Building Tomorrow's Urban Futures: Reflections on the "BuildDigiCraft" Project and the Pursuit of High-Quality "Baukultur" in Higher Education.

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Abstract
The BuildDigitalCraft project (2019 - 2022) underscores the importance of education in fostering interdisciplinary knowledge exchange for creating high-quality urban spaces. It highlights a shift towards deeply integrating digital tools into professional practices while acknowledging societal concerns about digitalization in education. Findings indicate a significant evolution in our approach, moving from using digital tools as aids to deeply integrating them into professional practices. This article advocates for academia to serve as a facilitator of emerging modes of learning and promote scientific self-reflection. It emphasises the multidisciplinary nature of high-quality Baukultur and advocates for the intertwining of crafting qualities, tacit knowledge, and qualitative immeasurable aspects with digital, quantifiable, and data-driven qualities.

Introduction
Building tomorrow´s urban futures with the global population shifting increasingly towards urban areas, there is immense pressure on higher education institutions to prepare students to design and manage cities that are sustainable, resilient, and inclusive. **Fast-paced urbanisation** brings forth challenges related to infrastructure development, housing, transportation, and environmental sustainability. Higher education institutions, particularly those focusing on fields like architecture, engineering, urban planning, and related disciplines, are encountering a multitude of challenges in adapting to the evolving landscape of the built environment. Schools are facing increasing demands to prepare students for **rapid economic, environmental, and social changes**, for jobs that have not yet been created, for technologies that have not yet been invented, and to solve social problems that have not yet been anticipated (OECD, 2018).

Considering the rapid transformations in society, there's a growing imperative to redefine the broader educational objectives in higher education. This entails prioritising individual and collective well-being, providing tools for navigating complexity and uncertainty, fostering competencies for societal transformation, and guiding principles for moving towards eco-systemic change (OECD, 2018).

Increasingly, it's understood that the rapid pace of scientific and technological advancement demands a broad spectrum of knowledge, skills, attitudes, and values in practical application. This is a complex responsibility of equipping students with the knowledge, skills, and mindset necessary to address the diverse and interconnected challenges and a broad spectrum of issues ranging from engineering, architectural design and urban planning to sustainability, social equity, and technological innovation. Moreover, there is a growing importance of cross-disciplinary efforts in responding to these challenges. Students are those who if equipped in knowledge and skills will actively drive change.

Today higher education institutions are confronted with **increasing demand for digitalisation**. Digital technologies emerged already in the early 1990s, leading to a new era of culture and economics centred around data that has already transformed much of our production methods (Carpio, 2017). Now, they stand poised to revolutionise many aspects of our ways of thinking and doing things to adapt to the ongoing digitally driven transformation. In the rapid urban development and pressures on advancing digitalisation of workflow, there is a risk of neglecting the diverse perspectives necessary for long-term sustainability and well-being in cities.

In the technologically advanced and highly digitally driven professional work **the values and leading principles of traditional craftsmanship in the built environment**, contributing to the construction, design, and preservation of architectural landmarks and structures, need to be reintroduced and validated again (Bögle et al., 2022). There is a need for a fundamental change in the way "we are doing things" and the way "we communicate and collaborate with each other", and digital technologies play a major role in this transformation process. Digitalization is advancing as a fundamental concept also within higher education institutions, which calls for encompassing quality concerns across various dimensions (Tømte et al., 2019).

BuildDigiCraft was a three years´ project (2019-2022) established by eight universities in a Baltic Sea region as a joint research inquiry. Project developed and implemented innovative teaching and training modules for young scientists, PhD candidates and advanced master's level students and was introduced as a collaborative and cross-disciplinary exploration of three important thematic pillars in higher education anchored in the built environment: (i) knowledge, (ii) process and (iii) material. The project aimed to bring an understanding of the changing paradigm of building cultures in the digital age explored in the context of the relation between professional practice and higher education. The project allowed for a joint exploration of the questions related to today's craftsmanship: *how is the ongoing digital revolution affecting the work of designers, architects, engineers, urban planners, and other professionals responsible for the shaping of the built environment, and what opportunities arise from the available digital and data processing technologies for creating innovative solutions for design, construction, maintenance and management of buildings and cities* (Bögle et al., 2022)?

The project aimed for developing a shared understanding among project participants what is the high quality of the built environment in the digital age. And how do we measure and enhance the perception of its quality? It stressed that the common and

ultimate ambition of crafting the built environment and our engagement with it, involving aspects such as planning, constructing, renovating, and preserving should be built on the holistic concept of "Baukultur". The holistic concept of high-quality **Baukultur** encompasses all activities with spatial impact, from craftsmanship details to large-scale urban planning and the development of landscapes. It refers to all activities with spatial impact of all actors involved over time. In Europe Baukultur forms foundations for two key EU initiatives: the Davos Declaration (2018) and the New European Bauhaus- NEB (2020). BuildDigiCraft aimed to explore opportunities to further develop the concept of Baukultur in the context of a highly digitalized world and urgent re-definition of the roles of higher education in training future professionals.

The project collected significant and abundant material. The findings presented in this article were chosen specifically to tackle its primary inquiry: how higher education can facilitate the emergence of new learning methods in the digital age, preparing the next generation of planners and designers to responsibly shape high-quality built environments (Baukultur)? How to better address the need for a professional mindset change regarding digitalisation, the changing professional roles, and the ambition to shape high-quality spaces? How can higher education strengthen collaboration and knowledge exchange between professions of the built environment?

The paper is organised into five sections. The first presents previous studies addressing the digital revolution's impact on reshaping design and planning practices. The second explains the context of high quality Baukultur in the digital age. The third section introduces the BuildDigiCraft project, its aim and role in the development of an innovative higher education module, and the insights gathered from participants during organised training modules. The fourth section presents and discusses the idea of contemporary craftsmanship in the digital building culture (covering material, process, and knowledge). The final section further explores and discusses the role of higher education in training building professions in the digital era.

Digital Revolution and Transforming Design and Planning

Digitalisation is revolutionising our society and all actions related to our professional world, and the way we are dealing with physical space (Bögle, at al. 2022). The digital revolution has profoundly impacted design and planning disciplines across various sectors, reshaping the way professionals conceptualise, create, and implement projects. Carpo (2016) argues in *The Second Digital Turn- Design Beyond Intelligence* that every technological innovation only happens when technical supply pairs with cultural demands. This indicates that today´s building cultures adopted digital technologies in their daily professional work but in different ways over time. Carpo distinguishes the first and second digital turn. The first came in the early 1990´s and was expressed in producing variations, digital fabrication of not identical copies, digital mass customization and visualisation. The old professional knowledge and skills started to be used on new computational platforms. In the second digital turn building cultures have learnt to adjust more work to computers due to faster and better collection, transmission, processing of data, and in general problem solving. With the advanced use of new digital tools today´s computational revolution is begetting a new way of thinking, leaving much scope of work to computers which creates a brand-new science. The new kind of science that is inherent in most today´s AI applications, that are based on random testing, trials, and errors, looking for a precedent. This is a different approach than in traditional building and engineering cultures looking for

formulas and rules to predict desirable solutions. Examples of digital twins gathering data in virtual and augmented realities for collaborative and participatory processes present new possibilities for collaboration but also change perspectives on planning and decision support (Dembski et al., 2020).

In higher education **digitalisation** encompasses how the adoption of digital tools and platforms influences the interactions and operations of individuals and organisations within social and organisational contexts (Pinheiro et al., 2023, as cited in Bloomberg, 2018, p. 4). On the other hand, digital transformation (DT) represents a broader process involving significant organisational adaptation across various domains, in addition to effectively implementing digital platforms and solutions. Consequently, higher education must not only focus on integrating emerging technologies but also address the need to adapt to the increasing demand for digitalization in the workforce and the evolving roles within professions related to the built environment.

Digital technologies bring forth new viewpoints on digital processes, evolving knowledge, and materials/data, and when intertwined with the physical realm, they hold the potential to enhance the qualitative aspects of the built environment (Bögle, at al. 2022). They have not only enhanced the efficiency and effectiveness of design and planning disciplines but have also opened up new possibilities for innovation and creativity. By leveraging digital technologies and embracing interdisciplinary approaches, professionals can continue to shape the built environment in ways that are more sustainable, inclusive, and responsive to the needs of communities and individuals. Consequently, the fundamental mission of design and planning disciplines remains unchanged: shaping the objects we create and the environment we inhabit (Carpo, 2016).

In Europe this mission put an immense emphasis on achieving a higher quality of built environment as in the course of the transformation to a knowledge society, the importance of knowledge and expertise for companies and organisations is crucial.
The UNESCO International Bureau of Education (IBE) distinguishes between vertical and horizontal articulation in education (International Bureau of Education, 2016). Vertical articulation involves organising content within a knowledge domain over time, while horizontal articulation integrates content from different domains within a grade level. Much of the knowledge is "tacit knowledge". Today´s version of vertical and horizontal alignment seems directly linked to the digital and the question arises what happens when people digitalize or digitally share tacit knowledge. The digital transformation of tacit knowledge has a political and democratic dimension (Pedro Esteves Galvão Aibéo, Günther H. Filz, and Vishal Singh 2021), in architecture and planning, spanning from educational questions (Ylirisku and Filz, 2018), to design approaches (Ruan, Filz, and Fink, 2022) to the meaning of material, materiality and the digital for Baukultur (Popovic Larsen and Filz, 2023).

High Quality Baukultur and Digitalisation
The idea of Baukultur put a high-quality built environment in the centre of the work of designers, engineers and urban planners, applying it just as much to craft-related detail as to large-scale urban planning. For higher education in design and engineering schools, it offers a platform for methodologies and tools for future experts in those professions. Two key EU initiatives operationalizing the concept of Baukultur are the

Davos Declaration "Towards a European vision of high-quality Baukultur" from 2018 and the New European Bauhaus (NEB) Initiative 2020.

Those initiatives not only emphasise the need for a fundamental shift of mindset among those professions shaping the built environment, but even more significantly but address society as a whole for the first time focusing on the quality of their living environment. It aims to address pressing global challenges, both societal and climatic through the lenses of the built environment which is one of the key factors influencing those challenges as the Buildings and Construction sector is the largest emitter of greenhouse gases, accounting for 37% of global emissions for over 34 percentage of energy demand in 2022 (UNEP & YCE+A, 2023). To answer those challenges NEB aspires to bring together stakeholders from all domains (Pentahelix) – citizens, experts, designers, businesses, and institutions – to envision more sustainable cities and territories, not just in Europe but globally.

As described in the chapter above digitization is changing the way we are now shaping the built environment. The New European Bauhaus as a guiding framework among its other priorities is pivotal in defining how the ongoing digital revolution is affecting the work of designers, architects, engineers, and urban planners. Within the BuildDigiCraft project, we seek to examine new opportunities that arise from the available digital and data processing technologies for creating innovative solutions for the design, construction, maintenance, and management of buildings and cities (beyond standard workflows and material use). To nurture a high-quality Baukultur the fusion of physical and digital realms is becoming ever more intertwined, mutually fuelling each other. Hence, the craftsmanship qualities, tacit knowledge, and immeasurable nuances have to be interlaced with digital, measurable, and data-centric approaches. This synergy promises to prompt future high-quality Baukultur and the high-quality of spaces.
In January 2018, European Ministers of Culture convened at the Davos Conference on High-quality Baukultur in Europe to explore pathways toward enhancing the quality of the built environment. In pursuit of this goal, measures of the perception of a high-quality built environment were required. In 2020, the identical inquiry gained significance and ascended to the forefront of political discourse in Europe. Consensus was reached that the overall concept of high-quality Baukultur should be embedded in Europe on a political and strategic level. Within the BuildDigiCraft project Baukultur the context of the Davos Declaration was tackled through the following three aspects:

1. The current built environment, encompassing both cultural heritage assets and contemporary creation, should be perceived as a unified entity. Existing constructions serve as an important Baukultur reference for shaping the future design of our built environment.
2. All endeavours affecting the built environment, from detailed craftsmanship to the planning and implementation of infrastructure projects having an impact on the landscape, are manifestations of Baukultur.
3. Baukultur extends beyond physical structures to encompass the processes involved in its creation (Bögle, at al. 2022)

Most importantly, the concept of Baukultur transcended its niche among built environment experts but was officially endorsed at a political level, which happened together with the understanding that the built environment is not only the collection of the existing and newly designed building stock and infrastructure but also encompasses all the processes and activities required for its creation.

Based on such an understanding, the Davos Declaration gives further incentives to society, politics and science to rethink the current situation which is marked through disciplinary blinkers, ephemeral profit maximisation and digital automation, as well as confronted by major ecological and climatic challenges which may jeopardise the future of our planet. In terms of BuildDigiCraft Baukultur quality was measured against eight major criteria from the Davos System: Governance, Functionality, Environment, Economy, Diversity, Context, Sense of Place, and Beauty, giving a comprehension framework to measure the quality of the built environment.

BuildDigiCraft Project (2019-2022)

The BuildDigiCraft project aimed to develop and implement innovative educational training module tailored for young scientists, PhD candidates, and advanced Master's level students, focusing on both teaching and training aspects (Bögle et al., 2022). It allowed students and experts trained in design, architecture, engineering, urban planning, and related fields to focus together on the question of how to create high-quality Baukultur in the digital age. The program was part of a long-term partnership between eight universities in the Baltic Sea region. They share similarities in history, climate, landscape, and craftsmanship traditions. Despite these shared traits, each place and university has its own unique character and educational culture. In a joint collaboration, the represented research and educational departments of the eight universities managed to develop and realise a one year online training program, funded by the Erasmus+ strategic partnerships program.

The starting point of the program was the examination of new possibilities arising from the use of digital technologies for innovation in building design, construction, maintenance, and city management. It evolved then to a higher education discourse on the future of the professions of the building and planning sector, emphasising the need for a new work ethos and a more craftsmanship-oriented approach in a digitally impacted work environment.

The project builds on two leading concepts. First, "craftsmanship" is identified and introduced as a main guiding principle in the context of the ongoing digital transformation of the planning, design, and construction sector. Then, the concept of Baukultur is used to refer not only to the existing and contemporary building stock and infrastructure but also to the processes and activities required for their creation. The German term Baukultur was introduced by the Davos Declaration (2018) as an official term in the international professional language of the specialists of the built environment. With the help of the Davos Baukultur Quality System (2021), the high-quality Baukultur level of places can be defined based on eight criteria, which the BuildDigiCraft project takes reference.

The project brings these two concepts together by arguing that craftsmanship is essential for setting up the framework for designing a new path leading to a high-quality Baukultur in the digital age. The values and leading principles of traditional craftsmanship, such as dedication, pride in one's own work, and mindful and sustainable dealing with the building material, need to be re-introduced and validated in the context of the ever-growing digitally driven work environment. Moreover, they are highly needed for the creation and shaping of high-quality built spaces, which protect the environment, fit their purpose, add economic value, result in spatial coherence, connect people, create a sense of space, and are also aesthetically designed (based on the Davos Baukultur Quality System).

The exploration of the concepts of craftsmanship, Baukultur and digitalisation creates the holistic project framework of the project, calling for "high-quality Baukultur in the digital age through craftsmanship". This framework allows for knowledge integration between the interdisciplinary backgrounds of the participants of the BuildDigiCraft training program. Thus, different research questions, methodologies, design principles and theories as well as the different scales of the built environment – from the structural and architectural detail through the building to the urban level – can find common ground to mutually benefit each other. Hence, the project addressed a growing gap in the higher-education curricula of design and engineering schools, which indicates a clear need for more reflection space and interdisciplinary discussion on joint professional approaches for solving fundamental societal challenges. Within the training program, advanced students, and young researchers, as well as experienced teachers, were given a common platform to mutually elaborate on the core values and leading professional principles for achieving high-quality spaces. At the same time, the exchange and peer-review with other specialists of the built environment allowed them to get to know new professional perspectives, work methods and scale of interventions applied in other closely related disciplines. Participants gained new skills and competencies for navigating and collaborating with professionals of other disciplinary fields, with whom in the future they will be jointly responsible for shaping buildings, spaces, and also work processes. An exchange that is imminent once real projects are being developed.

What is the BuildDigiCraft´s training approach and how does the training work? BuildDigiCraft equips future professionals with a method for an intellectual reflection on any physical intervention in the built environment. With the help of the BuildDigiCraft scientific model experts of the built environment can better assess the quality of their work process as well as the quality of their intervention (Bögle, at al. 2022)- The model allowed the participants of the BuildDigiCraft training program to set their individual research within the holistic framework of "high-quality Baukultur in the digital age through craftsmanship."

The concept of Baukultur is deconstructed in the project down to its three core elements: the Process, the Knowledge and the Material (Fig 1]). Shaping and maintainance of the built environment results in complex and diverse processes and includes design, planning, construction, maintenance, and as well as end of use phase. In broader terms, these Processes are influenced by the available Knowledge and understanding of Material.

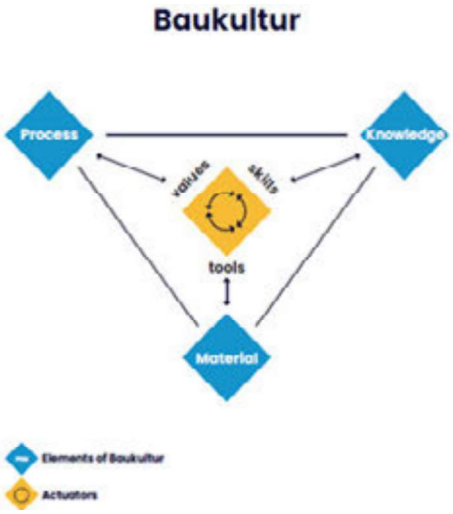

Fig. 1. BuildDigiCraft project triad model

The values, skills and tools serve to actuate the Baukultur developments and to carry out the Process (Bögle, at al. 2022).

Structurally the training programme was organised around four thematic blocks (Intensive Study Programmes - ISP), starting with the "Concepts and Fundamentals" going through to the "Digital Futures" and "Craft and Craftsmanship", culminating in a joint reflection on "Rethinking the Baukultur in the Digital Age" (Fig.2). Each training block built thematically on the previous one, at the same time in every block a new aspect was added, and a new work organisation was introduced. This allowed also for a non-consecutive participation in the separate program blocks. Each participant entered the interdisciplinary training program wearing their own "digital," "disciplinary," and "ethical" glasses ranging between a broad variety of thematic issues and questions related to the future of the built environment.
Prior to the beginning of each training block, selected participants received a set of preparatory tasks. The aim of these tasks was on the one hand to help participants present themselves at the beginning of the course, and on the other, to offer them guidelines for setting their individual research work within the scope of the BuildDigiCraft project. During the whole training program, three major sources of input were collected: (a) individual input by the participants, (b) input from the scientific team - in the form of supervision of the group work as well as contribution to the joint discussion rounds - and (c) external input coming from invited experts and renowned keynote speakers. The work formats which were used during the training range between individual presentations, supervised group work formats, intermediate and final group presentations, all accompanied by joint discussion rounds. Throughout each training block, the processes, knowledge, and material aspects in the individual projects were explored on the intersection level with the holistic framework of "high-quality Baukultur in the digital age through craftsmanship".

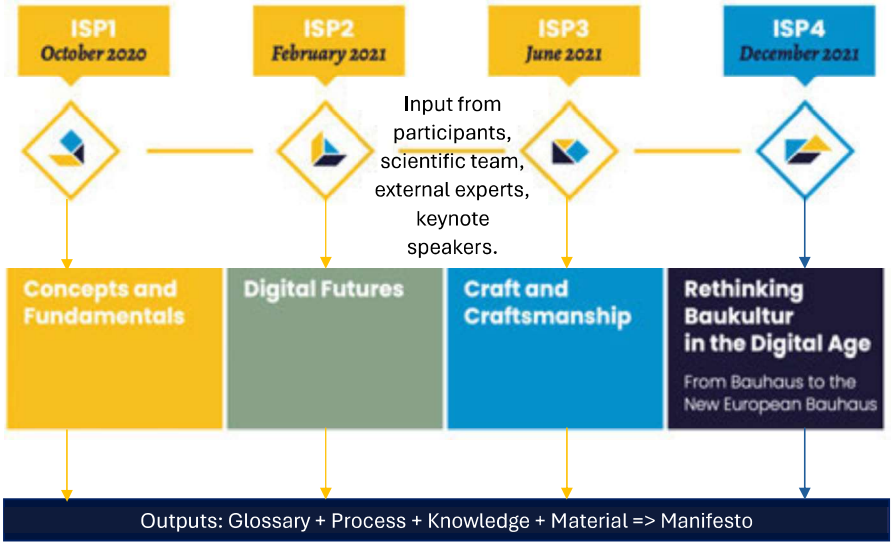

Fig. 2. Thematic framework and outcomes in the BuildDigiCraft project.

The BuildDigiCraft project also devised its own glossary, as highlighted in Figure 3. This glossary serves as an efficient tool for collaborative reflection on intricate research inquiries (Bögle et al., 2022). It offers an open methodological framework aimed at fostering a shared comprehension among project participants, achieved through a thorough exploration of concepts and ideas across different temporal and scale dimensions throughout the project's duration.

In the training program, participants were urged to continuously delve into the concepts and notions raised during discussions using a two-dimensional matrix model. This model encompasses the "focus" and "time" dimensions. The "focus" dimension, depicted on the x-axis, spans from "general" - accessible to a broad audience including non-specialists, to "specific" - utilised by professionals within their respective fields, and further to "narrow" - tailored specifically to the challenges of individual research projects like PhD or Master's theses of the training participants. On the other hand, the "time" dimension, represented on the y-axis, facilitates temporal analysis and interpretation of the evolving meanings and manifestations of notions and ideas across past, present, and future contexts.

The BuildDigiCraft matrix model generally built on the two-dimensional intersection of the main BuildDigiCraft concepts: Digital(isation), Craftsmanship and Baukultur on the "y" axis and the "Process", "Knowledge" and "Material" on the "x" axis (fig. 4). This allowed the participants of the training programme to explore the notions and concepts they posed both inwards - within their own focus and temporal scale, and outwards - within the overall project framework.

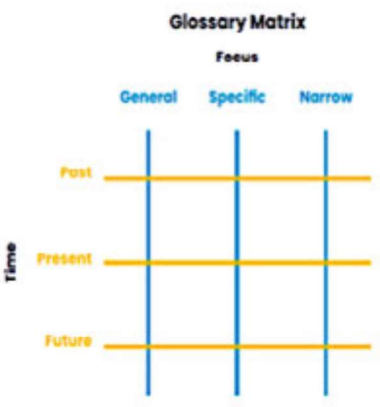

Fig. 3. Glossary matrix tool (Bögle at al., 2022)

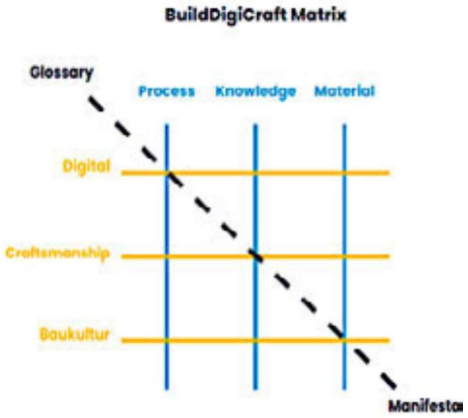

Fig. 4. BuildDigiCraft matrix model (Bögle at al., 2022)

The discussion outcomes of the BuildDigiCraft training programme together with the collected material from the two matrix models, as well as the material collected from the preparatory assignment tasks before each training block, were carefully post-processed and evaluated by the teaching scientific team. The collected material was explored, assessed, and classified using the BuildDigiCraft matrix model (Fig. 4). The project's involvement in discussions about contemporary craftsmanship in the digital era illuminated three essential professional domains: process, knowledge, and material. This understanding is vital for enhancing the role of higher education in preparing professionals for the digital age.

Redefining Today's Craftsmanship in the Digital Building Culture

BuildDigiCraft project aimed to broaden the understanding of the idea of craftsmanship in the digital building culture. Results from ISP3 presents that input on a wide range of topics in relation to the concept of craftsmanship in the digital age is introduced through the training, covering topics from digital disruption and the digital twin, through spatial planning, design, and construction, to the right to design, the link to heritage, and the fusion of arts and craft. Craftsmanship addresses in its essence quality, beauty, and resource efficiency. Craft values are deeply sustainable as their core value is quality and reducing wasteful approaches. It promotes a relation to sustainable material and techniques and offers tangible experiences through synergies of mind and hand while intimating satisfaction in achieving a level of mastery and highest quality.

Craftsmanship is associated with being humanistic and having artistic values that stand behind the work and the "material." Material is understood as both traditional building materials like "wood," but also data, emotions, and information from a community. Craftsmanship is thus transformed into the digital realm as representing, for instance, uninterrupted experiments, a special time quality as well as artistic quality.

The insights from project participants acknowledged that craftsmanship ethos in planning, designing, building projects is essential for strengthening the sense of belonging and commitment to the surrounding space. Digital technologies and "new" digital forms of material when linked to the onsite planning, design, construction process and knowledge production enable us to handle complexities of efforts.

There is a necessity of re-identification of the designer's work with the work of a craftsperson in the digital era (Caldenby, 2021). Digitalization highlights the importance of data and evidence-based knowledge, where the experience and place-based work of the designer need to be promoted. In the digital era, the qualities of craftsmanship that need to be sustained should include: "Materiality" (being real, not virtual), "Location" (being grounded), "Sustainability" (being adapted to nature), "Diligence" (being passive and professional), "Openness" (being vague), "Good life" (being human).

The BuildDigiCraft project generated an in-depth exploration of the fundamental aspects crucial in delineating contemporary professional domains for building cultures: Process, Knowledge, and Material, which participants addressed over the project's duration.

From the **Processes** identified as important for shaping and maintaining the built environment the project team chose to focus on the initial one - the design process (Bögle, at al. 2022). The design process is often overlooked as something invisible, not tangible. However, it is this series of decisions made in a design process that will eventually lead to poor or high-quality Baukultur. Designers involved in design processes of Baukultur have now access to new digitised, visualised and AI-processed information that was not accessible just a few years ago. If properly used, ideally it can help create a design process leading to higher levels of sustainability and cultural appreciation. However, digitalization also poses considerable risk, because design processes used to be regulated by industry standards and tradition. Those processes are now much freer, untransparent and less or not at all regulated. Therefore, the designers of today and tomorrow urgently need new type of design guidelines. BuildDigiCraft proposes such type of design process guidelines, that help designers reflect on the quality and values behind the performed by them design process in the digital context.

Knowledge and skills are key human capital elements of building a sustainable environment. This project guides and reflects on the important role of higher education in preparing the future generation of designers to take responsibility for shaping high-quality built environments, sharing knowledge and values of good craftsmanship. Moreover, exemplified results from the project show that in the age of digitalization and globalisation, there is an opportunity to use a wide set of digital tools for knowledge production and exchange.

The notion of **Material** and materiality was explored in the project beyond its pure and only physical form (Bögle, at al. 2022). Typically, physical material with all its characteristics/performance is described through data that is detailed, complex, and derived and presented in digital form. Whereas the (physical) material possesses the workability and formability that has historically been developed through tacit

knowledge and the craft of making. Currently, this is supplemented by material as data (data about the material) that facilitates better/more sustainable/ higher-quality design, architecture and building design. The two – the physical material and the digital material – are inseparable and without either of them, we would not be able to discuss material and materiality.

Higher Education in Training Professions for High-Quality Baukultur in the Digital Age

The contemporary role of academia has changed as it serves as a facilitator of emerging modes of learning, both knowledge production and knowledge exchange as described by Smith & Hairstans (2017). The new role of universities in advancing technological innovation and economic development as a "knowledge hub" defines a change for many universities from the late 20th century playing the role of "knowledge factory" for research, training, and commercialization until now. It seeks to animate indigenous development and innovation, spanning between industry, the government and society. High-performing institutions are those which effectively advance, distribute and recombine tacit knowledge. Some universities in parallel also serve as a 19th century "storehouse of knowledge," or a "knowledge factory" for research, training, and commercialization (late 19th century to the end of the 20th century). Community and non-governmental organisations (NGOs) play a special role in knowledge exchange fostering innovation in a particular sector or interest area.

The role and purpose of higher education in the built environment has increasingly come to be the preparation of young people across society to take on highly skilled positions in industry and society. The perspectives on knowledge production have evolved a lot, especially over the last decades when science faced growing demands for collaboration between researchers, and new research questions going beyond one discipline. Here more than ever, collaborating communities, researchers and decision-makers in building professions seek to tackle problems that require both specialised knowledge and integrative skills to cope with complexity.

In higher education, individuals should learn to grow in one's own work as professionals. Education and research should be directed toward how we can prepare individuals to grow in all of Aristotle's three categories of knowledge – episteme (scientific knowledge), techne (knowledge of craft) and phronesis (ethical knowledge). "Evidence-based design" is important but not always the right answer to wicked design problems in the built environment. The knowledge of the designer needs training to learn and implement the craftsman's practical knowledge: techne and evidence-based assessment related to episteme. Evidence-based learning is only a part of knowledge generation in higher education – the other involves individual learning.

The goal of the university is to create opportunities for students to make informed design decisions and explore phenomena-based knowledge. This includes learning about cultural values like the history of architecture and built environment (old and contemporary), humanistic understanding of design questions, state of the art and an awareness that every problem is unique involving phronesis. Students reflected on the "metacognitive knowledge" (Krathwohl, 2002) and learning to gain knowledge of general cognition as well as self-knowledge and awareness.

High-performing higher education institutions are those that effectively advance, distribute, and recombine tacit knowledge. The current role of the university as a facilitator of emerging modes of learning, knowledge production and information transfer embodies the necessity to combine all types of knowledge: explicit, implicit and tacit into the formal, semi-formal and non-formal tools of education, including the shift from teaching to learning. There is much explicit knowledge found in codes, and publications embedded within people and organisations. Still, the majority of knowledge regarding the built environment, including construction, is tacit or implicit. In academia, explicit knowledge in the form of data, records and documents (present in journal publications, databases, books, websites and videos) is relatively easy to disseminate. On the contrary, tacit knowledge is difficult to transfer by means of writing or speaking. It is embedded in people, organisations, societies, and cultures. It comes from experience, thinking, competence and commitment. In academia, tacit knowledge can be found in workshops, conference discussions, internships and exchanges.

Architecture, planning, engineering, etc. are professions where knowledge is about the ability of make well-grounded design decisions in complex situations. In the Reflective Practitioner (1983), the design theorist Donald Schön formulates the two fundamental concepts "reflection-in-action" (reflecting on the process) and "repertoire" (impressions, ideas, examples, and events) as essential elements of design /problem-solving work. It's individual and a result of experience, an extensive design practice based on reflection-in-action and a lifelong build of a personal repertoire.

The thorough examination of the project material through the lenses of Process, Knowledge, and Material - the foundational elements of Baukultur - marked a significant milestone in crafting a unified declaration of principles advocating for a fresh professional paradigm for superior built environments and work methodologies. In this context, the role of higher education for future professionals emerges as pivotal. The BuildDigiCraft scientific team's **Manifesto** not only provides contemporary and future professionals with both a methodological and contextual framework but also underscores the importance of higher education in shaping the next generation's understanding and practice. With actionable steps outlined in the Manifesto, higher education institutions can play a crucial role in equipping future professionals with the necessary skills and insights to navigate and contribute effectively to the evolution of high-quality Baukultur in the digital era (see Fig. 5).

The Manifesto for the BuildDigiCraft teaching method outlines six essential steps to enhance craftsmanship in the digital work environment of architects, engineers, and urban planners:

1. Acknowledge Elements Understand the components of Baukultur : Analyse your project by answering questions about the process, knowledge, and material you're using, as well as the values, skills, and tools involved.

2. Structure Your Project: Use the BuildDigiCraft matrix to organise your project along the axes of digitalization, craftsmanship, and Baukultur, as well as process, knowledge, and material.

3. Apply Glossary Matrix: Utilise the Glossary Matrix tool for your project.

4. Understand the Context: Recognize the changing paradigm of Baukultur in the digital age, considering aspects like the relationship between design and realisation, digital twin representation, and dealing with data.

5. Explore the context of Craftsmanship: Embrace craftsmanship's focus on quality, beauty, and resource efficiency, connecting with sustainable materials and techniques. Craftsmanship enhances the sense of belonging and commitment to a space and values humanistic and artistic qualities.

6. Make Tacit Knowledge Explicit: Share the symbiosis of material, design, and construction knowledge with others, bridging the gap between digital data and craftsmanship. Integrate craftsmanship skills into digitally driven projects for high-quality Baukultur in the digital age.

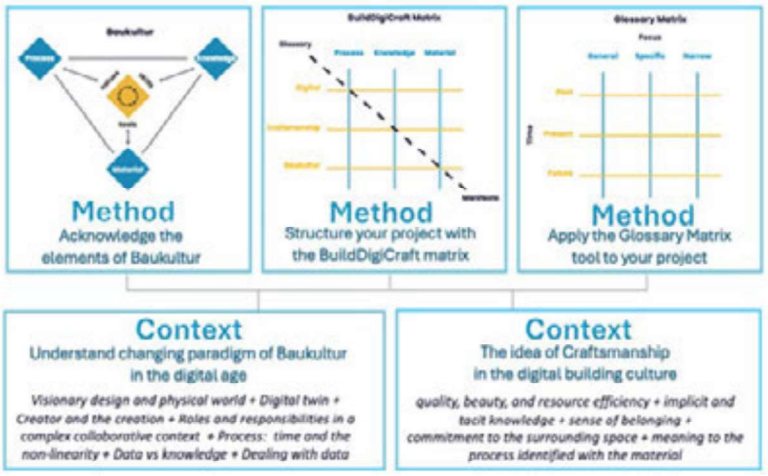

Fig. 5: The Manifesto as a "self- reflection model" and a user guide for the BuildDigiCraft interdisciplinary teaching method (Bögle, at al. 2022)

Discussion

The BuildDigitalCraft project developed between the years 2019 and 2022, overlapping with the beginning of COVID-19, presented an opportune moment to test digital platforms and discuss the utilisation of digital technologies for enhancing the shaping of the built environment. The BuildDigiCraft project findings demonstrate that our understanding of shaping the built environment has significantly evolved. The digital revolution is transforming our society and professional endeavours, profoundly impacting how we interact with physical space. Building on Carpo's (2016) distinction between the first and second digital turns, we see a shift from using digital tools merely as aids to integrating them more deeply into professional practices. This shift is driven by advancements in data collection, processing, and problem-solving, ushering in a new era where computers play a significant role in design and planning processes.

Digital twins, virtual and augmented realities, and collaborative platforms are examples of how digital technologies are changing perspectives on planning and decision-

making processes. They offer new possibilities for collaboration and participatory design, empowering stakeholders to engage more actively in shaping their environments. Despite these advancements, the fundamental mission of design and planning disciplines remains unchanged: to shape the built environment in ways that enhance quality and respond to the needs of communities and individuals. By leveraging digital technologies and interdisciplinary approaches, professionals can continue to innovate and create more sustainable, inclusive, and responsive built environments. This emphasis on achieving higher quality in the built environment is particularly pronounced in Europe.

The concept of high-quality Baukultur adopted by the Davos Declaration (2021), New European Bauhaus (2020) manifests itself in a multidisciplinary approach, encompassing notions such as built environment, cultural heritage, quality of life, social cohesion, well-being, resilience, and others. The impact factors, the areas affected, and the people involved form a complex set of units, the development into a holistic targeted system which is directly linked to the transfer of knowledge in a multidisciplinary environment. Principles defined for successful knowledge transfer – i.e., the provision of the horizontal flow of information, the rating and feedback, the time resource factor – can form the basis of an approach to building a high-quality Baukultur process

Knowledge, Process and Material became core elements of the thematic structure of the BuildDigiCraft project and much relevant for all design and planning work of disciplines anchored in architecture, urban planning, engineering. Additionally, the Glossary was co-created and discussed by project participants. These elements are considered very important for building a common platform for discussions and reflections among project participants representing different disciplines shaping built environment.

The results from the BuildDigiCraft project highlighted that the complex concept of shaping the built environment has evolved meaningfully due to the necessity of rethinking the role of science and its relationship to society and building cultures. As real-world problems become more complex, there's a growing demand for collaboration among various stakeholders, including academic and non-academic entities, to address interdisciplinary research questions. This interdisciplinary approach helped to realise that design, and planning professions may have different skills, and use different tools, but still can be unified by representing the same values. The essay "The many faces of knowledge" by Bernt Gustavsson (2000) gives an overview of concepts of knowledge that span from the three forms of knowledge formulated by Aristotle to contemporary discourses. He shows how Aristotle's three categories of knowledge – episteme (scientific knowledge), techne (knowledge of craft) and phronesis (ethical knowledge) – still hold relevance, not least for the application of knowledge in practice. In the higher education system these three forms of knowledge have been the framework for defining the criteria to be fulfilled for different academic exams.

Material in the digital era broadens the spectrum of purposes. Students and young researchers approach digital technologies easily and see them as promising endeavours for solving complex problems. There was a broad understanding among students that future building cultures will work on building models in the virtual world

to gather greater knowledge about the real world from simulations of data variables in these models. While technical and methodological skills are crucial, there's also room to explore broader themes and foster collaboration with emerging technologies like GPT, DALL-E, and others from OpenAI. By integrating these tools into the educational curriculum, students can gain a deeper understanding of how technology intersects with design, sustainability, and societal needs, preparing them for a more holistic approach to their profession. Moreover, the project reveals a shift in knowledge distribution, with a wider array of organisations and stakeholders contributing their expertise to problem-solving efforts.

In higher education, there's significant potential to incorporate overarching concepts like interdisciplinary training towards the goal of creating a high-quality built environment as a common value. The Manifesto arising from the BuildDigiCraft project encapsulated meaningful insights on navigating the complexity of professional craftsmanship in the digital era, while also emphasising the responsibility of shaping the built environment towards the creation of high-quality spaces (Baukultur). This emphasis is particularly vital when considering the diverse, intricate, and rapidly evolving urban landscapes of today. In higher education, our mission reaches far beyond the mere development of technical and methodological skills for self-reflection. Essentially, technical and methodological skills are crucial, but they should be seen as just the starting point. They lay the foundation for a broader educational experience that delves into understanding the complexities of one's professional field and the challenges posed by digitalization.

Conclusions

Higher education plays an indispensable role today in melding the intricate artistry of craftsmanship, tacit knowledge anchored in professional experience, and qualitative nuances with the precision of digital tools, quantifiable metrics, and data-driven insights. This synthesis is fundamental for nurturing the advancement of superior architectural and planning spaces through innovative processes aimed at cultivating a future defined by exemplary "Baukultur." In the end the fundamental mission of design and planning disciplines remains unchanged: shaping the objects we create and the environment we inhabit (Carpo, 2016). Advocates argue that interdisciplinary teaching and research leverage collaborative and creative strategies utilising digital mediums as a shared language. However, the digital realm encompasses more than just software; it encompasses methods of analysis, transformation, generation, fabrication, and monitoring.

Furthermore, digital data is heralded as tomorrow's essential material. Digitalization enables the development of new skills working with the complexity of data in the built environment and can provide efficient digital tools for seeking new research issues. Digital tools allow collecting of large amounts of qualitative data and working with different data sets. By merging data from several qualitative studies (metadata), research can pose questions that individual projects cannot raise.

Concurrently, the significance of preserving the essence of good craftsmanship in the digital age is underscored, entailing the collection, dissemination, and conversion of professional tacit knowledge into explicit knowledge. This entails creating design processes intertwined with a deep comprehension of physical materiality in architecture and urban planning. In the future, much more attention will be paid to

knowledge production and management in higher education supporting the transfer and creation of cultural values expressed in the Davos Declaration toward the vision of high-quality Baukultur. This involves learning how to apply conscious and well-debated design/problem solving, maintain and improve the qualities of places by construction, build social cohesion, promote environmental sustainability, or maintain and protect our cultural heritage.

In building tomorrow's urban futures higher education will need to strengthen training the skills of professional self-reflection that can only be done by interdisciplinary dialogue, intertwining of crafting qualities, tacit knowledge, and qualitative immeasurable aspects with digital, quantifiable, and data-driven qualities. This interweaving is seen as essential for fostering the creation of high-quality architectural spaces through creative processes aiming for a future high-quality "Baukultur". By adapting their curricula, fostering interdisciplinary collaboration, and promoting innovative thinking, these institutions can prepare future professionals to tackle the evolving challenges of urbanisation, sustainability, and social equity.

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