiveness, innovation and smart growth, i.e. an interdisciplinary, process-based approach (Hack *et al.*, 2012; Prause *et al.*, 2012; Er, 1997; Martin, 2009; Brown, 2008; Brown & Wyatt 2010; Best, 2011, 2015; Kaivo-oja, 2012; Whyte *et al.*, 2015, etc.).

The 'universality' of design management application has been already evident decades ago. Although further attempts towards strengthening role of design and acknowledgment of design as management function were made globally and in Europe, it is stressed that the vestiges of design management are rather of the European nature, associated with such scholars as Farr, 1965 and Gorb, 1976 (Chung, 1998, p. 66; Acklin & Fust, 2014, p. 2; Erichsen & Christensen, 2013, p. 107). Scientific literature on design management has been increasingly filled from the 2000s onwards with understanding, analysing and evaluating new constructs in the context of emerging and strengthening complexity in the social and economic settings. New business models have started to evolve that integrated design tools – design management and design thinking concepts and approaches were under scrutiny of scholars from both design and management fields (Osterwalder & Pigneur, 2011; Osterwalder *et al.*, 2014; Brown, 2008, etc.). Managerial approach implies using design as a reaction, whereas design-driven approach capitalises on design within organisational practices (proactive). Regarding the first, it was attempted to enhance design impact in organisations by accommodating management concepts and to improve design with management knowledge. In contrast, design approach involved examining design as a new paradigm and improving management with design knowledge (Borja de Mozota, 2011, p. 19). Design thinking has been also perceived as a business model for creative organisation implying processes, in which management tools and organisational capabilities are applied (Borja de Mozota & Kim, 2009, p. 68). However, key objectives of design management are still not achieved – establishing design as a practice, process and as an attitude in organisations. The rationale behind this is that the focus has been laid on focusing on management side of things rather than on design and designing. Indeed, too often the focus has been placed on design from a management view rather on managing from a design perspective (Cooper & Junginger, 2011, p. 539). However, again, this research presents the one-sided and mainstreamed design management perspective, i.e. managing design activities within an enterprise. As a result, there is a need to clearly reveal the potential of design integration in the management of operational and strategic processes of SMEs.

Today it is widely acknowledged that design management gains an increasing importance in providing companies with transformation value, i.e. where design is particularly employed not to manage projects but rather utilised as a core strategic resource and organisational capability, activity, process or phenomenon presenting the creative industry (Borja de Mozota & Kim 2009, p. 69). Indeed, based on the results from design-related

research studies, the scholars do confirm the emerging interlinkage between design and innovation. Specifically, sharing the same conceptual grounds, design management appraoch can be also perceived as twin-concept of innovation (Calgren, 2013, p. 56).

As a result, design, the same applies for innovation, can be used as a noun or verb and both. Design as well as innovation gain in the contemporary discussions an increasing attention on integration of external and open sources, i.e. open innovation and open design (Chesbrough, 2003; Prause & Thurner, 2013). The focus, however, is on question how the design process can be organised and managed towards product and service innovations on corporate and community (users) levels, thus creating a value (Whyte *et al*., 2015, p. 2) and enabling organisations to differentiate and position on the market (Porter 1985, p. 35; 1991, p. 103; 1996, p. 70). Although design is not only about invention, i.e. creating something totally new, it is a way of making (in)tangible impact through the implementation of ideas, i.e. design of products, services and experiences that touch, change and improve people's daily lives. In product or process innovation, design is important in activities related to functional or user characteristics, whereas in marketing activities design is significant in terms of styling, forming, as it yields product form and its appearance (OECD/ EC, 2005, pp. 48–49). In this understanding, design and the same applies for innovation, introduces a new meaning and value for its consumers, i.e. a new or significantly improved good or service, process or new marketing method, new organisational methods in business practice, workplace organisation or external relations (OECD/ EC, 2005, p. 46; Trott, 2012, pp. 12–15).

Using design to lower costs, achieve greater resource efficiency and quality on products and services compared to competitors and to gain stronger value and recognition by customers and users may lead to competitive advantage. Integrating design into specific organisational activities, which enable to create value – logistics (suppliers), development, operations (manufacturing), marketing and sales and after sale services – design becomes a part of the value chain. Thus, strategic design value can be generated not only at the top level of the value chain, e.g. strategic management level, but also at operational level. For this, design can create customer value at primary operational activities through differentiation/positioning gained on the market, at functional level through integrating design at organisational support activities and using design to improve and better coordinate functions, e.g. product or service design process. On top level, design adds strategic value through anticipation of changes in organisational internal and external environment (Borja de Mozota, 1998, p. 28).

Acknowledging design's value for organisations, its power to differentiate, position on the market and improve functionality of internal processes and external appearance of organisations (products, services), design can be viewed as a strategic resource by integrating the Resource-Based-View (RBV). Following the RBV, resources are all tangible and intangible assets, capabilities, organisational processes, attributes, information, knowledge, etc., i.e. all potential, which, in turn, when controlled by the enterprise, allows it to recognise and implement strategies bringing organisational efficiency and efficacy (Barney, 1991, p. 101; Boxall, 1996, p. 65; Crook *et al*., 2008, pp. 1150–1152). Design is a resource, because it is a process and can be employed within development projects. It is a resource, since design may bring value through being hardly duplicable, imperfectly imitable and non-substitutable. Design can influence products through giving them sense. Being design as a source of making sense of things, design implies messages to users, within the styling (e.g. form), functionality of a product, service or process (technology, cost), emotional and symbolic value, i.e. meaning. Meaning proposes to users a system of values by using a specific language, e.g. signs, symbols and icons that deliver the message (Verganti, 2008, p. 440). Thus, it is hardly to duplicate and imitate design, when a specific sense is given through design to a certain product, service or a process. Design is also knowledge, as it is used to generate new meanings or forms (Jonas, 2011, p. 1). Design may be perceived as capability too, capacity to deploy design resources by building on capability concept as developed by Amit & Schoemaker, 1993, pp. 35–37) and dynamic capability in today's world, as introduced by Teece *et al*., (1997, p. 516). Researchers already confirmed de-

sign being an asset, capability, resource, differentiator, integrator, transformer (Bruce & Jevnaker 1998; Gorb, 1990; Borja de Mozota, 2006; Kotler & Rath, 1984; Bruce *et al.*, 1999; Chiva & Alegre, 2009; Dumas & Whitfield, 1990; Perks *et al.*, 2005; Acklin, 2010, etc.). As a result, design can be used as an organisational asset as well as information for competitive advantage. Through combination of new information flows, organisation gets ability to exploit new linkages between its activities internally and externally (Porter & Millar, 1985, p. 152). Design becomes a valuable resource, as it enables to differentiate, integrate, transform and be a good business practice (Borja de Mozota, 2006, p. 45). Further, understanding design as a resource may create and offer a value proposition, reach markets, maintain relationships with customer segments and earn revenues (Osterwalder *et al.*, 2014, p. 152).

METHODOLOGY

The present research applied a hybrid research approach (Fereday & Muir-Cochrane, 2006, p. 80) combining inductive and deductive perspectives, analysing and identifying to capture the key phenomenon – design integration and its value for SMEs by design management model. The paper has pursued a manifold research path, whereby diverse research methods have been combined with the respective research approach and research tool. Five techniques were employed in exploring the objectives of the present paper:

- Research type: analytical, qualitative, practice-based and exploratory.
- Research approach: qualitative.
- Research method: qualitative – case studies, semi-structured interviews, expert assessments, trainings presentations, observations, field notes and memos.
- Research tool: design management concept.
- Research scope: 2011–2015.

The paper applies a qualitative research approach and discusses the value of design management for SMEs, which participated within the project 'Design EntrepreneurSHIP' in the time frame 2011–2015. Qualitative approach has been frequently utilised for the research purposes within academic design management research and related discourses, mainly driven by case study method (e.g. Borja de Mozota, 2006, 2013; Millward *et al.*, 2006; Acklin, 2011, 2013, etc.) and a series of studies conducted by the Design Management Institute (DMI), USA. Similarly, in case of studies on innovation related practices, scholars tend using qualitative case analysis also in developing a conceptual model. As a result, conceptual model can be derived from SMEs practices (cases) overt a longitudinal period (Shaw, 1999, p. 62ff).

SMEs, who took part in the project, are referred here to as individual cases comprising the macro case study (project). In total, eight SMEs were subject to the scrutiny and evaluation. Research on design management within innovation and growth, i.e. product, service or organisational development processes, i.e. creative processes, is more likely to deploy case studies accompanied by semi-structured interviews (e.g. Roy & Reidel, 1997; Bruce *et al.*, 1999). Already Svengren (1993, p. 444) recognised the importance of case study in dealing with design management as opposed to action research. As a result, a cross-case or multiple case (also collective) analysis (Eisenhardt, 1989; Miles & Huberman, 1994, p. 101; Stake, 1995, pp. 4–6; Yin, 2009, 2012), thematic/content analysis, template (concept) based approach to analysis to explore the data gathered at a predefined scheme identified prior the analysis as well as generated inductively from the data (Crabtree & Miller, 1992, pp. 93–109) were employed. The analysis of results of design application and exploitation are presented in a narrative way. Indeed, integration, analysis and evaluation of case studies, i.e. decomposition of company's performance (Borja de Mozota, 2013, p. 305) and presentation of results enables to showcase the partnership between design and management and to reveal the complexity of the phenomenon. Particularly, the project is viewed as a collective case, whereas SMEs as individual cases. These build a basis for cross-sectorial and cross-case analysis and justification of the design management phenomenon and its impact within different operational and environment setting. Here, the results and validation are grounded on the insights from the individual SMEs and their specific cases solved (SMEs cases). Each SME has a different case port-

Table 1. Longitudinal cross-border and research project scope consisting of the eight participating SMEs

Collective case	No.	Training case	SME scope
Training cycle I	1	Wismar 2012	SME 1
		Gdynia 2012	SME 2
		Stockholm 2012	Not direct SME case
Training cycle II	2	Rostock 2013	SME 3
		Gdynia 2013	SME 4
		Malmö 2014	Not direct SME case
Training cycle III	3	Gdynia 2013	SME 5
		Wismar 2014	Not direct SME case
		Kronovall/Malmö 2014	SME 6
Grand Showcase Training Session	G	Gdynia 2014	SME 7
			SME 8

(source: compiled by the authors)

folio available for the project, depending on enterprise's operational or environmental scope, problem or challenge complexity. The real-life cases (scenarios) of the investigated SMEs refer to the challenges that concern the technological array of SMEs, e. g. complicated fuel cell based system that gives heat, air conditioning and electricity through reduced Oxygen generation, thus providing an ecological fire protection system; heating and ventilation units' producer and distributor; bath and leisure furniture producer, miniature electronic systems producer, producer of ecological food products (based on regional apples as basic product), robotic systems and interior decoration producers. All considered SMEs were chosen for the project purposes (cross-border project) as well as subject to this research because all of them act as developers of new products or services pointing to high-tech areas or driven by high technologies. The formulated problems by the participating SMEs address product, service, organisational or marketing related problem. It is not necessary the design that needs to be changed. It is, however, argued by the researchers, taking into account the positive scientific results of other scholars, that design can act here as well as process facilitator, integrator, functional coordinator, and most important, value creator, thus leading to improvement (innovation) on product, service, organisational or marketing (positioning scale) in incremental or radical terms.

These SMEs cases were solved during the project life and bear real-life scenarios that imply a problem, a challenge or a particular search for a business opportunity. In brief, the project was designed in a manner that during interdisciplinary, international and cross-sectorial training sessions with a number of three per project year, real-life problems or challenges provided by SMEs, i.e. specific cases from Germany, Poland and Sweden were dealt with by intercultural, interdisciplinary and international project teams consisting of students, graduates and experts from these three countries and renown experts worldwide. Thus, a number of SMEs participated during a project year with eight SMEs in total and ten training sessions conducted.

A consolidating grand showcase training session with two additional SMEs rounds off the trainings and cases. In sum, three project years stand for three project milestones or three training cycles with three enterprise cases solved per year and two additional. This research considers only (beyond the project scope) eight SMEs in three training cycles, as the remaining three enterprises or organisations are not directly referred to as SMEs, and are therefore out of this research scope. Added to this are two additional SMEs from the Grand Showcase training session, with a total eight SMEs cases. The project gathered more than 120 design management practitioners, absorbers, developers and experts.

Case narration is held short, as cases are comprehensive. This, however, does not affect the reliability and validity of the research results. The key objective is to showcase the diversity of possible design management application and justify positive impact for entrepreneurial innovation and growth. Indeed, despite the different nature of SMEs, nearly all cases subject to scrutiny yield similar design management patterns, problems faced and observations made. In the proceeding, the results and implications for entrepreneurs are presented and discussed in order to meet their needs in the future based on summary reports from the SMEs cases.

RESULTS FROM CROSS-CASE ANALYSIS

By taking a look at all the SMEs under scrutiny as well as design management approaches applied within other company-related trainings, it is confirmed that design is likely to be the driving force on operational, strategic and socio-environmental level of the enterprise (its external performance on the market and linkage with customers). It implies a common thread embedded in all enterprise interactions, from the manufactured goods, over service proposition and customer management related to produced goods or services, towards self-supporting value networks. Indeed, design has been observed as a powerful source, resource, networking, organisational, coordination, integration and value sharing capability. It is indispensable knowledge and information, which can lead to product, service or process innovation, strengthened competitiveness and stronger performance internally and externally on the market as well as provide with better opportunities for business growth of SMEs.

These results are in line with observations from Chiva & Alegre (2009), who investigated Spanish and Italian home equipment companies and who were able to show that a strong integration of dedicated design activities into the R&D process shows a significant positive impact on the business success. Furthermore, Chiva and Alegre unveiled that higher R&D expenses alone are not sufficient for business success; even more important are design management skills, open innovation concepts and integration of design and R&D processes.

In the following, the SME cases are broken down in specific aggregated themes with regard to their contents, necessary to reveal the contribution of design to innovation on operation and strategic level in the economic and social context. As a result, the landscape of cases is presented only to what is necessary from the research objective point of view. The results gathered from the empirical inquiry are displayed in such a way that they reveal potential of innovations for SMEs (1), competitiveness (2) and growth path (3).

As the theoretical treatises of scholars suggest, innovation is key to both – competitiveness and growth. Indeed, the empirical evidence from all eight SMEs individual cases and SMEs cases dealt with support this contention. Enterprise, driven by design as an incremental process, is capable to generate and exploit innovation capacity for developing, producing and capitalising products, services or process within organisation itself. Design becomes a driver. Initially, innovation has been highly affiliated with the field of R&D (OECD/EC, 2005) and could hardly be allocated to the primary activities of the supply chain of an organisation needed for operational practices (Porter, 1985). Indeed, it was believed that innovation is not a crucial precondition for products or services to be delivered along the supply and value chains.

Yet, the SMEs cases reveal that innovation does not evolve just in the R&D line of the supply chain, i.e. is pulled by technologies, but is rather result of smart combinations of resources, activities and capabilities residing in technological, business and design domain. In fact, design when combined to technology and managerial perspective may lead towards new meanings and value creation for its customers, i.e. new or significantly improved good or service, process, new marketing or organisational method in business practice or external relations. This is also true for innovations, which enable solving a problem, developing a new idea, manufacturing and marketing a new construct, would it be product, service or process itself. Innovation is a process turning opportunity into new idea and ensuring its practical application in reality (Tidd & Bessant, 2013, pp. 18–22) as well as bringing value through its availability and access to it for its users via the market and/or other channels or distributed peer-to-peer and/or by the market (Gault, 2012, p.

Table 2. Results of design integration for innovation potential for all eight participating technology-led SMEs

SME	SME Case Scope	Challenge by SME	Organisational and operational field addressed by means of design integration	Result of Design Management Consultation	Innovation Form (4 Ps)
SME 1	Fuel cell based system for ventilation, air conditioning	MANAGEMENT-DRIVEN Attracting customers, Engaging in new markets Simplifying project message Improving project marketing	Strategic level Marketing & branding Improvement of organisational culture	Marketing Corporate identity strategy Branding Business strategy Customer management New Business Planning	Product Service Organisation process Positioning
SME 2	Heating and ventilation producer	DESIGN-DRIVEN Entry of new products on markets Developing new product appearance Improving product functionality	Operational level Strategic level	New forms of product Service, Increased technological product efficiency Improved functionality Marketing method Communication strategy & new business planning	Product Service Positioning
SME 3	Civil engineering enterprise	DESIGN-DRIVEN Developing of new building architecture Improving performance of architectural buildings	Strategic level Product value creation Marketing & communication	Solutions for customer experience Product delivery channels Products combined with socio-economic environment – Customer & end-user orientation	Product Service Process Positioning
SME 4	Producer of bathroom & leisure furniture made of Corian	DESIGN-DRIVEN Extending product line Improving branding Increasing value creation	Strategic level Product value creation Operational level Improving product appearance	Product modular systems Product applications Customers groups Market entry proposals	Product Service Positioning
SME 5	Producer of miniature electronic systems	MANAGEMENT-DRIVEN Creating new business strategy	Strategic level Business strategy Customer management Value Creation	Product applications Business strategy Customer groups	Product Service Positioning
SME 6	Producer of food consumer goods based on regional apple	MANAGEMENT-DRIVEN Consumer involvement Change of consumer's behaviour Change of the product	Strategic level Developing consumer experience Consumer engagement	End-users engagement and loyalty building, extended product portfolio	Product Service Positioning
SME 7	Producer of robots & robotic systems	TECHNOLOGY-DRIVEN Increase or change functionality of robot shielding enclosure	Operational level Strategic level Customer management Corporate identity and vision Selling & marketing strategy	Marketing Communication strategy Corporate identity Branding	Product Service Process Positioning
SME 8	Producer of moulding & constructing models as well as interior decoration & polymer processing	MANAGEMENT-DRIVEN Customer retention for new vessel design with distinct functionality User scenarios and marketing of meander structure	Strategic level Communication strategy Selling & Marketing	Storytelling Visualisation of the function Product applications	Product Service Process Positioning

(source: compiled by the authors)

9). Design is a tangible outcome, i.e. end product of the process or intangible, e.g. service or process, solution, etc. (von Stamm, 2004, p.11).

Innovations are driven by design and emerge as a result of smart design integration and are aggregation with technological and business readiness. Due to the limited scope, the table above canvases the key innovation results gathered from the interdisciplinary and intercultural trainings aimed to propose solutions for the SMEs. Mainly, these innovations are referred to as 'the 4Ps of innovation space' (process, paradigm [organisational], product and position [context or market]), as introduced by Tidd & Bessant (2013, pp. 24–29) and OECD/ EC (2005, p. 47). It is here to mention that also innovation is regarded as innovation when realised and exploited on the market, thus distinguishing it from invention, which implies just discovery of new product, service or process, the researchers acknowledge the proposed solutions for SMEs as innovative design-driven solutions or potential innovations (Keller, 2004, p. 243; Fagerberg *et al.*, 2006, p. 5ff). It is notably believed that such innovative smart solutions will be realised as real-life innovations in the next future, since the time beyond the project is still too short to successfully commercialise the developed solutions on the market by the pilot SMEs.

As the project results' canvas in Table 2 demonstrates, innovation can be notably traced within product, service, organisational improvement or position domain. Indeed, integration of design within business and technological organisational dimensions can streamline operational efficiency, enhance strategic enterprise orientation or improve perception within external setting – socio-cultural environment or on the market. Design is treated as a domain of innovation, thus enabling innovation generation driven by design or design-driven innovation.

The empirical results reinforce the already mentioned view that design can be considered as a source of innovation within SMEs. It is evident from the research that before the application of the design management concept and conducted consultations, SMEs alone were not able to solve the problems or challenges recognised. Yet, the integration of external design knowledge, i.e. design consultants and design agencies in most of the SME cases previously, did not yield any substantial improvement to solve the problems or challenges. By contrast, what is evident here, is that only the combination of all three arrays – design, business and technology and integration of the perception of all these arrays when developing a solution can be potentially feasible, credible and reliable for the concerned SME. This solution already shows innovation potential, not necessarily a radical one, but incremental. Indeed, it confirms the scholarly argumentation that design cannot be detached from business and technology. Design serves as integrator, facilitator and innovation driver, in particular combining all the necessary features and processes that are essential in delivering solid, appealing, functional, technology and market feasible elaborated solution – product, service, organisational process optimisation or organisational positioning option.

It also implies important development process within enterprise, improves production or service provision development and processes. Design improves products, services and processes in SMEs in their aesthetics, form and functionality. It enables achievement of desired or demanded by costumers' quality, efficiency, usability, durability, reliability, etc. The research also brings to light that design supports the development of new technologies, new technological combinations and aggregations, methods and tools.

From the empirical inquiry, it becomes evident that design integration may lead to different constellations or aggregations of innovation, diverse innovation space and different level of innovativeness. As the empirical data suggest, design integration supports in all the eight pilot SMEs generation of innovation potential by providing innovative solutions, even if they are not commercialised on the market yet. However, these solutions are reliable and feasible propositions for SMEs, which, it is argued and believed, will be exploited on the market in the next future, thus enabling to trace design value. Mainly, design integration leads towards improved product or service portfolio, better understanding of enterprise itself as well as external perception on the market. Employing design as a resource facilitates enterprise positioning and en-

ables the enterprise to sustain its positioning with the improved product or service quality, durable and reliable products, which better meet the needs of customers and end-users. With this being results, enterprises are able to streamline their competitive edge. Furthermore, improved product, service or internal process innovative solutions provide SMEs with clear opportunities for growth, e.g. through identification of new markets, new customers and end-users groups, new applications of products or services in different socio-economic or socio-cultural environment, etc.

In fact, it can be argued that innovation and design being driving part of innovation itself or design linked with innovation through creative process and creativity embeddedness (von Stamm, 2004, p. 11) is key towards enterprise competitiveness and growth, as hypothesised in the research question. Particularly, design enables to 'design', i.e. develop innovative solutions matching the needs and requirements of both – entrepreneurs and the society – customers and end-users. In this, it is valuable internally within enterprise and externally on the market. The developed solutions suggest clear linkage of functional, aesthetical, meaning and visual match expressed through a form (product) or solution (service or process). Indeed, the implemented solutions notably reinforce the functional dimension. Moreover, design integration allows product development from the idea towards the maturity phase. Specifically, different number of developed solutions provides SMEs with key strategic strengths – capability to diversify and differentiate from the other. Diversification is possible through application of solutions to a range of options, modifications and new combinations, thus enabling quantification of design-driven innovative solutions. This, again, might lead to business growth, entry of new markets or engagement of new customers and end-user groups. Therefore, design being key innovation source and designer as key enabler to innovate allows developing smart and sustainable solutions.

Design being as a driving force for the development process, i.e. innovation development, can aggregate all the necessary components and activities to deliver product, service or process. Much more important, design can make the product and service more visible and tangible through form and shape optimisation, and valuable for customers and end-users through specific meanings and values generated and associated with this specific product, service or process. Without design being as a point of departure for any development process, no efficient and effective form, functionality and meaning of a product, service or process can be achieved. As a result, when combined with technological and managerial resources, capabilities, knowledge and information, design may create a specific value for the enterprise through its different manifestation, e.g. being a source, resource, knowledge, information, organisational capability or asset. Design is an innovation enabler. It is a core activity within entrepreneurial ecosystem, operational and strategic setting and sound business opportunity leading towards desired intention of SMEs – capability to become competitive and to grow.

DISCUSSION

The results of our research underpin that design can be considered as a powerful tool, which enables to innovate, improve competitive strength and to increase business growth prospects and opportunities. Indeed, this potential of design can be aggregated under the term value creation, value proposition and value capturing for SMEs. Understanding design as a resource, knowledge, asset, information and capability allows tracing its value within product, service or process development as well as its effective and efficient commercialisation potential. Launch of innovations also require specific capabilities, knowledge, skills, facilities, resources, market knowledge, financial resources and certain level of infrastructure. It is, in other words, knowledge and entrepreneurial know-how that makes innovations successful on the market (Fagerberg *et al.*, 2006, p. 5ff).

Yet, the results of the conducted research, especially in the context of SMEs, can be benchmarked with results from the well-known and very successful group of SMEs, so-called 'hidden champions' (Simon, 2009). The researchers do recognise clear parallels between both studies. Hidden champion represents a SME, which is a world leader in a niche market. Hidden champions are rather German

phenomena, since they constitute a part of German 'Mittelstand' (SME sector), and about two thirds of all global hidden champions (ca. 2.000 worldwide) are located in Germany. The research object 'hidden champion' leads to a deeper understanding of SME management and allows a better comprehension of characteristics of those SMEs, which can globally compete with global counterparts. Important characteristic of hidden champions is resilience against economic crises, their large annual growth rates of about 25% and the creation of large numbers of new jobs. Some currently large companies like SAP, Fresenius or Würth have started as a hidden champion but grew out of this group to well known brands.

However, the most important characteristic for a hidden champion strategy is his special contribution to innovation. Specifically, hidden champions enjoy average annual R&D rate of about 6% representing twice the R&D rate of normal SMEs together with high patenting activities, i.e. the number of patents is five times higher than in normal SMEs (30 vs. 6 patents per 1,000 employees) (Simon, 2009). Consequently, hidden champion possesses an average innovation advantage of up to five or more years. Unfortunately, until now no results are known for hidden champions about design rates, the role of design in innovation and integrative design approaches.

The analysis of our empirical data suggests that design alone does not bear such innovation potential for products, services, organisational processes or improvement of enterprise's positioning. By contrast, the results show that design together with other innovation activities lead in the frame of an integrated approach to enhanced product development and improved competitiveness. A more detailed view of the SMEs' cases displays that those SMEs, which aimed at focusing only on solely classical design (physical appearance) (e.g. changing form or shape) solutions (e.g. SME 4 or SME 8) were proposed with solutions, which tackle, challenge or target their external performance on the market, internal organisation processes or are directly linked to technological and functional dimension of their products, services produced and delivered. This, indeed, leads towards proposition that effective design integration and design management in an enterprise needs to link up creative, managerial and technological capacities and capabilities. Concentration solely on design and its isolation from the fields of business and technology might negatively affect business practices or even miss to supply them with any feasible solutions.

Consequently, the implementation of a successful design management (consultation) is related to the specific enterprise development task – improving and adapting the organisation and the internal processes as well as enhancing the skill level of design management, open innovation concepts as well as integration of design and R&D processes (Chiva & Alegre, 2009). This enterprise development task is something, which is also well known from hidden champions, which are famous for their long-term thinking, especially in case of qualification and development of their employees professional knowledge and solid learning and development capabilities (Simon, 2009). Under these circumstances, successful and integrative design management constructs are able to evolve.

In sum, the research pointed out that the designer, economist or manager and engineer should cooperate to achieve complex structures and ensure combination of form, shape with functionality and customer needs. Respectively, business activities of a particular enterprise should not be restricted to management, design or technology. In fact, just by combining these three arrays, the enterprise can transfer to successful business entity. Similarly, all three fields need to be involved within design management process. As a result, the research results suggest that design being a heart of innovation or driver for innovation itself is able to provide with the value combining operational and strategic dimension of the enterprise (Fig. 1).

Value is expression of competitive strength. It manifests through first, innovative product, service or processes solutions, second, competitiveness, business modelling and strategy, and third, the ultimate achievement of competitiveness, the brand. The interplay of all three arrays reflects the cooperation patterns within a given SME, since there exists a mutual interdependence between these particular fields. Besides, an important implication of close dovetailing of the creative, business and technological realm appears to be efficient and effective inter-

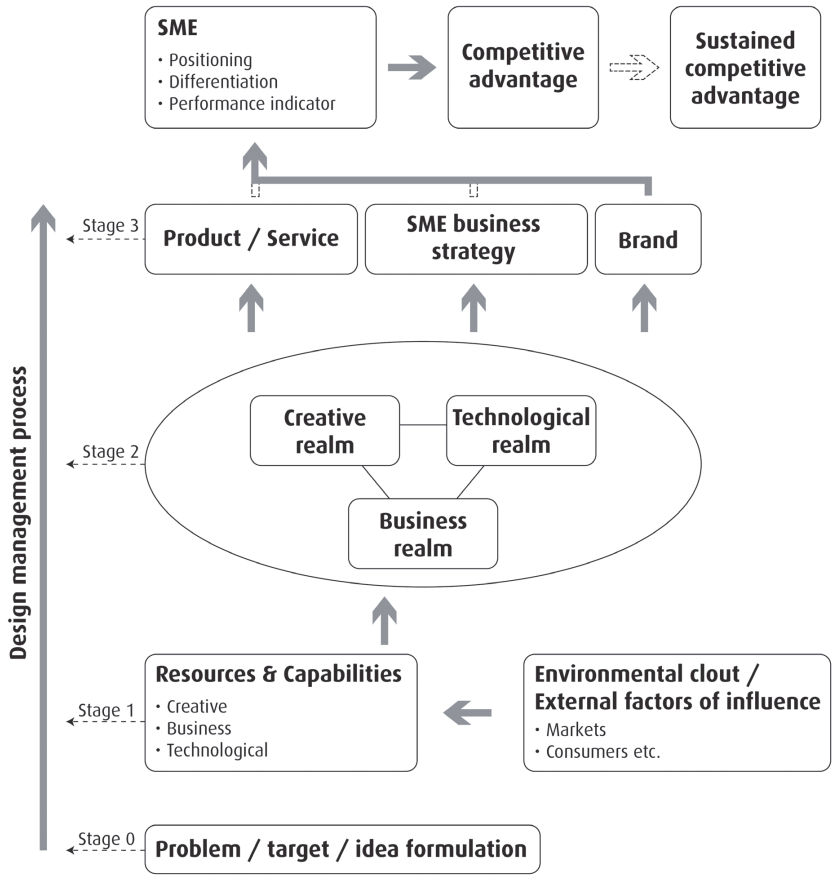

Figure 1: Process-based design management for SMEs

(source: compiled by the authors)

nal and external communication within the SME. Due to the common communication, there might result an effective cooperation of all three terrains.

CONCLUDING OBSERVATIONS AND IMPLICATIONS

From the strategic intent, it might be argued then that design can be strategically deployed and exploited for innovations. Strategic acting of design within the business frame can be delineated as a critical dynamic collaboration across operational and management practices of organisations or companies successfully utilising design capabilities. For this, design integration for innovations resulting in value proposition on corporate level have positive implications for operational and strategic indications and provides with new opportunities. By echoing the empiric study of the German Design Council (GDC, 2010), on operational level, design integration has the potential to lead towards increased operational and economic efficiency, environmental efficiency (e.g. lower carbon footprint, less energy consumption) and social efficiency (e.g.

individual customisation, user engagement and acceptance, customer loyalty). Beside that, strategically, design positively affects enterprise, since it enables diversification of activities, products and services. Design streamlines differentiation and positioning, supports strategic flexibility, resource efficiency, customers and end-user satisfaction. It creates value, provides with competitive advantage and enables better predictability in terms of competition, innovation potential, market penetration and similar. Indeed, design is valuable resource, an innovation within the enterprise operational and strategic interactions.

The observed design management practices and validation of design impact for innovation, competitiveness and growth is not free from limitations. The main limitation remains, however, sectorial concentration when dealing with SMEs, since the research focused on design practices within high technology driven or manufacturing SMEs. For this, it is necessary to continue the research in this field, by, for instance, undertaking sectorial comparative studies how design is being integrated and exploited within different sector SMEs.

The research pointed out, as addressed in the reference study of hidden champions, that becoming smart players as 'hidden champions', offers an opportunity to better understand the role of design in innovation processes due to the high importance of innovation activities as well as due to strong focus on employee qualification and enterprise development, thus paving the ground for successful implementation of integrative design management concepts. Until now, the characteristics of hidden champions are well studied, but unfortunately, the role of design within the innovation process has been marginalised. Case studies revealed already that it might be fruitful to continue further research in this area.

Forthcoming future research should support design management model application by measuring design value and employing a higher number of SMEs cases in order to enable quantified validation and to develop key performance indicators (KPIs) for design management models. Further, comparative analyses and impact analyses should be done showcasing after the certain time lapse how the provided innovative solutions for pilot eight SMEs turned into real innovations, commercialised on the market or exploited in another way. Nevertheless, the managerial positive implications for SMEs already proved to be a success, as the empirical data yield. Providing a practice-oriented incremental design management model bears also the chance to support design-driven innovation application and innovation capacity building for whole SME sector by extending the already known success factors from hidden champions.

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Appendix 6: Taxonomy and overview of DM definitions

Time frame	Main Perspective	Role of design	Focus of DM
1940s–1950s	Design as a function	Product quality	None
1960s-1970s	Design as a style	Quality communication	Project management
1980s-1990s	Design as a process	Innovation	New Product Development (NPD / innovation management
1990s-2000s	Design as a leadership	Creativity strategy	Brand
2000s-onwards	Design as a thinking	New business model	Creative organisation
own research focus (added by researcher)	**Design as a catalyst & driver**	**Innovation & transformation in digital age**	**DM as a management and organisational culture practice**

Design Management (DM) Taxonomy and Definitional Overview	
Province of Design Application	**Definition**
DM	DM makes the existence of design activities visible within the company structure, and establishes the fact that company does not regard design as an informal activity, but instead, has a formal design program (Blaich, 1993)
DM	DM is the planned implementation of design in order to achieve company objective (Borja de Mozota, 2003)
DM	Since DM may imply using design in the managerial practices (de Mozota, 2011, 19), DM can be perceived as applied innovation, i.e. capturing the talent and resources available inside and outside organisation to create new products, environments and new user perspectives. Strategic initiatives are applied by using design to, e.g. foster culture of innovation (Design Management Journal, 1998, 17) or as innovation process (Borja de Mozota, 2006, 47).
DM	DM was defined in chapter one as the organizational and managerial practices and skills that allow a company to attain good, effective design (Chiva & Alegre 2009, 425, 435).

DM	DM is ongoing management – and leadership – of design organizations, design processes, and designed outcomes (Cooper et al., 2009)
DT	Design Thinking refers to a methodology that approaches innovation activities with a user-cantered design mind-set (Brown 2008, 86). Design thinking emphasizes design's involvement in the strategic level in the organization (Brown 2009, 7, 37), as well as the holistic approach to design i.e. design not as styling but as part of the process from the very beginning (Brown 2009, 7).
DT	Design thinking has been also perceived as a business model for creative organisation implying processes, in which management tools and organisational capabilities are applied (Borja de Mozota and Kim, 2009, p. 68).
DT	Design Thinking applied to business strategy and business transformation involves the visualization of concepts and the actual delivery of new products and services (Cooper et al., 2009)
Design	Design, the same applies for innovation, introduces a new meaning and value for its consumers, i.e. a new or significantly improved good or service, process or new marketing method, new commercialised methods in business practice, workplace commercialised or external relations
Strategic Design	SD management research frequently addresses design as a resource, core competency, capability and capital. Its role moved from just fitting to the industry towards becoming heart of the business model and value creation (Borja de Mozota, 1998, p. 26; Borja de Mozota & Kim, 2009, p. 67). It is a competitive advantage and strategy. It is a process and styling leading towards strategic competitive advantage (Borja de Mozota, 2006, p. 45ff).
Strategic Design	ST implies using DM to drive and implement corporate strategic goals. Both processual and strategic attributes of DM are herewith addressed, since strategic design creates vision, integrates and orchestrates collaboration across disciplines in order to arrive at real value to all stakeholders involved in creative solutions to business, social and environmental problems. It is about contribution to business performance management (p. 3). In this, strategic design drives organisations by learning, strategic planning, catalysing innovations and delivering on operational, tactical and strategic levels (Holland and Lam, pp. 116-117).
Service Design	Service design has been evolving for more than 10 years; it is still a young field that seems to be on the verge of blossoming. In service design, we see the melding of the customer experience and experience economy phenomena heralded by various keen observers of changing market mores.

Service Design	Aims to create services that are useful, use- able, desirable, efficient, and effective Is a human-centred approach that focuses on customer experience and the quality of service encounter as the key value for success Is a holistic approach that considers in an integrated way strategic, system, process, and touch-point design decisions? Is a systematic and iterative process that integrates user-oriented, team-based inter- disciplinary approaches and methods in ever-learning cycles
Service Design	Relying on a designer's sensibility, it incorporates elements and tools from several domains to attain various and, at times, competing objectives: customer satisfaction or appreciation, designer satisfaction or sense of accomplishment, problem resolution, economic and environmental sustainability, and practical beauty

Appendix 7: OTHER RELATED PUBLICATION VI

Laima Gerlitz (2015). Design for Product and Service Innovation in industry 4.0 and emerging smart society. Journal of Security and Sustainability Issues, 5 (2), 181-198, 10.9770/jssi.2015.5.2(5), (**1.1 classification**).

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DESIGN FOR PRODUCT AND SERVICE INNOVATION IN INDUSTRY 4.0 AND EMERGING SMART SOCIETY

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Abstract. Within the context of the increasing digitalisation and intertwining cyber and physical dimensions connected by Internet, the paper aims at contributing towards understanding and conceptualising extent and scope of design integration for smart production and services and value generation for smart society including enterprises, customers and end-users. Research on design integration within the industry 4.0 or "internet of things" phenomena from strategic management perspective is still marginalised. Concepts from strategic and innovation management as well as open innovation including design and industry 4.0 perceptions are linked to propose a practice-oriented design integration approach for business practices in developing and exploiting new products or services in industry 4.0 context. The paper proposes conceptual approach to design integration and implementation within product or process development processes leading towards valuable innovations on corporate and societal level. It exemplifies how smart digitalisation and new enabling technologies might generate innovations driven by design as a tool and process. Design's role is demonstrated by intertwining dimensions of information, knowledge, technology, communication and society with different players and stakeholders, who share production or service inputs and outputs between different stakeholders in an open, distributed and co-existing way at different spatial and temporal scale.

Keywords: design, design-driven innovation, design value, value creation, industry 4.0.

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1. Introduction

In recent years, society is progressively moving towards a socio-technical-digital ecosystem, in which physical, virtual dimensions are increasingly intertwining, and more interactions between people, machines and digital technologies are taking place to serve the needs of society, to benefit the economy, environment, to improve our lives and to deliver meaningful experiences, which shared bring value added for all involved in the ecosystem –

manufacturers, services providers, customers and users.

Indeed, it is now a time of structural transformation within the ecosystem – economy and society. Evolutionary, it is moving from the agrarian society, over industrial revolution in 19th Century towards a smart industrial and service driven society characterised by advanced manufacturing and key enabling technologies, bio-based products, clean vehicles, sustainable construction, smart grids and digitalisation of business processes, networks, products and services (EU industrial policy, European Commission 2014, "For a European Industrial Renaissance").

In particular, it is a strong need for such developing trends when taking into account the socio-economic indicators in Europe and globally, and for innovations in the social, economic, environment, business, technological and societal setting. Europe demonstrates large and growing market potential in the context of smart ecosystem. Advanced manufacturing technologies change the way of companies' performance – they shift towards smart value chains or using technologies, which benefit the environment, e.g. environmentally friendly technologies (Wintjes 2013, p. 2; Guruz, Scherer 2014).

In this light, the present research presents an attempt of showcasing an increasing strategic role of design in the context of the current industrial evolution, smart production and digitalisation area and its value for different design stakeholders – companies, customers, end-users, etc. This will be undertaken by combining key approaches from the innovation and management fields – open innovation, design innovation. The paper is organised as follows. The next section presents the key concepts and common thread with integration of design and its tools to better embed design role and its potential in the context of industry 4.0 or smart production for innovations. The third section displays the methodology of the research. In the succeeding section, the results from the case studies are discussed. The fifth sections argues for a new perspective in the paradigm of value of design in smart production and potential of innovations through integration with consumers of smart products and services. The paper concludes with key observation-based implications and future research perspectives.

2. Theoretical background – industry 4.0, innovations and design

Aiming to reveal design value and integration within industry 4.0 trend, conceptual design of the present research is based on integration of concepts and approaches employed within strategic management – Porter's value chain and competitive advantage (Porter 1985; 1991; 1996), resources and capabilities (Barney 1991; Teece *et. al* 1997; Wahl, Prause 2013); innovation management – innovation process and open innovation (Trott 2012; Tidd, Bessant 2013; Chesbrough 2003; von Hippel, 1998; 2001; 2005; Grubicka, Matuska 2015; Hoffmann, Prause 2015). Through linking corresponding concepts and their conceptual meaning with design and its value proposition for innovations, design becomes crucial enabler for smart product manufacturing and service innovations.

2.1 Industry 4.0 and product / service innovations

Evolutionary, this trend refers to as fourth trend in industrial system – the so-called industry 4.0. Often, it is called the fourth industrial revolution. Term "Industry 4.0" has been predominantly used in the German scientific literature (Brettel *et al.* 2014; Sendler 2013; Kagermann *et al*. 2013; Bauernhansl *et al*. 2014; Kagermann 2015; Burmeister *et al*. 2015, etc.). Indeed, it was established by the German Ministry of Education and Research as a roadmap to promote German high-tech industry and its strategy. Research on industry 4.0 is highly interlinked with such phenomena as "Internet of Things", "Industrial Internet", "Internet of Things", "Data and Services" and "Smart Factory 4.0", "Advanced Manufacturing" and "Smart Manufacturing", etc. and their examination (Kagermann *et al.* 2013; Vermesan, Friess 2013; Porter, Heppelmann 2014; Westerlund *et al*. 2014; Simonite 2014; Tvaronavičienė 2014; Rezk *et. al.* 2015, etc.). The present research has adopted the term "Industry 4.0", as other concepts mentioned above are likely to be small and usually complement the complex phenomenon of industry 4.0, emphasising consistent digitalisation and linking physical objects and subjects,

real and virtual worlds and enabling them to communicate in a real time.

The core idea behind this trend is to secure high-tech manufacturing location, jobs and welfare to people in a certain region to generate the competitive advantage (Ramsauer 2013, p. 6; Avigdor *et al.* 2014, p. 2; Krückhans, Meier 2013, p. 31). Nevertheless, this current and future trend is of more evolutionary nature. It may be stated that the transfer towards industry 4.0 emerges in a smart society not from fast and disruptive changes, but as evolutionary process in a continuous and steadily way, integrating physical objects (technologies, machines and people) into the information network. The Internet has come before the fourth industrial revolution has started. Now, it is only about connecting through Internet with intelligent machines, systems production, processes, customers and consumers to form a sophisticated network, thus turning the real world into information system (Dujin *et al*. 2014, p. 7; Kagermann 2015, p. 25). Therefore, in this context, innovations are rather new adaptations or transformations by using technologies, which to some level are already developed. Foray *et al.* refers in this context to smart specialisation and structural evolution, which is driven not by radical innovations, but by adaptation to radical transformation. Generating new information and knowledge for the future economic value from an old, it is possible to arrive at new activities and new structural changes by using existing industrial commons, such as R&D, engineering, manufacturing and other capabilities that sustain innovation (Foray *et al.* 2011, 8; Rezk *et. al.* 2015). As a result, in this course, it can be referred more to incremental (Kirzner, 1973, p. 35) rather than radical innovations (Schumpeter 1911, p. 409-410; 1942 p. 82-83). Whereas incremental innovation implies the level, which improves a certain technology as compared to a previous level, i.e. continuous improvement, radical innovation has very far-reaching impact, e.g. automobile or airplane. Nevertheless, incremental innovations are important, since they constitute a basis for radical ones and bring with economic benefits (Fagerberg *et al.* 2006, p. 7-8). Yet, these industry 4.0 innovations are sustained rather disruptive innovations (Christensen 1997, p. 40f), whereas disruptive innovations bring a very different value as compared to the previous one and are likely to replace sustained ones. In this case, industry 4.0 can be understood as incremental process, which may enable either sustainable or radical disruptive innovations for the market and proposing new values for businesses.

Analysis of the value of design for product and services innovations in smart and digitalised production or service development processes remains narrowed mostly to research in the field of open innovation or user-centred approaches, such as user communities or user innovations (Jawecki *et al*. 2011; Füller *et al.* 2007, 2011, 2012; Gault 2011; Dell'Era and Landoni 2014; Baldwin, von Hippel 2009; von Hippel *et al.* 2011, etc.). Most of scientific outputs display service and organisational innovations for smart factories and digitalisation systems (e.g. Lee *et al.* 2014; Rezk *et. al.* 2015) losing a clear linkage with design and its value of design for product, service, social or organisational innovations. Role of design for innovations through user involvement related to industry 4.0 or smart production processes is likely to be underrepresented in this context.

2.2 Design as a resource, capability and innovation enabler in industry 4.0

Significance of design and its value proposition for business and thus economy has been the research focus of strategic management (Kotler, Rath 1984; Borja de Mozota 1998; 2003; 2006; Raulik *et al.* 2008; Cooper, Press 1995; Dumas, Mintzberg 1989; 1991; Walsh *et al.* 1992; 1996), marketing and branding (Murphy 1990; Meier-Kortwig 1997; Meffert, Burmann 2002; Giersch 2008; Esch 2012) architecture and design methods (Asimov 1962; Archer 1965; Simon 1969; Jones 1970; Guruz, Scherer 2014), engineering (Lawson 1980; Rowe 1987; Cross 1986; March, Smith 1995; Hevner *et al.* 2004; Cuneo *et al.* 2014), organisational and entrepreneurship (Lorenz 1986; Bruce *et al*. 1999; Kretzschmar 2003; von Stamm 2004; Grzecznowska 2005; Acklin 2013; Design EntrepreneurSHIP project 2014) and innovation related studies (Dickson *et al*. 1995; Cawood 1997; Cox 2005; Theter 2006; Chiva, Alegre 2009; Verganti 2006; 2008; Brown 2008; Koostra *et al.* 2009; EU Commission Staff Working Document 2009 and 2013; Rampino 2008; 2011; Bitard, Basset 2014; Rezk *et. al.* 2015) and research for several decades.

Design, the same applies for innovation, can be used as a noun or verb. Here, the focus is on design as an activity and process leading towards strategic and competitive advantage and innovation. The focus is on how

the design process can be organised and managed towards product and service innovations on corporate and community (users) levels. Design as a process may propose tangible and intangible value, because it serves as a tangible/intangible source and connector between creativity, i.e. generating new ideas and innovation, i.e. placing new ideas on the market and applying creativity to all the activities necessary to bring these ideas into use either as product, service or process innovations, thus creating a value (Whyte *et al.* 2015, p. 2) and enabling organisations to differentiate and position of the market (Porter 1985, p. 35; 1991, p. 103; 1996, p. 70). Although design is not only about invention, i.e. creating something totally new, it is a way of making (in)tangible impact through the implementation of ideas, i.e. design of products, services and experiences that touch, change and improve people's daily lives (Design Management Conceptualisation and Application, Design Entrepreneur-SHIP project 2014, p. 8). Using design to lower costs, achieve greater resource efficiency and quality on products and services compared to competitors and to gain stronger value and recognition by customers and users may lead to competitive advantage. Integrating design into specific organisational activities, which enable to create value – logistics (suppliers/partners), development, operations (manufacturing), marketing and sales and after sale services – design becomes a part of the value chain. Thus, strategic design value can be generated not only at the top level of the value chain, e.g. strategic management level, but also at operational level. For this, design can create customer value at primary operational activities through differentiation/positioning gained on the market, at functional level through integrating design at organisational support activities and using design to improve and better coordinate functions, e.g. product or service design process. On top level, design adds strategic value through anticipation of changes in organisational internal and external environment (Borja de Mozota 1998, p. 28).

Acknowledging design's value for organisations, its power to differentiate, position on the market and improve functionality of internal processes and external appearance of organisations (products, services), design can be *viewed* as a strategic resource. Following Resource-Based View (RBV), resources are all tangible and intangible assets, capabilities, organisational processes, attributes, information, knowledge etc., i.e. all potential, which, in turn, when controlled by the enterprise allows it to recognise and implement strategies bringing organisational efficiency and efficacy (Barney 1991, p. 101; Crook *et al.* 2008, p. 1150-1152). Design is a resource, because it is a process (Whyte *et al*. 2015, p. 2; Er 1997, p. 293; Hack *et al.* 2012, pp. 140-141). It is a resource, since design may bring value through being hardly duplicable, imperfectly imitable and non-substitutable (Barney 1991, pp. 105-106; Boxall 1996, p. 65), it may influence products through giving them sense. Being design as a source of making sense of things, design implies messages to users, within the styling (e.g. form), functionality of a product, service or process (technology, cost), emotional and symbolic value, i.e. meaning. Meaning proposes to users a system of values by using a specific language, e.g. signs, symbols and icons that deliver the message (Verganti 2008, p. 440). Thus, it is hardly to duplicate and imitate design, when a specific sense is given through design to a certain product, service or a process. Design is also knowledge, as it is used to generate new meanings or forms (Jonas 2011, p. 1). As a result, design can be used as an organisational asset as well as information for competitive advantage. Through combination of new information flows, organisation gets ability to exploit new linkages between its activities internally and externally (Porter, Millar 1985, p. 152). As a result, design becomes a valuable resource, as it enables to differentiate, integrate, transform and be a good business practice (Borja de Mozota 2006, p. 45). Further, understanding design as a resource may create and offer a value proposition, reach markets, maintain relationships with customer segments and earn revenues (Osterwalder *et al.* 2014, p. 152).

Design may be perceived as capability too, particularly when using design as an activity and process – capacity to deploy design resources by incorporating organisational processes to provide enhanced productivity of its resources as well as a strategic flexibility and protection for its final product or service. Design capabilities can be developed over long-term through learning processes and are based on developing, carrying and exchanging information through organisation's human capital. As a result, to deploy design resources, tangible or intangible capabilities need human input (would it be organisations, customers or users) for information-based organisational processes and intermediate goods / invisible assets (Amit, Schoemaker 1993, pp. 35-37). Nevertheless, in today's dynamic word, especially in changing ecosystem and new forms of organisation – industry 4.0, such design capabilities must be dynamic. As a result, design must be able to integrate, build and reconfigure internal

and external competences to address rapidly changing environments. In this, new and innovative forms of competitive advantage can be achieved through dynamic capabilities (Teece *et al.* 1997, p. 516), whereby design is recognised as resourcing, organisational coordinative, protective and innovative capability deploying design resources (Jevnaker 1998, p. 21).

Understanding design as a resource, knowledge, asset, information, capability allows tracing its value within product / service development process and effective commercialisation, i.e. innovation. Launch of innovations also require specific capabilities, knowledge, skills, facilities, resources, market knowledge, financial resources and certain level of infrastructure. It is, in other words, knowledge and entrepreneurial know-how that makes innovations successful on the market (Fagerberg *et al.* 2006, p. 5ff). It is process turning opportunity into new ideas, ensuring its practical application in the reality (Tidd, Bessant 2013, p. 18-22) and bringing value through its availability and access to it for its users via the market and/or other channels or distribution peer-to-peer and/or by the market (Gault 2011, p. 9). In this light, design becomes an important enabler for innovation within the dynamic emerging smart community. Design, the same applies for innovation, introduces a new meaning and value for its users.

From strategic intent, it might be argued then that design, which has been perceived as knowledge, as discussed above, can be strategically deployed and exploited for product/service innovation. Strategic acting of design within the business frame can be delineated as a critical dynamic collaboration across operational and management practices of organisations or companies successfully utilising design capabilities. In the context of industry 4.0, such strategic indicators of design enable clear strategic opportunities advocated by scholars and practitioners: competitive strength, flexible manufacturing, individual customised products and services, innovative business models, new working and collaboration ways, resource-efficiency (production on demand), production at a place of use or in the market and user engineering through his integration in development process (Bartevyan 2015 p. 2). Indeed, innovation, and thus design, as showcased above, can beat on the market with same value enablers (Francis, Bessant 2005, p. 172ff).

Design can be perceived as applied innovation, i.e. capturing the talent and resources available inside and outside organisation to create new products, environments and new user perspectives. Strategic initiatives are applied by using design to, e.g. foster culture of innovation (Design Management Journal 1998, p. 17) or as innovation process (Borja de Mozota 2006, p. 47). Similarly, Brown describes design thinking as an approach to innovation, i.e. to process, which ends with a certain innovative solution (Brown 2008, p. 9). Sharing the same conceptual grounds, design management and design thinking approaches can be also perceived as twin-concepts of innovation (Carlgren 2013, p. 56).

Taking the complementarity and intertwining of design and innovation pertaining to importance and impact for functionality, technology and strategic indicators for value creation, design integration within corporate product/service development process in the context of industry 4.0 can be conceptualised, as demonstrated in Figure 1. It presents a tentative approach within current economic and social environment on how design might be perceived, integrated and exploited for smart economic and social solutions. It also demonstrates the shifting paradigm away from design used to be subject to the validation through testing, prototyping and assessment in terms of technical feasibility towards integrated design assuring high level of playroom for creativity and its tangible/intangible outputs in form of products, services or processes.

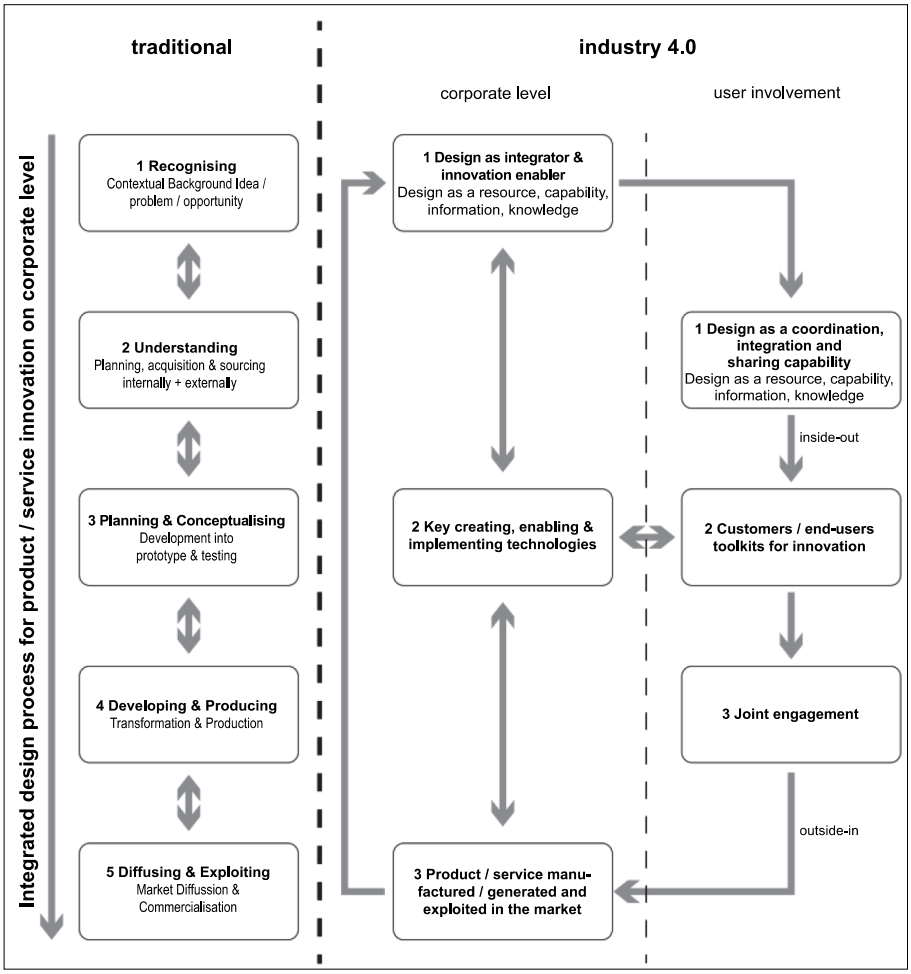

Fig. 1. Integrated design as a tool and process for innovations in industry 4.0 ecosystem

Source: compiled by the author

4. Methodology

The research analysis and assessment of design integration and exploitation practices in industry 4.0 discourses is reflected through integration of five principal research techniques: research approach, research type, methods, tools and scope. Since, as has been underpinned during the present research discourse, specific conceptual focus on integrated design process for innovations is to great extent lacking in the industry 4.0 research streams from strategic perspective (the present one being highly circled around individual segments and outputs of innovation processes, such as smart products, services and solutions), a qualitative approach is likely to be suited to increase significance of design application as innovative process for product/service innovation and to enrich the topical literature.

In the course of the present research process aimed at exploring visibility and feasibility of design integration and its value proposition and strategic advantage in industry 4.0. related discourses, the paper has adopted a qualitative research approach. As underpinned by Shields and Rangarajan, exploration-driven research is likely to be qualitative. It aims at understanding the topic, which seems to be underdeveloped (2013, pp. 26-27). A

deductive, thematic analysis and interpretation of data was conducted. The reasoning started with development of logical explanation behind the phenomenon of design integration and exploitation for product/service innovation and strategic value creation in industry 4.0 discourses. Yet, Spiggle designates her approach for consumer-related research, her research approach proposal is likely to be true for the present research (Spiggle 1994, p. 492ff). Drawing on the particular concept by Spiggle, categorisation of data was carried out according to the application and performance domains of industry 4.0, performance areas of design, operational and strategic indicators and key creating, enabling and implementing technologies within the context of industry 4.0.

The paper is built upon analytical, qualitative and practice-based research type. It can be argued that a "funnel" has been deployed for research purposes, i.e. the information and data have been acquired, assessed, deployed, distilled, justified, synthesised, amalgamated and presented. Building upon Dixon-Woods et al., both integrative and interpretative syntheses technique have been integrated. Particularly, material and information was combined concerned with the theme, pooled and compared. As a result, topical data was aggregated for the purpose of the analysis. It is also an interpretative attempt, since synthesis has been achieved through accumulating particular concepts in the research streams into higher-order conceptual approach (2005 p. 46).

With regard to research methods, there were employed descriptive and qualitative research methods, such as cross-case or multiple case analysis (Eisenhardt 1989; Miles, Huberman 1994, p. 101; Stake 1995, pp. 4-6; Yin 2009; 2012), thematic/content analysis, template (concept) based approach to analysis to explore the data gathered at a predefined scheme identified prior the analysis as well as generated inductively from the data (Crabtree, Miller 1992, pp. 93-109, etc.). The analysis results of design application and exploitation within industry 4.0 are presented in a narrative way. Integration of information from industry 4.0 cases becomes feasible through conceptual frameworks presented in the preceding section. Drawing on design as a common thread, design manifestation in industry 4.0 might be presented in the economic and social context, i.e. design conceptualisation and exploration in innovation processes on operational (product/services development), innovation output and impact level (operational, performance, economic, environmental and social efficiency, strategic advantage and value proposition for customers and users).

For the purpose of the research, the developed research tool – an integrative model in section 3 has been applied to analyse, synthesise and evaluate the data, and thus, design integration in industry 4.0. The research scope was not limited to any specific time frames, as the data were gathered from archives, and industry cases analysed are not bound to any specific period. Nevertheless, taking into account the novelty of this industry 4.0 trend, the cases concerned reveal role of design for innovations emerged on the market in the period of over last three to four years. Further, due to the regional background, this present research is limited to case studies from Germany in terms of location scope. The observation yields the natural context and is conducted without direct researcher participation. For this, it makes it is free from bias, which could arise through experimental research environment.

5. Results from the cross-case analysis

Taking into account the present context of industry 4.0, and potential domains of design integration for innovation in this discourse, the present section presents the examination results regarding design integration in the following chosen domains of industry 4.0 practices, and thus reveals the tenets of industrial and service design potential in the following discourses:

- Industrial manufacturing – design integration in product / service development (case 1);
- Service sector – transport and mobility servicing (vehicle maintenance) (case 2);
- Energy efficiency – energy saving at home (case 3); and
- Customer / user engagement – tools in vocational education schools (case 4).

It is clear that the cross-case analysis might bear an extensive challenge in making complex research results more critical in terms of comparison as well as when articulating specific conclusions that reveal the role of design for innovations in industry 4.0 as well as its perception and performance in terms of different process

segmentation. Nevertheless, the multiple cases were examined based on the structural approach presented in the section on the concept taking into account key variables of design performance from the processual point of view (development phase) within a particular industry 4.0 discourse (one of the four fields mentioned above), innovation creation and value capturing.

The present paper does not describe the individual cases in detail due to limited scope. Indeed, the description of case studies does not influence the aim of the research and showcasing of key outputs when integrating the design. On the contrary, the analysed cases demonstrate the individual segments of innovation creation and value creation in operational, economic, social and environmental context. As a result, the cases were broken down in a particular segments in terms of their contents, necessary to reveal the contribution of design to innovation on operation and strategic level in the economic and social context. As a result, the landscape of cases is presented only to what is necessary from the research objective point of view.

5.1. Design for innovative products / services

Complying with the principles of the cross-case analysis, the focus remains on understanding and revealing the research phenomenon – design and its embedding in the industry 4.0 context. From the comprehensive umbrella perspective, as the analysed results from all four industry / sector domains of industry 4.0 trend demonstrate, all innovative processes reveal the integration of design or tend themselves to be integrative design-driven innovation processes.

First, the design integration and tangibility in all four cases concerned is evident. It is a development process, an innovative process, since it marks the change of development product / service as compared to the previous ones exploited on the market. Indeed, as it is stressed in the research streams, design process can be twinned with innovations process against the background of the same processual segments and output indicators shared. In case 1, where the industry player and manufacturer of industrial product chosen – washing machines for households – does change the development process of producing spare parts for household washing machines. Supply of spare parts after the end of the product life cycle, i.e. injection moulded plastic part of household washing machines. In this particular case, we may argue that the integrated design process (as showcased in figure 1) already starts with the deploying design as information, knowledge and a specific research.

As the previous practices showed on the corporate level, the design output (the plastic part) produced did not seam to be sustainable and efficient in terms of economic, operational and environmental sustainability. The spare parts for household washing machines maintenance were produced in advance to secure a demand from customers / users based upon request for maintenance. Further, they did not seam to ensure higher level of functionality, technical and economic flexibility: in case of stopped manufacture of a specific household washing machine model, the produced spare parts in advance were subject to change and could not be integrated in the available models. On the contrary, the use of design in the industry 4.0 context becomes possible when understanding design, as underpinned above, as a certain knowledge and organisational / corporate capability to deploy the design resources (Teece *et al.* 1997, p. 516), in this particular, case all resources that enable production of the output (product) in a new way – meanings, functions and forms.

In such a case, combining design resources, capabilities, information and knowledge on how a new, specifically defined and tailored spare part for a particular model of household washing machine can be expressed via new form, meaning or function, design enables generation of innovation – new spare part produced on demand, i.e. whenever needed by the customer / end-user. In contrast to a common integrated design process, design process in the context of industry 4.0 does integrate a different number of process stages (reference figure 1). Innovation generation in step 1 emerged from adopted, new, modified or absorbed design knowledge, resources deployed, knowledge and capabilities utilised, can be directly linked to developed product (in this particular context – spare part) exploited on the market by households (customers / end-users). In this light, innovation generation (conceptualisation) and its exploitation on the market are linked through key creative (design) innovation technologies that directly refer to design (design software enabling form and shape of a new spare part),

drawing, prototyping, visualisation and simulation) and key enabling technologies that link innovation generation and exploitation (production) via design. In case 1, it is 3D printing as creative innovation technology that enables the design of product to be implemented and produced. The spare part for household washing machine is produced through match of creative technology (3D printing) with ITC technologies, as Internet and software. Owing to the creative technologies that enable innovation and linking up with the enabling parameters, the design process can be speeded up, streamlined and customised.

Within the industry 4.0 context, it might be argued, design becomes as a cornerstone of the innovation processes that enables delivery of innovative products and processes. Design is likely to be embedded in all segments of the development processes – starting from design as an integration and enabler (knowledge, capability, etc.), deploying design capability in visualising and producing the desired product and delivering it to the customers / end-users. On the corporate level, an efficient and effective utilisation of design capabilities is a key for innovations. As the case 1 demonstrates, sufficient design knowledge, deployed by using specific creative technology may generate the desired product. Souring externally, acquiring new knowledge and sources, developing prototypes and testing become to a highly extent redundant. Stages 2-4 as known from the traditional integrated design process for product / service innovations can be merged and / or replaced by key creating, enabling and implementing technologies (Dodgson *et al.* 2008, pp. 5-6). Combined, such technologies already integrate the traditional stages, as, e.g. planning, conceptualisation, validation, (thus, excluding the need of prototyping) and production.

As the system linking up enabling indicators with such creative innovation technologies has been validated, a playroom for designers or creative potential and capabilities employed in the product innovation process is extensive. Specific design knowledge and capabilities integrated in the development process (such as knowledge on combining shape, material and securing functionality of a spare part for household washing machine) are necessary when matching the appearance of a product and its functionality. As claimed by Wood *et al.* 2011, design (shape and form, meaning, function) must satisfy the functionality of such a product, which should be chosen also in terms of materials and functionality compliance. Furthermore, design principles are integrated in all three types of technologies, as all of them hold design-immanent properties. Design being as a driver for development process, can aggregate all the necessary components making up a product, and much more important, make the product / service visible, tangible through form and shape and valuable for customer / end-user through specific meanings and values generated. Without design being as a stepping stone for any development process, no efficient and effective form, functionality and meaning of a product / services can be achieved in industry 4.0.

Addressing the integration of design and its potential for innovation, or even, in more revolutionary terms, being innovation, on the corporate level, design also acts as enabler integrating customers / end-users into product / process development processes (cases 2-4). Industry 4.0 calls for integration of people, machines and technologies. It is community and customer experience that has been prioritised within the industry 4.0 on the European level (European Commission, Innovation Policy 2015). Customer experience and communities are regarded as necessary enablers for growth and efficiency drivers, infrastructure and technology for industry 4.0. in Europe (Bechtold *et al.* 2014, p. 5). For this reason, involvement of customers, users or end-users into innovation processes – open innovation processes – respectively, where customers and end-users do contribute towards increasing product / process efficiency with their inputs towards product / service, becomes essential. In this regard, design and integrated design processes (Figure 1) serves as an approach for capitalising from customers / end-users experiences and contributions for organisations and companies. Perception of design as coordinative, integrative and sharing activity within an organisation enables to involve customers / end-users (von Hippel 2001, p. 9). Sharing the design as a tool, its conceptualisation and generation via key enabling technologies, customers / end-users can be effectively and efficiently involved in the innovation process today (von Hippel, Katz 2002; von Hippel 2001; 2005, etc.).

To exemplify, case 2 deals with the transport and mobility service sector in Germany, specifically vehicle maintenance in the automotive trade sector, including full-service supply of car workshops to their customers / end-users. Compared to the previous case 1, this particular case covers both parts of the integrated design

process in industry 4.0 – corporate and user-involvement (Figure 1). In this case, effective product and services development process as well as both target groups are essential for the entire value chain and value creation to both customers / end-users. Design is integrated in all three segments of the supply and value chain – spare parts producing sector / supplier, automotive trades / vehicle maintenance workshops and vehicle customers / end-users. When integrating the key creating, implementing and enabling technologies – which can be called design / innovation technologies – in this supply and value chain, design becomes a key competence and capability in terms of coordination, integration, knowledge and competence sharing as well as innovation enabler. Respectively, design can increase efficiency and effectiveness of supply chain performance (in terms of supply / delivery time) and value chain performance (streamline value creation and perception by customers / end-users through ascribing or granting new meanings, symbolic values, etc. to the products and services concerned). In this particular case, key creative (innovative technology) – 3D printing – transfers the value of design into a new, innovative dimension. Particularly, this is a case for old-timers, which are to a higher extent subject to replacement of wear parts. Through deployment of design capabilities into this field (visualisation, simulation and combination to the technologies and functionalities), replication (production) of vehicle parts, which are no longer on the market as a result of stopped manufacturing) becomes feasible. As a result, through design, the value of old-timers and especially related higher repair costs get new meaning within end-users (car owners). The same applies to other segments and stakeholders of the supply and value chain. For instance, through streamlining of key creative (design) technologies for innovation (e.g. adopting more flexible printing of spare parts, cheaper materials, etc.), efficient design capabilities, when deployed, can lead towards more flexible and efficient supply and value chain – in certain cases, for instance, becoming independent as automotive trades / vehicle maintenance workshops from the supply of spare parts from the spare parts producer and transforming to supply of such spare parts to the customers / end-users directly.

Similar are observations made from case 3, however, here, customers / end-users are left much more extensive space of action. With regard to one of the industry 4.0 tenets, as prioritised on the European level – the issue of smart home or smart living – characterised by higher energy savings as well as energy efficiency reveals a slightly different performance or appearance of design in innovation products. More specifically, design is a source and resource of new value creation and new coordinative and sharing competence and capability. The new value creation emerges only upon adaptation of new design tools for innovation technologies and involvement of customers / end-users into the product / service development and exploitation. To exemplify, German companies used to produce traditional products necessary for households and ensuring comfortable and cosy living, mainly, divided in four key product groups (windows and systems; security installations; home access (garage, gates); outdoor). New innovation in this field and transformation trend towards smart living or smart home emerged owing to integration of new, combined design skills and capabilities – design tools. For instance, design role of being integrator and coordinator enabled integration of customers / end-users together with operational control of home devices and installations produced by such German companies. The innovation itself and new value creation emerged via granting design new properties – design became as a customer / end-user tool in form of applications that can easily be installed and managed via key enabling indicators – Internet, WiFi, accessibility of server, etc.) as well as key creative (design) technologies – apps (applications). Customers / end-users are granted extensive manoeuvring room in terms of designing, i.e. conceptualising, adapting and utilising the functionalities of a product / service enabled by the producer / service provider. In such a case, customer / end-user and producer / service provider are linked through the so-called design tools, in this particular case – app (von Hippel, Katz 2002; von Hippel 2001; 2005, etc.). In this regard, the producer / service provider of a product / service for smart home / smart living has access to the generation and exploitation of the design tools by customer / end-user and thus may benefit in making additional necessary adaptations of product / service or other movements on the market. Further, the design capability of customers / end-users can be also utilised by producers through key enabling technologies to benefit from design capability of customers / end-users through individualisation of the app and application of different functionalities to the personal needs in terms of new innovative utilisation ways, adaptation possibilities, etc.

Connected with the results mentioned above are evaluation results from case 4, where playroom for design capabilities are left to pupils of vocational education schools, especially in terms of completing half of the

vocational education in laser producing specialised enterprise. In this context, the educational hardware (e.g. tablets) is used by pupils to enable them to develop and utilised design (innovative) capabilities. In contrast to the previous cases examined, the results from these particular cases reveal the design capability for innovation within the educational array. In this case, pupils as end-users are utilising design resources, tools and thus building design-driven capabilities, which integrated in the form of tablets, can be utilised as a new knowledge and information to be integrated in the corporate product / service development processes (design as integrator).

5.2 Design impact level for innovation outputs and strategic value creation

Bearing in mind the role of design, which has been already revealed in the preceding section, this part summarises key observations regarding specific areas of impact of design within the innovation processes and its impact reach. All analysed cases showcase positive value creation and its strategic role on operational, corporate strategic, environmental and social levels based on integrated design process approach for product / service development. It is to be emphasised here that value creation and capturing includes both corporate and customer / end-user level. Nevertheless, from the perspective of strategic design manifestation greater focus is placed on strategic contribution of design for organisations.

Operational level. Building upon observation of design manifestation in all four fields of application within the industry 4.0 context (cases 1-4) the present research may state that the role of design on operational level is crucial, since it influences, first, operational efficiency. As all cases demonstrate, operational efficiency has been streamlined or sustained either through design in product or service development in form of innovations within the industry 4.0 discourse. To exemplify, aesthetic appearance is of vital importance in both product and service development. In case, where form / shape of the product (external appearance expressed through design) is highly linked to the meaning or symbolic value, external appearance of the product / services embedded through design becomes crucial for generating new meanings of such a product / service. Integrated design in development processes enables manufacturing of new feasible forms and / or combinations of products / services (e.g. smart living when combining traditional products with new design-driven processes (apps user involvement in design processes, spare parts production for old cars, or production of spare parts on demand, etc.).

Further, with regard to the development process, effective and efficient design integration acts as a driver for efficient utilisation of resources (materials, personnel, equipment, etc.) and related capabilities. Key design capabilities and innovation implementing technologies in the industry 4.0 array are likely to be sufficient to develop innovative product / processes (in the cases analysed). As exemplified, development processes become shorter through effective design integration – creative (innovation) implementing technologies (e.g. 3D printing). Indeed, such technologies already integrate design knowledge, resources and capabilities, as products / services are already designed in their shape / form with visualisation or similar software and linked in terms of the viability and the available technology – 3D printing – to ensure the highest possible functionality of such a product / service. When utilised in the development process, such technologies tend to contribute to shorter development cycles – planning, research, testing and prototyping – and may become redundant for producing a new product / service and exploiting it on the market. Such technologies do already possess the validation of design (meaning and functional appearance) and thus ensures durability of a product / service over a longer time of use. In this sense, also manufacturability of products / generation of services may be streamlined in terms of time and resources employed. Supply, delivery or production time is reducing. Materials utilised are deployed in an efficient way and ensure flexibility in terms of resources acquisition and deployment. Enabling technologies ensure higher integrity of design internal and external properties and peculiarities for product / service innovation. Quality of a product / service is a key result of integrated design, as it efficiently and effectively merges the symbolic representation of a product in form / shape with technology, thus achieving aesthetics and functionality of the final result (product / service) (Candi 2005, p. 3).

Such design integration and implementation enables value creation and value capturing within operational practices, as mentioned above – addressing real-time and emergent needs in a predictive manner, offering an in-

novation product / process synergising and involving customers / end-users in the development process to share and benefit from the experiences. Possibility of easy replication (e.g. spare parts produced using 3D printing) assures value capturing. It is not necessary to predict the needed number of spare parts any longer and to produce them in advance storing them in warehouses. They can be manufactured on demand taking into account shorter production cycles, resources efficiency and stronger customer / end-user involvement.

Corporate strategic level. With regard to this indicator, design enables crucial economic efficiency in terms of increased productivity (e.g. spare parts) as well as flexibility within the supply and value chain through control / adaptation of design resources, competences and capabilities. A manufacturing enterprise, which traditionally used to be subject to production and warehousing of spare parts, is able now with utilisation of, e.g. creative (design technologies) to produce such spare parts on demand. This, in turn, enables cost savings originally used for production and rent costs and location flexibility.

Creating something new (invention) and utilising this new on the market with creative (design tools), e.g. 3D printing, visualisation software, apps, etc. enable organisations to differentiate and gain new positioning. Companies utilising such design tools and integrating it in product / service development process may easier enter new markets or market niches as well as streamline their supply and value chains (e.g. direct customers, end-users involvement). As a result, flexible operational capacity enabled through real-time aggregated and mobilised design capabilities significantly contribute towards several strategic assets – productivity optimisation and strategic flexibility.

Environmental context. From the environmental responsibility perspective, design integration and implementation in the industry 4.0 context enables organisations to introduce more environmentally friendly practices. Linking up with the example mentioned above, new integrated design approaches combined with key innovation creating technologies (3D printing) have positive impact on corporation strategic orientation: from the logistical point of view, production of spare parts on demand reduces logistical practices, and thus, environmental impact. Energy and fuel consumption can be efficiently saved through reduced logistical interactions, as the need for warehouses and their integration in the supply chains become unnecessary. As a result, the environmental impact is also reduced through saved energy usage and fuels used to transport and distribute spare parts concerned. This, in turns, allows greater sustainability of product / service through material savings, reduced resource usage and ecological mindset.

Taking into account the last indicator of design – design for social efficiency – this performance can be underpinned through observations from cases referring to service generation and exploitation (mainly cases 3 and 4). This is particularly crucial in context of digitalisation and open innovation. Specifically, design integration in development processes allows increased individual customisation through providing customers / end-users with design generating and implementing tools. Customers / end-users can individually design the final stage and performance of their own products (e.g. as in case on app to adapt to the individual needs house installations, devices, etc. in terms of energy saving, security, etc.). Using the provided design tools (technical app), customers / end-users are able to develop the products / services they need – e.g. increase / decrease lighting or heating, control security installations over the app. In this, they do not change the original products / services provided, but grant new meanings to the existing ones, making these innovative.

From the corporate perspective, this bears an important value creation and capturing for organisations. Through joint engagement of enterprise experts and customers / end-users and their connectivity possible through creative innovation implementing technologies and enabling indicators (Internet, software, platforms, apps, etc.), enterprises are granted access to design knowledge, resources and information generated by customers / end-users. Respectively, this new knowledge can be deployed by enterprises for adaptation or replication of new products / processes that meets customers / end-users needs to a greater extent than original ones (reference figure 1). Meeting of customers / end-users needs through providing them with a greater playroom for creativity (designing products / services by themselves) can be seen also as an important source of customers loyalty and new potential customers / end-users involvement.

6. Concluding observations and implications

Currently, design enjoys increasing recognition as an integral part in innovation-driven economy on organisational, business, societal and policy levels. Nonetheless, its integration within the industry 4.0 research streams is emerging, especially from the conceptual perspective. Growing advocacy of design is highly associated with the retrenching European industrial and business performance patters, mounting competition and socio-economic challenges having stronger direct and indirect impact on our society (e.g. health, energy, mobility, environment, etc.).

In the context of industry 4.0, the present research contributes towards deeper understanding of capitalisation possibilities through design integration, implementation and exploitation in product or service development processes for enterprises. Practice-oriented approach proposes a solution on how design can be traced, integrated and utilised within innovation processes. It also underpins perception of design within innovation processes. Integrated design process for product / service development can be perceived as innovation process, and design is an essential knowledge, resource and capability in innovation process of industry 4.0.

From the strategic perspective, design might positively influence value creation and capturing on organisational operational and strategic levels, for both enterprises and customers / end-users, as observations showcase. Particularly, design-driven development processes lead towards flexible manufacturing and servicing, individual customised products and services, innovative business models, new working and cooperation patterns, resource-efficiency (production on demand), production location flexibility and effective customers / end-users engagement through their integration in development process.

Design also proposes value in terms of sustainability, environmental and social efficiency. Effectively employed, design as a tool and process can streamline performance of supply and value chains, reduce logistical interactions and make additional activities redundant. This, in turn, has positive implications for environment through, e.g. carbon footprint and energy reduction, at the same time ensuring social efficiency – stronger social recognition by customers / end-users for socially and environmentally responsible performance of an enterprise.

Design is perceived as a driving force for smart manufacturing, smart products and services connected with customers and consumers, increasing resource efficiency, business performance and competitiveness and level of innovations. Nevertheless, with regard to the findings, the intensity or external perception of design and its integration within the innovation product or process development process may differ. The reason behind this is a level of design tangibility and perception.

Design is traceable and viable via tangible appearance (would it be sign, form, shape, styling, etc.) combined with function and technology as well as through giving this specific form significant and designating its relation to other things, end-users, economic, environmental or social environment, customers and end-users. Through specific signs, symbols and forms, the product service developed becomes more tangible than compared to other cases, where the perception and tangibility of design is attached to intangible tenets, such as meanings, symbolic values, etc. In these particular cases, the meaning is expressed through a particular service, which can become valuable when exploited on the market by consumers or end-users.

As a result, the proposed framework integrates both perspectives – industrial and service design, targeted to support enterprises to better understand and streamline their operational and strategic patterns internally and externally on the market. The shortcoming of this proposed conceptual approach lies in the limited application practices and a number of qualitative cases observed. For this reason, the forthcoming research is set out to enrich the body of empirical findings highlighting practical orientation of the proposed framework and its integration in modern enterprises practices within the industry 4.0 trend. It is intended to specifically support this grounded framework and demonstrate its increasing coordinative, integrative and innovative capacity for product or service development practices.

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Appendix 8: OTHER RELATED PUBLICATION VII

Hack, A., Prause, G., & Maknytė, L. (2012). Design Management and Branding for SMEs: Experiences from the DesignSHIP Project. In: Muravska, T., & Prause, G. (Eds.). European Integration and Baltic Sea Region Studies: University-Business Partnership through the Triple Helix Approach (131−150). Berlin: Berliner Wissenschaftsverlag. (Regional Business and Socio-Economic Development), (**3.2 classification**).

Design Management and Branding for SMEs: Experiences from the DesignSHIP Project

Abstract

The paper at hand elucidates the underlying effects of design management and branding on the corporate level from the strategic management perspective. By building upon the resource-based view, concepts of brand and branding, the paper attempts to fill the void between design management, branding, and business strategy for SMEs by proposing a coherent and multidimensional approach on design management that integrates the existing perspectives. The design management model generated is validated by the five propositions formulated that are tested and discussed by bearing on the relevant empirical evidence.

Keywords: design management, brand, branding, business strategy

Introduction

In the face of increasing competition, firms have been searching for new tools and measures to deploy for their business strategies. Design Thinking, Open Innovation, and Design Management are popular topics on both business and regional development agendas, since innovation has been recognised as the key driving force for the economic grow and social wealth. Innovation emerges often as a result of cross-sectoral and cross-cultural combinations of technologies, design, and business models. Design management has been recognised as a key discipline, activity and sound instrument to bring innovative ideas to the market and transform them into market-successful and competitive products and services. Design management is an essential enabler. It coins and accelerates business performance of a firm, its positioning on the market as well as its internal and external perception. However, the proposed concepts for implementing design management are often too academic and abstract and do not take into account the special needs of entrepreneurs and SMEs.

In this light, the paper at hand calls for validation of design management and its correlation with branding as a holistic strategic approach to anticipate the business and general performance of corporates in the face of constantly rising competition.

A complex and problematic nature of such peculiarities has been addressed within the European discourses. There has been seen an essential need to tackle these particular irregularities prevailing in the region in terms of design management and to estimate, how design can meet challenges in industry, services, and society as well as boost the competitiveness, economic, and social innovations in the South Baltic Region. In order to counteract these particular tendencies, the EU approved in Summer 2011 the INTERREG IVA project "DesignSHIP – Integration of Students, Graduates and SME's in terms of Industrial Design Management" within the frame of the South Baltic Cross-border Co-operation Programme 2007-2013 involving four partners from Poland,

Germany, and Sweden. The overall idea of the project is to facilitate the integration and education of students, graduates, and SMEs operating in the design sector and to develop sustainable design management concepts for SMEs. One of the key goals of the project is to develop and test a cross-border training programme devoted to knowledge transfer end the exchange of sound practices gathered from the creative, business, and technological realm that are oriented to the needs of entrepreneurs.

The present paper is organised as follows. The paper begins by defining some key concepts and approaches that underscore the development of the design management approach from a holistic perspective. Next, a framework for perceiving design management as a coherent, consistent, and multidimensional approach is developed. In the subsequent section, the framework generated is explored by bearing on empirical data gathered. The paper concludes by describing the main insights and locating potential for the further research.

Mapping relevant theoretical approaches and concepts

In order to embed design management as a strategic holistic approach, the discussion turns towards strategic management approaches and brand-related concepts that serve as a point of departure for development of a solid conceptual grounding discussed in the following. There are three central approaches and concepts to justify the perspective adopted in this paper: the resource-based view (RBV), concepts of brand and branding, as well as the branding triangle model.

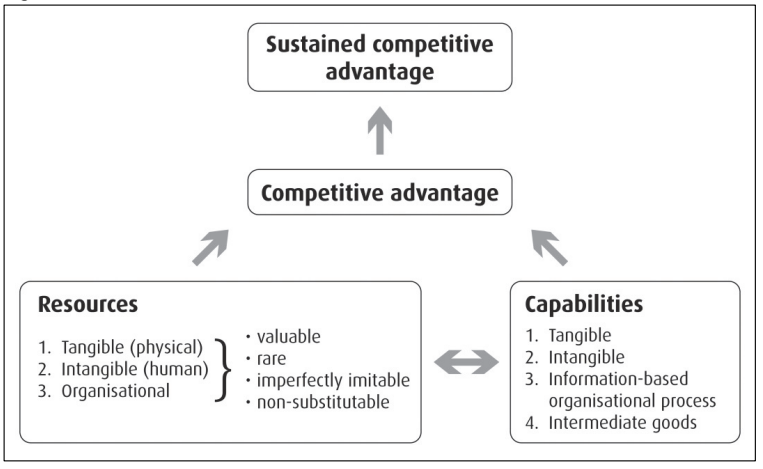
Resource-Based View (RBV)

By drawing on Wernerfelt, the resource-based view provides the perception of corporates as a broader set of resources from a strategic perspective, i. e. a basis to address key issues when generating the corporations strategy. Regarding the specification of the resource itself, Wernerfelt understands by a resource anything that can contribute to a strength or weakness of a given corporation (Wernerfelt, 1984, p. 172). Barney takes this a step further and provides a more detailed notion of the resources of a firm. Accordingly, to the potential resources of a particular firm he allocates all assets, capabilities, organisational processes, firm attributes, information, knowledge etc., i. e. all potential that, in turn, when controlled by this firm allows it to recognise and implement strategies that improve the firm's efficiency and efficacy (Barney, 1991, p. 101). A clearer notion of resources can be generated by confronting the perceptions of resources and capabilities, as outlined by Amit and Schoemaker. By drawing on their observations, capabilities refer to a firm's capacity to deploy resources by incorporating organisational processes and are generated by a firm to provide enhanced productivity of its resources as well as a strategic flexibility and protection for its final product or service. Moreover, in contrast to resources, capabilities are based on developing, carrying, and exchanging information through the firm's human capital (Amit and Schoemaker, 1993, p. 35). Regarding differentiation of resources, there can be differentiated tangible, for instance, machinery, personnel etc., and intangible resources, such as knowledge, brand names etc. (Wernerfelt, 1984, p. 172). This typology can be enhanced by bringing in the distinction of resources, as provided by Barney. In this

respect, Barney differentiates between physical capital resources (technology, equipment, geographical location of a firm, and its access to raw materials), human capital resources (experiences, relationships, and insights of individual managers and employees in a firm) and organisational capital resources (a firm's formal reporting structure, its planning, controlling, coordination systems, as well as information relations among groups within a firm and between a firm and those in its environment (Barney, 1991, p. 101). Capabilities, like resources, can be differentiated as well. Amit and Shoemaker distinguish between tangible or intangible capabilities and to the bundle of capabilities allocate information-based organisational processes and intermediate goods and invisible assets (Amit and Schoemaker, 1993, p. 37).

As emphasised by Wernerfelt, resources can generate profits to a specific firm (Wernerfelt, 1984, p. 172). With regard to competitive advantage, Barney differentiates between competitive advantage and sustained competitive advantage, where the former emerges when a firm is implementing a value leading towards a strategy that cannot simultaneously be implemented by any current or potential competitor. The latter one implies the same attributes as the former one, but in contrast to this presupposes that a particular current or potential competitor is unable to duplicate the benefits of this particular strategy implemented by a firm (Barney, 1991, p. 102). What is of essential importance in this context is the identification of resources that carry with them potential to generate competitive and sustained competitive advantage. Following Barney, the focus should be concentrated on strategically crucial resources that are valuable, rare, imperfectly imitable and non-substitutable. Provided that a given firm possesses such resources, it is therefore able to develop resource-based advantages that can be sustained over time (Barney, 1991, pp. 105-106). The general resource-based view is depicted in the figure below.

Figure 1: The Resource-Based View

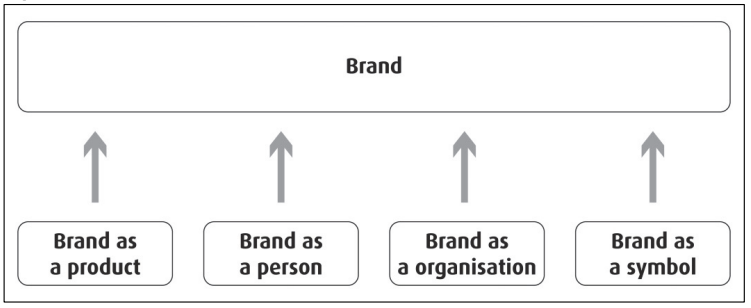


Source: own draft; based on Barney 1991; Amit & Schoemaker, 1993.

Brand, Branding, and Branding Triangle Model

The concept of brand enjoys broad popularity in diverse research streams. Broadly, it can be defined as a conception of a product or service, as perceived and embedded by a customer. More specifically, brand stands for a result of variety of measures employed over a longer period of time and experiences of customers induced by these measures (Meffert et al., 2002, pp. 6-8). By adopting an identity-oriented approach of brand management, as coined by Meffert and Burmann, a brand can be understood as a multidimensional construct. In detail, a brand can be perceived as a sum, a bundle of brand-relevant attributes deriving from the product, personal, organisational, and symbolical dimensions. Within the product dimension, there can be recognised such significant components as technical-qualitative design, visual design, and price level of products or services. The personal dimension implies the image of typical users, cultural embeddedness, and market entering time. The third dimension incorporates such attributes as brand name and trademark, whereas the last dimension points to behaviour of employees and corporate tradition (Meffert and Burmann, 2002 pp. 51-65).

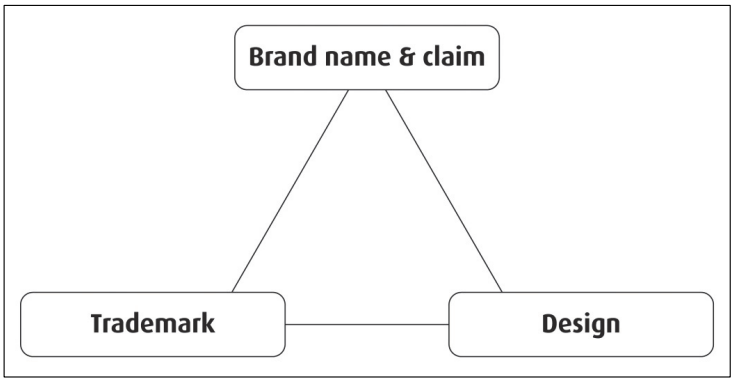
Figure 2: The Concept of Brand



Source: own draft, based on Meffert and Burmann, 2002.

Similarly, as in case of brand concept, there have been made numerous attempts to define branding. Murphy understands by branding a holistic and coordinated organisation of all marketing mix elements in order to establish a coherent, relevant and differentiated image of a brand for its customers. Therefore, branding implies such key components as product, price policy, distribution, packaging, brand name, communication, as well as overall design and presentation of a brand (Murphy, 1990, p. 4). As elaborated later on by Murphy, branding is an identification process deployed to distinguish products and services from that of the competitor as well as to differentiate particular business from that of the competitor in the marketplace (Murphy, 2008, p. 191). Following Esch, branding can be conceived as a comprehensive process that incorporates all measures, tools, etc. to build a brand by viewing it from a holistic perspective. Within brand building processes, a significant tool proves to be the branding triangle, which enables the tracing of the interplay between diverse brand elements. Namely, brand name (1), trademark (2), and design of particular product or service (3), as outlined below (Esch, 2012, pp. 214-217).

Figure 3: The Brand Triangle



Source: adapted from Esch, 2012, p. 217.

Conceptualising Design Management and Branding: A holistic and multidimensional view

Working through the thematic literature dealing with topical subjects of design management and branding, it becomes evident that a series of attempts have been made to conceptualise design management and branding topics. Close scrutiny of profound relevant writings revealed, however, that there is lacking of uniform and a solid approach to be applied when dealing with both design management and branding topics. What is lacking here is a clear and distinct conceptual foundation of interface between design management and branding, of their interplay and mutual complementation from a holistic perspective.

The centre theme here frames the reasoning on the extent to which the incorporation and combination of the approaches and concepts discussed previously contributes to the perception of design management and its correlation with branding as a holistic strategic approach to anticipate the business and general performance of corporations in the face of constantly rising competition.

Design management can be designated as very specific or very broad. Since the present paper underscores the strategic nature of design management, design management implies a business strategy for corporations. Broadly, design management can be understand as all methods, means, and tools referring to the planning, realisation, and controlling of the effective use of design to achieve business objectives, where design management is perceived as a holistic process extending across all design fields aimed to create a homogeneous image of a corporation (Kortwig, 1997, pp. 17-19). Definitions of design management in similar fashion are to be found in numerous other writings, where design management is regarded as a series of organisational and managerial skills and practices to optimise the design process (Chiva and Alegre, 2009, p. 426; Koostra et al., 2009, p. 9). Consequently, design management has been narrowed down to the design field and its impact on diverse business practices. By echoing several studies, design has been deployed to enhance business performance (Chiva and Alegre, 2009; Tether, 2005), to determine design clout on the economic outputs of corporates (Kretzschmar, 2003; Grzecznowska, 2005), to manage and accelerate innovations

(Dickson et al., 1995; Verganti, 2006; Brown, 2008; Koostra et al., 2009; EU Commission Staff Working Document, 2009) or to gain competitive advantage (Borja de Mozota, 2003). By bearing on respective thematic literature, it can be stated that within design management array, design has been perceived and dealt with in a myriad of ways. However, it is obvious that within design management discourses, design has been considered as a construct used to deduce or justify respective practices. In contrast to these particular research streams, the paper argues that design management should not be limited to the analysis of the design field. By contrast, it reasons that a different approach should be employed. Thus:

Proposition 1: Design management is not to be restricted to the use of design field. Design management should be enhanced by bringing in two further arrays, namely, technology and business, thus generating holistic, coherent, and multifaceted view on design management.

In order to validate this view, at this point, it is inevitable to integrate approaches and concepts discussed in the previous section that due to their substance appear to yield a sound and similar reference potential. Combined together, these concepts make it possible to suggest a holistic and coherent approach.

Bearing in mind the fact that design management as an approach aims to provide substantial foundation to generate business strategies for corporations, it appears plausible to start with design management from the resource-based perspective. As coined in several treatises (Rasche, 1994; Barney, 1991; Crook et al., 2008), the resource-based view facilitates the development of a strategy for a firm. By echoing Peteraf, the momentous potential of the approach prevails in applying it to corporate strategy, issues referring to the scope of the firm as well as for single business strategy (Peteraf, 1993, p. 187). In this light, it is reasonable to start the generation of a particular forthcoming business strategy by, first, identifying relevant resources. This process shapes the first stage of the design management process (figure 4). At this point, it is worth mentioning that within the thematic research, there has been made some contribution to conceive design as a resource. Borja de Mozota defined four characteristics to conceive design as a resource: design as differentiator (1), integrator (2), transformer (3), and as a good business (4) (Borja de Mozota, 2006, p. 45). Nevertheless, although this article recognises design as a resource, it is claimed here that, in this particular context, it is solely design that has been perceived as a resource. Therefore, the following proposition is put forward:

Proposition 2: The resource-based view and recognition of external environmental factors of influence facilitates the identification of relevant resources and capabilities in terms of design management.

The paper at hand calls for involvement of other relevant resources within the design management process. Following the attempt to apply design management on a corporate level as well as following the resource-based view, that the resources have to be identified that, appropriately employed, can lead towards achievement of competitive advantage. It is, however, reasonable to start the identification within the design field, like proposed by Borja de Mozota. It has to be complemented by

incorporating business and technology fields yet. The point here is that a corporate should strategically start with its internal analysis, i. e. recognise design management-relevant resources residing in design, technology and business fields, that, in turn, should meet four fundamental requirements, as determined by Barney (Barney, 1991, p. 105-106). The reasoning behind the idea to enhance the resource bundle by bringing in the fields of technology and business is that a corporation, as a complex and multilayer structure, is equipped with resources that can be allocated to the fields of design, business, and technology. Although there has been much discussion within the research discourses over the differentiation of resources in terms of types (Wernerfelt, 1984; Barney, 1991; Grant, 1991; Amit and Schoemaker, 1993; Hoopes et al., 2003), the paper offers a different perspective on the typology of potential resources. With regard to design management, the paper argues for classifying particular resources into three respective groups: creative (1), business (2), and technological (3) resources. Accordingly, all resources that fall within the scope of design and, respectively, business and technology will be located to the particular type of resources. An important point is here that it is not necessary to strictly divide them into groups, as proposed by several scholars (see general RBV in figure 1). This intention can be justified by the following example. Within the technological array, there might be identified such resources that, in turn, can be ascribed to different types. For instance, machinery (tangible), technological knowledge as human capital (intangible), or organisational resources such as technological managers, engineers, employees, etc. Hence, in this light, the classical differentiation according the degree of observability (1) into tangible and intangible (Wernerfelt, 1984), in terms of type of capital (2) into physical capital, human capital and organisational capital (Barney, 1991), or even based on the functionality and the field in which the respective resource is being used (3) into financial, physical, human, technological, reputation, and organisational resources (Grant, 1991, p. 119) seems to lack respective substance. By drawing on the available classifications as well as the fact that the notion and typology of resources imply a broad spectrum for interpretations, the paper does not see in this sense a solid justification to follow this way. By contrast, what is at issue here is the identification of such resources that are rare, valuable, imperfectly imitable, and non-substitutable. What creative, business, and technological resources can be identified is subject to a given firm, to a particular context etc. A key implication in this regard provide Crook et al. arguing that despite what type of a resource has been identified, resources do relate positively to performance regardless whether it is referred to resources in manufacturing versus service firms, diversified versus undiversified firms, and large versus small firms. The key argument is here that the link between performance and strategic resources is essential and relatively constant in numerous contexts (Crook et al., 2008, pp. 1050-1052).

To optimise the conceptual foundation for design management, the paper argues that the resource base should be enhanced by respective capabilities. An important issue in this particular context is the notion that capabilities are frequently developed in functional arrays, for instance, brand management and marketing or when combining physical, human, and technological resources at the corporate level (Amit and Schoemaker, 1993, p. 35). Moreover, since within the RBV literature there emerged a distinction between resources and capabilities and their distinct role, capabilities do

underpin the resource base (stage 1). Besides, the incorporation of capabilities appears to be necessary, since by echoing observations generated in the previous section, capabilities are of vital importance, as they reveal a firm's capacity to deploy resources identified. Similarly, as in case of resources, it was decided here to narrow down the typology of capabilities to the three groups: creative (1), business (2), and technological (3). This statement might be justified by the fact that capabilities, like resources, possess similar reference potential, e.g. tangible and intangible resources and capabilities etc. Nevertheless, to underline, each type of capabilities implies a capacity mixture of people and practices to enact these respective capabilities (Hoopes et al., 2003, p. 890). To exemplify, creative capabilities might imply designers and creative-based practices or even the design department within a firm. Consequently, these capabilities individually or together can be valuable for their own or increase the value of resources. Within business capabilities, there can be mentioned, for instance, marketing, managerial, organisational, controlling etc. capabilities. Finally, product innovations or specific manufacturing practices can be ascribed to technological capabilities. However, these implications may lead one to assume that the conceptual distinction between resources and capacities from this particular point of view tends to be narrow and reveal interface to a particular extent. In this respect it is proposed that the identification of resources and capabilities should be proceeded simultaneously. The bundle of resources and capabilities should be looked at as complex and multilayer.

To finalise stage 1 of the design management concept, it is inevitable to not restrict it to the internal analysis of a given firm (identification of resources and capabilities). By contrast, it is emphasised here that environmental conditions do have respective impact on the identification process of resources and capabilities. This statement is justified as follows. It might be accurate to underline that a successful performance of a firm is determined by the industry structure in which the firm is operating, and strategic behaviour of the firm (conduct) within this industry as well (Meffert and Burmann, 2002, p. 38). In addition, following Porter, a sustained performance of a firm derives from relevant competitive advantages gained due to appropriate positioning of this firm in attractive industries (Porter, 1996, p. 61). As a result, a firm's performance is significantly subject to external factors. Namely opportunities and threats the firm faces within its competitive environment, thus generating an outside-in or, respectively, external perspective. By drawing on these observations it is argued here that the focus should be on both internal analysis of a firm's strengths and weaknesses as well as external analysis of opportunities and threats. As a result the application of the resourced-based view appears to be plausible, since it examines resources of a firm that, when appropriately applied, can lead to the sustained competitive advantage of this particular firm. Nevertheless, the paper does not deny the impact of external factors on a particular firm. In contrast, when dealing with design management and branding on corporate level, as well as with regard to developing a particular holistic approach, the examination of external aspects should be addressed as well. As pointed out in several academic writings, respective management-oriented analyses should not be limited to the application of the resource-based view or inside-out perspective solely. From the strategic point of view essential in this context is the recognition of both perspectives, since both of them follow the same path, namely, to

realise competitive advantages of a given firm (Möhlenbruch and von Wichert, 2007, p. 2). Beyond this, as emphasised by Meffert, it is the market that decides what resources tend to be economically relevant (Meffert, 2004, p. 297). By drawing on Wernerfelt, it is worth to recall the duality between markets and resources (Wernerfelt, 1995, p. 172). In this light, by incorporating and combining both internal (resources and capabilities) and external (environment, markets etc.) perspectives to a particular firm, both approaches enable to generate a solid and balanced stage 1.

Proposition 3: Identification of relevant resources and capabilities as well as their interplay and mutual complementation contributes to the effective and coherent design management.

Turning now to the stage 2 it is argued here that in order to implement effective design management it is not enough just to recognise relevant resources and capabilities in the face of environmental clout. In contrast, particular resources and capabilities should be recognised as a whole, coherent and consistent. It should be treated as a complexity. Of particular importance is in this regard the interplay and mutual complementation of each bundle of resources and capabilities.

At this point three particular realms have been conceptualised: the creative, business, and technological realm. In concrete terms, within each realm there meet, by drawing on Barney's observations (1991), all assets, capabilities, organisational processes, firm attributes, information, knowledge that can be ascribed to this particular array. However, the emphasis here is not to list all potential resources, capabilities, skills, etc. The central theme here is what manifestations this interplay leads to and what results can be obtained. In this light, it is argued that the consistent, coherent, and balanced interplay can result in brand generation. At this point it is necessary to revert to the branding triangle. According to Esch (2012), the branding process encompasses three dimensions, namely, brand name and claim (1), trademark (2), and design (3). Respectively, it might be claimed here that brand name and claim presupposes, first, creative features. More specifically a sound and effective development of brand name and claim requires creative resources and skills, i. e. there is needed a creative potential, a designer. Nevertheless, an effective etc. brand name can be developed by bringing together all relevant actors, namely, designers, language specialists, managers, marketing specialists, etc. This already implies the interrelation of different arrays. Regarding the second element, trademark, it is principally the designer who's field of expertise is sought. However, as in the first case, the decision on logo, etc. should be weighted out in plenum with managers and engineers. Finally, the last dimension of design, including corporate and or product design, points to the interface of creative, business, and technological realms, since, for instance, product development process requires its visual and technological designing, manufacturing, marketing, distribution, etc. Therefore, by bearing on these observations, it can be highlighted that there exist a clear interface, an overlapping between the branding triangle model and the model of interplay of creative, business, and technological realm (stage 2). The main difference is, however, that the proposed interplay model contributes towards a more holistic, coherent, and consistent approach. Whereas the branding triangle has been so far employed within marketing-led or brand management research streams, the

deployment of the model proposed induces its application in diverse design management discourses as a general model based on resource-driven perspective.
Finally, the interplay model generated to advance to the last stage, namely, brand. With regard to this assumption following proposition has been formulated:

Proposition 4: Given the potential influence of interplay between the creative, business, and technologic realm, design management can be conceived as a significant contributor towards effective branding and brand being a result of this respective interplay.

At it is apparent in figure 4, brand emergence shapes the last stage of the design management process (stage 3). As a result, brand emergence implies, first, identification of relevant resources and capabilities in the face of possible environmental clout. This proposition can be maintained by drawing on insights gathered from the brand management research discourses. Meffert and Burmann state that brand originates from an appropriate combination of resources (Meffert and Burmann, 2002, p. 39). The paper at hand takes a step further, hence. Explicitly, first, it makes an attempt to propose the model pointing out that brand development is subject to such aspects as where to search for resources, what resources to recognise as well as what combination of the resources is decisive. Second, the framework suggests a different perspective. It argues that the manifestation of a brand underlies the interplay of all three stated realms. By drawing on the concept of brand in figure 2, as developed by Meffert and Burmann (2002), brand is a consistent and coherent construct embedding creative (design and symbol-based), business (organisational and personal-based), and technological (product-based) attributes. The manifestation of brand in this sense conveys the same characteristics as proposes by Meffert and Burmann, however, in a generalised and consolidated way. Third, in contrast to respective papers emphasising brand as a resource, the paper makes an attempt to conceptualise it as a construct, as a source in order to obtain competitive advantages. By contrast, its emergence is traced back to the interplay of the respective attributes residing in the creative, business and technological realms. Consequently, brand as a result may be deployed for further purposes. Bearing in mind these lines of reasoning, the paper proposes the following proposition:

Proposition 5: Homogenous, consistent, and coherent design management spanning across the identification of resources and capabilities, their interplay, and effective implementation, thus resulting in a brand, may lead towards specific performance gains and, respectively, achievement of competitive and sustained competitive advantage.

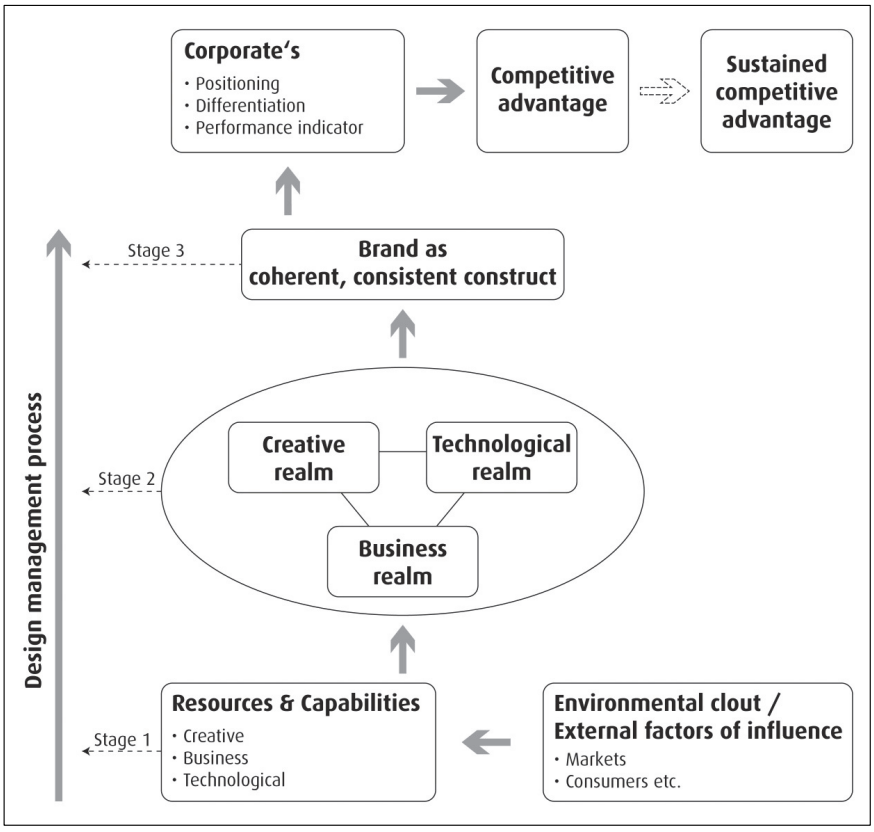
Therefore, the framework combines observations located in both resource-based view papers and literature on brand. Both of them, although formulated slightly differently, reveal similar reference potential, namely, underscore the optimal outcomes: market positioning, differentiation, business performance, increase of awareness about the particular firm, as well as its internal and internal embedding and manifestation. However, these issues have been addressed in different discourses–strategic management-led and marketing or brand management-oriented studies. The present paper attempts to trace the link between them. It is argued here that brand as a result of interplay of respective resources and capabilities does lead towards competitive and,

respectively, sustained competitive advantage. Hence, in order to trace the linkage of design management, branding and brand with the firm's strategy, it is necessary to convey an appropriate referential basis. In this case, it is the resource-based perspective. To justify, the resource-based view conceives firm-internal factors, namely, firm-specific and unique resources and capabilities as primary contributors to competitive advantages of a particular firm (Giersch, 2008, p. 78).

By bearing in mind the initial definition of design management stated in the beginning of this section, design management can be understood as a coherent, consistent and complex process accumulating and effectively using all strategically vital methods, means, and tools referring to the creative, business, and technological realm. Provided all relevant and necessary requirements and criteria are met and combined, results in a brand emergence contributing to firm's performance gains, its solid positioning, strong differentiation from its competitors, as well as its internal and external strengthening (perception) that respectively can confer competitive and sustainable competitive advantages to this particular firm.

As a result, propositions formulated throughout the discussion in this section can be aggregated into the following statement. The whole framework facilitates a holistic and multidimensional view on design management due to the fact that it incorporates diverse concepts and approaches. It contributes towards the general application of this framework despite the size of the corporation, industry in which it is operating and other preconditions. Besides, the framework aims at revealing the interface between resources and capabilities, design management, branding, brand. Therefore, it underpins the idea of a holistic, coherent, consistent, and multidimensional view on design management. It simplifies a generation of a business strategy.

Figure 4: Design management and Branding as a holistic approach



Source: own draft; based on concepts adapted.

Method and empirical evidence

In exploring design management and branding processes from a strategic perspective, the paper has followed a qualitative approach. Since the paper has argued for a holistic, comprehensive, coherent, and multidimensional view on design management and branding, the empirical analysis requires a sound response from all three arrays: design, business, and technology. Besides, an interdisciplinary and real-life context appears to be of vital importance. Accordingly, this attempt has been facilitated by a qualitative-oriented and practice-based approach. In this respect, a promising venture to undertake an empirical analysis was the design management training session in Wismar in April 2012 organised in the course of the implementation of the EU cross-border project "DesignSHIP – Integration of Students, Graduates and SME's in terms of Industrial Design Management" within the South Baltic Cross-border Co-operation Programme 2007-2013. The rationale behind this choice is the following. First, these interdisciplinary-oriented design management seminars serve as a substantial indicator to reveal design management through an interdisciplinary lens, since due to the

involvement of the creative, business, and technological dimension these seminars manifest the interdisciplinary environment. Second, these particular seminars reveal the need to incorporate all three respective arrays when dealing with topical issues of design management and branding. Finally, training in design management reflect how design can meet the challenges in industry, services, and society as well as to boost innovations, thus resulting in increased competitiveness on the corporate level. Since the objectives of this training initiative appears to overlap to a great extent core points reasoned in this present paper, it was decided here to use these design management seminars as the setting most suitable to gather objective and reliable data for the empirical analysis.

Empirical data used for the analysis have been obtained within the scope of the design management seminars. There were open questionnaires distributed to students, graduates, and representatives of SMEs. Besides, the body of empirical evidence was complemented by semi-structured interviews conducted with experts representing the design, business, and technology fields. Therefore, the empirical analysis was carried out based on reflections, discussions, and results gathered during this particular design management initiative. All informants and interviewees were personally involved into the design management training session in Wismar. The propositions formulated in the previous section were tested by focusing questionnaires generated and interviews conducted on aspects and issues underscoring resources and capabilities, environmental influence, the interface of design with the business and technology realm, and implications of design management for a firm.

Analysing design management and branding issues in such a way has the advantage that it enables the location of the perceptions of those who are immediately dealing with design management issues. Besides, interdisciplinary perceptions contribute to the attempt to reveal which of the three arrays addressed needs more attention, how it might be realised, and at which point these three realms interface. Furthermore, the approach enables the finding of a common referential base, as well as the potential to trace further significant issues that might merit further attention within this thematic research.

Findings from the research

The present paper has articulated fundamental relationships between design management, branding, and business strategy generation resulting into the holistic approach (figure 4). Theoretically, this particular approach has been underscored by the five propositions formulated during the course of arguing. The core of this section is to estimate whether and how the empirical analysis justifies the development of this model and its contribution to strategic management practices.

Proposition 1: Design management is not to be restricted to the use of the design field. Design management should be enhanced by bringing in two further arrays. Namely, technology and business, thus generating a holistic, coherent, and multifaceted view on design management.

The analysis of the empirical data gathered connotes that in order to undertake an effective design management in a firm, there is a need to bring together designer, economist or marketer, and engineer. Concentration of the focus solely on design and its isolation from the fields of business and technology may negatively affect business practices. By echoing the perceptions of experts, the designer, economist or marketer, and engineer should work together in order to represent a firm in which they are working as a complex structure. Accordingly, the business activities of a particular firm should not be isolated to management, design, or technology. Only by combining these three arrays the firm can be perceived as a coherent and consistent entity. Similarly, as emphasised by respondents, all fields should be involved within design management process. The interplay of all three arrays reflects the cooperation patterns within a given firm, since there exists a mutual interdependence between these particular fields. Besides, as was pointed out by approximately one third of respondents, an important implication of close dovetailing of the creative, business, and technological realm appears to be the communication within the firm. Due to the common communication there might result an effective cooperation of all three terrains.

Proposition 2: The resource-based view and recognition of external environmental factors of influence facilitates the identification of relevant resources and capabilities in terms of design management.

Nearly the majority of the respondents argued for the need to find respective resources when dealing with a particular company. This step should be treated as the point of departure when dealing with the design management processes. An important measure that was validated during the respective design management seminars proved to be the so-called checklist. To give more detailed information, each of the checklists is comprised of questions, statements, etc. that pinpoint particular resources and capabilities of a given firm residing in all three fields, namely, design, business, and technology. Accordingly, representatives of each respective department can locate resources and capabilities that are recognised by them as rare, valuable, non-substitutable, and hardly imitable. Consequently, by bringing the identified resources and capabilities together there can be generated a solid resource and capabilities base (figure 4). Nevertheless, it might be accurate to mention here that a small proportion of the respondents highlighted that consumers and users of products and services play a significant role within the design management process. In this light, the incorporation of the external perspective into the model of design management appears to be plausible.

Proposition 3: Identification of relevant resources and capabilities as well as their interplay and mutual complementation contributes to the effective and coherent design management.

Due to the fact that the formulation of this preposition was inevitable with regard to the development of the particular design management approach, its validation is similar to that of the first one proposition. More specifically, as it was observed during the expert interviews, it is inevitable to initiate the simultaneous interplay of the three particular arrays, especially in the face of increasing competition, thus facilitating the firm's business strategy formulation. An important remark might be made here when

echoing some topical papers. As pointed out by Kotler and Rath, a common mistake of the firm's management is to bring designers into the new product development process or to bring the wrong type of designer (Kotler and Rath, 1993, p. 19). Similar propositions can be found in writings of Brown (2008) and Ott (2005). Besides, as it was experienced during the design management seminars held in Wismar, April 2012, when a real-life case was deployed in order to experience design management from the practical perspective, by neglecting the coherent, consistent, and simultaneous interplay of the creative, business, and technological realm, a corporate's business performance can be jeopardised which, in turn, impedes concrete performance gains. By bringing the designer, following Kotler and Rath (1993), not in the first stage when the idea generation process occurs, but in the stage when the product development process is carried out, can have several implications. To exemplify, it's not easy to change the design related attributes, such as the logo, the corporate name, or its marketing activities when the firm is operating. These reflections were gathered from the expert interview.

Proposition 4: Given the potential influence of interplay between the creative, business, and technologic realm, design management can be conceived as a significant contributor towards effective branding and brand being a result of this respective interplay.

By bearing on the empirical data, respondents named brand as a result, a construct of the process involving all three realms, namely, the creative, business, and technological. Although the brand was listed as a result by a very small proportion of informants, the majority of the respondents listed the product being as an outcome of this coherent and consistent interplay. In this light, it might be argued that, when drawing on the concept of brand (figure 2), brand clearly implies some attributes pointing to a particular product or service. By recalling the new perspective on design management and branding (figure 4), brand implies creative, business, and technological attributes, since there were located some overlappings between the concepts of brand and branding. However, in this particular case, brand is perceived more as a result to be employed for further purposes, especially, to gain competitive advantages. Similarly, as it was stated by the respondents, brand enables the "selling", i. e. bringing the special product or service to the market. Being brand, this particular product or service may lead towards the differentiation from the competitors and strengthening the position on the market etc. that, in turn, accelerates the firm's business performance generally.

Proposition 5: Homogenous, consistent, and coherent design management spanning across the identification of resources and capabilities, their interplay and effective implementation, thus resulting in a brand, may lead towards specific performance gains and, respectively, achievement of competitive and sustained competitive advantage.

As a result of the analysis undertaken, the last preposition might be considered as a general finding gathered from the empirical evidence. Thus, the employment of the generated approach on design management and branding as a consistent, coherent, and multidimensional one might facilitate the firms day-to-day businesses. By bearing in mind aspects located in each of the stages (figure 4), a given firm is able to base its

forthcoming design, management, and business initiatives and strategies on the specific resources and capabilities it possesses. Furthermore, the firm should not disregard the external influence. More precisely, resources, capabilities, etc. employed should be weighted with regard to the consumers need, i. e. what is demanded on the market. Besides, when passing all the stages, the firm is able to generate a brand, thus increasing its business performance, performance gains, its differentiation, and anchoring among both its employees and customers. The practical application of the model developed induces the firm to reflect upon its internal cooperation, i. e. how designers, managers, and engineers are working together and in what sense they can enhance their productivity, since the designer might not be well familiar with the product and firm's organisational structures and, vice versa, managers and engineers might not have a good command of how to convert the ideas into the visual language etc.

Conclusions and further research

In exploring design management and branding from a different perspective the paper has argued that design management can be perceived as a coherent, consistent, and multidimensional view consisted of three different stages. An important proposition has been made within the approach development process regarding brand and branding. The analysis shows that by bearing on different strategic management-led concepts and approaches it is possible to generate a holistic view on design management without separating design as a significant factor for the business performance. Besides, the paper demonstrated that building upon key stages identified a firm can establish a brand, achieve competitive advantages and performance gains, and therefore shape its business strategy. The shortcoming of such an approach applied is recognised. One limitation of this perspective on design management and branding lies in the fact that it was tested when applying the qualitative approach. Nevertheless, the paper provides additional insights into the comprehensive terrain of design management and strategy formulation. The analysis conducted and generalisations made imply, however, that further deepening of the proposed approach by incorporating further research methods and a broader sample may yield additional fruitful insights and knowledge as well as anchor the holistic view on design management within the topical discourses.

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Curriculum vitae

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Place of birth:	Vilnius, Lithuania
Citizenship:	Lithuanian

Contact data

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Education

2014 – 2017	Tallinn University of Technology, PhD student
2008 – 2011	University Flensburg, Syddansk University Double Master Degree in European Studies
2005 – 2007	Vilnius University Master Degree in Translation
2001 – 2005	Vilnius University Bachelor Degree in German Philology
1989 – 2001	Vilnius Radvilos Gymnasium School leaving (maturity) certificate

Language competence

English	Fluent
German	Fluent
Russian	Good
Lithuanian	Mother tongue

Professional employment

2000 – present	Hochschule Wismar University of Applied Sciences: Technology, Business and Design European Project Manager, Senior Researcher, Lecturer. Key competence areas: financial and administrative coordination and management of European projects within the frame of the European Programmes Baltic sea Region, South Baltic Programme, Central Europe, Horizon 2020 and Erasmus+. Application for European funding of interdisciplinary research projects. Research in the fields of design management, creative industries, innovation, regional smart specialisation, regional innovation systems maritime transport and economics, Liquefied Natural Gas (LNG), supply chain management and clusters, shipping technologies, cross-border and interregional cooperation and development of cross-border regions.
2014 – 2016	Hochschule Wismar University of Applied Sciences: Technology, Business and Design. Lecturer in Project Marketing for BA students in Business Law
2015 – present	Hochschule Wismar University of Applied Sciences: Technology, Business and Design.

Lecturer in Multimodal Transport Corridors for MA students in Digital Logistics.

2009 flensburg.school for Advanced Research Studies
Scientific assistant.
Key competence areas: preparation and implementation of database for the reference library, inventory of book titles for the database system.

Selected Projects

General project manager and senior research, Interreg VA project CTCC – Creative Traditional Companies Cooperation, duration: 2017-2020.
Project manager and researcher, Interreg VB project SMART_watch – Regional branch observatories of intelligent markets in Central Europe monitoring technology trends and market developments in the area of smart specialisations, duration 2017-2020.
Project manager and researcher, Interreg VA project INTERMARE South Baltic – Internationalisation of South Baltic maritime economy, duration: 2017-2020.
Project manager and researcher, Interreg VB project TEST-4-SME – Laboratory network for testing, characterisation and conformity assessment of electronic products developed by SMEs, duration: 2017-2020.
Project manager and researcher, Interreg VA project Go LNG – LNG Value Chain for Clean Shipping, Green Ports and Blue Growth in Baltic Sea Region, duration: 2016-2019.
Project regional manager, Interreg IVA project MarTech LNG – Marine Competence, Technology and Knowledge Transfer for LNG (Liquid Natural Gas) in the South Baltic Sea Region.
Project regional manager, Interreg IVA project Design EntrepreneurSHIP – Integration and education of students, graduates and SME's in terms of industrial design management.
Project partner in the Study commissioned by the European Commission (DG MOVE) in the frame of tender 2014.
Project communication and financial manager (Lead Partner) TEMPUS IV project Green Engine – Eco-Engineering – environmental processing and sustainable use of renewable recourses and bio-waste.
Financial and communication manager (Lead Partner) Interreg IVB project Baltic.AirCargo.Net – Improvement of the air cargo transport sector by service-oriented ICT-methods and processing logistic network.

Elulookirjeldus

Isikuandmed

Nimi:	Laima Gerlitz (sünd. Maknytė)
Sünniaeg:	1982 12 03
Sünnikoht:	Vilnius, Leedu
Kodakondsus:	Leedu

Kontaktandmed

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Hariduskäik

2014 – 2017	Tallinna Tehnikaülikool, Doktorant
2008 – 2011	Flensburgi Ülikool, Saksamaa / Syddani Ülikool, Taani Euroopa magistriõppe magistrikraad
2005 – 2007	Vilniuse Ülikool, Leedu Vastuvõtu magistriõpe
2001 – 2005	Vilniuse Ülikool, Leedu Saksa filoloogia bakalaureus
1989 – 2001	Vilnius Radvilos gümnaasium Koolist lahkumine (tähtaeg)

Keelteoskus

Inglise keel	Kõrgtase
Saksa keel	Kõrgtase
Vene keel	Algtase
Leedu keel	Emakeel

Teenistuskäik

2012 – ...	Wismari Ülikool Euroopa projektijuht, vanemteadur Euroopa programmide finants- ja halduskoostöö ja juhtimine Euroopa programmide raames: Läänemere programm, Lõuna-Läänemere programm ja Erasmus + Interdistsiplinaarsete uurimisprojektide Euroopa rahastamise taotlemine Teadusuuringud disainijuhtimise, loomemajanduse, innovatsiooni, piirkondliku nutika spetsialiseerumise, piirkondlike innovatsioonisüsteemide, meretranspordi ja majanduse, veeldatud maagaasi, tarneahela juhtimise ja klastrite, laevatehnoloogiate, piiriülese ja piirkondadevahelise koostöö ja arengu valdkonnas
2014 – 2016	Wismari Ülikool ärijuhtimise BA üliõpilaste projektijuhtimise lektor
Alates 2015	Wismari Ülikool digitaalse logistika magistrantide multimodaalsete transpordikoridoride lektor
2009	Flensburg School for Advanced Research Studies Teaduslik assistent Referentsraamatukogu andmebaasi ettevalmistamine ja

rakendamine, andmebaasisüsteemi raamatute pealkirjade inventuur

Valitud projektid

Projektijuht ja vanemteadur, Interreg VA projekt CTCC – traditsiooniliste ettevõtete koostöö, kestus: 2017-2020.
Projektijuht ja uurija Interreg VB projektis SMART_watch – Kesk-Euroopa intelligentsete turgude piirkondlikud harukonverentsid, mis jälgivad tehnoloogia arengut ja arenenumate turgude arengut, kestus: 2017-2020.
Projektijuht ja uurija INTERREG VA projektis INTERMARE South Baltic – Läänemere meremajanduse rahvusvahelistumine, kestus: 2017-2020.
Projektijuht ja uurija Interreg VB projektis TEST-4-SME – VKEde poolt väljatöötatud elektrooniliste toodete testimise, iseloomustamise ja vastavushindamise laboratoorium, kestus: 2017-2020.
Projektijuht ja uurija INTERREG VA projektis Go LNG – Veeldatud maagaasi väärtusahel puhta laevanduse, roheliste sadamate ja "sinise" kasvu jaoks Baltimere piirkonnas, kestus: 2016-2019.
Projekti piirkondlik juht, Interreg IVA projektis MarTech LNG veeldatud maagaas – Läänemere lõunaosas LNG merendusalase pädevuse, tehnoloogia ja teadmiste edasiandmine.
Projekti regionaaljuht, Interreg IVA projektis Design EntrepreneurSHIP – Tööstusdisainilahenduse juhtimisega seotud üliõpilaste, lõpetanute ja VKEde integratsioon ja koolitus.
Projektipartner Euroopa Komisjoni tellitud uuringus (DG MOVE) pakkumismenetluse raames 2014. aastal.
Projekti kommunikatsioon ja finantsjuht (juhtpartner) TEMPUS IV projektis Roheline mootor – ökodisain – taastuvate allikate ja biojäätmete keskkonnasõbralik töötlemine ja säästlik kasutamine
Projekti kommunikatsioon ja finantsjuht (juhtpartner) Interreg IVB projektis Baltic.AirCargo.Net – Õhutranspordi sektori parandamine teenustele orienteeritud IKT-meetodite ja logistikavõrgu arendamise kaudu