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The Academic

Third Space.

The Impact of Interdisciplinary Higher Education on Socio-technical Innovation in Urban Development

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The Academic Third Space. The Impact of Interdisciplinary Higher Education on Socio-technical Innovation in Urban Development

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Why do we need to pay more attention to the development of our cities and regions?

What has been clear to many urban planners for decades has now been identified by academic, professional, and political discourses: Urban development is a key field of policy and action for resolving environmental, social, and economic challenges.

The knowledge economy has rediscovered the production factor 'land' not just as a physical resource, but as urbanised networks of locations. Cities compete for the attraction of talents and have become a node of innovation and growth. The increasing urbanisation of economic activities goes hand in hand with a rediscovery of cities as places to live. The demand for housing in urban cores is increasing, which results in a rise of social inequalities within cities and between urban, suburban, and rural areas. And, while the construction of buildings, quarters, and entire cities is a primary consumer of (grey) energy and, hence, a decisive contributor to climate change, it is also deemed to be the most sustainable form of settlement with dense urban fabrics and energy-efficient patterns of mobility. Urban development affects all areas of social and economic activities, and it is a critical set screw towards sustainable urban futures.

Why can we not leave urban development to urban planners alone?

Urban planning as the discipline that is primarily concerned with urban development is not ready for the enormous challenges and ambitions for two reasons:

Firstly, the attempt to steer urban development from a primarily administrative position is deemed to fail as urban futures are not the result of regulatory frameworks but of processes of co-creation that involve various public and private stakeholders. Improving the governments' regulatory frameworks alone will not lead to sustainable patterns of urban development. Good practices towards sustainable urban development need to be an integral part of all relevant public and private activities.

Secondly, a curricular analysis of 28 programmes in urban development reveals that the already overextended curriculum of planning students cannot be extended indefinitely. As a result, planners are only superficially familiarised with the spatially relevant fields of knowledge. Most recent technological progress, latest research results in the social sciences, and new forms of process organisation are inevitably closed books to them as those are to everyone who is not a respective expert. As urban development affects all fields of social and economic activities, it is necessary to activate the expertise and knowledge of all spatially relevant disciplines for urban development. Together those disciplines can develop socio-technical innovation that leads to more sustainable patterns of urban development.

How do we induce socio-technical innovation into urban development?

Socio-technical innovation is the result of the interplay of knowledge from different social as well as technical sciences. Innovation in practice and academia is often hindered by departmental structures that separate distinct communities of experts and knowledge. Overcoming those boundaries is of up-most importance, but shall not result in the abolition of those boundaries. Disciplinary communities are a pre-condition for developing highly specialised knowledge that creates innovative potential at first.

The empirical analysis of 22 practices in urban development reveals the emergence of new governance arrangements. Integrated institutions of innovation both in the public and private sector take over the responsibility or play at least a critical advisory role in delivering strategically important urban development projects. Those strategically important projects renew the repertoire of urban concepts based on the close collaboration of disciplinary experts. This interdisciplinary collaborative work environment is not achievable in ordinary practice because it requires more resources in terms of personnel and time. It is, therefore, all the more critical that innovation of strategically important projects regularly disseminates into planning practice within the existing departmental structures.

What does academia need to do?

Academia needs to acknowledge its responsibility for providing scientific expertise to transformational processes of innovation. It requires a more proactive role of all academic fields in shaping innovation and transfer innovation into practice. Orientation towards practice cannot be just the task of so-called applied sciences that operate under conditions of reduced resources and limited research opportunities. The application of scientific knowledge is not a 'light' version of science but the pinnacle of complexity that deserves proper academic attention.

However, urban development and other fields of application for scientific expertise are not just the results of clear-cut scientific answers. It requires weighing up different disciplinary knowledge, public and private interests, and individual values, and hence, is a science-based normative task. Traditional academic structures do not justice to complex challenges. A new complementary branch of academia is required that is interdisciplinary and transformative. This branch is the academic 'third space.'

What does 'third space' mean for urban development and urban planning?

Urban planning departments (better called urban development departments) must find a new role of third space co-learning and co-research environments. Instead of building a distinct disciplinary community, urban planning must open up and invite students and researchers from all spatially relevant fields. This requires new institutional setups, changed academic career structures, and the further de-

velopment of pedagogical and curricular idiosyncrasies towards interdisciplinary co-learning. The complexity of urban development requires a variety of experts types for which increased flexibility of curricular choice for bachelor's and master's students seems best. I suggest the following as the result of an explorative research approach:

Firstly, the diversification of bachelor's degrees in the form of field-specific, practically oriented, specialised programmes need to be stopped. Following the dictum of 'problem-finding before problem-solving', education needs to provide disciplinary knowledge first, before students can introduce disciplinary insights to interdisciplinary, transformative co-learning environments. The bachelor's level should be about a universal, yet (multi-)discipline-based education that opens up various opportunities as part of which graduates can contribute scientific knowledge to societal challenges.

Secondly, a new type of urban development third space department needs to offer two things: interdisciplinary co-learning for students of a variety of disciplinary backgrounds, and a platform for multidisciplinary education that is provided by the underlying disciplinary communities themselves. The balance of inter- and multidisciplinarity is crucial because interdisciplinarity as a form of collaboration of disciplinary specialists serves the purpose of innovation, while multidisciplinarity is a necessary condition for disseminating innovation into routine practices that are constrained by limited resources.

Urban development requires both the collaboration of interdisciplinary specialists for socio-technical innovation as well as interdisciplinary generalists for the dissemination of innovative urban concepts into routine practice.

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Introduction

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The Need for Steering Urban Development 1.1

Urban development has increasingly been identified as key field of expertise in solving social, environmental, and economic challenges of the future (e.g. WBGU 2016; UN 2017). The world is urbanising at a rapid pace. Around 55% of the world's population is currently living in cities – in comparison to 33% in 1960 and a projection of 68% by 2050 (World Bank 2018; UN DESA 2018). Globalised knowledge-based economic activities favour spatial and relational proximity (Glaeser 2009), which reinforces the high share of population in urban areas in developed countries and leads to rapid urbanisation in emerging ones. Cities across the world are regarded as drivers of economic and social development.

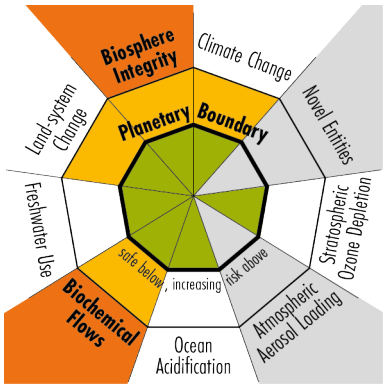
> *'In the new knowledge economy, cities have found a new significance as nodes for innovation and communication' (Madanipour 2006: 180).*

Ecological, Social, and Economic Challenges of Urbanisation 1.1.1

Urban development has become a key field of policy for resolving ecological, social, and economic challenges.

The consequences of worldwide urbanisation are noticeable in various respects. The following are just a few examples: Housing prices have skyrocketed over the past decade – not only as a local phenomenon in a few places but as a defining feature of the 21st-century global city (Florida & Schneider 2018). The average living space per person decreased for the first time in many decades in European Cities in recent years (Martel 2017; Bury 2018; Huther 2018). Space in cities becomes increasingly scarce with the effect of the displacement of low-income residential places, but also less productive economic activities (Förster et al. 2017). Cities become segregated by the economic capabilities of individuals and firms (UC Berkeley 2015; Helbig & Jähnen 2018).

Ecological Boundaries to Human Life on Earth Fig. 1
(Own Graphic based on Steffen et al. 2015)



The design of cities and metropolitan areas is also decisive for tackling environmental challenges. The construction of urban infrastructure and buildings alone consumes more than 50% of all resources that Germany used in 2015 (Destatis 2017). Considering the long lifespan of buildings and infrastructure, decisions that are made today cannot be corrected soon. The developed settlement patterns and employed construction standards predetermine the energy consumption for mobility and households, which equates to another 10 to 15% of overall resource consumption (Destatis 2017; Umweltbundesamt 2018). Hence, the scientific advisory board on environmental change to the German federal government (WBGU 2016) calls in analogy to Polanyi's (1944) 'Great Transformation' of the industrial revolution for a sec-

ond great transformation of our cities. Cities are both cause and solution. While urbanisation is the decisive consumer of energy, it is also the place of innovative solutions. Steering patterns of urban development effectively is, hence, key to solving various socio-economic and environmental challenges including those that potentially endanger the planetary ecosystem (see Fig. 1, cf. 'planetary boundaries' in: Rockström et al. 2009; Steffen et al. 2015).

1.1.2 Socio-technical Innovation as a Driver of Sustainable Urban Transformation

Urban development patterns are insufficient to resolve ecological, social, and economic challenges despite constant technological progress.

Current development patterns are globally insufficient. European cities, for instance, have been permanently under-supplying housing for decades (Barton & Wilson 2018). The fastest-growing American cities are those in Texas and Arizona that are dominated by unsustainable settlement patterns such as low-density suburbia (Tanzi 2018). And, 'China used more concrete in 3 years than the US used in the entire 20th century' (McCarthy 2014).

On the other hand, technological and scientific progress has solutions for the majority of the challenges mentioned above. Concrete, for instance, could be largely replaced or at least partially complemented by other materials (Sonebi et al. 2016; Teh et al. 2017). Cities could be constructed with higher densities and in better coordination with public transportation infrastructure (Bertolini 1999; Knowles 2012). Energy production could technically be decentralised and renewable (Nguyen 2007; Fleten et al. 2007; Yaqoot et al. 2016). And, the potential of information and communication technologies for 'smarter' cities has just recently become an area of research (Townsend 2013; Joss et al. 2017; Haarstad 2017; Fernandez-Anez et al. 2018).

Despite the academic progress, experts and governance do not succeed in implementing sustainable urban development patterns. While in itself, the implementation of the solutions above seems self-evident, the academic discourse misses a holistic view on the technical solutions in its socio-economic context. The current socio-economic system does not act in a coordinated fashion towards a sustainable, social, and economically just urban future (WBGU 2011). Progress is made in various sectors individually. Overall systemic change requires, however, socio-technical innovations across public and private actors, various areas of intervention, and in academia (e.g. Brand 2008; Herrmann et al. 2016). Socio-technical innovations are elements of systemic advancement, combining both technological progress and social innovation (Geels 2004). They are based upon the joint con-

sideration of technical and social aspects such as the implementation of renewable energy and their economic effects, dense urban settlements and their resident's behaviour, or – in general – technical planning and political decision making. Murray et al. (2010: 3) define social innovation as 'new ideas (products, services and models) that simultaneously meet social needs and create new social relationships or collaborations'.

1.1.3 Disciplinary Fragmentation and Transformative Interdisciplinarity

The discourse on the development of cities and regions is scattered among many different disciplines.

Such an integrated view opposes the fundamental principles of the division of labour both in academia and in practice (Campbell & Harrison 2015). Universities split up into academic faculties, public administration consists of various departments, and private companies specialise in offering a limited amount of products or services. Not doing everything is what allows us to become good at a specific thing. The division of labour goes hand in hand with 'a coordinated utilisation of resources based on an equally divided knowledge' (Hayek 1945).

The development of cities is subject to the contradiction between the division of labour and knowledge, and the need for a systemic approach. Both the academic discourse, as well as the actions taken in practice, are scattered among various uncoordinated actors. Effectively, cities are the result of a multitude of individual decisions, for example, decisions of investments by private companies, the legal-political framework, the appropriation of urban space by citizens, infrastructural investments by the government, and the mechanisms of social security systems. Cities are a product of co-creation (Rooij & Frank 2016).

Cities are both object of analysis in the social sciences and an object of design for architects, engineers, and planners. Architects design buildings, engineers construct infrastructure, sociologists study social patterns in cities, and economists look at cities as locations of economic activity.

This fragmentation of the discourse on cities is the result of the subdivision of academia into disciplines. Disciplines are socially constructed territories of knowledge (Scott 2005). Criteria for an academic discipline are, for instance, a common base of knowledge, a common object of investigation, or a common body of methods and techniques (Stichweh 1979). The boundaries between disciplines are fluid, renegotiated continuously, and evolving – primarily due to scientific advancement and the increase of knowledge. The fragmentation of disciplines reaches its limits when methods,

theoretical discourses, and objects of investigation become scattered among various disciplines hindering a productive discourse.

Therefore, interdisciplinarity emerged as 'the dialogue between the disciplines' (Vosskamp & Vahlbusch 1986: 17). Recognising that disciplines are always insufficient in describing systemic interrelations, academia tries to remain relevant to issues of society by collaborating across disciplinary boundaries (DeHart Hurd 1991). Interdisciplinarity offers two potentials: firstly, it facilitates a dialogue between disciplines, including both technical and social ones, and secondly, it allows academic arrangements that cater to specific social challenges.

1.2 Urban Development: A Boundary Practice

1.2.1 The Emergence of Planning: Rationalist and Communicative Planning Theory

Urban planning is based upon the assumption that the development of cities and regions is comprehensible and steerable.

Concerning urban development, the first interdisciplinary systemic approaches emerged at the beginning of the 20th century, at first as post-professional programmes for architects and engineers – for instance, the University of Liverpool's degree in civic design and programmes at University of Karlsruhe and University College London (Frank et al. 2014). Theory describes the period until the mid-20th century as modernism. Modern planning regards the city as a comprehensible, steerable system. McLoughlin (1969: 81) describes planning as the regulation of errors appearing in a 'machine-like system'. Engineers can survey and construct cities. The city is the product of infrastructure, buildings, and open spaces.

At the beginning of the second half of the 20th century, 'a critique emerged that the planning and design of the modern cities was a blueprint of placelessness, of anonymous, impersonal spaces, massive structures and automobile throughways' (Ley 1987). Chiefly social scientists were concerned with the effects of modern urban design on interpersonal behaviour and society. It seemed evident for them that engineers were capable of constructing an efficient city but were blind and ignorant towards the impact of their infrastructural and design interventions. The academic critique went hand in hand with the civic uprising of the 1960s against social patterns and the technocratic government. The journalist Jane Jacobs (1961) became a leading figure of the American discourse on modernist planning and design.

The Pendular Swing of Rationality
(Own Graphic based on Gilliard & Thierstein 2016)

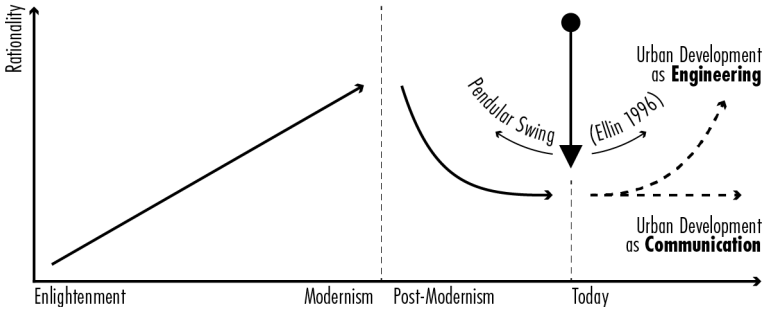


Fig. 2

Communicative planning theory, despite its heterogeneity (Schönwandt 2008: 13), replaced the rationalist understanding of the modern era. The best development solutions were no longer based alone on the engineers' analysis but were the result of a communicative process between experts, citizens, and stakeholders. Decisions were no longer subject to scientific objectivity but rather an inter-subjective process of negotiation (Healey 1992). However, communicative planning theory does not break with the rationalist assumption that cities are comprehensible and steerable (Tewdwr-Jones & Allmendinger 1998). Instead, communicative planning theory embeds the technical expertise of engineering into a social and political process of knowledge generation, which Habermas (1981) calls 'communicative rationality'. Differently from what planning theory usually argues (Schönwandt 2008; Gilliard & Thierstein 2016; see Fig. 2), rationalist planning of the modern era is not the culmination of constant scientific advancement starting with the Enlightenment. Selle's (1995) model of layers visualises how new conceptions of planning theory have added to a repertoire of planning instruments and methods (see Fig. 3). Ellin (1996: 223) therefore concludes:

> *"While contemporary [post-modern] urban design largely breaks from the modern project in theory, its implementation is nonetheless embedded in it."*

The increasingly diverse role planners need to assume made the expansion of the academic discourse on urban development from engineering and design to the social sciences a necessity (Albrechts 1991). Socio-economic impact and political governance became focal points of a newly emerging discipline of urban planning (Frank et al. 2014). The rising interest for urban design and development by geographers, sociologists, and economists and the introduction of social science to urban development curricula made dedicated higher education programmes necessary. A general increase in building efforts after the Second World War facilitated the emergence of independent planning programmes after

1945 (Frank et al. 2014). Universities designed these urban planning programmes with interdisciplinarity in mind (Frank et al. 2014). The academic staff consisted of professors and researchers from various relevant disciplines – including technical fields such as architecture and civil engineering, but also social sciences such as economics and sociology. The idea of interdisciplinarity went hand in hand with other academic reforms such as 'flat hierarchy, autonomy of student administration and the decline of academic authority' (Gilliard & Thierstein 2016). A study by the American Planning Association from 2007 (Hoch 2012) shows the enormous breadth of today's planning curricula, but also illustrates how these curricula struggle to impart all necessary knowledge. On average, only 50% of graduate has obtained the necessary knowledge per field of expertise. A recent German debate between two groups of planning practitioners and academics (Höing et al. 2014; Altrock et al. 2014) comes down to the question whether or not the planning curriculum is overextended, and on what part of the curriculum educators should focus?

Fig. 3 Three Generations of Planning Thought (Own Graphic based on Selle 1995)

The status of urban planning as an independent discipline is, hence, subject to ongoing debates. Urban development is, in fact, still a study object in both engineering and social sciences (Marcuse 2011; Frank et al. 2014; Gilliard & Thierstein 2016). Other disciplines keep publishing relevant literature on urban development, academic staff in planning institutes is multidisciplinary, and practitioners are graduates of various disciplines. The critique is a particularity of the planning disciplines. Other systemic disciplines, that concern themselves with cross-cutting issues, have been able to establish recognised own expertise. Architecture, for instance, combines perspective from social sciences, engineering, and arts for designing buildings, but architecture has developed an independent, exclusive, yet not always clear-cut core of

Urban planning is the attempt to merge all discourse on urban development.

knowledge. Only architects feel able to teach architecture to students, and in order to practice architecture, someone needs to be an architect. Planning misses such an exclusive core, at least to a certain extent. So, while the emergence of planning as an independent field of study categorises it as an academic discipline, its nature is of a different kind. Bridging across other disciplinary boundaries that separates different bodies of knowledge that are relevant to urban development defines the discipline of planning. Therefore, I call planning a 'boundary disciplines' (Gilliard & Thierstein 2016: 51) recognising both the disciplinary character of its institutions and not just the multidisciplinary nature of its practice (Amin 2005; Alexander 2015).

Boundaries are a sociological concept describing both the discontinuation of interaction across boundaries, and continuity and sameness within them (Akkerman & Bakker 2011: 133). In the case of traditional disciplines, boundaries separate collective bodies of knowledge and methods that, in turn, define disciplinary communities. Boundaries delineate traditional disciplines. Boundary disciplines, on the other hand, are academic fields that try to bridge across boundaries based upon the assumption that some challenges demand an own continuous academic discourse including knowledge from various disciplines (cf. 'boundary practice' in: Wenger 2000: 237). The disadvantage of such an intensive approach to bridging boundaries is that the boundary discipline itself builds new boundaries to other disciplines. This boundary-building side-effect can be problematic because it can lead again to discontinuous knowledge production (Balietti, Mäs & Helbing 2015), which it initially intends to overcome. The academic discourse on urban development is despite the emergence of urban planning as an independent, interdisciplinary boundary discipline scattered among various disciplinary communities. The current debate on smart city technologies exemplifies how other disciplines – in this case, computer science and engineering – suddenly dominate a discourse that could and, perhaps, should be at the heart of the discipline of planning.

Towards Complexity Theory of Urban Development 1.2.2

Urban planning does not steer the development of cities and regions. Urban development is co-created.

The inability of planning to develop an own disciplinary core is based on at least two observations: Firstly, experts increasingly question the assumption that the city as an object is comprehensible and steerable (e.g. Bettencourt 2013). And secondly, the power to potentially steer urban development has shifted due to deregulation, privatisation, and public de-funding from a powerful state to diverse groups of

public and private stakeholders. The provision of the urban is less than ever before the sole task of the government but has become the focus of various private actors instead (Madanipour 2006). A diversifying network of actors dealing with urban development confronts urban planning.

The academic discourse on planning theory pays more and more attention to complexity theory (Coyne 2005; Weber & Khademian 2008; Brown 2010; Khemis & Goui 2014; Zellner & Campbell 2015). Many academics no longer regard the city as a comprehensible and steerable system, but rather as a complex system. Complex systems are not just complicated to understand, but generally incomprehensible by definition. They refuse simplification and abstraction. While communicative planning theory assumes that the inter-subjective planning consensus reached by weighing-up and debating various interests corresponds to the best possible solution, complex planning theory contest the existence of a systemically ideal solution. Rittel & Webber (1973) argue that the nature of planning problems is 'wicked', which means in essence that problem formulation lies in the eye of the beholder, problems are not solvable, only conflicts are resolvable, and planning decisions are always subject to alternatives. Hence, there is no one ideal solution but multiple alternative futures (Alaily-Mattar & Thierstein 2014). The planning process that determines which future materialises is political and normative but also underlies the limitation of what is technically, socially, environmentally, and economically possible. Not all desirable futures are also reachable. The concept of alternative futures does not describe all possible futures, but those futures that people believe to be desirable and systemically feasible.

While a powerful state had the sovereignty of defining which future is desirable, today's parliamentary decisions compete with value formations of non-political processes of society and the individualised interests of citizens and companies. This becomes increasingly visible in the formation of public opinion as part of participation processes, which contests democratically made parliamentary decisions but are in turn quickly contested by an ever-changing society. The privatisation of public space, and the development of coherently managed – in some instances, gated – communities manifest physically competing ideals for the urban future. According to complex planning theory, this means that there is not only no systemically ideal future but also not the one politically pursued future. Coordinated actions for achieving a common goal are, therefore, unlikely.

The city as a complex construct is subject to conflicting interests of various value systems and economies. Competing alternative futures co-produce today's city (Rooij

& Frank 2016; Terryn et al. 2016). The academic discourse on cities has started to consider this complexity. New educational programmes from various disciplinary perspectives have emerged during the last decade – some as an expression of a particular future, others as a re-interpretation of interdisciplinarity in urban development. Education for urban development has diversified beyond the orthodoxies of planning. Graduates have started to work in a new variety of employment contexts. Fewer planners work directly for the public government. Private consultancies, engineering offices, and even firms of other sectors become important employers.

Urban Development as Transformative Science 1.2.3

The coordination of urban development processes requires a proactive role of science.

Transformative sciences have emerged as a response to increasingly heterogeneous value systems during the last decades (Schneidewind 2016). Science neither follows a purpose or goal defined by society nor finds itself in a scientific limbo detached from society. The lack of shared values and coordinated action by society urges researchers and educators to use their power to influence political and business decisions. Transformative sciences aim at tackling practical challenges – either directly in practice or by supporting the transformative capacity of stakeholders with knowledge transfers (WBGU 2011). Academics in the field of sustainability studies, for example, try to induce systemic changes by close collaboration with politics, society, and businesses.

Transformative approaches are currently being discussed in parts of the planning community (ARL 2016, 2017; Weith & Danielzyk 2016), but are de facto a core element of urban planning programmes in universities since their emergence. The collaboration with actual stakeholders has always been part of planning project courses. Having a potential impact on actual planning processes is a vital part of the motivation for both educators and students. Cities that host universities with planning programmes appear to benefit from the plentiful amount of ideas produced by students year after year (Knieling 2018).

Planners would usually argue that they stand in for the public interest. However, transformative science assumes a proactive role representing its value system. The notion of the public good loses its relevance with the dissolution of shared values and goals of society (Thierstein 2018). Hence, planners are instead advocates of interests of some public groups than of an abstract public good. Multiple factors shape the interest that planners serve: for instance, the employer, the client, the planner's values, and professional ethics. The professional ethics are usually linked to international pol-

icies and academic consensus – especially regarding sustainability (UN 2015, 2017), less so regarding social and economic issues. Academics have played a crucial role in shaping various aforementioned international polices. Hence, academia itself has to be regarded as a key actor in the formation of societal value systems. The so-called 'Third Mission' of universities conceptualises the proactive role of academia as transformative science (HRK 2017).

The increasingly politically active role of the academy is not without consequences. Sciences and arts that committed to a value-free production of knowledge were able to achieve scientific and artistic freedom. Sciences and arts that pro-actively participate in the political processes of society become subject to critiques, counter-arguments, and even hostility as any other political actor (Strunz & Gawel 2017, 2018). Detractors see in transformative science a primary catalyst of increasing scepticism towards science, and even the root of today's post-truth-society. This society knows no differentiation between evidence, guesses, assertions, and lies (Strohschneider 2014). Detractors of transformative science forget, however, the fundamental critique of the detachment of academia from actual ecological, economic, and social challenges. Tackling systemic challenges of urban development requires new modes of scientific research such as interdisciplinarity, transformative science, and boundary disciplines, which are complementary to established disciplinary units (Grunwald 2015).

Boundary disciplines, such as urban planning, need to balance between scientific neutrality and normative professional ethics, disciplinarity and interdisciplinarity, as well as the urge to steer systemic changes and the co-evolutionary reality of development.

1.3 Aim and Structure of Dissertation

The tension between various poles allows for a multitude of different educational approaches. It is easy to observe a diversification of programmes enabled by changing frameworks of higher education. The presented dissertation investigates the relation between interdisciplinary education and urban development practice. The focus of the work is to understand how interdisciplinary education and disciplinary-technical knowledge production in academia can contribute to socio-technical innovations in practice.

The recent diversification of educational programmes in the field of urban development has been an initial observation leading towards this dissertation. The perpetual critique on the results of urban development practice and the disciplinary practice of urban planning further validated my interest. The growing importance of steering urban development as a measure of solving present and upcoming environmental, social, and economic challenges reassured the importance of reflecting current educational approaches.

My pathways into urban development started with an undergraduate degree in urban planning, continued with an interdisciplinary master's degree in urban design, and my doctoral research and teaching activities at a department of architecture. My academic socialisation is, hence, rooted in planning. However, I have been exposed to the critique towards the discipline of planning and alternative approaches to urban development over the past years.

The term of interdisciplinarity has, however, been a constant companion regardless of the context I studied or worked in. Interdisciplinarity is arguably the most significant structural challenges to academically tackling issues of urban development. It has been the underlying motive for implementing urban planning degrees but is also the foundation on which current critique towards planning builds. The work is, therefore, at its core, concerned with the relationship between interdisciplinarity and urban development. This interest can be expressed in the form of the following two questions:

How is interdisciplinarity conceptualised in higher education programmes that aim at training professionals for urban development practice? **Q1**

How does interdisciplinarity need to be conceptualised in higher education to contribute to socio-technical innovations? **Q2**

The work considers urban planning as the standard conceptualisation of interdisciplinarity, and as the standard approach to educating professionals for urban development. It serves as the benchmark and as the status quo. Newly established degrees that try to address urban development issues are compared to urban planning. The first reference to a new programme has been the MSc Urbanism – Landscape and City programme at the Technical University of Munich (TUM). The programme makes use of the consecutive division of higher education into bachelor's and master's degrees. Students holding various spatially relevant degrees are admitted and learn to tackle urban development issues collaboratively (Wolfrum & Schöbel-Rutschmann 2011). My initial research confirmed that the approach at TUM is not unique and that a new pattern emerges that conceptualises interdisciplinarity as a collaborative effort of different disciplinary experts.

This conceptualisation differs from how planning programmes operate. Urban planning consists of consecutive bachelor's and master's programmes and a self-conception of being an own independent discipline. Interdisciplinarity in urban planning is conceptualised as a thematic synopsis of all relevant fields of knowledge. Planners are all-rounders, having learned the basics of many disciplines but always through the lens of urban development.

The critique that fuels the emergence of new collaborative master's programmes is that planners work highly normative. Kraker, Lansu & van Dan-Mieras (2007) are astonished that the pedagogical debate on education for sustainable development believes that it is more important to impart values than knowledge-based competencies. The planner's knowledge of relevant fields seems to remain just superficial. Planning concepts travel from one city or even continent to another without a proper understanding of how planning interventions affect urban development (Healey 2012). This argument is, therefore, the base for the central hypothesis of this dissertation.

H1 *Socio-technical innovation for the development of cities and regions originates not only from the interplay of knowledge of various spatially relevant disciplines, but also from the collaboration of experts of those disciplines.*

The work approaches this hypothesis from two sides: education and practice. Chapter 2 discusses the choices of methodology and defines essential terminology. The third chapter develops a systemic model that explains the relationship between interdisciplinarity and urban development in the case of education and practice. The model is based on various assumptions which are formulated in the form of hypotheses that guide the following chapters.

Chapter 4 presents an in-depth analysis of 28 curricula. The analysis shows how planning and new collaborative approaches differ in terms of imparted competencies and reveals the pedagogical and institutional implications of different conceptualisations of interdisciplinarity in urban development. The collected empirical data allows for identifying inconsistencies in the argument of planning critics and shortcoming in terms of curricular implementation. The data also helps in identifying whether it is possible to do necessary changes and have a consistent implementation of collaborative programmes in urban development. As a second step, the work then compares both the conception of interdisciplinarity in planning and the collaborative conception with the expectation of 22 leading practitioners in chapter 5. Aside from the personal viewpoints of the interviewees, the interviews concentrate on the actual implementation of interdisciplinarity in the interviewee's respective firms.

The sixth chapter draws conclusions from the comparison of what is achievable in higher education and of what appears to be a practical implementation in urban development practice. Recommendations are made for both educators and policymakers in higher education. Chapter 7 discusses potential implications for the theory of planning, the academic system, planning practice. The research's limitations and the requirement of further research are highlighted.

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Research Approach and Methodology

2

Epistemic Interest 2.1

The second chapter develops the research approach, explains its choice, and discusses its limitations. The first section clarifies the epistemic interest and defines the key terminology of this work. The second section describes the research strategy, which is based on abductive reasoning, qualitative-relational methodology, and of international comparative scope. The choices are justified in comparison to alternative research approaches. The third section explains the empirical methods that are employed and how they complement each other.

The primary research questions Q1 and Q2 (see section 1.3) express the research interest. Those questions raise the necessity to define three terms: interdisciplinarity, urban development, and socio-technical innovation. The meaning of interdisciplinarity is constructed by differentiating it from terms such as disciplinarity, cross-disciplinarity, multidisciplinarity, and transdisciplinarity. Drawing from the communities of practice literature further constructs the meaning. Urban development, as such, is not an academic discipline. The meaning of urban development is constructed based on other disciplines and primarily in differentiation to urban planning. Innovation is also widely used and has gained recent popularity. The work takes a constructivist approach to offer suitable definitions.

Definition of Interdisciplinarity 2.1.1

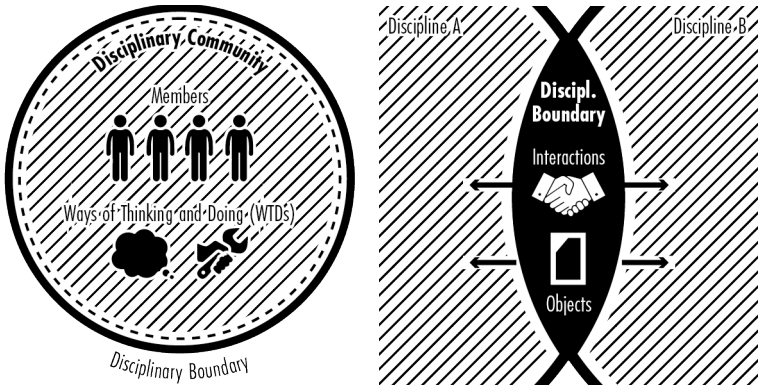
Disciplines are the institutionalisation of academic communities. Boundary disciplines institutionalise boundaries.

Interdisciplinarity describes integrated activities that involve more than one academic disciplines. We need to differentiate interdisciplinarity from similar terms such as multidisciplinarity, transdisciplinarity, and cross-disciplinarity that also describe activities that involve more than one discipline. The dissertation uses a constructivist approach to define the meaning of all four terms. Other authors may use two or more of these terms interchangeably or rely on different definitions.

The word 'discipline' originates from the Latin words disciplina meaning instruction and discipulus meaning disciple or pupil. A discipline is a field of study or branch of knowledge in the academic context. Universities reflect the idea of disciplines by its separation into multiple academic departments - often also called faculties, schools, or colleges. Departments offer one or more study programmes covering less or more closely defined fields of study. The discipline defines what a student will learn, how a researcher will study, and what a professor will read; but it also defines what stu-

dents will not learn, how a researcher will not study, and what a professor will not read (Krishnan 2009). Disciplines define, therefore, both: 'communities' and 'boundaries' (Wenger 2000; see Fig. 4). Both terms originate from the communities of practice (CoP) literature that studies the cooperation of working groups within a company and looks at their capacity to innovate cooperatively. Section 3.2.2 provides a closer look at CoP-theory.

Fig. 4



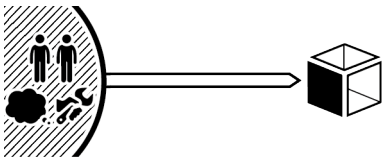
Academic Disciplines as Communities of Practice
(Own Graphic based on Wenger 2000)

With the progress of knowledge, the division of academic labour has increasingly become finer. Scientific progress relies on specialisation. The amount of English-language scientific journals has consistently grown 'with average rates of 3.46% [per year] from 1800 to the present day' (Mabe 2003: 196). Let us assume that this trend persists, but no specialisation would occur. A researcher that reads articles of 20 journals regularly today would need to read 40 journals in 20 years from now. The growth of academic literature and academia, in general, goes inevitably hand in hand with its specialisation.

Fig. 5

Specialisation in terms of academic staff and their ways of thinking and doing (see Fig. 5) has allowed us to understand many aspects of nature and society in great detail. Medical conditions that would have undoubtedly led to death a few decades ago can be treated or even healed today. Modern car engines, better building standards, and environmentally friendly materials can reduce CO2-outputs. And, transportation will soon run mainly electric. Disciplinarity is the organisational form, how science specialises.

Disciplinarity
(Own Graphic)



However, while medicine can treat severe health conditions, the number of people with the condition of obesity has quadrupled in developing countries since 1980 (BBC News 2014). CO2 emissions per household in the UK have still risen by roughly 3% per year between 1990 and 2004 (Druckman & Jackson 2009). And, issues of congestion and pedestrian-unfriendly cityscapes will not be solved by going electric with our cars.

It is important to frame these problems within a broader context. Obesity is not just a medical issue. Its causes are diverse, including the socio-economic status of families, local availability of healthy groceries, food education, work-life balance, and the use of different forms of mobility. Mobility, for instance, is usually not the concern of medicine, nor is the production and distribution of food. The issue of obesity goes way beyond the disciplinary boundaries of medicine, and the other examples are both similarly complex.

Cross-disciplinarity
(Own Graphic)

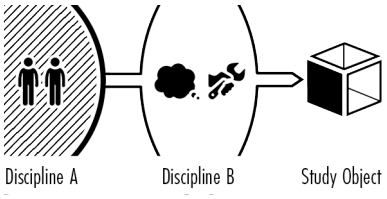


Fig. 6

Thus, many other disciplines study obesity, e.g. Florida's (2009) article on 'the geography of obesity' in the Atlantic. Such an article can be described as cross-disciplinary. Cross-disciplinarity looks at an issue that is usually associated with one discipline through the lens of another discipline (see Fig. 6). In the example, Florida looks at the medical issues of obesity with the methodology of a geographer. Cross-disciplinary research does, however, not lead to an integration of knowledge across disciplinary boundaries, firstly, because cross-disciplinary research follows the purpose of only one discipline, and secondly, because research in one discipline is mostly unread in another one. The disciplinary institutionalisation of the interdisciplinary field of urban development in the form of urban planning is a series of cross-disciplinary approaches if we accept the notion of planning being a discipline. Lembcke (2015) argues, therefore, that many scholars confuse interdisciplinarity with holism. The integration of disciplines does not equal a discipline considering different disciplinary aspects.

Academics, organisations, and policymakers, therefore, look into different forms of integration of multiple disciplines as a necessity for solving many of the most pressing issues of our current society.

Multidisciplinarity
(Own Graphic)

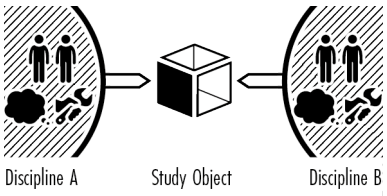


Fig. 7

The simplest way of integrating multiples disciplines is multidisciplinarity. In this case, multiple disciplines work independently on a common issues (Choi & Pak 2006; Nicolescu 2014; see Fig. 7), e.g. obesity. The medical department could study different ways of treatment. The department of education could investigate how schools can teach a healthy diet. And, the department of geography could map the locations of shops with fresh fruit and vegetable options. In the end, researchers of all departments would exchange their finding and draw - if possible - a common conclusion. Multidisciplinarity is easy to achieve because researchers can employ the ways of thinking and doing - such as terminology and methodology - that they are used to within their respective field of study. Interaction across disciplinary boundaries is only required when comparing research results. A potential shortcoming of multidisciplinary approaches is that recommendations by different disciplinary groups either compete

for shared resources or, even worse, are conflicting. The geography department may conclude that better accessibility by public transport enables residents of areas with less healthy food options to shop differently for groceries elsewhere. Improved public transport could, however, drop the share of bicycle usage for commuting, and the medical department suggested to raise the use of bicycles as it prevents obesity. Multidisciplinary projects may also struggle to identify some potential solutions in the first place because only combining information from multiple disciplines early on can identify those solutions.

Fig. 8

Interdisciplinarity goes further. An interdisciplinary project involves multiple disciplines but only one common research strategy (Choi & Pak 2006). Interaction across disciplinary boundaries is constantly needed (Vosskamp 1986). If the departments of medicine, education, and geography engaged in an interdisciplinary project on obesity, they would meet early on in the project to develop a joint research strategy and discuss how various methods interact with each other (see Fig. 8). Methods can be borrowed from individual disciplines or can be developed jointly (Nicolescu 2014). Shared methods that bridge across disciplinary boundaries are called boundary objects by Wenger (2000). The high level of integration required for interdisciplinary projects challenges every researcher to re-think familiar ways of thinking and doing. In most of the literature, 'transdisciplinarity' describes approaches with an exceptionally high level of integration of multiple disciplines (Vosskamp 1986). Some researchers argue that transdisciplinarity is fundamentally different emphasising that the body of knowledge on complex issues such as obesity can not be associated with one discipline. Instead, they argue there is a body of knowledge independent from academic disciplines and thinking within disciplinary boundaries is even futile for understanding those issues. Transdisciplinarity is based upon a similar critique like interdisciplinarity, but questions the role of disciplines itself. In academic practice, many researcher argue that the concept of transdisciplinarity does not produce different research from interdisciplinarity. The necessity of specialisation in academia is given (Krishnan 2009) - as argued earlier. Transdisciplinarity does, therefore, not provide any helpful advice on how to structure research.

Interdisciplinarity
(Own Graphic)

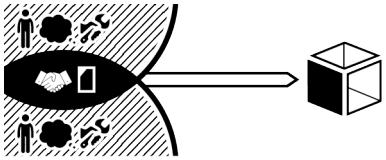
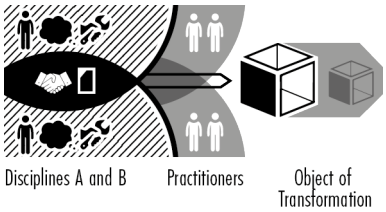


Fig. 9

More recently, academics use the term 'transdisciplinarity' differently (Thomson Klein 2014; Khoo 2017). 'Trans-' stands in this case for transformative. Transdisciplinary researchers understand themselves as actors of transformation. Instead of just providing knowledge for practice, transdisciplinarity tries to take part in solving problems directly. Transdisciplinary research approaches, in that sense, integrate knowledge and experience from outside ac-

Transdisciplinarity
(Own Graphic)



ademia (Lieven & Maasen 2007; see Fig.9). The knowledge that is typically not part of academic research could, for example, be so-called target knowledge. Target knowledge describes what society deems to be desirable based on norms and values.

A transdisciplinary approach can theoretically only involve one discipline. However, the complexity of challenges in society requires, most of the time, the involvement of multiple disciplines. The literature on transdisciplinarity takes interdisciplinarity, therefore, mostly as a given. This assumption can, however, not be made in the context of this research. Planning that has been implemented as a discipline trying to steer urban development has undoubtedly a transformative orientation. However, whether planning is interdisciplinary or not is what the dissertation tries to find out. Thus, the work mitigates using the term transdisciplinarity and differentiates instead its components transformation and interdisciplinarity, of which interdisciplinarity is in the focus of this research. This rules out further any confusion with aspects of such as the integration of practitioners into teaching, which is not subject to this work.

Definition of Urban Development and Planning 2.1.2

The dissertation differentiates urban development from urban planning. The term 'planning' is used in two different ways: The narrower understanding stands for a state-led administrative activity of regulating land-use. The more open understanding includes all aspects of spatial development. The much narrower understanding of planning - most of the times referred to as Stadtplanung (in English: urban/town planning) or Regionalplanung (in English: 'regional planning') depending on the scale - as the legal regulation of land use is predominantly used in public administration, today. The term Stadtplaner (in English: urban/town planner), for instance, is a legally protected occupational title in Germany that does not only require an accredited university degree but also practical experience in applying the most commonly used planning instruments. A planning graduate that works for a developer designing and building even larger areas of a city is, therefore, usually not a Stadtplaner despite having a significant impact on urban development. Public administration in Germany further differentiates various types of planning such as Stadtplanung - often interchangeably used with Bauleitplanung -, Stadtentwicklungsplanung or Städtebau. The first term refers to the preparation of statutory zoning plans, the second one to the preparation of strategic documents regarding the overall spatial development of a city, and

the last term to the morphological and typological design of buildings blocks and public space. This compartmentalisation of planning goes hand in hand with the administrative structure of at least larger cities.

Despite the subtle differences between these terms, universities do not consistently use an overarching term in order to reflect the variety of tasks planning graduates might encounter. Instead, one or another term is used to illustrate that planning is concerned with cities or regions and not, for instance, with business plans. As a result, Stadtplanung at HafenCity University is practically the same as Stadt- und Regionalplanung at TU Berlin, Raumplanung at TU Dortmund, or Urbanistik at Bauhaus-University as the analysis of curricula in this work indicates (see section 4.2). All of these terms are equally used as an umbrella term referring to a diverse range of practices from traditional top-down statutory planning to bottom-up local activism. Planning in universities has, hence, a broader meaning than in practice, yet describes a distinct discipline.

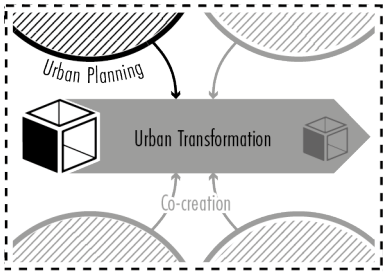
Internationally, universities and academics have organised themselves under the term 'planning'. The Association of European Schools of Planning (AESOP) represents universities across Europe - e.g. all four above mentioned German universities. The Association of Collegiate Schools of Planning (ACSP) represents US-American universities. And, the Global Planning Education Association Network (GPEAN) is a worldwide network of eleven associations including AESOP and ACSP. The counterpart for practitioners is called 'International Society of City and Regional Planners' (ISOCARP). Despite the duality of the term 'planning' in academia and practice, planning as a discipline is linked to planning as a professional practice.

Fig. 10

Urban development as a term leaves the notion of a discipline and stands for the even wider interdisciplinary, co-creative understanding of steering the development of cities and regions. Many stakeholders beyond the boundaries of the planning community contribute to this development (Förster & Ramisch 2016). Urban development is often used as a passive term describing the changes that occur in cities and regions. This work instead views urban development as an act of co-creation of multiple disciplines of which planning is one (see Fig. 10). The result of co-creating cities is the transformation of the urban condition. The confinement to the spatial descriptor 'urban' shall not be understood as a restraint to the urban scale. Urban is used as a description of the predominant spatial condition of today's world (see section 1.1). Urban development can, therefore, be practised in dense cities as well as sparsely populated landscapes.

Urban Planning, Urban Development, and Urban Transformation

(Own Graphic)



Definition of Socio-technical Innovation 2.1.3

Socio-technical innovation is a term introduced by the relatively young academic field of science and technology studies (STS). STS researchers are concerned with technological and scientific progress and how it affects society, people, and politics (Hackett et al. 2008). A socio-technical system is, hence, a system which describes the interrelation of human behaviour, technology, and science. This relation is at the heart of this dissertation. Section 1.1 raises the fundamental question of why society seems unable to cope with pressing challenges such as climate change while being able to develop highly complicated technologies like self-driving cars.

The dissertation introduces as an explaining factor the issue of disciplinarity and interdisciplinarity. I argue that the disciplinary structure is due to specialisation highly efficient in inventing new technologies (Brandt & Schubert 2014), but inadequate at providing answers to systemic challenges. Invention is not the same as innovation. In its simplest definition, invention describes the act of coming up with something genuinely new, while innovation describes the improvement of existing products and services (Sridhar 2018). While you may contest the notion of new as every invention is rooted in previous knowledge, I believe the differentiation of new and existing is helpful in this case. Improving an existing product and service requires a broader understanding than coming up with something new. If a new product is introduced, it is an educated guess on how people may use it. It is a bet on its usefulness, but nobody knows for sure until it is released. If you improve an existing product, you can already know how people use it. Useful improvements require a deep understanding of its application. Keeping this analogy in mind means that innovation is naturally the result of the understanding of both the technology and how it affects human behaviour. Invention is, however, rooted in technical possibilities.

I differentiate, therefore, technical invention and socio-technical innovation. The operationalisation of both terms corresponds to the notion of disciplinarity and interdisciplinarity. Technical invention describes the renewal of disciplinary knowledge. That may be the introduction of electric vehicles, new construction materials and techniques, or new governance approaches. Technical does not necessarily refer to physical technology but also includes techniques. Socio-technical innovations are, however, new systemic approaches (Geels 2004). For instance, how a new governance regime interacts with the introduction of electric vehicles. In order to transform cities sustainably, socio-technical innovation is, hence, necessary.

2.2 Research Approach

The research is mostly explorative. I am interested in how interdisciplinarity relates to urban development, and whether improving urban development patterns requires interdisciplinarity. Chapter 1 introduces the notion of socio-technical innovation for this purpose, which bases on the assumption that innovative practice requires the interplay of knowledge from multiple disciplines and the collaboration of experts of those disciplines. Ultimately, the research aims at improving higher education, so that new graduates can transform urban development practice to be more economically, socially, and environmentally sustainable and 'just' (Fainstein 2011).

I want to disclose that I worked in two positions of programme administration at the Technical University of Munich (TUM) and the HafenCity University Hamburg (HCU) between 2014 and 2018. As such, I have been responsible for managing and developing potential future concepts for the master's programme of Urbanism – Landscape and City at TUM and the bachelor's and master's programmes of Urban Planning at HCU. Experiences that I have made personally during this time may have influenced certain findings that I present during this work. The curricula of both programmes were set up before my employment. Neither of them represents or have implemented the findings of this work.

2.2.1 Action-oriented, Abductive Research

The work intends to provide innovative policy advice for universities and educational administration. The work is action-oriented, but not a piece of action research. The research approach and the methodology are designed accordingly and combine both analytical parts based on the principles of empiricism and a conceptual part that is in itself a research-based design process.

Action-orientation or, in other words, a transformative agenda, requires a different approach than deduction and induction. Deductive research starts with formulating rules based on theory and veri- or falsifies these with the help of empirical data. Inductive research turns around the deductive research order. The researcher makes case-specific observations first, tries to identify resulting patterns, and concludes by proposing new rules and theories. This work employs an abductive approach instead.

Abductive research combines both approaches. It starts similarly to inductive research with observations. These observations are, however, of distinctive character as they

contradict with previous knowledge of the researcher (Shank 1987; Andreewsky & Bourcier 2000). In the case of this dissertation, the starting point is the observation that education for urban development increasingly diversifies into various specialised fields, which contradicts planning theory that argues for a more comprehensive, interdisciplinary look at planning issues. The educational practice seems to drift apart into various pieces, while academic theory tells us to look at these pieces altogether. The idea of an all-round planner competes with the idea of multiple specialists.

The first notable difference between inductive and abductive researchers is the source of motivation. While an inductive researcher is curious about the phenomenon he observes and a possible explanation for it, the abductive researcher's interest arises from theory which seems inapplicable to his observations (Shank 1987). Abductive work presumes that to its observation is always a generalisable explanation (Shank 1987). A quality of abduction is, therefore, its ability to differentiate between the universal and the contingent (Kovács & Spens 2005). Accordingly, this work tries to develop a new theory on how to implement interdisciplinary education in urban development for socio-technical innovation.

Abductive Research Structure

(Own Graphic adopted from Kovács & Spens 2005)

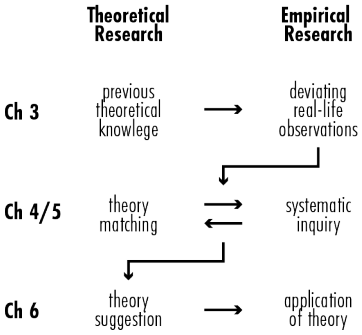


Fig. 11

Abduction starts with adjusting the theory first before conducting more systematic, empirical inquiry (see chapters 3-5). The main part of abductive research follows consequently similar patterns to deductive research. However, deduction proposes rules based on logical, exclusive explanations. In deduction, there is only one logical explanation which arises from the overall theoretical framework. Abduction proposes new rules based on the 'clues' the observation gives the researcher (Shank 1987; see chapter 6). Abductive reasoning can, therefore, be described as an act of creative intuition, providing a plausible answer for a contradicting phenomenon (Andreewsky & Bourcier 2000). This creative act can result in a great leap forward that deduction and induction cannot deliver for the development of theory (Taylor, Fisher & Dufresne 2002). It is about an explorative discovery of explanations (Levin-Rozalis 2010). The abductive process of theory matching is supported by systematically continuing the empirical inquiry process. Case-specific data collection and theory building are, therefore, going iteratively hand-in-hand in an abductive research process (see Fig. 11).

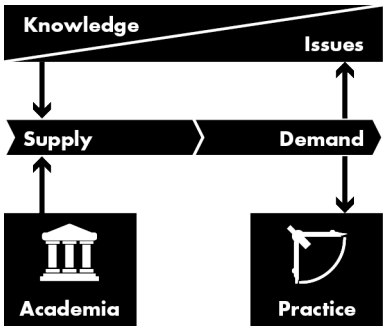
Different from both deductive and inductive research, abductive research does not end with proposing or verifying new theory but instead ends on elaborating the meaning of an adjusted theory for specific cases. The orientation towards recommendation on educational policy in this work follows that idea (see chapter 6).

2.2.2 Qualitative-relational Research

An abductive, action-oriented research approach calls for a qualitative methodology (Kovács & Spens 2005; Olsson & Olander Roese 2005). The dissertation employs an impact model which guides both the empirical process and the interpretation of gathered data. The impact model is a specific form of systemic model focussing on the aspect of systemic change over time due to purposeful interventions.

Fig. 12

Systemic Interest
(Own Graphic)



The dissertation is part of a larger body of research on urban development theory. The work's ambition is to improve the impact which urban development practice has on our spatial environment. It focusses on the role which higher education could play in shaping a more effective urban development practice. The work can, therefore, not be limited to investigating education, but must instead investigate the systemic relations to practice (see Fig. 12).

The systemic approach of research roots back to Bertalalanffy's (1968) general systems theory. The concept of systemic thinking emerges from his biological studying of organisms.

> *'In the late 1920's von Bertalanffy wrote: "Since the fundamental character of the living thing is its organization, the customary investigation of the single parts and processes cannot provide a complete explanation of the vital phenomenon"' (Bertalanffy 1972).*

He suggests studying systems as 'sets of elements standing in interrelation' (Bertalanffy 1968: 37). Since then, systems theory has gained popularity being adopted across various disciplines from the natural sciences and engineering to the social sciences (Boehm 1973; Luhmann 1984; Chen & Stroup 1993). Systems theory faces the critique that its simplistic implementation cannot represent actual complex relations adequately. The brief view on the history of planning (see section 1.2) shows how rationalist planning has fallen out of favour. Complex planning theory, including its predecessor of communicative planning theory, do, however, not break with systems theory. Instead, the methods of application and interpretation have changed. Rationalist researchers argue that systems can accurately represent actual conditions as long as the systemic model is just good enough.

My research, as well as other contemporary research, employ systems theory and focuses on identifying patterns instead of definitive answers. In developing the research approach, I loosely draw inspiration from two recent ideas: actor-network-theory (ANT) and relational interpretism. ANT

is one of the key methodologies of STS. It breaks with a convention of systems theory. Typically, systems represent the interrelation of things or people. For instance, a spatial network shows a system of locations and connections; a social network represents people and its relations. ANT introduces relations between people and things (Latour 1996). While this appears to be only a minor change, it is beneficial in understanding how technological progress shapes human behaviour or how scientific progress in one discipline shapes the systemic practice of urban development. Having an unequal pair such as a student and the academic system in one systemic model as the result of the communities of practice approach creates challenges for which ANT can provide a helpful tool of thought (Lee & Hassard 1999; Fox 2000). All relations are of a different kind. Operationalisation becomes difficult. Thus, the research employs a qualitative approach. While individual elements of the system are quantifiable, its relations are not.

This goes along with the combination of two fundamentally different epistemological paradigms (cf. Shin 2014). The methods that are employed to study the elements of the system are rooted in empiricism. Despite being qualitative, the methods are made as transparent as possible, leading to reproducible, objective results. The systemic look at all empirical results and its relation are, however, influenced by the epistemic interest. The research approach falls, therefore, in the category of relational interpretism. This goes hand-in-hand with the action-orientation. The advice of this dissertation is not the result of an educational experiment, which must be deemed impossible due to the systemic magnitude. This work is instead a theoretical piece, which lays open an interpretation of patterns in education and practice for urban development.

International Comparative Research 2.2.3

While higher education has been primarily based on national policies for centuries, the Bologna Process has created a common European Higher Education Area (EHEA). International mobility is wanted, encouraged, and financially supported. The practical and academic discourse on urban development is also internationalising. Concepts such as the Bilbao effect travel across borders (Alaily-Mattar & Thierstein 2018).

Nevertheless, national regulations, employment markets, and professional cultures remain to play an important role. The research has a particular focus on education and urban development in the German-speaking countries of

Austria, Switzerland, and Germany (DACH). This is partly because of practical reasons. As a former German student and a Germany-based researcher, I have greater insight into the debate and challenges of higher education and urban development in Germany and its neighbouring countries. However, I believe that the three German-speaking countries are also particularly interesting case studies. There are three common approaches to educating experts for urban development in Europe: firstly, planning as an independent discipline, secondly, planning as engineering, and thirdly, planning as social sciences (Frank et al. 2014). All three approaches are present in Germany. While most Northern German states implemented independent degrees, the South as well as Switzerland favour education linked to architecture (see section 5.1.1). The DACH-countries are at least to a certain extent representative for the educational approach to urban development across Europe.

Urban development as a practice is also subject to national frameworks and its particularities (Dühr, Cowell & Markus 2015). Without trying to work out the exact differences, it seems necessary to introduce at least one control. The United Kingdom and Ireland were chosen for two reasons. All three educational approaches are equally present, although planning as an independent discipline is not as contested as in some parts of the DACH-countries. In the case of education, the DACH-countries and the UK and Ireland are, hence, similar. The opposite is the case for urban development practice. Urban development and particularly the governments attempt to steer urban development are rooted in the legal frameworks of these countries. Most European countries use a civil law code based on a constitutional foundation. The UK and Ireland, as well as other parts of the former British Empire, base their legal system on so-called common law. This fundamental difference translates into two development systems. While most European urban development is plan-based, the UK has a discretionary system (Booth 1995, Munoz Gieden & Tasak-Kok 2010). In simplified terms, that means that development follows a legally-binding land-use plan. Development proposals are admissible as long as they fulfil the plan. The plan binds both the developer as well as municipalities granting planning permission. Planning in the UK is currently moving towards a plan-led system, but is mostly still subject to written policies that require spatial interpretation by the developer. Development is, hence, subject to negotiations between the developer and responsible authorities. Granting planning permission is at the discretion of the authorities. While the difference is often not as clear-cut as presented,

development practices in the UK and Ireland on the one hand and the DACH-countries, on the other hand, are the two ends of the legal spectrum.

The dissertation tries to deliver both a particular insight into urban development practice and relevant education in the DACH-countries, the UK, and Ireland, but also findings that are transferable to other European nations within the EHEA due to the recognition of general patterns. The following chapters demonstrate that the general patterns of interrelation between academia and practice and the formation of innovation are the same despite the fundamental differences of the legal system.

Methodology 2.3

The dissertation's methodology consists of the review of literature and three empirical parts that loosely follow the suggested structure of a lead-user study (Churchill, Hippel & Sonnack 2009: 27). A lead-user study is a form of a product development process, in which a firm collaborates with lead-users. Lead-users are those that a adopt a new product or service first, but also shape the nature of innovation by its early appropriation. A lead-user is not only benefiting from a particular innovation but pro-actively seeks its development. Employing a lead-user-inspired methodology differs from traditional market research, but also does not neglect the potential insight users can provide. It helps to overcome the conflicting positions in the development of higher education programmes. Academia has recently looked at the demands of practice more frequently in an attempt to respond to the critique that higher education would not teach enough relevant practical skills. Many academics fear that higher education loses its independent, critical role of reflecting practice and instead becomes a form of vocational training. Indeed, the variety of demands practitioners formulate for education is mostly ineffective in informing curricular design, because the breadth of different expectations exceeds the capacity of most programmes. So, redesigning curricula is not as simple as just asking practitioners what graduates they need.

The lead-user approach focusses on leading-edge practices and tries to identify common patterns of expectations towards education. Those expectations are then compared to what higher education as a provider deems to be able to deliver. The lead-user-inspired approach combines the latest pedagogical developments in academia with the latest innovative development practices.

Table 1

Step	**Lead-user Framework**	Chapter	**Methodology**
I	Preperation of lead-user project	3	Literature Review and Impact Model
II	Indentifiying trends and key customer needs	4	Curricular and Pedagogical Analysis
III	Exploring lead-user needs and solutions	5	In-depth Interviews with Practitioners
IV	Improving solution concepts	6	Toolbox and Examplary Application

Structure of Methodology
(based on Churchill et al 2009: 27)

The methodology consists of four phases (chapter 3-6) corresponding to the four phases of a lead-user study. The initial preparatory phase (chapter 3) develops the impact model. The impact model is based on a review of literature, introduces key literature for later argumentation, and serves as the base for interpreting the empirical data. Chapter 4 identifies trends in education and the spatial needs that graduates shall be able to cater for (Phase II, cf. Table 1). A curricular analysis of bachelor's and master's programmes for urban development reveals the current state and recent dynamic of education. A curricular analysis is a content analysis of educational curricula. A curriculum determines the overall learning objectives of a programme by regulating the courses students can or must take. Learning objectives have primarily replaced the term content in the debate on education. Learning objectives put the learner or student in the focus of the debate. Education is about enabling a student to acquire a new skill or take in new knowledge. Learning objectives are, hence, ideal for comparing supply and demand of graduates as it allows a debate on somebody's abilities rather than the pedagogical questions on how to achieve it. This structured view on education is combined with pedagogical insights into relevant studio courses. Together curricular and pedagogical analyses reveal what and how students learn.

Chapter 5 discusses the results of qualitative, in-depth interviews with lead-users in practice to understand the needs of employers that are known for innovative practices. The interviews are designed as qualitative, in-depth interviews (Misoch 2015: 88ff). A strictly structured questionnaire was dismissed for two reasons: Firstly, many interviewees will not have thought about the topic in detail beforehand. The theoretical nature of research requires, however, adequate time to reflect. Secondly, the research itself is explorative. The loosely structured format allows discovering new ideas in the process of each interview.

While chapter 4 provides information about the supply of graduates, chapter 5 is about the demand for them in practice. Chapter 6 is a research-based design phase. It translates the impact model into recommendations for educators

and policymakers in higher education. Each empirical method is explained in detail at the beginning of the respective chapter.

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Impact Model and Hypotheses

3

The Impact Model and its Perspectives 3.1

The impact model provides a systemic view of socio-technical innovation in urban development and how it can be induced by higher education. The model describes the impact of education. Hence, it does not represent a systemic equilibrium but a pattern of transformation. The impact model is based upon a series of hypotheses that are based upon the review of literature. These hypotheses guide the empirical research that is presented in the subsequent chapters. An explicit list of hypotheses is in section 3.5.

The impact model does not represent a systemic equalibrium but a system of transformation.

The impact model (see Fig. 13) is based upon a couple of key structuring features. It is divided horizontally into three perspectives: the knowledge, the procedural, and the institutional perspective. Vertically, the diagram splits into two parts. The left part represents academia, the right part practice. The impact model introduces two readings of how education and practice relate. While the first way of reading the relation of education and practice is based upon the principles of supply and demand, the second reading introduces a transformational approach. The left and the right side of the impact model are connected in its centre by a linear schematic from input to impact. The schematic is based upon the logic model developed by the W.K. Kellogg Foundation (1998, 2004). The original purpose of the logic model is to assess the effectiveness of Kellogg's charity programmes in enhancing child development.

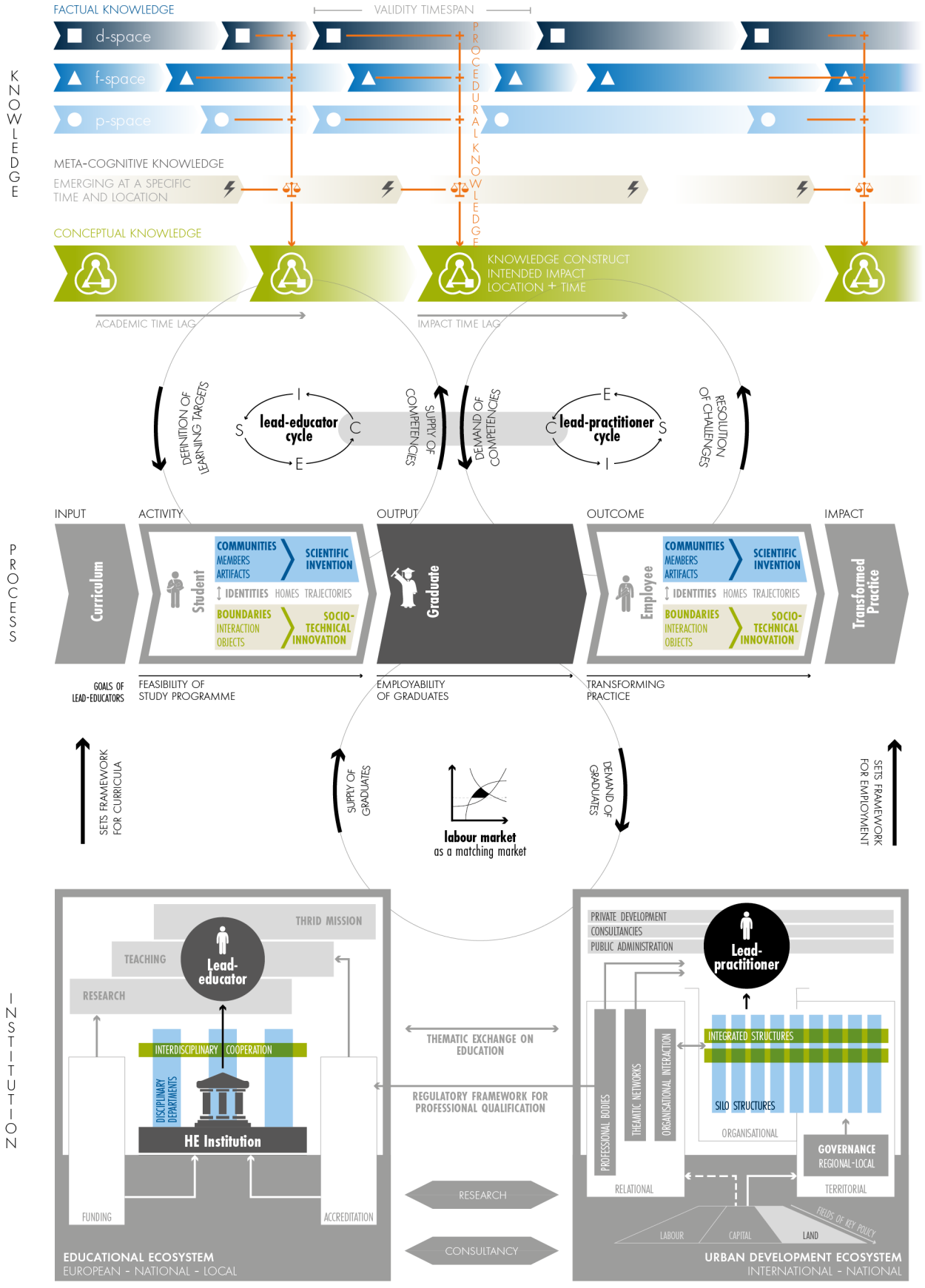
Goals of Higher Education Table 2

short-term	feasibility of study programme
mid-term	employability of graduates
long-term	transforming practice

At first glance, both models do not work well together. While a market is about the balance of demand and supply, the logic model is about deliberate transformation. An effective charity programme is intended to minimise its demand. At the same time, a producer of goods and services wants to maintain a steady growth of sales by meeting and creating customer needs. Paradoxically, both intentions hold for higher education. Universities try to meet the demands of employers, but they also question common practices and may even want their graduates to transform practice. These are two sides of the same coin because graduates must get into practice in order to change it. Both goals of educators must further be achieved within the given resources of higher education - e.g. the limited timespan of a programme, the limited number of staff, and the study-life-balance of the students (see Table 2). The following chapter is structured along the lines of three perspectives with a focus on the interrelations.

The procedural perspective (section 3.2) introduces two cycles of knowledge production and socio-technical innovation: the lead-educator, and the lead-practitioner cycle.

Fig. 13 The Impact Model (Own Graphic)



Furthermore, the section looks at the processes of social learning in academia and practice. The section draws from organisational studies in the field of management.

The knowledge perspective (section 3.3) introduces a first understanding of the required competencies for socio-technical innovation in urban and regional development. The understanding is based on theory but also a document analysis of both educational policy and the formulation of competencies by the professional body.

The institutional perspective (section 3.4) looks at the conditions under which lead-educators and lead-practitioners can innovate and how the institutional context is enabling or preventing the implementation of interdisciplinarity and innovation-oriented education. The institutional context is conceptualised as ecosystems of lead-educators and lead-practitioners. The ecosystems approach draws from the economics of innovation. The perspective combines particularities specific to urban development with general conditions of higher education and employment.

The Procedural Perspective 3.2

The procedural perspective is at the core of the impact model. It tries to provide answers to two central questions: firstly, how can education induce innovation into urban development practice, and secondly, what kind of pedagogical approach can equip graduates with capacities for innovation?

Employability, Impact Orientation, and Matching Markets 3.2.1

Graduates are (human) ressources of knowledge and innovation.

Education and practice get into contact on the labour market. Graduates are human resources of new knowledge and ideas for organisations in practice. Graduates are, hence, not only a resource of labour but also the embodiment of knowledge capital, and therefore of particular importance for innovation and knowledge-based economic activities (Lödermann & Scharrer 2010). As human capital, they are also tradeable goods which are affected by the dynamics of demand and supply. If graduates with certain competencies are in high demand, but universities educate only a few of them, the expected average wages will rise. However, various other factors influence the formation of wages including labour agreements, minimum wage, but also non-monetary compensation such as lay-off protection, social appreciation, promotional prospects, and opportunities of further education (Weeden 2002). Apart from the expected income, students also choose the subject of their studies based on per-

sonal interest, the quality of the education, and the prospect of finding an enjoyable job. Hence, the quantity of supply does consider not only anticipated financial returns but also the preferences and interests of society. The market core function is not the formation of wages, but the facilitation of matching graduates to employers. Thus, the labour market is not a price market but a matching market (Blanchard & Diamond 1989).

Qualification defines traditionally the quality of a graduate.

Traditionally, the academic degree is the primary quality criterion of graduates in a qualification-based educational system. Degrees certify that students have obtained a standardised curriculum of knowledge and methods. Curricula in qualification-based systems link a specific job profile to a suitable education. For instance, the Royal Town Planning Institute (RTPI) represents the profession of planners in the United Kingdom. The RTPI has implemented an accreditation scheme for higher education programmes. Graduates of accredited programmes can apply for membership to become a chartered town planner. The degree itself defines that the graduate is qualified for being a town planner.

When planners primarily worked in public administration, qualification 'can be interpreted as one form of licensing that eventually leads to occupational closure' (Klein 2011: 256). The government or the professional body can limit the number of people receiving qualification by setting quotas on student numbers. Generally low unemployment and the growth of the economy and public administration ensured for decades that qualification holders became eventually employed. Monitoring of unemployment and demand figures in each field could be used to adjust demand and supply.

Problems for qualification-based job markets arise when the balance of demand and supply becomes upset. The long-term reduction of jobs in public administration culminating in austerity measures during the European debt-crises as a consequence of the late-2000s recession has led to an oversupply of planners (Jaffar, Aziz & Taufek 2014). In a state of oversupply of applicants for jobs, qualification cannot determine alone who will or will not be hired. Other attributes of the applicant, such as experience, come to the fore.

Employablity replaces Qualification as part of labour market and educational reforms.

The concept of employability is, however, not only a reaction to a mismatch on the labour market but rather a bigger 'shift away from the bureaucratic career structures' (Brown, Hesketh & Williams 2002: 4). Long-term careers with a single employer have become rare. Flexibility is seen to be the critical factor of innovation and success for companies, but also the progress of someone's career. The change of educational policy from qualification to employability and the associated diversification of programmes supports this market-based logic.

The underlying assumption is that a society whose economic activities are primarily based on knowledge-intensive sectors requires a higher degree of specialisation and diversification of its education. Students are supposed to enter research-oriented activities quicker. This seems only achievable if employers can find accurately fitting graduates.

Let us think of the following example. An architectural office requires competencies in computer science to simulate aspects of their designed buildings digitally. In a qualification-based system, the employer would look for a computer scientist. The challenge of hiring a computer scientist would be that he may not have a sufficient understanding of architecture to simulate buildings in a meaningful way. On the other hand, if the company hires an architect, his competencies regarding computer simulation may not be adequate to achieve the expected quality of the simulation. An employability-based system must, therefore, be built around the principles of more flexible combinations of curricular content. It is not about the knowledge per se, but about the use of knowledge for a particular context (Moore, Rydin & Garcia 2015).The ideal candidate for the aforementioned architectural office would be an architect with substantial knowledge in computer science or a computer scientist who learned to use his skills in an architectural context. Thus, employability-based policy facilitates both specialisations as a particular sub-field of a discipline and specialisation as purposeful recombination of knowledge from various disciplines.

Employablity is about individualied qualities and not standardised profiles.

Employability is generally defined as 'an individual's chance of a job in the internal and/or external labor market' (Forrier, Verbruggen & Cuyper 2015: 56). It is an absolute and a relative measure. While absolute factors such as an achieved qualification, acquired competencies, and so-called soft skills such as interpersonal behaviour are making an applicant's profile more desirable, he will still not become employed if other applicants have achieved a higher qualification, are more competent, and seem to have better soft skills. Bringing university graduates into employment is, therefore, about providing a more competitive educational package.

In a qualification-based system, educators have only a minor influence on forming the educational package. The education has to fulfil the requirements that the professional body or a governmental agency have set up. There are only limited flexibilities within these requirements to shape innovative curricula, which in turn are not necessarily valued because the importance of the qualification itself overshadows them. However, if the qualification is not the primary concern of an employer, educators have the chance to design curricula that create an attractive package for employers.

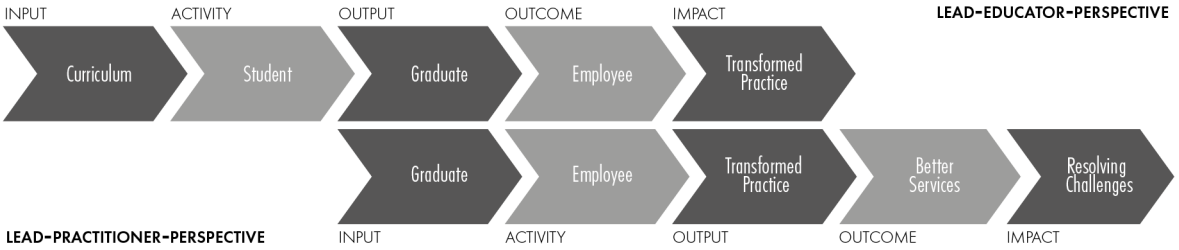
Education needs to balance between supplying graduates for the demand of practice and changing practice by educating students critically towards common practices.

The demand and supply logic of matching markets implies that universities are geared towards fulfilling labour market needs. This stands, however, in contrast to the academic freedom of research and education. Although universities will experience difficulties in maintaining an educational offer that does not lead to employment, academic freedom allows them to experiment with curricular changes and new study programmes. Especially on the level of individual courses, educators tend to critically discuss established norms and practices. Universities can be leaders of thought that try to change practice by innovative educational formats.

This transformational aspect is represented as a chain of effects in the systemic model. The curriculum of a study programme ('input') must be designed in such a way that the 'activity' of delivering the programme is feasible, the 'output' of graduates is employable, and that the 'outcome' is a new generation of graduates in strategically important positions in urban development (see Fig. 13). As an 'impact', educators hope to change established practices and subsequently resolve some of the most pressing urban and regional challenges.

Activity, output, and outcome are mutually dependent. If a programme is infeasible to study, nobody graduates. If nobody employs graduates, they will not end up in strategically important positions. These interdependencies receive another dimension if we take a closer look at the employer's perspective. So far, the argument has focussed on the transformational intention of educators and has seen the need of employers as a given restriction to innovation induced by education. However, Kaps et al. (2017) empirically show that 'schools are no longer the only privileged places for thinking. [...] New schools of thought', or what I call lead-practitioners, are often the initiators of innovation in architecture and planning. Fig. 14 overlays the 5-step-impact-schematic for educators with another 5-step-impact-schematic for employers. From an employer's perspective, the graduate is the input, his employment within particular organisational structures is the activity, the provided service of the employer's institution is the output, hopefully better results are the outcome, and resolved challenges are potentially the impact. The employer also balances short-term suitability of the graduate to the company's team structure and demands of customers with the potential of service improvements. Thus, employers can and must also be 'leaders of thought' (Dalton 2015).

(Own Graphic) The Induction of Innovation based on Lead-educators and Lead-practitioners Fig. 14



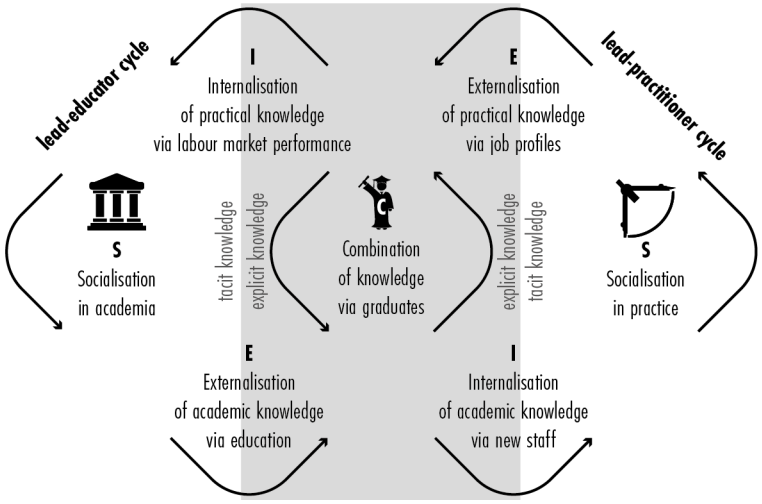
I selected the term 'leaders of thought' in analogy to 'lead-users' (Churchill, Hippel & Sonnack 2009). Lead-users are defined as people that (a) 'face needs that will be general in a marketplace […] month or years before the bulk of that marketplace encounters them' (Urban & Hippel 1988: 569) and (b) 'benefit significantly by obtaining a solution to those needs' (Urban & Hippel 1988: 569). In other words, lead-users try to maintain a competitive advantage as service providers over others. The term 'early adopter' is more frequently used but allocates a passive role. Lead-users are, however, central to the production of innovation as they shape innovation by their appropriation. Thus, innovation is the product of a collaboration of developers and users. Innovation is not the result of a one-way relation between academia and practice in which academics produce and impart new knowledge that becomes applied in practice. An effective innovation ecosystem aligns the innovative capacity of lead-educators and 'lead-practitioners.

The labour market acts as a social learning system transfering knowledge and experience from acadmia to practice and vice versa.

Educators and practitioners get into contact on the labour market through the means of trading graduates. Two cycles of innovation intersect at this point: the 'lead-educator-cycle' (LEC) and the 'lead-practitioner-cycle' (LPC). LEC and LPC are two circular processes of knowledge production. Fig. 15 employs the SECI-model (Nonaka & Toyama 2003) to take a closer look at the process of knowledge production. The model differentiates explicit and implicit knowledge – so, the knowledge that has been documented explicitly in a book, for example, and the knowledge that people hold without documentation or even being aware of it. The SECI-model and other similar theories of knowledge production assume that the interplay of both knowledge categories produces new knowledge within a social framework (Curado & Bontis 2011). The act of academic research, for instance, starts with a review of explicit knowledge in terms of literature. The researcher internalises the knowledge by reading and remembering. When the researcher does his empirical work

and discusses his experience with colleagues, he critically reflects upon the explicit knowledge based on his observations. At this moment, his reflections are implicit knowledge that only exists within the researcher's mind. In order to share this knowledge, he externalises his thoughts in the form of academic papers.

Fig. 15



The Labour Market as an Interface of Innovation
(Own Graphic based on Nonaka et al 2000)

For both LEC and LPC, the graduate is explicit knowledge as the human embodiment of new innovative ideas. This may appear counterintuitive because the graduate himself holds the knowledge internally. He is not a readable book, but he is a tradeable good and as such explicitly available. Before students graduate, educators run through a process of knowledge generation. It starts with the educator's previous experience with earlier student cohorts. The educator observes if the graduate can work innovatively and how potential employers react to his educational package. These observations become internalised, discussed with colleagues, and lay the foundation for curricular reforms. A new curriculum and the subsequent education is then the process of externalising newly generated knowledge. After hiring a graduate, the practitioner runs through a similar process of knowledge generation. It starts with internalising the graduate and the graduate's knowledge into the processes of the practitioner's organisation. Working in collaboration with colleagues produces new bodies of implicit knowledge that lies within the company and becomes externalised as part of the product or service the organisation delivers.

Furthermore, LEC and LPC are not only connected via the graduate. Practice externalises its knowledge in the form of plans and policies, and subsequently, the urban spaces both shape. Depending on the perspective, this produces urban qualities or issues that become the object of the educator's curriculum. Innovation is, therefore, a bidirectional

process between lead-educators and lead-practitioners. The moment of combination in which graduates transfer from education to practice and issues are transferred back into education defines the matching market.

The labour market is not the only market that is a potential resource of innovation in urban development. If we take a closer look at the employer's side again, we may ask the question of what an employer's institution does and whom he does it for? If the graduate works in public administration, the answer is rather abstract. The public cannot act as a client, but its representation through politics can. If the graduate works for a consultancy, the client is often public administration. Innovative ideas that consultancies develop will only get in effect if public administration shares them. The expectations if clients need to match with the employer's ideas. This relation is not the focus of this work as it has been discussed previously as a process of social learning between the public and the private sector (Förster 2014). However, it is important to keep in mind that higher education is not the only setscrew for innovation in practice.

3.2.2 The Theoretical Framework of Communities, Boundaries, and Identities

The process perspective of the impact model is based upon a 5-step-impact-schematic showing how universities can induce innovation to urban development practice. The previous section also shows how this schematic is embedded within a longer impact chain. Lead-practitioners as well as (lead-)clients can similarly be the origin of new thought. Theoretically, we could extend the impact chain in both directions (see Fig. 14). How do universities select new professors, for instance? Extending the impact chain is not of particular value for this research, but it allows us a more abstract view on the pattern that emerges. The labour and the service market, which forms in-between the employer and his customers, are matching markets. These matching markets appear every other step in the impact chain. In-between, there are phases of activity, which we will explore in the following.

Innovation occurs when knowledge of two distinct fields is brought together.

Markets are places of exchange. Knowledge is transferred from academia to practice and vice versa. The phases in-between are processes of knowledge production within a particular ecosystem. It describes how knowledge is produced in academia and how it is produced in practice. The dissertation selects a constructivist approach to conceptualise these internal processes of knowledge production with the help of literature on communities of practice (CoP). CoP-literature discusses innovation in firms. The underlying assumption is

that innovation occurs as the result of combining knowledge and expertise from different departments of a company. It is, therefore, important to facilitate the exchange of knowledge between employees from different departments.

The same basic argument can be made for academic disciplines. The innovative capacity of interdisciplinarity lies in the collaboration of experts from multiple disciplines. I adopt WENGER's (2000) definition of entrepreneurial innovation as my definition of socio-technical innovation. The foundation of a socio-technical innovation is the existence of multiple communities and their integration across their boundaries. Two characteristics define communities: firstly, the group of members, and secondly, the common body of knowledge (see section 2.1.1: Fig. 4). Boundaries separate these communities. Hence, boundaries describe the discontinuity of social interaction and knowledge.

Communities come in various forms and sizes. Institutionalised communities in academia range from research teams and individual institutes, to departments and entire schools. In most universities, institutional boundaries largely align with thematic boundaries. Academic departments are in these cases based upon disciplines. Multiple disciplines may also share a common department. It is also not unlikely that a professor of one discipline is associated with a department of another discipline in a cross-disciplinary sense (see section 2.1.1). In practice, the congruency of disciplines and institutionalised communities is lower. While public administration usually consists of multiple communities in the form of departments, many businesses have dissolved institutional community structures altogether, and operate on task-to-task bases. Instead of disciplines, professions come to the fore in practice. Professional bodies represent its members across all emplo

ers they work for. Professions may be a subgroup of a discipline, align with a discipline, or may also relate to multiple disciplines. The RTPI, for instance, consists mainly of people holding a planning degree but is under specified conditions also open to alternative educations such as geography and architecture.

Communities and boundaries serve two different purposes as part of an innovation ecosystem. Communities are relevant for producing 'powerful knowledge' (YOUNG 2013). Powerful knowledge (PK) is the knowledge that is not accessible to those outside the community. PK is the reason why someone hires an architect to build a house and not a planner even though a planner may have had architecture lessons, too.

Innovation is not the result of combing superficial knowledge but powerful knowledge that is not accessible to those outside an academic community.

According to Wenger (2000), communities require a critical mass of members, leadership, and internal coherence. Only thereby, it becomes possible to nurture a process of internal exchange that allows for further developing knowledge. In turn, he assumes that if there is only one computer scientist in a company of architects, the computer scientist misses a professional, disciplinary exchange on the process of knowledge in his field, falling behind his peers' abilities.

Boundaries, on the other hand, are potentials for socio-technical innovation. The exchange of PK between communities leads to critically reflecting upon the community's ways of thinking and doing, and established patterns of problem-solving. Crossing boundaries is generally possible in two ways: firstly, by means of objects, and secondly, by means of interaction (Wenger 2000; see section 2.1.1: Fig. 4).

Boundary objects mediate between communities. They are shared theories, artefacts, and work processes (Wenger 2000). In its most uncoordinated way, objects are a matter of fact. Transport engineering influences planning just by placing stations and stops theoretically without any consultation. But objects such as Bertolini's (1999) node-place-model can also be used more proactively as a tool of coordination between disciplines (Gilliard et al. 2018).

The term interaction describes the collaboration of members of at least two different communities. Interactions range from one-time encounters to regular exchange and intensive projects (Wenger 2000). So, for instance, an academic department that is home to multiple disciplines may host regular exchange between professors of different disciplines as part of regular department meetings. However, this may not mean that substantial exchange research-wise happens. Instead, two institutes of different departments may work together on a research project facilitating a more intense exchange of knowledge over a given period of time.

A special form of interaction is the boundary practice (Wenger 2000). In this case, a new community emerges to permanently broker between two other communities. As argued in section 1.2.1, the discipline of urban planning is such a case (Gilliard & Thierstein 2016). The consequence is that a boundary practice establishes new boundaries (Wenger 2000). Despite its own boundaries, a boundary practice cannot exist without the communities it tries to broker between. Urban planning as a boundary discipline may play a crucial role but is not alone. Disciplinary communities and boundaries cannot be thought separately. Planning as a boundary discipline is defined by its boundaries, which in turn are the result of other disciplinary communities itself.

While communities are in most cases institutionalised, boundaries are mostly informal, case-to-case collaborations (Millar 2006) except boundary practices and formalised processes with the help of boundary objects. Thus, an integrated ecosystem of communities and boundaries is based upon institutions and informal culture of exchange. The cultural aspect of how planners and other professionals operate has gained increasing attention in recent years (Knieling & Othengrafen 2015; Vries 2015). Whether or not institutionalisation of boundaries is beneficial for an interdisciplinary exchange is highly debated. A recent questionnaire among leading planning thinkers (Kunzmann & Koll-Schretzenmayr 2015) reveals a general disagreement upon the question of whether or not the emergence of planning as an independent discipline is universally beneficial for urban development. Supporters argue that institutionalisation keeps the issue of urban development on the agenda (Babalik-Sutcliffe 2015; Dericioğlu 2015; Finka 2015; Mironowicz 2015). Detractors argue that institutionalisation has led to a separation of issues with no holistic view on the urban environment remaining (Baudelle 2015; Gallent 2015; Lapintie 2015; Zonneveld & Nadin 2015).

Disciplines are the institutionalisation of academic communities. Boundary disciplines institutionalise boundaries.

While the issue of institutionalisation is an important issue regarding potential implications of this research, the underlying dynamics of what facilitates cross-boundary exchange can be conceptualised differently. At the centre of this research stands the education of students, the graduate as the connection between academia and practice, and the practitioner as the talent for socio-technical innovation. Hence, personal attributes describe the link between communities and boundaries.

Wenger (2000) uses the term 'identity', which may correspond to the term role in most of the planning literature (Howe 1980; Albrechts 1991; Steele 2009). An identity is someone's sense of belonging and knowledge of his situatedness within a larger system. Identities are, hence, products of homes and trajectories (Wenger 2000). A home may be the disciplinary communities, the university someone graduated from, or the working team with his form. Our understanding of home usually falls into fractals (Wenger 2000) meaning that an architecture graduate specialising in 3D-visualisation may be the 3D-expert within his architectural office, but may also be the architect within a meeting of visualisation experts. Trajectories describe someone's connection to other people, but also his change of connection over time. The trajectories, for instance, may be limited if someone has remained within a community from education to practice, but

Researchers and students do not correspond one-to-one with communities but are rather complex identities of fractured multimemberships.

may also be multilateral if someone has branched out into different professions or nurtured an exchange to other communities.

Interdisciplinarity requires social learning environments.

Homes are, in other words, someone's belonging to a community, and his trajectories define his abilities to broker across boundaries between communities. Education that tries to enable socio-technical innovation needs to develop communities but focus on building bridges by enabling boundary interaction through individual trajectories of students. This requires a much stronger focus on interdisciplinarity as this enables students to build connections to other students from other disciplines.

It is not only about a graduate's education alone, but about the education in its social context. Interdisciplinarity is a social learning process that bases upon scientific learning in communities. In other words, interdisciplinarity is learned socially through interaction across boundaries.

The Knowledge Perspective 3.3

The knowledge perspective raises a key question that educators are interested in: What do graduates need to know for practice in urban development? This question needs to be answered in two ways: Firstly, what do they need to know to get employed, and secondly, what do they need to know for innovation? We will approach the answers by taking a competency-based approach.

Professional Competencies 3.3.1

Competencies define someone's employability.

Competencies have become a crucial terminology in education and employment. They are directly linked to the concept of employability. In qualification-based educational systems, educators design courses around content. Qualification is defined by the content of the curriculum. In contrast, employability-based education aims at equipping students with the ability to use knowledge in the specific case of application. Hence, the diversification of degrees occurs. The earlier example of a computer scientist in an architectural office illustrates that it is not about the computer knowledge per se, but about his ability to use it in an architectural context.

The literature generally distinguishes professional competencies from social, personal, and other forms of competency. The latter forms of competency are often subsumed as the so-called soft skills. While soft skills have become an important concern of education, teaching professional com-

petencies remains central for universities. Definitions of professional competency vary, but they have in common that a competency describes someone's *ability to handle a situation' (Keen 1992: 112).

In management literature, you find the term core competency. A core competency is the ability of a company that no other company does better (Prahalad & Hamel 1990: 82). For instance, Google's core competency is providing a search engine for the internet. Google, as a company, has branched out over the years, making various soft- and hardware, and providing numerous online services. At its core, Google has, however, developed algorithms for online searching. There is currently no other online company that provides a search engine that is nearly as successful. The search algorithms are currently developed further by experimenting with artificial intelligence and machine learning. The core competency itself is, hence, based on the underlying core knowledge in the field of mathematics and computer science. The competency of providing an online search engine is the combination of Google's fundamental knowledge and its ability to use it.

Educational studies adopt the terminology of competency (Stoof et al. 2002). Competency is the student's ability to use knowledge. While core competency is used as a relative term defining a company's ability in comparison to another, education uses competency as an absolute term. The term competency has to be understood as a shift from learning content to learning outcomes that falls in line with the shift from qualification to employability. Qualification is based on acquiring a defined set of knowledge and skills. Employability is based on the graduate's ability to use the knowledge and skills for the purpose of the potential employer. Courses are, therefore, no longer defined by the content alone, but rather aim at imparting competencies. This shift towards outcome-based curricula has been part of the Bologna Process that standardised the descriptions (Flood Strom et al. 2004) and processes of designing curricula by common regulations within the European Higher Education Area (EHEA) (Ministry of Science, Technology and Innovation Denmark 2005: 63).

Professional competencies describe someone's ability to employ knowledge.

Learning outcomes are described as competencies that consist of two components: a construct of knowledge, and a cognitive ability. The definition roots back to Bloom's (1956) taxonomy of educational objectives. Bloom's revised taxonomy (Anderson et al. 2001) differentiates six levels of cognitive ability. These are represented by numbers from one to six on the horizontal axis of the codebook (see Table 3), that is later used for the curricular analysis (see chapter 4). The number one represents the lowest cognitive ability of re-

Factual Knowledge Categories in Comparison to Categories Defined by Professional Bodies and Academic Organisations Table 3

		1 - remembering	2 - understanding	3 - applying	4 - analysing	5 - evaluating	6 - developing
A	**Basic Disciplinary Knowledge**						
Ad	*about the Physical Environment*						
	Ad-ARCH	Morphological and Typological Knowledge about the Built Environment					
	Ad-LAND	Morphological and Typological Knowledge about the Natural Environment					
	Ad-INFRA	Knowledge about Infrastructure					
e.g.		*the ability to recognise different typlogies of residential buildings*	*the ability to understand the differences of residential typologies*	*the ability to use different typologies in urban design proposals*	*the ability to classify the differences of typologies*	*the ability to assess the quality of different typologies*	*the ability to develop residential typologies*
Af	*about the Functional Environment*						
	Af-ECON	Economic Knowledge					
	Af-SOC	Sociological Knowledge					
	Af-ECOL	Ecological Knowledge					
e.g.		*the ability to list forms of subsidised housing*	*the ability to interpret how housing subsidies work*	*the ability to apply subsidised housing policy*	*the ability to analyse how housing subsidies affect the housing market*	*the ability to evaluate whether housing subsidies achieve its intended effect*	*the ability to propose housing policy that provides housing to low-income households*
Ap	*about the Procedural Environment*						
	Ap-LAW	Legal Knolwedge					
	Ap-ADMN	Administrative Knowledge					
	Ap-MGMT	Management Knowledge					
e.g.		*the ability to recall relevant laws for urban development*	*the ability to interpret planning law for a building application*	*the ability to apply planning law for setting up a zoning plan*	*the ability to identify loopholes in zoning plans*	*the ability to assess the shortcomings of planning law system*	*the ability to rewrite planning laws*
B	**Composed Interdisciplinary Knowledge**						
	B-GLOB	Knowledge on Universal, Transferable Principles					
	B-LOCL	Knolwedge on Locally Contingent Concepts					
e.g.		*the ability to name different urban development principles*	*the ability to distinguish a city's design by its underlying development principles*	*the ability to apply development principles when designing a city*	*the ability to select a suitable development principle for a city*	*the ability to compare strength and weaknesses of development principles*	*the ability to develop new development principles*
C	**Methodological Knowledge**						
	C-ANLY	Analytical Knowledge					
	C-SYNTH	Synthesising Knowledge					
	C-COMM	Communicative Knowledge					
e.g.		*the ability to identify different forms of communication*	*the ability to contrast different forms of communication*	*the ability to conduct different forms of communication*	*the ability to select a suitable form of communication*	*the ability to assess the communication's effectiveness*	*the ability to strategise communication*
D	**Meta-cognitive Knowledge**						
	D-META	Theoretical and Experiencal Knowledge on Urban Development Works					
e.g.		*the ability to name different roles as part of an urban developent process*	*the ability to understand someone's role as part of an urban development process*	*the ability to assume a particular role as part of an urban development process*	*the ability to classify the stakeholder's roles as part of an urban development process*	*the ability to recommend a certain role as part of an urban development process*	*the ability rearrange the set-up of roles as part of an urban development process*

membering knowledge, and six represents the highest cognitive ability of creating knowledge. In between, two stands for understanding, three for applying, four for analysing, and five for evaluating. Besides the aforementioned verbs, there are many synonyms or words describing similar cognitive abilities – e.g. recalling, listing, and naming instead of remembering, and assessing, deciding, and concluding instead of evaluating (ETHZ 2013).

There are two underlying assumptions to the cognitive abilities: firstly, the higher the cognitive ability, the more difficult it is to learn, and secondly, cognitive abilities build on one another. So for instance, if a student shall be able to analyse something, he must also be able to remember and understand respective knowledge. Thus, learning outcomes are relative to each other and have to be analysed within the wider context of its curriculum. If a course in the first semester tries to reach cognitive level six, the course must also impart all previous cognitive levels one to five. However, if the same course is part of the second semester and a previous course in the first semester has already reached the cognitive ability of three, the course can focus on the levels four, five and six.

This is further complicated by the fact that higher education has been split into bachelor's and master's degrees. Learning outcomes of master's degrees can base upon cognitive abilities acquired at the bachelor's level. However, the cohort of a master's course may consist of students with different previous knowledge. If a master's course builds upon competencies from the bachelor's education, students may start at various different levels of existing ability. The empirical analysis takes this complexity into account by analysing not only various master's degrees, but also the three principal groups of undergraduate education in architecture, planning, and geography (see chapter 4).

The second defining part of competency is the construct of knowledge. Bloom's revised taxonomy (Anderson et al. 2001) provides a general categorisation. It differentiates four categories of knowledge: factual, conceptual, procedural, and meta-cognitive knowledge. Factual knowledge consists of basic terminology, specific details and elements. Conceptual knowledge are theories, models, structures, classifications, and principles. Procedural knowledge describes skills, methods, and techniques. And, meta-cognitive knowledge summarises knowledge about the discipline's abilities and restrictions, but also purpose, and ethics. These are generic categories that various academics would phrase differently. Procedural knowledge is often described as skills, and textbooks often use attitude instead of meta-cognitive knowledge. The French words of savoir (knowledge), savoir-faire (knowledge

of doing), and savoir-être (knowledge of being) perhaps capture the meaning in the most elegant way (cf. Bulgarelli, Lettmayr & Menéndez-Valdés 2009: 37).

Knowledge in urban development is the combination of knowledge from a variety of disciplines.

It is easy to identify that most categorisations will not differentiate between factual and conceptual knowledge. The word factual seems to be an unfortunate choice because the term is linked to truth, which itself is a contested concept in cases such as constructivist research. Many fields of research and teaching – especially in the social sciences – will avoid talking about facts. However, it is difficult to get around the notion of facts in urban development. Not only do legal regulations require planning to work on the basis of evidence, but politicians and citizens will also ask for reports, documents, and plans that provide evidence for developments (Davoudi 2006). The call for evidence-based planning seems to be in direct conflict with the notion of complexity (see section 1.2.2). In order to understand how planners still cope with evidence, the following part will briefly recapitulate the history of planning approaches (cf. section 1.2).

Early planning theory is strongly based on rationalist ideas. Rationalist planning theory bases upon the assumption that spatial conditions can be analysed and interpreted in an objective way. A planning statement is true if it corresponds to the state of the spatial condition. Identifying facts in urban development is, therefore, a matter of accurate analysis. The better the analytical tools are, the better spatial assessments provide evidence. Since the communicative turn in planning theory, this understanding of truth is, however, in question. Communicative planning theory largely builds upon the theories of Habermas (Healey 1992). Habermas (1981) defines truth in a consensual way. A statement is true if all can agree upon it. Participation and community involvement are based upon the assumption that engaging with citizens and stakeholders creates an inter-subjective view on spatial conditions which can serve as facts in the development process. However, urban development is mostly about decisions that affect some in a positive way and others in a negative. The not-in-my-backyard (NIMBY) phenomenon illustrates that communication can often not achieve consensus for all development proposals.

Rittel & Webber (1973) explain this by the notion of 'wicked' and 'tame' problems. Planning deals with wicked problems that are interlinked with other problems and cannot be solved. Tame problems, on the other hand, can be clearly defined and are solvable. A typical planning process of designing a city street may illustrate the differences well.

Road construction projects often start within the transportation department. Traffic management has identified regular hold-ups on a road. The analysis shows that the

amount of vehicles in peak hours exceeds the possible number of cars that can drive on the street within a given period of time. In order to increase the capacity, the transportation department suggests widening the road by another lane. The aforementioned case deals with a tame problem. The transport engineer can clearly define the problem and provides a solution. A planning department would take over the case subsequently in order to achieve planning consent for widening the road. The planners would inform other departments as well as affected stakeholders about the proposal and asks them if they have any objections. It is easy to think about objections that could be raised by the green space department that loses greenery along the road, by cyclists and pedestrians that have to squeeze on the limited remaining space, or by local residents that fear rising noise levels due to faster-moving traffic.

If we look at the congestion from the perspective of local residents, the problem is a completely different one. Residents will identify the number of cars as too high for living along the street. A solution could be to divert the traffic on other roads. The problem is, again, tame for the residents. They can clearly define the problem and provide a solution. The planning department has to make a decision. Should it either follow the solution of the engineers or the residents? While the problem appears to be tame for the engineers and the residents, the planner faces a wicked problem. Whatever the planner decides, the resolution will either compromise traffic flow or noise protection. Another way to look at the differences between tame and wicked problems in urban development is to think about external and internal problems. As long as the planning department asks external stakeholder and experts, there seem to be clear solutions. Only when planners start to weigh up between different solutions, the problem becomes wicked.

Knowledge from other disciplines is imported as given facts and combined normativly for the generation of urban concepts.

In light of the aforementioned example, the differentiation of factual and conceptual knowledge becomes useful. Factual knowledge is the knowledge that is provided by external expertise – in our case, the field of transportation. The planner assumes that the solution provided by the transportation department is based on sound engineering and analytical evidence. The statement that the amount of vehicles requires a wider road is taken in as a fact. Similarly, planners will take the statement of the residents that the noise level would be unbearable as a fact, too. The best way to think about factual knowledge in urban development is regarding it as disciplinary knowledge.

Disciplinary refers to other disciplines such as transport engineering that provides basic knowledge to the urban development process. In order to identify those disciplines,

the codebook draws from Boesch's (1989) categorisation of space: distance-, function-, and process-space. These categories correspond to various documents of professional bodies and other academics that attempted to group relevant knowledge in planning and urban development (AESOP 1995; APA n.d; Fischler 2012; RTPI Yorkshire 2012; Hoch & Fischler 2012; PAB 2012; van den Broeck 2012; ASAP 2014). D-, f-, and p-space are sub-categorised based on these documents.

As a result, I identify nine disciplinary fields that provide factual knowledge to urban development. The list is not exclusive and may generalise but provides a good understanding of the scope of knowledge that is relevant to urban development. Physical space is mainly the concern of architects, landscape architects, and civil engineers. Buildings, streets, and open spaces define the urban design of cities. The functionality of cities as places for social and economic activities and as a habitat for flora and fauna is subject to social, economic, and environmental sciences. The last group of disciplines look at space from a perspective of regulation and change. It includes law, management, and administrative sciences.

In order to solve the dilemma of our example, planners fall back on the second category of knowledge: conceptual knowledge. In the 1950s and 60s, the vision of town planning for the motorcar would have led to a decision in favour of widening the road. Today, environmental and health concerns increasingly limit car access to cities. The planning department would perhaps invest in cycle lanes or public transportation infrastructure to substitute car traffic by other means of transportation. Conceptual knowledge in urban development is the synthesis and a normative emphasis of different factual disciplinary knowledge. It can, therefore, be described as normative interdisciplinary knowledge.

Procedural knowledge needs to be differentiated from knowledge about processes. Especially, planning as an independent discipline has shaped a complex understanding of how the state interacts with private actors when steering land-use. There is a wide range of instruments from participatory workshops to top-down lawmaking that is at the core of planning knowledge. In this work, knowledge about processes is therefore defined as factual knowledge from the field of planning in its narrower understanding (cf. section 2.1.2).

Besides statutory and non-statutory instruments, planners, architects and other experts alike employ various methods, techniques, and skills. This is so-called procedural knowledge. A method, for instance, could be having a stakeholder meeting, doing GIS analysis, or visualise a concept in 3D. Methods are deliberate actions towards an intended impact (Förster 2014). Methods are used as a sequence of

events in order to prepare the use of instruments that make changes to the physical, functional, or organisational regime of space. So, while instruments directly interact with the spatial condition, methods are techniques of working towards the employment of instruments (Förster 2014).

Urban development requires methods to combine knowledge from different disciplines.

Procedural knowledge is of particular importance for planning because it is the necessary link between factual disciplinary and normative interdisciplinary knowledge. While rationalist planning favoured analytical methods as the means of weighing up between different disciplinary perspectives, communicative planning highlights the importance of communication-based on an inter-subjective definition of truth.

Förster (2014) differentiates three categories of methods: analysis, visualisation, and communication. While using the codebook on curricular learning outcomes, it became evident that analysis can appear in two forms: analysis and synthesis. Analysis in its narrower sense is concerned with understanding a particular part of a wider system. Typical techniques of research are isolating variables by giving other variables a fixed value. Thereby, researchers can analyse the effect of one variable without the complication of side effects by changes of other variables. Looking at the aforementioned example, the transport engineer analyses the effect of widening the road on traffic flow. Other aspects, such as road greenery, are out of his equation. Urban development, on the other hand, has to deal with multiple variables that are constantly changing and affecting each other. Urban development is based upon the engineer's analysis but concerned with the interrelation to other analyses of experts with varying perspectives – such as the noise problem of the aforementioned example. Therefore, it is the task of urban development to synthesise multiple analytical views. Analytical knowledge is, hence, closely linked to discovering factual knowledge. Synthesis, on the other hand, leads to interdisciplinary conceptual knowledge.

Communicative knowledge binds both categories together. I argued before that interdisciplinarity is a form of social learning. As such, it is a matter of listening, presenting, arguing, conveying, and shaping opinions. Interdisciplinary knowledge is normative as it is inter-subjective.

Visualisation is not of value as a separate category in this research. I would argue that visualising is a technique that is essential to analysis, synthesis, and communication. An architect's analytical toolbox is, for instance, primarily visual. Synthesising often works through visual tools such as mind maps, flow charts, or more sophisticated systemic models. And, visualisation is, of course, a key technique of communication.

The last knowledge category of Bloom's revised taxonomy (Anderson et al. 2001) is meta-cognitive knowledge. This category comprises a wide range of aspects from knowledge about its own abilities, about its own and other disciplines and practices, work ethics, the understanding of somebody's role, to name just a few. There are various educational approaches that impart such knowledge, for instance, theory and ethics courses, work placements, or general studies modules. The term theory must be specified as theory of urban development and not theory in urban development. Meta-cognitive knowledge is about (meta-)theory of how urban development acts, not about what plans and policy of urban development contain. In this research, I do not further categorise meta-cognitive knowledge. The breadth of forms and a lack of consistency among educational approaches make further differentiation not very informative.

The breadth of different categories shows that the boundary discipline of urban planning is highly multidisciplinary. Guidelines of professional bodies reflect this by asking universities to impart a basic understanding of each field to planning students.

Contingency of Knowledge 3.3.2

Anderson et al. (2001) introduce the categories of factual, conceptual, procedural, and meta-cognitive knowledge as generic categories in education. A particularity in the field of urban development is the interdisciplinary nature of conceptual knowledge in comparison to the disciplinary nature of factual knowledge. Urban development concepts are essentially the combination of evidence and assumptions from multiple relevant disciplinary fields.

Conceptual knowledge in urban development is temporally contingent.

In addition, conceptual knowledge is of normative nature as the process of weighing up different disciplinary knowledge is based upon the planner's imagination of the future. His imagination is, however, only one of many alternative futures (see section 1.2.2). Therefore, it is important to point out that conceptual knowledge is not stable over time. Progress of knowledge in just one of the disciplines relevant for urban development can mean that the implications in a systemic context change drastically. Normative majorities change over time equally, which may require a revised process of weighing up. Together, interdisciplinarity, normativity, and ephemerality make conceptual knowledge in urban development 'contingent' (Healey 2012).

The contingency of conceptual knowledge in urban development shall not be confused with low consensus. Collins (1994) argues that social sciences tend to have lower

consensus, and thereby, lower rates of innovation due to limited technical progress in terms of methodology and research techniques. Natural scientists would take former research findings as a given because newer research techniques based on new technological opportunities would lead to potentially more interesting and more prestigious results instead of repeating old research designs (Collins 1994). So instead of redesigning the steam engine over and over, engineers have just moved on developing combustion engines and nowadays electric motors. While low consensus is relevant to certain sub-fields of urban development such as the sociology of urban development, urban development itself is not necessarily low consensus.

On the contrary, experts in urban development have a high level of agreement upon predominant urban concepts. For example, while the car-friendly city has once been deemed the path to progress, the dismantled tramways and obsolescent bicycles have celebrated a revival over the last decades in many developed countries of the Global North. Modernist urban designers almost universally agreed upon principles such as the separation of motorised and non-motorised traffic, and contemporary urban designer again almost universally agree upon allocating more space to public transportation and non-motorised traffic as well as reintegrating both with the remaining cars on the traditional street level.

It shows that consensus is generally high but only within a limited time span. Low consensus in the social sciences and the asynchronicity of social and technical innovation are important factors that contribute to the contingency of conceptual knowledge.

Apart from this temporal contingency, urban concepts also differ based on their locality (Sun, Chan & Chen 2016). Rapidly developing countries such as China, for instance, have invested strongly in road infrastructure providing at least bearable conditions for car traffic in its mega-cities. Chinese urban development does not simply copy the car-friendly urbanism of Europe's and America's 1950s and 60s. Instead of neglecting public transportation, China has invested in urban metro systems, and national high-speed rail, too. Chinese inventions in the construction of high-speed rail infrastructure are nowadays returning to Europe and North America.

Conceptual knowledge in urban development is spatially contingent.

Healey (2012: 189) describes this phenomenon as 'travelling ideas' adding the notion of 'universality' of conceptual knowledge. 'Planning could be promoted as a universally beneficial policy approach' (Healey 2012: 192) that justifies a simple 'uprooting and transplanting' of ideas as a '"universally valid" pathway for human social development' (Healey 2012: 191). This notion stands in line with the idea

of continuous progress, starting from the Enlightenment to the modern period (see section 1.2.1: Fig. 2). The very basic idea of systematic inquiry, research, and academia is based on human progress based on the accumulation of knowledge. Hence, temporal and spatial contingency does not mean that urban concepts are always newly developed ideas. Urban development resorts to similar engineering solutions but may associate very different expectations with their implementation.

In summary, constructs of conceptual knowledge are based upon a universal concept, which Healey (2012) calls the 'travelling idea'. These concepts may be as simple as widening the road, installing surveillance cameras, building high-rise towers, or participate local citizens. Urban planners, architects, engineers, or other experts intend a certain impact by employing any of those concepts. This intended impact is the contingent part based on location and time. The claim of Rittel & Webber (1973: 164) that 'every wicked problem is essentially unique' does not mean that each urban development proposal is unique, too. The underlying disciplinary knowledge is part of a history of knowledge production and evolution.

Powerful Knowledge and Socio-technical Innovation 3.3.3

The impact model reflects the idea of contingency, but also universality and academic progress by the fading arrows. At the time of inventions or development, new knowledge is usually the closest to reality. The empirical data of the research is relatively up-to-date. The research is based on the latest available literature. The validity of such knowledge decreases naturally over time as new data becomes available, and new ideas are spread via literature.

Our understanding of the local context appears in the opposite way. In the beginning, only a few will experience occurring urban issues. Slowly, more people become aware of it, and it requires additional time until a systematic inquiry is able to describe the problem. When urban development conceptualises a problem and develops resolutions, it deals with inaccurate information and outdated knowledge. The multidisciplinary nature of knowledge in urban development further complicates the matter. While some knowledge may be very recent, knowledge from other disciplines may be already slightly old.

Besides this immanent character of being outdated, imparting knowledge in urban development faces another challenge. During the time between educators conceptualising a programme or course, and students having achieved the

learning objectives, knowledge may have already become outdated. While this is a general phenomenon for all disciplines, it is of greater relevance in fields that deal with social and economic issues. While knowledge, as explained earlier, becomes obsolete naturally due to scientific progress, knowledge on issues of the society outdates due to societal changes itself. The time span of validity is, therefore, rather short for knowledge in urban development. This issue becomes especially apparent when comparing the time span of validity to the time it takes from a student starting a programme to reaching a significant position in urban development practice, later on.

Conceptual knowledge in urban development looses validity over time.

A permanent renewal of knowledge is required. The absence of the renewal of knowledge does not mean that urban development stagnates conceptually. Instead, lacking innovation leads to a gradual decline of the validity of socio-technical urban concepts due to new technical and social inventions or changing societal value systems. This results in a challenge for urban development. While interdisciplinary conceptual knowledge is ultimately the base for urban development plans and policy, it is only of short validity. Instead, disciplinary factual knowledge is of particular importance to an innovation-oriented education and practice, because it needs to be recombined for socio-technical innovation.

Experts of the discourse on urban design may refer in this case to contextualism. Contextual urban design and architecture aim at providing locally specific and temporally adequate designs instead of universally valid design principles. In educational terms, a contextual approach that aims at finding innovative solutions on case-to-case bases must focus on factual knowledge and the ability to recombine it to conceptual knowledge.

Urban development requires the constant re-translation of powerful disciplianry knwoledge into urban concepts.

However, not every part of factual knowledge is of relevance for innovation. Socio-technical innovations are based upon both technical and social invention; hence, the latest available knowledge of each relevant discipline. In contrast to common opinion (AESOP 1995; APA n.d; Fischler 2012; RTPI Yorkshire 2012; Hoch & Fischler 2012; PAB 2012; van den Broeck 2012; ASAP 2014), it is not sufficient for interdisciplinary work to understand just the basics of each relevant discipline. Interdisciplinary work that shall fulfil the purpose of delivering socio-technical innovation must have access to the latest available knowledge, which Young (2013) call, therefore, 'powerful knowledge' (PK). PK is the knowledge that is generally not available to others outside the disciplinary community. It differentiates experts from the interested. In analogy to core competencies, PK is what offers disciplines a competitive advantage over other disciplines in solving certain scientific questions. PK is the result of leading-edge research activities and a deep understanding of its

discipline. PK is inaccessible to those without sufficient insight into the associated discipline. Socio-technical innovation appears when PK from multiple disciplines is newly combined (Schumpeter 1934).

Innovative urban development requires experts that, firstly, have a deep disciplinary understanding and are able to keep up with the scientific progress of the respective discipline, and secondly, are able to work collaboratively to combine disciplinary factual knowledge into interdisciplinary conceptual knowledge. Urban planners do not fulfil this definition because they learn of every field a little but nothing in-depth (cf. section 4.2). Ultimately, the creation of innovative urban concepts is the goal of innovative urban development. Experts working in urban development must work within their disciplinary boundaries and beyond.

The Institutional Perspective 3.4

The third perspective focusses on the institutional setting for socio-technical innovation in urban development. The dissertation utilises the ecosystem terminology as part of the scientific debate on innovation (Stam 2015; Sipola, Puhakka & Mainela 2016; Deeb 2017). The term ecosystem originates from the studies of ecology and describes how living organisms and non-living components interact and affect each other within a certain habitat. If, for instance, a new species is introduced to an existing habitat, it may affect all other organisms and components with the effect of changing the overall system. As a result, some species may thrive under the new conditions, and others become extinct. Economics has adopted the ecosystem terminology to describe conditions, under which certain businesses benefit. In recent years, cities and regions discussed how they could shape ecosystems that let specific economic branches such as the creative class, the knowledge economy, or most recently start-ups and young entrepreneurs grow (Florida 2016). The ecosystem terminology gives the general systems theory (see section 2.2.2) an evolutionary perspective describing a state of transformation instead of balance. Understanding the systems of academia and practice as ecosystems helps to understand the conditions, under which innovative ideas thrive.

3.4.1 European and National Educational Policy

The academic ecosystem has changed dramatically over the past decades due to the European Bologna Process, a shift of regulatory power from national administrations to the European Union (EU) on the one hand and to individual institutions of higher education on the other hand (Estermann & Steinel 2011). The Bologna Process is the attempt of the EU to create a common European Higher Education Area (EHEA). The standardisation across the EU means significant changes in educational policy for most member states. These changes are so significant that almost twenty years after the Bologna Declaration (EU 1999), most countries are still in a transitional period adapting to new regulations. The changes most prominently affected the degree and programme structure. The conditions for educators and researchers as well as funding mechanisms remained largely country-specific.

The BA-MA-system enables the shift from qualification to employability.

When the EHEA adopted its qualification framework (QF-EHEA) in 2005, it combined the political proclamation of introducing a multi-cycle degree system (EU 1999; EU 2003) with the structural characteristics of the European Credit Transfer System (ECTS). The qualification framework distinguishes three cycles of higher education: bachelor's, master's, and doctoral degrees. These cycles are equivalent to level 6 to 8 of the European Qualification Framework of Lifelong Learning (EQF). Additionally, it recognises a short cycle 'within or linked to the first cycle' (QF-EHEA: 62). This formulation ensures that no European country is obliged to introduce or accept a short-cycle. On the other hand, a foundational study period as previously typical in Germany is covered by European regulation. Each cycle has been defined by a typical minimum of ECTS credit points (see Table 4). The introduction of an EHEA-wide two-cycle system serves two purposes: firstly, providing a meaningful qualification for the labour market faster, and secondly, allowing diversification of degrees in order to meet specialised needs of the labour market. It is, hence, an important tool for implementing the shift from qualification to employability.

Table 4 Three Cycles of Higher Education of the European Higher Education Area

Cycle	Degree	EQF level	ECTS Credits	Years
1st Cycle	Bachelor's	6	180 - 240	3 - 4
including short cycle			*thereof 120*	*thereof 2*
2nd Cycle	Master's	7	60 - 120	1 - 2
3rd Cycle	Doctoral	8	not specified	not specified

The QF-EHEA serves as a framework that requires national adaptations. Most study programmes in all European countries have since been converted into bachelor's, master's, or doctoral degrees. There are still nationally specific degrees that fall within the same levels of the EQF. These are, for instance, the qualification-based German Staatsexamen in case of lawyers and teachers, for which the examination is not conducted by the university but by the state. Another example are job-specific postgraduate diplomas or certificates that British universities award.

British and Irish universities have undergone less significant changes – at least on the surface. Most countries in the English-speaking world had a bachelor's and master's system in place beforehand. Most UK universities have a 3(+1) years + 1 year division in place. Students obtain a bachelor's degree without honours after 3 years of education and a bachelor's degree with honours after 4 years. By European law, both degrees allow admission to master's degrees, although most master's students will have an honours degree. Most taught master's programmes have been shortened to one-year 90-ECTS degrees. Students can alternatively obtain a postgraduate diploma after accumulating 60 ECTS credit points before submitting a master's thesis. There are also research master's in existence. These are either two-year thesis-only programmes or integrated one-year study periods of a longer PhD programme.

The two-cycle system is new to higher education in the DACH-countries. Beforehand, study programmes had a regular duration of 4 years, often excluding the period for writing the final diploma or magister thesis. The introduction of the bachelor's-master's-system is a consecutive division of the overall study period. German, Austrian, and Swiss universities adopted mostly three-year-long bachelor's and two-year-long master's degrees. Alternatively, 4+1 and 3.5+1.5 systems are in place. Theoretically, students can also combine a three-year-long bachelor's and a one-year-long master's degree, if this is not in conflict with admission requirements. Programmes of the same subject that are consecutive shall in total be no longer than five years in German universities (HRG: §19(4)). Consecutive degrees are those that were four- to five-year diploma or magister degrees beforehand. Exceptions are, however, in place with some universities offering a 4+2 system bending the definition of what is consecutive and what is not.

Study programmes themselves are subdivided into modules. Modularisation is the subdivision of a programme into thematically and temporally contained learning units. Each learning unit imparts a defined set of competencies that are assessed in an examination at the end of each module.

Modules can consist of multiple courses of different format that prepare the student in combination for the exam. The process of selecting the appropriate format and content of courses and the exams for the intended learning outcomes is called 'constructive alignment' (Biggs, n.d.).

The ECTS effectively prescribes a competency-based system to the EHEA.

In 1989, the EU introduced as a precursor to the Bologna Process the European Credit Transfer System (ECTS) to make courses and examinations across European universities comparable. It served, firstly, as a conversion system for recognising exams that students had passed in a foreign university as part of the European Erasmus exchange programme. Since then, it has developed from a standard for student mobility into a standard for curriculum design, quality assurance, and programme documentation within the EHEA.

At its core, the ECTS standard (2015) regulates the students' workload in the form of credit points (CP). ECTS CP represent the total time of study and examination, including both time in the course and learning individually. The ECTS is an accumulative system. Based on the definition that one CP equates to 30 hours of workload, students of a full-time programme are asked to accumulate 60 CP per year. 60 CP equate to 1800 hours of work, which in turn equals 45 weeks of full-time employment – given an average of 40 hours per week.

CP are only awarded for achieving learning outcomes, not just partaking in a course. Hence, the introduction of the ECTS effectively establishes the use of competency-based curricula (Tchibozo 2010). While ECTS CP describe a student's workload, so basically the amount of curricular content, they are only awarded for achieving competencies that are based upon that content.

The workload of an individual module is usually between 5 and 12 CP with the exception of the thesis module that is up to 30 CP in case of master's programmes. The introduction of modules fulfils three purposes within the EHEA: firstly, it implements the shift from qualification to employability; secondly, it enables a greater degree of mobility for students, and thirdly, it serves as an instrument for curriculum design and quality control.

Modules must be understood as part of the shift from qualification-based to employability-oriented programmes. While a professional qualification requires multiple years of studying, individual competencies that, in sum, make somebody employable can be taught in smaller learning units. These learning units, called modules, can be combined in such a way that they equal former qualification-based degrees, but can also provide new educational pathways for specialised labour market needs.

Programme accreditation gives professional bodies greater influence on curricular design.

Subdividing programmes into smaller learning units has enabled a diversification of programmes. Modules have become building blocks for designing curricula. With enabling universities to design completely new curricula, demand for new ways of quality control arises. Traditional disciplinary qualification is a socially constructed concept that underlays a constant process of negotiation between the academic discipline, professional regulations and the associated community of practice. Norms and standards for disciplinary qualifications have been established over decades. Course content is flexible if it is socially acceptable within this system of norms. With the introduction of employability, curriculum design is no longer bound to these established normative systems. Instead, universities need to argue which purpose programmes fulfil and why programmes are designed in a certain way. For this purpose, all countries within the EHEA introduced an accreditation system. Accreditation agencies check, first of all, for compliance with the EHEA regulations but also look for consistent argumentation why a programme is needed. Guidelines by disciplinary accreditation boards and professional bodies assist this process.

Those institutions often reject the employability-paradigm. For instance, only people that are members of the architectural chamber can be an architect or planner in Germany. German legal practitioners must acquire a Staatsexamen, a traditional state-controlled degree in higher education. In addition to legal requirements, monetary mechanisms and the reputation of formal degree stabilises professional qualification. This system of professional degrees exists in different countries to a various extent – from rather liberal policies in Switzerland and the UK to strict policies in Germany and Austria. The German architectural chamber does usually not recognise degrees under four years of studying, but most bachelor's degrees are only three years long. Bachelor's degrees are still widely overlooked in the DACH-countries, especially in the disciplinary field attached to urban development. Instead, professional bodies have issued with a profound effect extensive ECTS CP lists stating what they expect universities to teach (Greenlee, Edwards & Anthoney 2015; Dawkins 2016).

Kunzmann (2008) identifies this problem and advocates for a minimum of four years in planning programmes. Only thereby, universities can balance CP requirements and the academic freedom of designing a curriculum. However, the remaining one-year of study is hardly enough to provide meaningful further education, especially considering that half

of the total 60 ECTS CP of a one-year master's programme will already be required for a master's thesis. Hence, universities increasingly exceed the maximum five-year study period.

Without additional funding programme diversification leads to rigid curricula

Modularisation has been subject to continuous critique over the past decades. Both students and lecturers complain about the increased number of examinations, constant assessment, and an associated restraint of course selection. While students had relative freedom in choosing courses before modularisation as long as they were prepared for the intermediate and final exam, current curricula require students to select specified modules and pass all associated exams. This is, however, largely due to the implementation of modules at universities. Programmes already consisted of individual courses before modularisation. Instead of developing appropriately-sized learning units, individual courses were relabelled as modules often well below the workload of five CP. If a study programme consists of no module larger than five CP, a student must pass at least 36 exams until graduating with a six-year bachelor's degree. Considering that many universities have also implemented modules without effectively controlling the number of exams per module, some students will have to pass even more exams.

Restraining the flexibility of the student's course choices is not directly the result of modularisation. Curricula can still provide the freedom to choose between various modules. However, many study programmes have rigid curricula, of which most courses are obligatory. This is because diversifying degrees is only meaningful if degrees are different and fulfil the expectation of a degree's name. The more specific the degree's name is, the more specified its curriculum must be. The specificity of a degree is reinforced by the limited amount of staff conducting courses. While the number of study programmes has increased rapidly over the last years, the overall number of academic staff in relation to students numbers has not increased. The ration of around 1 to 7 of academic staff to students has remained stable for the last ten years in Germany (Destatis 2017). The statistic hides, however, the fact that the number of students per professor has risen from below 49 to 64 at German universities from 1995 to 2013 (Schiller, Mahmud & Kenkel 2015). The stable ratio of staff to students is not the result of the steady growth of public funding but based on an increased amount of third-party funding raised by universities (Estermann & Bennetot Pruvo 2011). Those third-party funded academics are, however, mostly not involved with teaching.

German education policy uses the CNW indicator (in German: Curricularnormwert) that describes the amount of teaching necessary to deliver a curriculum. The CNW in-

creases with the number of elective courses and decreases with the number of students per course. Highly specialised programmes must balance low students numbers with less elective courses.

The intended diversification of programmes requires additional funding. Specialisation, as well as interdisciplinary education, are not for free. On the contrary, large disciplinary study programmes are most cost-effective. Since the introduction of the Bologna Reform, the national governments' expenditure on education has, however, fallen from 5.1% of the GDP in 2003 to 4.6% in 2017 (Eurostat 2019). Aside from a lack of funding, the allocation of funding does also not support the goals of the Bologna Process. Funds of universities consist of public and third-party funding. Public funds are allocated based on basic figures and ensure that all administrative and educational as well as some research tasks can be conducted. Additional funds for additional staff and extensive research projects is provided by research councils. Those are both in Germany and the UK half-governmental, half-academic institutions that evaluate research proposals and allocate funds. They are institutionally or internally organised as disciplinary communities and have not changed significantly. Disciplinary structures and research proposals are implicitly favoured.

The Bologna Reform has not tackled the academic career system.

Similarly, the academic career system has been largely unaffected by European standardisation. Germany, Austria, and Switzerland have a two-tier doctoral qualification system: firstly, the doctoral degree, and secondly, the Habilitation. The Habilitation is similar to the first doctoral degree. While the first doctoral degree is written under the supervision of a professor, the Habilitation is not. The Habilitation has traditionally been the requirement for being appointed as a professor. Today, universities in all three countries also accept equivalent academic achievements.

Before being appointed as a professor, academic staff generally falls into the category of a research and teaching associate (in Germany: Wissenschaftlicher Mitarbeiter, in Austria: Universitätsassistent, in Switzerland: (Ober-)Assistent). Associates are either PhD candidates or postdocs that aspire a Habilitation. Most associates are responsible for both teaching and research, however, with exceptions primarily in case of research associates that work only on a specific research project. Almost all newly appointed associates work based on temporary contracts. The duration of temporary contracts in Germany is, for instance, limited to six years until graduating with a PhD degree and another six years until graduating with the Habilitation. Permanent positions other than professorships have generally been abolished in Germa-

ny and Austria. Permanent positions as senior associates have become exclusive to Switzerland. As part of the internationalisation of academia, all three countries introduced assistant (in Germany: Junior) professorships. These are temporary positions that grant postdocs the title of a professor as well as academic independence. Assistant professorships are bound to a qualification agreement, which includes the requirement to pass through the Habilitation process. After the Habilitation, a promotion to a permanent professorship is likely, but not ensured.

The United Kingdom and Ireland have only one level of doctoral degrees. The PhD is usually required for being appointed to any academic position. PhD candidates are not regarded as academic staff and fall into the category of research students. Postdocs are then generally either employed as research and teaching assistants, or fellows in the UK. Fellowships provide greater academic independence, while assistants usually work under supervision. Both assistantships and fellowships are temporary positions. Ireland employs postdocs usually as lecturers but also based on temporary contracts. Postdocs that prove excellent research records and substantial teaching experience can apply for permanent positions. Permanent positions include lecturers, senior lecturers, readers, associate professors, and (full) professors. These positions are granted based on academic achievements and years of experience. All permanent positions, as well as fellowships, are usually independent in its teaching and research.

Table 5 Comparison of Salary of Full-time Academic Staff (Data based on EUI 2018; Figures in Euro)

Title	Germany	Austria	Switzerland	Ireland	United Kingdom
Permanent Positions					
Professor	4200 - 8250	4400-6200	11000 - 18000	8000 - 12000	6000 - 9800
Reader				6500 - 9000	5250 - 6500
Senior Lecturer				5250 - 7800	4750 - 6000
Lecturer				2800 - 6800	4000 - 5000
Qualification Positions					
Junior Professor	4200 - 5500	3250 - 3850	10000 - 15000		
Postdocs	3500 - 5500	2400 - 3750	6500 - 7100	same as lecturers	3250 - 4250
PhD candidates	3500 - 4200	2400 - 3750	3500 - 6000	tuition fees apply	tuition fees apply

In comparison, the German, Austrian, and Swiss systems are quite attractive to doctoral candidates. They are regarded as academic staff, including both the experience but also the obligation to teach and research, as well as a salary. The postdoc period is, on the other hand, extremely com-

petitive and far less attractive than in the UK and Ireland. While the British and Irish systems have a staggered system of various permanent and non-permanent positions, post-docs in Germany, Austria, and Switzerland are confronted with the risk of having to leave academia if they have not been appointed as a professor after graduating with a PhD. Consequently, many German, Austrian, and Swiss academics will eventually leave academia or go abroad. University staff is, hence, primarily on temporary contracts and with limited experience in both teaching and research. As nobody is staying for a longer period, nobody is inclined to invest in anything apart from personal academic achievements. This leads to a significant lack of continuity for most staff and a great reliance on the small body of professors. This is particularly problematic in combination with the current system of academic reputation.

Recent trends in academic career structures favour disciplinary research over interdisciplinary teaching.

The internationalisation of academia and greater mobility of academic staff requires international standards for academic reputation. While certain international trends can be observed, national practices differ. The UK higher education systems encountered major reforms in 2010, when public funds for university programmes were cut significantly, effectively leading towards hidden privatisation of universities (UCU 2010; Martell 2011; Coman 2014). UK universities do not only charge much higher tuition fees since then, but staff evaluation has become stricter with an emphasis on reducing cost and increasing third party funding (Pritchard 2012). Universities select and evaluate staff increasingly often by the number of journal publications, and the amount of third-party funding. The attention of academics has shifted from long-term strategic engagement with their institutions, local collaboration with communities, and engaging with students towards publishing and fundraising. Regular evaluation of staff has made writing long monographs with substantial research findings largely impossible. The highly increased numbers of overseas students that have become a major income stream for British universities had an effect on teaching quality. While the greater economic pressure has driven out some of the bureaucratic lethargy from universities, it seems to have overshot its initial ambitions.

Raising efficiency in regards to teaching resources and increasing the number of publication are general trends despite the more stable public funding of higher education in Continental Europe. The demand for high-level publications combined with employment on temporary bases and the increasing competitiveness on the post-doctoral level creates an environment, in which long-term investments into curricular and pedagogical development seems secondary (Dopheide

ET AL. 2015). But even if teaching is a central concern, the modularisation and formalisation of workload figures have helped in assessing good teaching in terms of efficiency. A career-oriented academic does not only benefit from greater amounts of high-impact publications, but also from greater numbers of students whom he teaches and who evaluate him well. Implicitly, many recent reforms favour teaching formats that cover many students in contrast to supporting more individualised learning formats.

Hence, the shift from qualification to employability and many other parts of the Bologna Process encounter significant rejection by universities. While major parts of the reform package have been implemented, the sheer amount of fundamental changes seem to overstrain the transitional capacity of academia, national policymakers, and employers. Even elements of the reform that have already been implemented structurally are not fully understood and accepted yet. For example, many curricula of bachelor's and master's degrees in Germany are still based upon the curricula of the equivalent former diploma degrees with the effect that studying only the bachelor's or the master's degree is incomplete. A flexible combination is often not possible.

The subdivision of universities into faculties separates bodies of knowledge. As study programmes are in most cases an integral part of the formation of faculties, its curriculum is designed around the capacities of its faculty. Each faculty has developed different ways of thinking and doing, which require time and effort to be connected to each other. It is, hence, no wonder that independent planning degrees were implemented as separate institutionalised disciplines despite the initial intention to shape interdisciplinary programmes (as discussed in section 1.2.1).

3.4.2 Urban Development as a Key Field of Policy

Urban development is affected by two contrary changes in practice: firstly, an increased interest in urban development as a key field of local policymaking, and secondly, a shift of power from public administration to various public and private stakeholders (GILLIARD & THIERSTEIN 2016). This becomes particularly visible by looking at two figures. While the number of higher education programmes in urban development has risen rapidly in the last 20 years (FRANK & KURTH 2010), the share of planning graduates employed in public administration has decreased (see section 5.4.1).

Planners as well as other experts in urban development work primarily in four fields, today: public administration, private development, consultancies that provide services

to both the public and the private sector, and academia. The last one is not of particular interest for this research. Public administration and consultancies have both specialised as well as interdisciplinary structures. A transport department is a sectoral department concerned with the issues of transportation. The planning department has the task to integrate concerning itself with transportation and all other matters relevant to urban development. Consultancies can fall within the same categories. Private development has mostly an integrated perspective, but from the point of view of an individual company and its interest.

Urban development is the most important area in which local governments and communities can innovate to resolve environmental, social, and economic challenges.

The work of all three forms of organisation is linked territorially as well as relationally. Public administration is theoretically in the most powerful position as it can effectively block all development based on its legal instruments. However, it is often incapable of initiating development without private investment. The attraction of private capital is, hence, often the goal of governments. The location of firms, for instance, provides jobs and increases direct and indirect tax income which can be in turn invested in public infrastructure and services. In order to attract firms, the literature on the knowledge economy (Florida 2003) identifies talent as a key factor of attraction. The influence of local government on educational policy and conditions is, however, limited. The local government's biggest asset in attracting private capital is land.

Plan and urban policymaking are key tasks of municipalities. Steering urban development can, thereby, be a decisive factor in increasing inter-city competitiveness (Danielzyk 2008). Due to the enormous importance of cities for national and local economies, effective urban governance structures, including effective urban planning policies have become an important part of the international debate on sustainable development (UN 2017). Countries such as Germany where the right to self-government of municipalities is constitutionally guaranteed serve as a blueprint for the reorganisation of countries with centralised governance structures.

Urban development is, hence, a key field of intervention for the local government to attract private capital. Private firms have, however, also identified the spatial environment as a key field of investment in order to increase their own productivity. While the optimisation of logistical processes is of importance to industrial processes, knowledge-intensive economies look for urban environments that foster informal interaction. Urban design has put the quality of public spaces and interface of public and private space to the fore. Large-scale campuses of private companies and privatised commercial spaces document the growing interest in land as a resource of capital formation.

These circumstances seem ideal for innovative urban development practices. Public administration is, however, less capable of utilising land as a strategic resource. The lack of staff in public administration based on a policy that allocates a minor role to state intervention and a major role to market forces - especially in the UK - is hereby a decisive factor (see section 5.4). Urban design and private interest in investing in urban qualities is a sign of compensation. The power of steering urban development has shifted from public administration to various public and private stakeholders. Cities are not the product of public planning, but the result of processes of co-creation (see section 1.2.2). Socio-technical innovation is, therefore, not the outcome of a singular planning department, but of the interplay of multiple actors. Lead-practitioners work, hence, in three levels of environments. The organisational ecosystem describes the internal structure of a firm or institution. The territorial ecosystem describes the regime of policies within the locality of practice. And, the relational ecosystem describes work cooperation beyond the geographic context. One of those cooperations is via the professional body, which has a stabilising effect on education as already discussed. It is the professional body's task to protect the interest of its members, which are often of monetary nature. Keeping up regulations that limit the number of people who can offer a service that the professional body's members offer is an essential tool. Besides monetary interests, a thematic exchange is also facilitated. We can, however, observe that the amount of networks facilitating exchange has grown significantly. It is, for instance, not only the RTPI that links academia to practice in the UK but also other organisations such as the Town and Country Planning Association (TCPA), the Urban Design Group, or the Academy of Urbanism. Regulatory power is not required for shaping thematic interests.

Local governments are not able to activate the innovative potential of urban development due to the co-creative nature of urban development processes.

3.5 Hypothesis

The impact model provides an analytical base for the empirical work. A series of hypotheses are derived from the underlying literature. These specify the primary hypotheses (introduced in section 1.3):

(H1) *Socio-technical innovation for the development of cities and regions originates not only from the interplay of knowledge of various spatially relevant disciplines, but also from the collaboration of experts of those disciplines.*

While not explicitly stated, the hypothesis is a generalised version of the assumption that all-round planners do not have enough in-depth knowledge of the relevant fields. Hence, disciplinary experts are required. The second and third hypotheses specify this argument further. I assume that urban planners base their work on concepts that they studied beforehand. These concepts are contingent, which means that they are inapplicable for the transfer from one to another project. The collaboration of disciplinary experts starts in contrast with the relevant factual knowledge, and therefore, has a larger potential to produce innovative ideas.

Urban planning is largely based upon contingent conceptual knowledge, which leads to a normative reproduction of existing concepts. **H2**

Only the collaboration of disciplinary experts provides access to powerful knowledge in all spatially relevant disciplines, which in turn is necessary for socio-technical innovation. **H3**

The process perspective supports the argument further. While knowledge in urban development is of interdisciplinary nature, urban planning is set up to be an own independent discipline. Hence, the institutionalisation of urban planning as a community seems an obstacle to socio-technical innovation that appears along boundaries. Instead, higher education should focus on interdisciplinarity to capture the potentially innovative learnings, which are the result of interaction across disciplinary boundaries.

The institutionalisation of urban planning as a boundary discipline dealing with urban development hinders the collaboration of disciplinary expert. **H4**

Refocussing higher education on boundaries is necessary to capture the innovative potential that lies in the collaboration of different disciplines. **H5**

The last hypothesis look at the institutional aspects of transforming the educational system towards a more collaborative conception of urban development. The shift from qualification- to employability-based policy is understood as a chance because the notion of qualification is closely linked to the one of a specific discipline and respective profession,

while employability allows more flexible competency profiles. The literature review shows, however, that institutional adaptation requires additional reforms.

H6 *The implementation of educational programmes that fulfil the requirements of H1 needs the full implementation of employability-based educational and labour market policy.*

The Innovation Ecosystem of Academia 4

Empirical Method 4.1

This chapter is the first empirical part of the research looking at education from a supply perspective. The empirical work is largely based upon a curricular analysis of 28 programmes in urban development and is complemented by a pedagogical analysis of project-based learning, and results of a separate study focussing on the institutional set-up of programmes. The chapter takes a closer look at some of the assumptions that underlay the impact model.

Pre-study and the Selection of Programmes 4.1.1

The empirical base for analysing the knowledge perspective of education for urban development consists of a curricular analysis of 28 programmes in the fields of urban planning, architecture, and geography. The selection of the 28 programmes is the result of a comprehensive pre-study of all study programmes in Germany, Austria, Switzerland, the United Kingdom and Ireland that are relevant to urban development.

The selection process started with a systematic search for master's programmes relevant to urban development. The master's level is a suitable starting point as it marks the usual endpoint of tertiary education. Most professionals in urban development do not just hold a bachelor's degree. Based on the selection of master's degrees, relevant bachelor's degrees were identified.

National Databases of Study Programmes in Higher Education Table 6

Country	Website
Germany	hochschulkompass.de
Austria	studienwahl.at
Switzerland	uni-programme.ch
United Kingdom	educationuk.org
Ireland	educationinireland.com

I used publicly available national online databases for searching for study programmes (see Table 6). The government agencies responsible for higher education of the respective country run or sponsor those websites. In each database, I run a series of queries. Every query consisted of two terms: a spatial and an activity descriptor (see Table 7). Additionally, I searched for compound words such as 'urbanism', 'urbanistics', and 'städtebau' in both German and English. I used English search terms on all websites and German terms only on the websites for Germany, Austria and Switzerland (DACH-countries). Italian and French were not used on the Swiss database, because I focussed on German- and English-language programmes for practical reasons. The search resulted in 46 postgraduate master's programmes in Germany, 5 in Austria, 1 in Switzerland, 157 in the United Kingdom, and 12 in Ireland.

Table 7

Activity Denominators	DACH	UK/IRE
Development	19%	19%
Planning	42%	61%
Design	21%	29%
Studies	21%	9%
-ism	12%	4%
Others	14%	17%

+

Spatial Denominator	DACH	UK/IRE
Spatial	23%	17%
Territorial	2%	-
Regional	27%	14%
Metropolitan	2%	-
Urban	69%	71%
Town	-	7%
Community	-	2%
Rural	2%	2%

Naming Conventions of Study Programmes in Urban Development
(Own Graphic)

Naming conventions within and across countries differ significantly. 71% of all programmes use variations of the term 'urban' as a spatial reference. Programmes in the DACH-countries tend to refer more frequently to the terms 'spatial' and 'regional'. British and Irish programmes refer to 'town' and 'rural', which is uncommon in the DACH-countries.

'Planning' is the primary term to describe the associated activity in both English- (61%) and German-speaking countries (42%) – followed by 'design' (29%) and 'development' (19%) in the UK and Ireland, as well as 'studies' (21%), 'design' (21%), and 'development' (19%) in Germany, Austria, and Switzerland. Furthermore, around 12% of the German-language programmes use terms ending on '-ism' or '-istics', but only 4% in the UK and Ireland.

Table 8

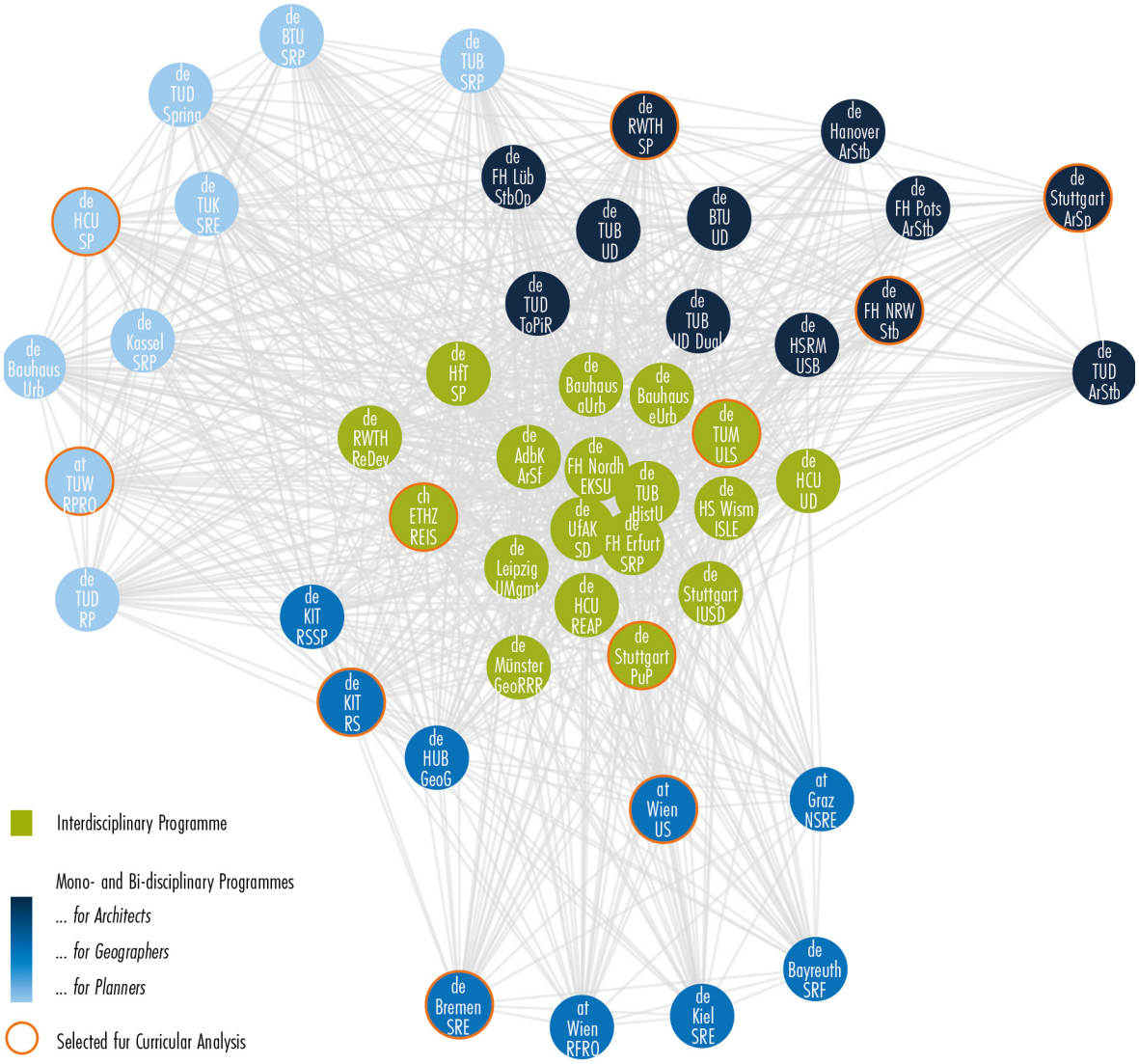
Research into planning education suggests that there are three different disciplinary approaches (Marcuse 2011; Frank et al. 2014): planning education that is based in the social sciences, planning education based in the wider field of engineering (including architecture), and planning education as an independent discipline. For the purpose of differentiating those approaches, I categorised each programme based on the subjects of the bachelor's degrees that allow admission. The most common undergraduate degrees that universities expect students to obtain prior applying for one of these master's degrees are planning, architecture, and geography (see Table 8).

Number of Master's Programmes in DACH-countries Accepting Students with the Following Degrees

Undergraduate Degree	Count
Planning	32
Architecture	25
Geography	24
Landscape Design or Planning	16
Urban Design	16
Environmental Engineering	12
Civil Engineering	11
Sociology	10
Economics	9
Law	6

Using the required bachelor's degrees as a basis for a network analysis supports the existence of the three education approaches. Fig. 16 shows the 52 master's programmes of the DACH-countries. Each node of the graph represents one programme. The edges represent the number of undergraduate disciplines that allow admission to both connected programmes. The closer nodes are together, the more undergraduate disciplines that allow admission they share. Programmes that admit students from various backgrounds are in the middle of the graph. Programmes that are consecutive to only one undergraduate discipline are at the edge of the graph.

(Own Graphic) Network of Master's Programmes in Germany, Austria, Switzerland Fig. 16



There are three traditions of education for urban development: urban development as planning, via architecture, and via geography. A fourth interdisciplinary pathway into urban development emerged as part of recent educational diversitfication.

Dark blue nodes represent programmes that primarily require a bachelor's degree in architecture, mid-blue geography, and light blue planning. Some programmes that are open to architects are also open to landscape architects and (civil or environmental) engineers. Some programmes that admit geographers also admit students with other degrees in the social sciences, such as sociology or economics. Nodes that sit right at the transition from one shade of blue to another admit students from both disciplinary backgrounds. While there are interdisciplinary programmes in the field of urban development for the combinations of planners and geographers as well as planners and architects, there are no such programmes for the combination of architects and geographers. Green nodes represent programmes that admit students from all three fields. The three traditions of planning education become clearly

visible from this analysis. However, a fourth, interdisciplinary approach (here: in green) appears to be quantitative as relevant as the others - at least considering the number of programmes.

Fig. 17

Network of Master's Programmes in the United Kingdom and Ireland
(Own Graphic)

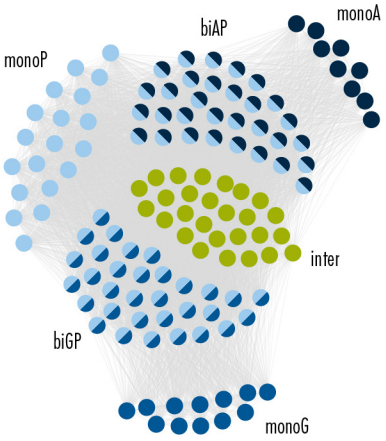


Fig. 17 is based upon a simplified, analytical approach. Admission requirements in the UK and Ireland are generally less strict regarding the discipline of the undergraduate degree. Students can more easily change their subject from under- to postgraduate studies. By just taking the three most common undergraduate degrees - planning, geography, and architecture - into account, the graph becomes visibly more clear. There are six distinct forms of degrees: 'mono'-disciplinary programmes taking in just students from one discipline, 'bi'-disciplinary programmes taking students from two fields of study, and programmes that could be regarded as fully interdisciplinary.

It is important to keep in mind that Fig. 17 does not consider all undergraduate degrees, e.g. no landscape architecture. Many degrees that appear to be 'mono'-disciplinary may be open to students with more than one disciplinary background. A programme could, for instance, be open to architects and landscape architects and would still appear to be 'mono'-disciplinary. Regarding 'bi'-disciplinary degrees, again those degrees can take in students from more than two disciplinary backgrounds, but only from two of the list of planning, geography, and architecture. It must be pointed out that there are no degrees open for architects and geographers that are not open to planners. Despite that, there are degrees which are advertised as conversion programmes. Universities design those curricula in such a way that people with any undergraduate degree other than planning can acquire the competencies for statutory planning practice and become chartered planners. Planners are admitted to those programmes, too. This may be an option that attracts foreign students aiming at formal accreditation in the UK. The analysis treats these conversion degrees as a group separate from other interdisciplinary degrees.

A total number of 28 programmes have been selected for a curricular analysis to understand the differences between the types of postgraduate degrees in urban development. The selection has been made in a way that each category consists of English- and German-language programmes. The selection is not intended to be representative for all degrees, but its scope allows in contrast to studying individual cases the identification of patterns. Table 9 shows the full list of analysed programmes. The public availability of module descriptions limited the number of programmes suitable for evaluation significantly. Nine undergraduate degrees in

List of Analysed Study Programmes

Table 9

No	Degree	Programme Title	University	Department
Bachelor's Programmes in (Urban) Planning				
deHCUplan	BSc	Urban Planning	HafenCity University Hamburg	*not applicable / no departmental structures*
atTUWplan	BSc	Spatial Planning	Vienna University of Technology (TU Wien)	Department of Architecture and Planning
ieUCDplan	BA	Planning, Geography, and Environment	University College Dublin	School of Architecture, Planning, and Environmental Policy
Bachelor's Programmes in Geography				
deGUFgeog	BA/BSc	Geography	University of Frankfurt	Department of Geoscience and Geography
ukCFgeog	BSc	Geography (Human) and Planning	Cardiff University	School of Geography and Planning
atVIEgeog	BA/BSc	Geography	University of Vienna	Department of Geoscience, Geography, and Astronomy
Bachelor's Programmes in Architecture				
chETHZarch	BSc	Architecture	Swiss Federal Institute of Technology (ETH)	Department of Architecture
deTUDarch	BSc	Architecture and Urban Design	TU Dortmund University	Department of Architecture and Civil Engineering
ukCFarch	BSc	Architecture	Cardiff University	Welsh School of Architecture
Master's Programmes for Planners				
deHCUmonoP	MSc	Urban Planning	HafenCity University Hamburg	*not applicable / no departmental structures*
atTUWmonoP	MSc	Spatial Planning	Vienna University of Technology (TU Wien)	Department of Architecture and Planning
ukLIVmonoP	MCD	Town and Regional Planning	University of Liverpool	Department of Geography and Planning
Master's Programmes for Geographers				
deBREmonoG	MA	Urban and Regional Development	University of Bremen	Department of Social Science, Institute of Geography
atVIEmonoG	MA	Urban Studies	University of Vienna	Department of Geoscience, Geography, and Astronomy
ukGLAmonoG	MSc	City and Regional Planning	Glasgow University	School of Social and Political Sciences
Master's Programmes for Architects				
deNRWmonoA	MSc	Urban Design NRW	Universities of Applied Sciences in NRW	
deSTGmonoA	MSc	Architecture und Urban Planning	University of Stuttgart	Department of Architecture and Planning
ukEDImonoA	MSc	Architectural and Urban Design	University of Edinburgh	School of Architecture and Landscape Architecture
Interdisciplinary Master's Programmes for Planners and Geographers				
deKITbiGP	MSc	Regional Sciences	Karlsruhe Institute of Technology	Department of Civil Engineering, Geo- and Environmental Sc.
ukNCLbiGP	MSc	Regional Development and Spatial Planning	Newcastle University	*Jointly run by geography and architecture departments*
Interdisciplinary Master's Programmes for Planners and Architects				
deRWTHbiAP	MSc	Urban Planning	RWTH Aachen University	Department of Architecture
ukCFbiAP	MA	Urban Design	Cardiff University	*Jointly run by geography and architecture departments*
Total Conversion Master's Programmes				
ukCFbiAG	MSc	Spatial Planning and Development	Cardiff University	School of Geography and Planning
ukNCLbiAG	MSc	Town Planning	Newcastle University	School of Architecture, Planning and Landscape
Interdisciplinary Master's Programmes for Planners, Geographers, and Architects				
chETHZinter	MSc	Spatial Develop. and Infrastructure Systems	Swiss Federal Institute of Technology (ETH)	Department of Construction, Environment, and Geomatik
deTUMinter	MSc	Urbanism - Landscape and City	Technical University of Munich (TUM)	Department of Architecture
deSTGinter	MSc	Planning and Participation	University of Stuttgart	*Jointly run by departm. of architecture, geography, and law*
ukLSEinter	MSc	City Design and Social Science	London School of Economics	Department of Sociology

planning, geography, and architecture have been included to understand how bachelor's and master's education are built upon each other consecutively.

The following section discusses the intended learning outcomes of all analysed programmes. The analysis makes use of European standardisation due to the Bologna reform. The codebook is applied to learning outcomes in terms of professional competencies. Each learning outcome is coded according to the cognitive level from one to six, and according to the construct of knowledge. The weight of a learning outcome is defined by the workload achieving it. The workload of each module given in ECTS CP has been divided by the number of learning outcomes of the respective module. As a result, there is a spreadsheet like the codebook for each programme that allocates the CP-workload to all category combination. It is important to highlight that this form of analysis assesses the stated learning objectives (cf. Bergmanns et al. 2015). The more up-to-date and the more precise module descriptions are, the better the results reflect the actual teaching of the analysed programme.

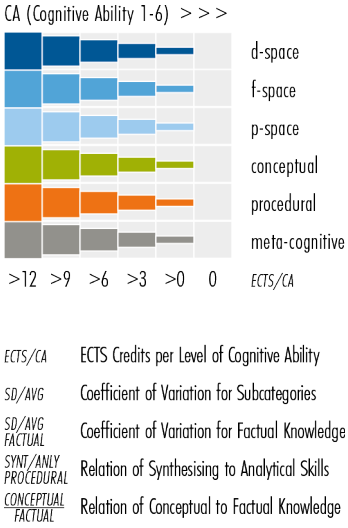
4.1.2 Method of Evaluation

Fig. 18

The data is presented aggregated for entire programmes, combinations of programmes, or as an average of multiple programmes of the same category. I developed a standardised graph and a couple of standardised indicators. Fig. 18 illustrates how to read these competency profiles. The graph is based on a 6x6 grid. Each row represents a category of knowledge. Each column represents the cognitive levels from one to six. If a graduate of a programme reaches the competency to analyse urban concepts, the fourth square of the fourth row is marked. Because educational theory assumes that analysing requires the abilities of remembering, understanding, and applying, all squares left it are also marked.

The wider these blocks are; the more workload students spend on achieving these learning outcomes. If no previous course has taught lower levels of cognitive ability regarding conceptual knowledge, the workload is spread equally on all cognitive levels. Including both cognitive abilities and workload allows assessing the discrepancies between intended and realistically achievable learning outcomes. For example, reaching the ability to create urban concepts in one course without any previous knowledge in the respective field is rather ambitious. Whether or not the workload is adequate, can be assessed by looking at the indicator 'workload per cognitive ability' (ECTS/CA).

Legend to Competency Profiles
(Own Graphic)



Because urban development is a cross-cutting practice, the disciplinary breadth of a programme is of interest. Urban planning has been designed with interdisciplinarity in mind. Two coefficients of variation (SD/AVG) indicate whether programmes balance different categories of factual knowledge and respective subcategories within. A coefficient of variation is the standard deviation divided by the average expected value. This indicator is comparable regardless of absolute size. The higher the indicator, the more specialised programmes are.

Regarding procedural knowledge, the relation of synthesising to analytical knowledge (SYNT/ANLY) seems adequate as an indicator for differentiating abilities of problem finding and problem-solving.

The last indicator describes the innovative capacity of conceptual knowledge. The capacity is not based upon the quantity of conceptual knowledge but the amount of factual knowledge in relation to conceptual knowledge (FACTUAL/CONCEPTUAL). Having almost no competency in factual knowledge but great amounts in regard to conceptual knowledge can mean that programmes are rather norm-based than evidence-based. Innovative capacity is given by concepts that rely on the latest factual knowledge from all respective fields. However, the indicator is flawed as it incorporates the total amount of factual knowledge of all fields in comparison to conceptual knowledge. A course may only have a relatively small amount of factual knowledge but concentrated in one field. A student of such course can have innovative capacity if he works in collaboration with students of other disciplines. The indicator may, however, suggest that the programme is highly normative.

The following section splits into four parts: firstly, the analysis of bachelor's degrees, secondly, the analysis of planning-based master's degrees, thirdly, the analysis of architecture- or geography-based master's degrees, and lastly, the analysis of interdisciplinary degrees.

4.2 Diversification of Educational Pathways

4.2.1 The Relevance of Bachelor's Degrees

The focus of the empirical research are master's degrees and their combination with bachelor's degrees. The focus is based upon the assumption that the complexity and the interdisciplinarity of urban development require extensive education. This corresponds to common opinions in academia and the usual requirements of professional bodies in urban planning (see section 3.4.1). Nonetheless, bachelor's degrees need to be considered. Firstly, bachelor's degrees are responsible for most workload students undergo, even if the student continues to study on the master's level. Secondly, educational policy demands bachelor's degrees to prepare for employment also as a stand-alone. And thirdly, bachelor's degrees are an admission requirement for master's programmes.

Architecture, geography, and planning do not correspond to d-, f-, and p-space knowledge.

Given the three disciplinary approaches to planning education – planning as engineering, planning as social science, and planning as an independent discipline (see section 4.1.1) – and given the three disciplinary branches of spatial knowledge: d-space, f-space, and p-space (see section 3.3.1) – it is easy to assume that each educational approach represents one branch of spatial knowledge. The analysis shows, however, that this is not the case. Fig. 19 illustrates the distribution of CP on the relevant parts of knowledge defined in the codebook (see Table 3). More than 80% of factual knowledge in architectural degrees is d-space knowledge. Planning and geography degrees have a more balanced distribution of all three categories of factual knowledge. While the coefficient of variation for factual knowledge is between 0.12 and 0.56 for all planning and geography programmes, it is on average 1.11 for all architectural programmes (see Fig. 20).

Fig. 19 Distribution of Knowledge Categories in Bachelor's Programmes (Own Graphic)

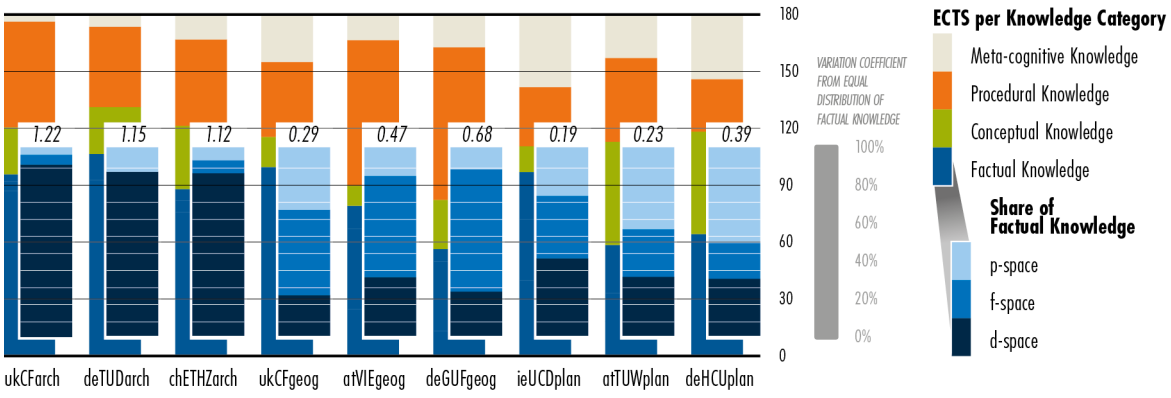


Fig. 19 also illustrates that the selected bachelor's degrees in planning and geography in the UK and Ireland differ from those in Germany and Austria. The British and Irish degrees put a much higher emphasis on basic factual knowledge. Both degrees are therefore discussed separately.

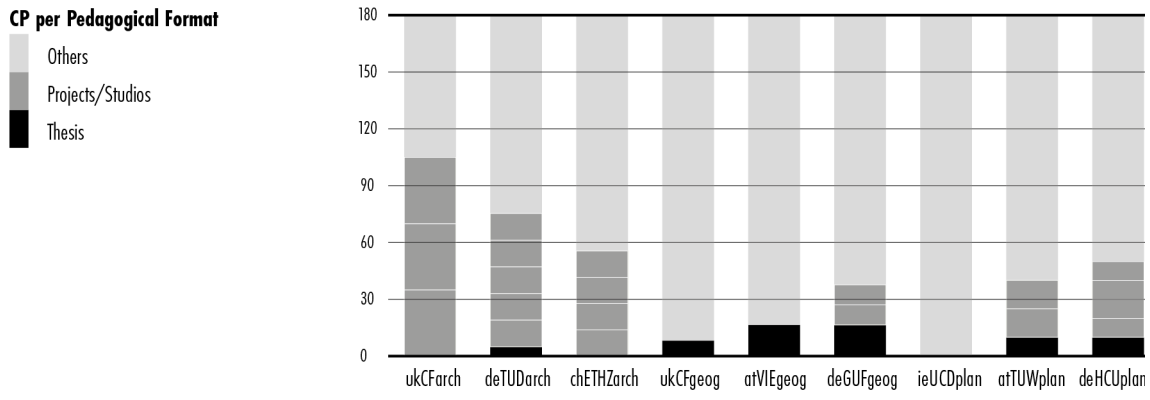
Architecture is specialised on architectural d-space knowledge.

The three analysed bachelor's programmes in architecture show a clear pattern. The majority of CP is spent on imparting knowledge about the physical attributes of the built environment. Thereby, students reach the ability to create and design buildings and structures. 13.8 CP per cognitive level is the highest value illustrating the high degree of specialisation (see Fig. 27). In addition, the high coefficient of variation for d-space knowledge illustrates that architects are furthermore just focused on buildings largely omitting open space or infrastructural design. An internal analysis of bachelor's degrees at the Technical University of Munich (TUM) shows that landscape architecture degrees are similarly specialised focussing on open spaces omitting buildings (Gilliard 2017). Other basic disciplinary knowledge plays almost no role in architecture, supporting the typical preconception that architects are completely focussed on constructive and aesthetic features. Methodologically, architectural graduates do not lack analytical skills as some might assume. The procedural knowledge is balanced between analytical, synthesising, and communicative skills. The teaching of meta-cognitive knowledge varies from university to university largely.

All three programmes of architecture put an emphasis on issues of urban development in the form of urban design studios. The quota of conceptual knowledge to factual knowledge is low in comparison to planning degrees, which means that urban design concepts may not be primarily based on normative ideals but on architectural knowledge. On the other hand, the low variation of factual knowledge shows the limited scope of architecture-based urban design. Architects

(Own Graphic)

Distribution of Pedagogical Formats in Bachelor's Programmes Fig. 20



have only access to powerful knowledge (PK) in the field of architecture, and hence, limited capacity for socio-technical innovation alone.

Geography is mostly analytical, while planning and architecture are design-oriented.

The two analysed bachelor's degrees in geography with a specialisation on human geography in Germany, and Austria put a strong emphasis on procedural knowledge. Fig. 20 illustrates that analytical skills are the core of the curriculum. 12.8 CP per cognitive level for procedural knowledge is comparable to both architectural and planning degrees (see Fig. 24). Geography students, however, are the only students reaching cognitive level 6, which means that they are able to develop new analytical techniques. Communications skills are, however, only marginally represented. Synthesising skills are absent. This goes hand in hand with the minor role of conceptual knowledge. Despite the ambitious learning outcome, geographers are not prepared for developing their own urban concept (see Fig. 24: 3.2 CP per cognitive level for conceptual knowledge).

The graduate's ability to evaluate d- and p-space knowledge and create f-space knowledge is also questionable. 1.8 to 6.6 ECTS per cognitive level reveals a low workload to achieve these learning outcomes. Geographers have gaps in knowledge regarding p- and d-space knowledge. Good graduates will most likely be able to evaluate economic, social, and ecological issues better than graduates from any other field, but physical qualities and an understanding of how cities are planned are largely absent.

Despite the focus on f-space factual knowledge, geography graduates are still rather all-rounders than specialists giving them limited access to PK. Bachelor's graduates in geography are probably the least prepared for urban development practice, which practice has also recognised. Geographers, who want to work in urban development, are usually required to have additional qualifications.

Geography and planning are generalist nature covering all kinds of factual knowledge.

Despite the large variety of names for planning degrees, the analysis shows that there is a relatively stable core of learning outcomes in the curricula of German and Austrian universities. The module descriptions also provide a more realistic impression of the cognitive level that graduates reach than in geography. Methodologically, planning students have obtained both analytical and conceptual skills as well as communicative abilities. Meta-cognitive knowledge plays a crucial role both in the form of theory courses and courses of general studies. Planners receive insight into all disciplinary aspects of spatial knowledge with a slight tendency towards d- and p-space-knowledge. Planning graduates mostly understand

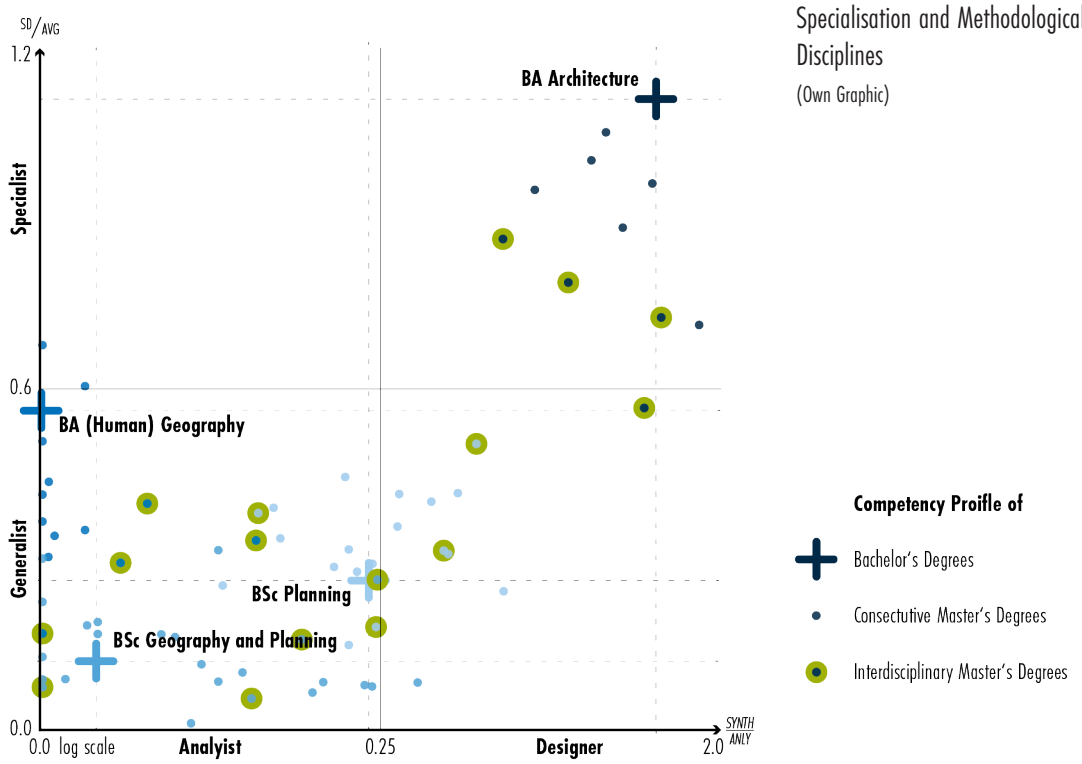
the basics of all spatially relevant fields but are barely able to apply them, yet critically reflect upon them. Planners focus instead on interdisciplinary conceptual knowledge which is taught in study projects throughout the programme (see Fig. 25). The quota of conceptual knowledge to factual knowledge is 0.85 – the highest of all analysed bachelor's degrees.

Bachelor's graduates in planning seem to be the best-prepared graduates for urban development practice. However, planning graduates have no access to PK, and thereby, no capacity for developing actual socio-technical innovation. Urban concepts of planners are largely based on previous conceptual knowledge. It is therefore not surprising that Healey (2012) observes that urban concepts are reproduced and travel across the globe.

The two analysed planning and geography degrees in the UK and Ireland are both similar, and therefore, regarded as a single separate group of degrees. Both degrees favour basic disciplinary knowledge over conceptual and procedural knowledge. This is of particular interest because the focus on factual knowledge is potentially giving access to PK, and thereby, increasing the innovative capacity. 5.8 ECTS per cognitive level or higher shows that graduates are more intensively prepared to apply and critically evaluate disciplinary knowledge than their German or Austrian fellows. The comparison to 13.8 ECTS per cognitive level on d-space knowledge in case of the architectural education shows, however, that an all-round education can only achieve in part the abilities of a mono-disciplinary degree. PK seems still in no reach for British and Irish graduates. In addition, these degrees impart very limited conceptual knowledge.

The presented data shows that previous knowledge of master's students in the field of urban development can be manifold. Fig. 21 locates the bachelor's programmes on a two-dimensional chart. The horizontal axis represents the methodological focus between analytical and synthesising skills. The vertical axis shows the degree of specialisation. Bachelor's programmes in architecture are a highly specialised degree on d-space knowledge with a strong focus on skills of conceptual thinking. Graduates of bachelor's degrees in planning and geography, on the other hand, are generalists, of which geographers focus on analytical methods, and planners obtain both analytical and conceptual skills.

Fig. 21



Specialisation and Methodological Focus of Disciplines
(Own Graphic)

Educational pathways into urban development have rapidly diversified.

While the number and the diversity of educational offers on the bachelor's level relevant to urban development are limited, the master's level has diversified significantly in recent years. Frank & Kurth (2010) observe an increase of consecutive programmes from seven diploma degree before to nine bachelor's and fifteen master's degrees after the Bologna reform. In addition, they identify a plethora of non-consecutive degrees on the master's level, similar to the analysis of this dissertation. However, not only the sheer number of degrees increased but splitting up tertiary education into two cycles allows the combination of bachelor's and master's degrees from different universities, at least within certain admission requirements. Graduates of bachelor's degrees in urban planning enjoy the greatest freedom in choosing master's degrees relevant to urban development. Apart from consecutive planning degrees, students have access to all bi- and interdisciplinary degrees. Geography and architecture are the two most relevant disciplines for urban development practice apart from planning. The following sections discuss the consecutive educational pathways in planning, geography, and architecture before discussing bi- and interdisciplinary programmes.

Selection of Competency Profiles based on a Bachelor's Degree in **Architecture**

(Own Graphics)

Fig. 22

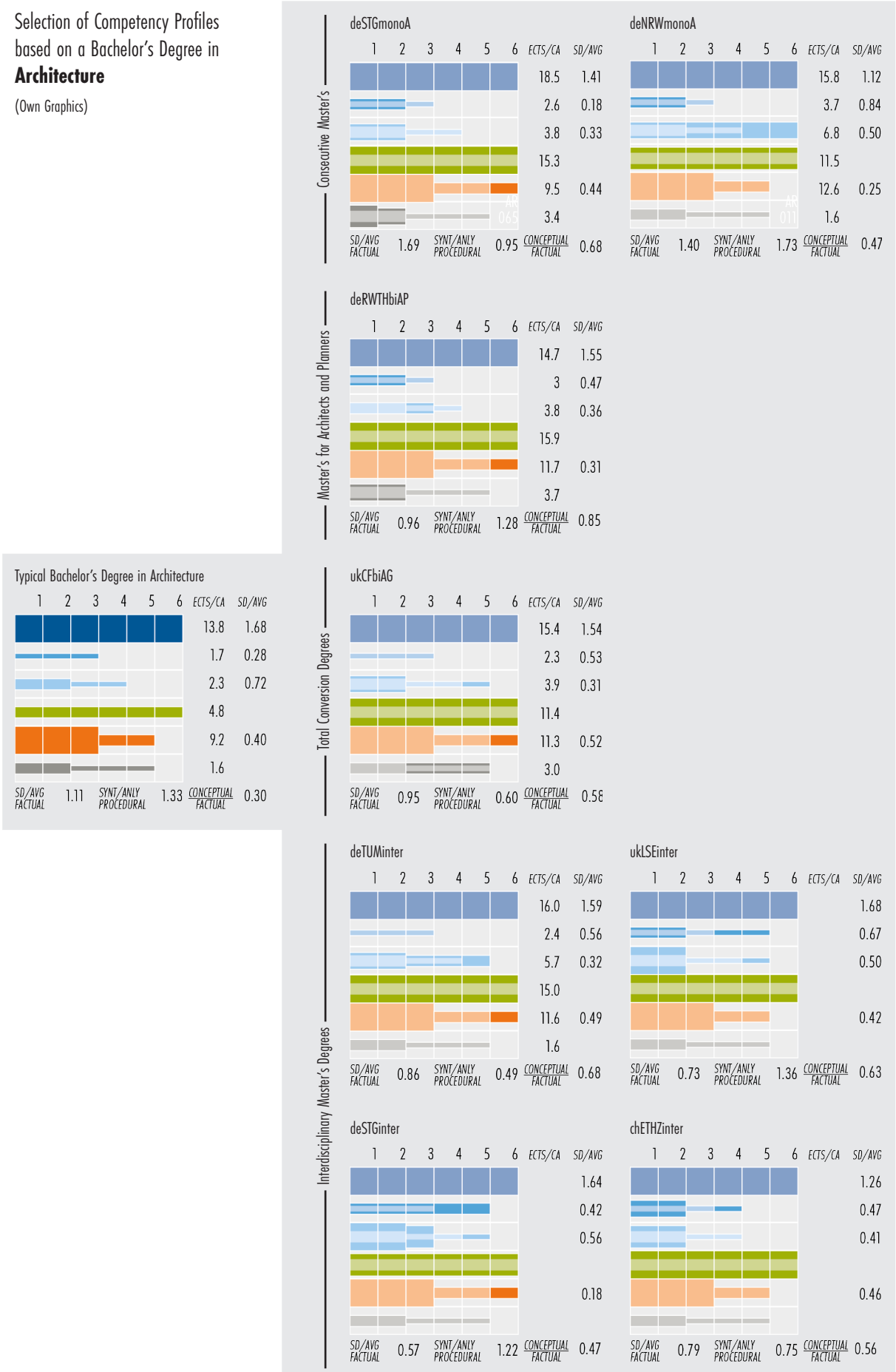
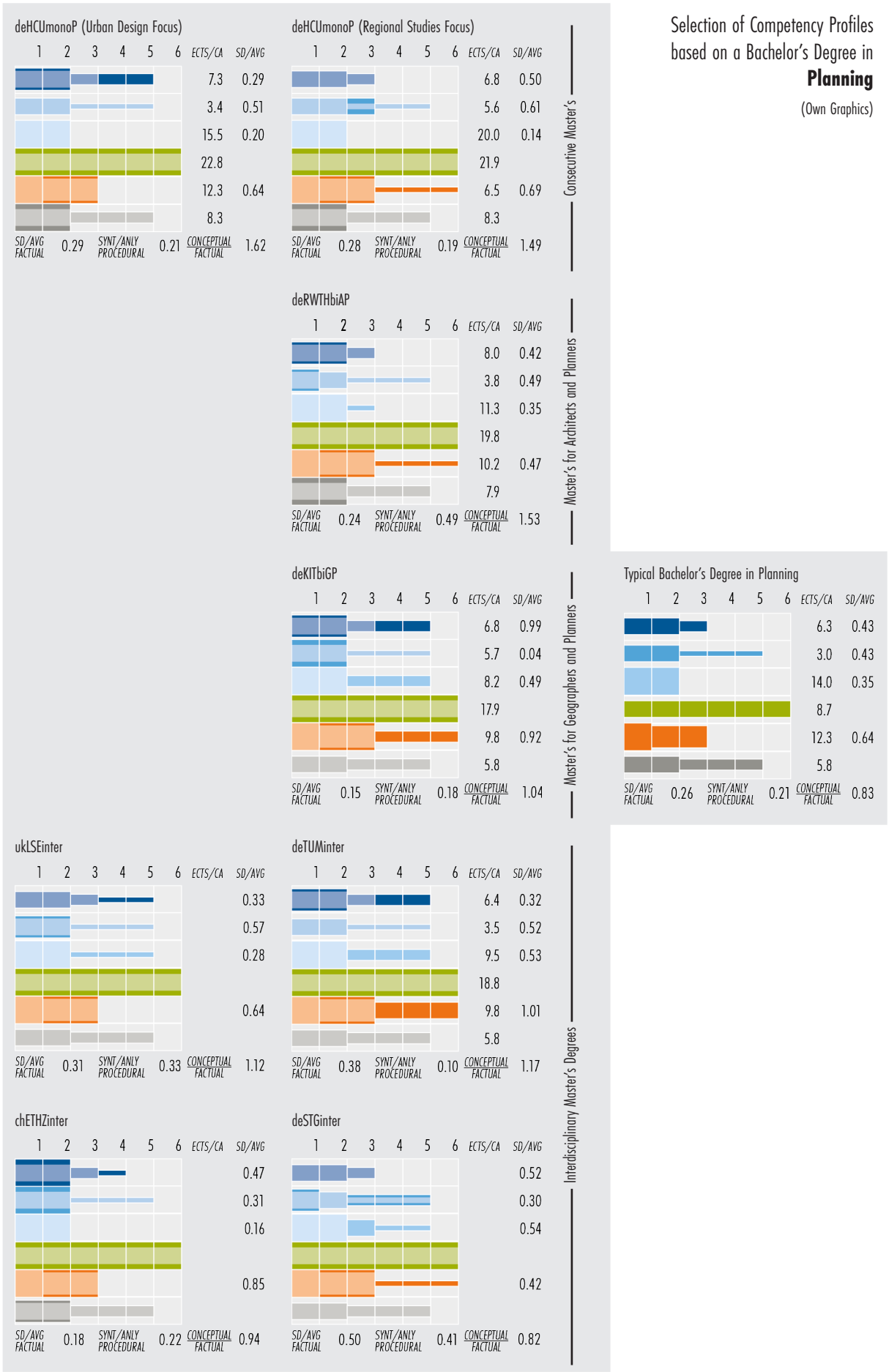


Fig. 23



Selection of Competency Profiles based on a Bachelor's Degree in **Planning**

(Own Graphics)

Selection of Competency Profiles based on a Bachelor's Degree in **(Human) Geography**

(Own Graphics)

Fig. 24

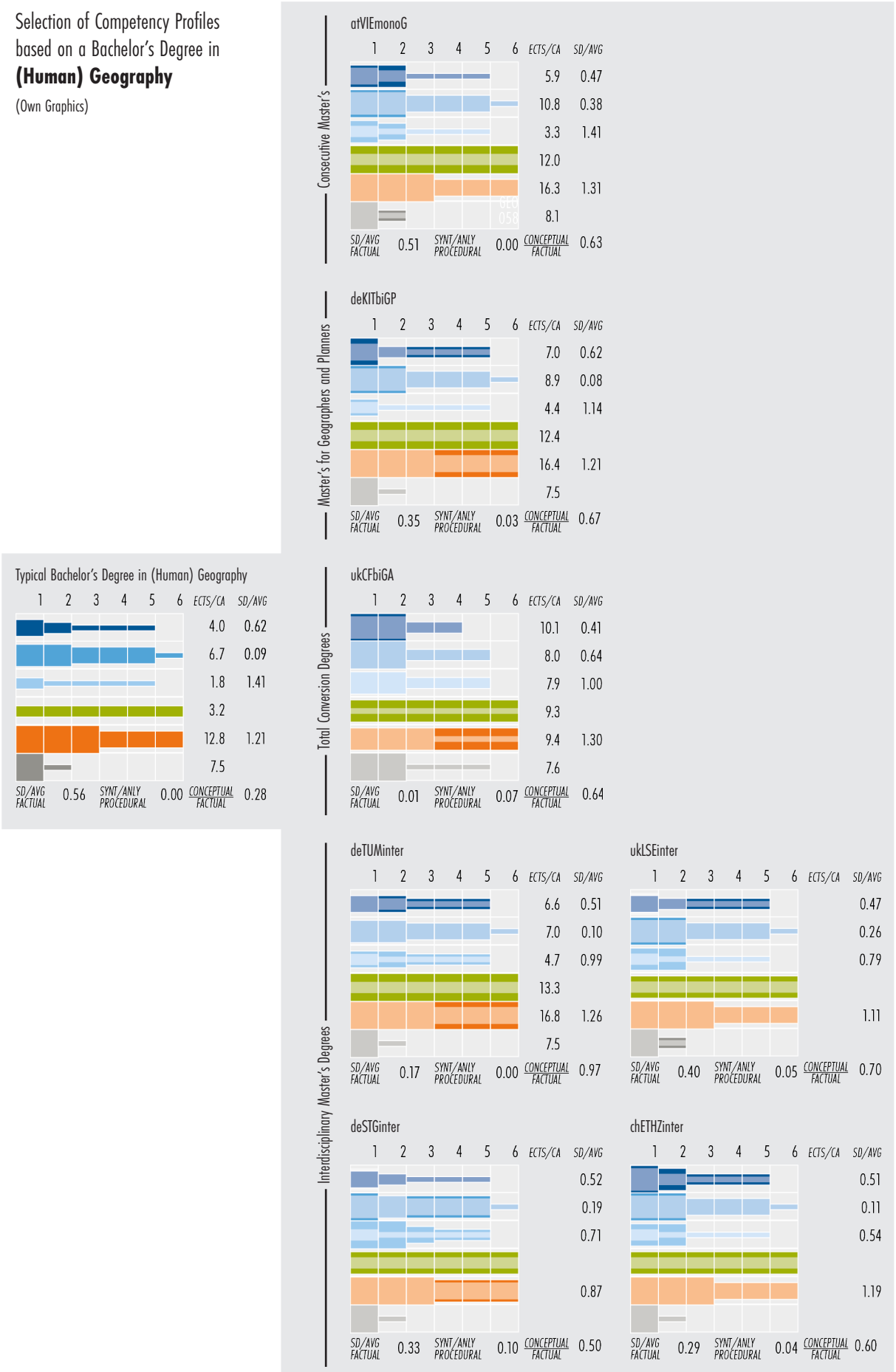
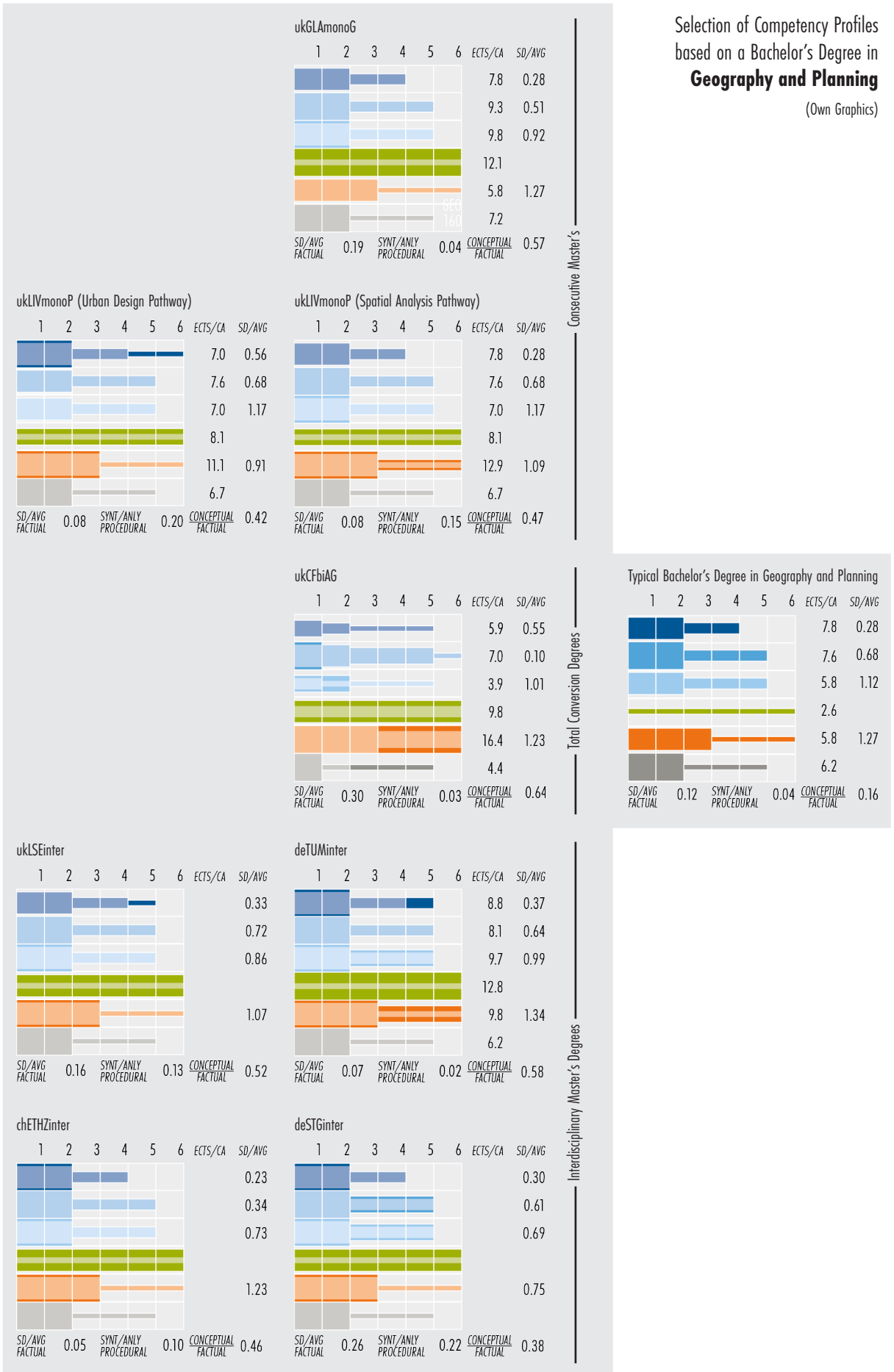


Fig. 25

Selection of Competency Profiles based on a Bachelor's Degree in **Geography and Planning**

(Own Graphics)



Urban planners develop conceptual knowledge based on normativity.

Consecutive master's degrees in planning follow a similar logic as the respective bachelor's degrees. The core of the planning curriculum remains conceptual knowledge. Project courses remain the key pedagogical format accounting for up to 50% of the overall CP workload. The pedagogy is largely based upon the principle of 'practice makes perfect'. Procedural knowledge and meta-cognitive knowledge is deepened, but no higher cognitive ability is achieved. The curricula offer a wide range of different factual knowledge. While on the bachelor's level students are forced to take courses in all areas, master's students can specialise. The competency profiles show two exemplary options, how planners can focus on d-space, and f-space knowledge (see Fig. 23). Master's degrees in planning are basically multiple degrees in one. All options show that the increase in factual knowledge remains insufficient to reach levels of PK. Hence, despite the fact that planning graduates have the most choices of master's degrees, their choice has very limited impact and leads to the same competency profile in principle. Master's graduates in planning lack innovative capacity similarly to their bachelor's peers

This means that planning concepts in practice are based upon either (a) superficial, potentially outdated factual knowledge, (b) values and norms rather than factual knowledge, or (c) the collaboration with other experts. However, collaboration with other experts is not part of most planning degrees. Admission to consecutive planning degrees is mostly limited to graduates of planning bachelor's. Section 4.4 shows that the extent of interdisciplinary cooperation differs greatly from university to university, but even universities that have made interdisciplinarity a part of their key pedagogical concepts - e.g. the HafenCity University (Knieling 2018) - struggle with creating multidisciplinary learning groups.

Thus, I conclude that the low interlinking with other disciplines, the consecutive nature of planning degrees, and the associated disciplinarily homogeneous student cohort reinforce the formation of institutional boundaries around planning, effectively hindering the brokering aspect of planning as a boundary discipline. The core of planning in regards to planning graduates is not the production of factual knowledge but a tradition of conceptual thinking based on normativity.

Apart from consecutive bachelor's and master's programmes in planning, specialised master's degrees on the basis of bachelor's degrees in architecture and geography are the two most relevant pathways into urban development practice.

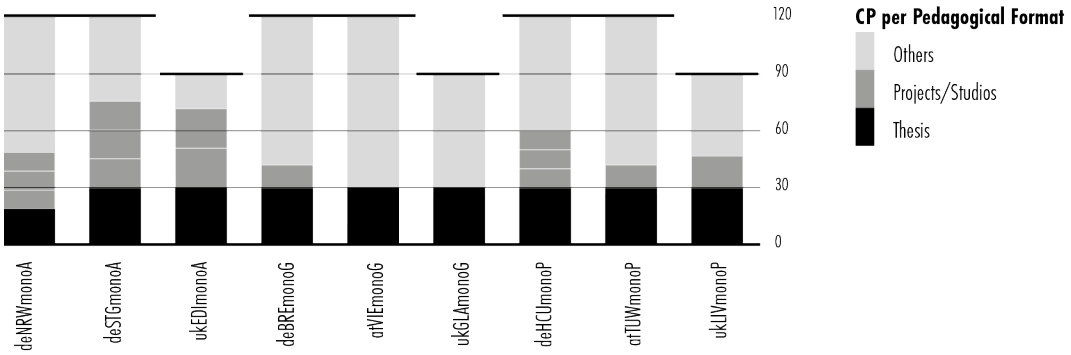
Geographers and architects historically dominated the discourse on urban development before the emergence of independent planning programmes.

Geographers develop urban concepts as a logical consequence of rigerous analysis.

The analysis is based upon master's degrees that are consecutive to bachelor's degrees in geography but are not geography themselves. These are already specialised degrees on the subject of urban development. In contrast to both planning and architecture, geography is not based upon an engineering tradition. Instead, geography as a social science concentrates on studying and analysing the city. This becomes especially apparent when looking at the relation of synthesising knowledge to analytical knowledge. Neither bachelor's graduates nor graduates of consecutive specialised master's degrees have any substantial training in using methods of synthesis.

The competency profile of a master's graduate in urban studies holding a bachelor's degree in geography states, however, the ability to develop conceptual knowledge. On first glance, this appears to be contradictory. A graduate shall be able to develop a concept without the ability to synthesise. Rationalist and communicative planning theory are both based upon the assumption that there is an objective or inter-subjective ideal future (see section 1.2.1). Hence, developing a plan for the future is the result of analysis and communication. As long as a geographer analyses the issues of urban development sufficiently enough and spends enough time to identify the needs, interests, and views of stakeholders, his analysis provides the ideal answers to the development issues on hand. Complexity theory discards this assumption arguing that there are indeed multiple possible futures (see section 1.2.2). Developing urban concepts is not just based on rigorous analysis but is also the result of weighing up interests and needs (Batty 1979).

Fig. 26 Distribution of Pedagogical Formats in Consecutive Master's Programmes (Own Graphic)



The methodological focus of geography-based degrees is also represented by the pedagogical format. While planning and architecture degrees include project-based learning as the primary format, geography degrees consist of lectures, seminars and excursions (see Fig. 26). While seminars can include project-like exercises, seminars are of lower workload, and hence require greater pedagogical guidance. Section 4.4 discusses the unique features of project-based learning in greater detail. As a result, geographers have well established methodological competencies in analysing, but very limited abilities in translating analytical results into development options. In regard to factual knowledge, geography and planning share a similar thematic breadth, a kind of 'innerdisciplinary interdisciplinarity' (Frey et al. 1995). The master's degrees cannot compensate for the limited specialisation and depth of bachelor's degrees in geography. Geographers remain without access to PK like planners. In regard to procedural knowledge, geographers have the potential to develop new analytical methods, which in itself may be powerful.

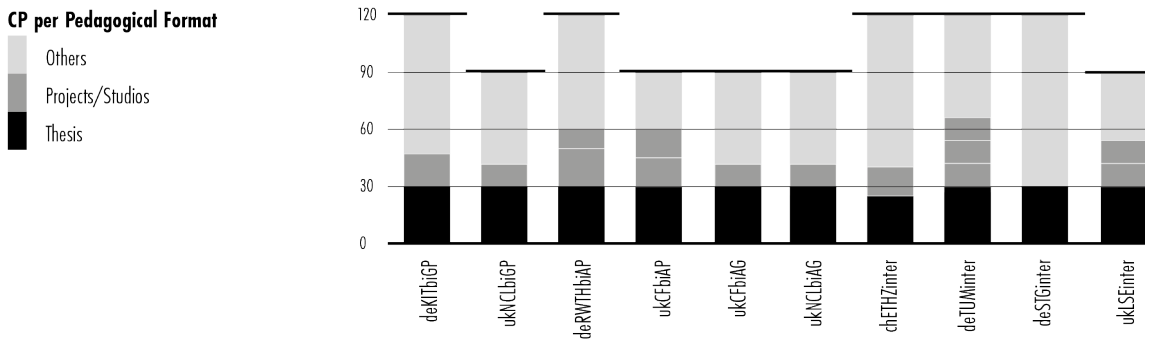
Architects develop urban concepts as the sum of buildings, blocks, and open spaces.

Architecture has also always been concerned with the development of cities. In simplified architectural terms, cities are the sum of all buildings and the spaces between them. The second aspect holds true if you include landscape architecture. This d-space-centred perspective on cities is still dominant in today's architecture and urban design discourse (e.g. Höing et al. 2014). Architects are experts of the physical built environment. Master's graduates are in this respect no different to their bachelor's counterparts. Fig. 22 shows two exemplary programmes that are consecutive to bachelor's degrees in architecture. D-space knowledge remains dominant but is complemented by conceptual and in case of the MSc Urban Design NRW also by p-space knowledge. In addition, these master's graduates reach the highest cognitive ability in applying and eventually also developing procedural knowledge regarding synthesising.

(Own Graphic)

Distribution of Pedagogical Formats in Interdisciplinary Master's Programmes

Fig. 27



The most important pedagogical format is the architectural studio. A studio course is a specific form of project-based learning, which differs in various respects to planning projects. Section 4.4 discusses the difference in greater detail.

The architect's concentration of d-space knowledge is an opportunity and threat at the same time. On the one hand, an architect alone will approach urban development primarily from a physical point of view. Urban concepts developed by architects are centred around the combination of form, function, and aesthetics. The case of modernist urban design and the associated social challenges in modernist housing estates illustrates the insufficient understanding of architects for social processes. Contemporary urban design and architecture remain subject to strong critique as missing the needs of the general public. On the other hand, architects have access to powerful d-space knowledge. In contrast to planners, architects are well trained in thinking three-dimensionally about space. The design of buildings and urban spaces benefits from this ability. Especially in situations where architects are absent, for instance, at the periphery of urban regions, the results of urban development lack spatial qualities (Michaeli 2018). While it is no option to leave urban development to architects alone, integrating PK of architects into the urban development process is of great potential.

In summary, planners, geographers, and architects are all prepared for developing urban concepts but with distinct ways of thinking and doing that are inherently linked to theoretical shortcomings. Table 10 summarises the three different approaches and the interdisciplinary alternative.

Table 10 Shortcomings of Established Educational Pathways into Urban Development (Own Graphic)

	... develop urban concepts based on ...	**... but with the shortcomings of ...**
Planners ...	... established previous concepts ...	... neglecting the contingency of conceptual knowledge.
Geographers ...	... rational analysis ...	... neglecting the normative nature of urban concepts.
Architects ...	... powerful knowledge in architecture ...	... neglecting the multidisciplinary nature of knowledge in urban development.
Interdisc. Groups ...	... the combination of PK from various disciplines .	

Interdisciplinary degrees admit students holding various bachelor's degrees. They come in various forms regarding content and admission criteria. Three groups of degrees can be identified: (a) urban and regional studies, (b) urban (and regional) design (Carmona 2016), and (c) urban development. These names are not a conclusive scheme, and most programmes have their own name, but they serve as labels illustrating overarching types. The comparison of competency profiles of these degrees reveals only minor differences. Firstly, the bachelor's degrees are of much greater significance in terms of workload, and secondly, the overall curriculum of interdisciplinary master's degrees is mostly like planning degrees. There is a balance between various types of factual knowledge with a slight tendency towards f-space knowledge in the case of degrees of type (a), and towards d-space knowledge in case of the degrees of type (b). Programmes of type (c) have the greatest breadth of factual knowledge. Like planning programmes, interdisciplinary programmes in urban development cannot provide substantial specialisation that provides access to PK to graduates.

Fig. 23 exemplifies this in case of four interdisciplinary degrees that admit students of planning bachelor's. None of the programmes reaches the cognitive level of developing in any field of factual knowledge. The average ECTS/CA is well below the necessary workload for reaching PK.

Interdisciplinary degrees are based upon the assumption that students contribute powerful knowledge of their undergraduate discipline to a collaborative urban development process.

However, if we shift our attention from students holding a bachelor's degree in planning to students holding a disciplinary degree such as architecture, a different picture emerges. Fig. 22 shows the competency profiles of the same four interdisciplinary degrees holding a bachelor's degree in architecture. While there is still only a marginal difference between the competency profiles, graduates of bachelor's in architecture carry on their access to PK into the master's programme. If students of other disciplines, e.g. engineering, sociology, law, or others, carry on their own different set of PK, the combination of different types of PK can lead to more innovative conceptual knowledge.

The potential of integrating disciplinary experts such as architects into the urban development process is the basis for interdisciplinary programmes. It is not the goal to align the different competencies, but rather practice collaboration across the disciplinary boundaries. Hence, project-based learning is the focal point of interdisciplinary education. In contrast to the master's programmes that are specifically catered towards a specific bachelor's degree, there is no effective complementarity between the factual knowledge of the bachelor's and the master's level. The complementarity lies

within utilising the factual knowledge of a bachelor's graduate and combining it with previous knowledge of other graduates for developing urban concepts. The value of interdisciplinary degrees does not lie in the unique competency profile of its graduates, but rather in practising interdisciplinary collaboration as a social learning process.

4.2.4 Diversified Pathways into Urban Development

There are two major roles in urban development: all-rounders and collaborators.

The analysis shows that there are various academic degrees preparing different profiles for practice in urban development: (a) all-rounders, (b) focussed all-rounders, (c) brokering collaborators, and (d) specialised collaborators (see Fig. 28).

Most of those degrees aim at educating all-rounders. These all-round graduates obtain competencies in various fields of factual knowledge, learn to develop conceptual knowledge, can apply various types of procedural knowledge and are familiar with fundamental meta-cognitive theories. The dominant educational pathway for becoming such an all-rounder consists of two consecutive bachelor's and master's degree in urban planning. There are also master's programmes that complement bachelor's degrees of other disciplines in such a way, that the final competency profile is of all-round nature.

Interdisciplinary master's programmes are, on the other hand, an alternative or even opposing model. The theoretical critique is that all-rounders do not obtain enough understanding of each relevant field to develop impactful urban concepts. Instead, all-round planners rely on normative ideas and uproot and transplant planning ideas without a proper understanding of the context (Healey 2012). Educators of interdisciplinary programmes argue that urban development must be a collaborative endeavour of all spatially relevant disciplines. Practising this collaboration is the primary purpose of interdisciplinary degrees. The competency profile of an individual graduate does not necessarily reflect this, because it is not a quantitative difference of the distribution of competencies but a qualitative difference of how urban concepts are developed (see Table 10).

Specialised collaborators underwent a specialised bachelor's degree and an interdisciplinary master's degree. Planning and geography students that take an interdisciplinary master's course do not have the necessary specialisation as part of their bachelor's programmes. The curricular analysis shows that these graduates appear to have roughly the same competencies than students doing a programme that is catered towards their specific bachelor's degrees. The dif-

ference is, however, that planning and geography graduates that take an interdisciplinary programme learn to collaborate with graduates of specialised disciplines. While their role is not bringing in PK, it can be a role of brokering between specialised disciplines.

Educational Pathways and Roles in Urban Development
(Own Graphic)

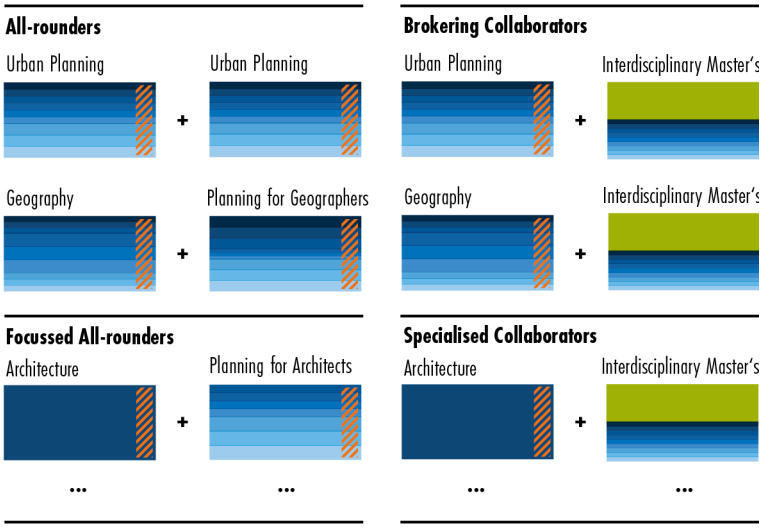


Fig. 28

Interdisciplinary Project-based Learning 4.3

A key component of most analysed curricula is project-based learning (see Fig. 26f). Between 10 to 15 ECTS credit points per semester in planning, architecture, and interdisciplinary programmes of urban development are allocated to project or studio courses. The courses appear to be similar on first glance but differ indeed significantly in terms of pedagogy and learning objectives. This section takes a closer look at the differences and commonalities and explores the potential of projects for interdisciplinary work. The section is largely based on previous research that I conducted in parallel to this systemic research.

Architectural Studios and Planning Projects 4.3.1

Project-based learning originates from craftsmanship where apprentices learn from skilled masters. This model remains dominant in architectural studios.

Planning projects and architectural studios are arguably based on the same idea: 'Practice makes perfect.' Both planning and architecture programmes let students repeatedly work on tasks to develop solutions for close-to-reality problems. Expectations on the quality and feasibility of proposed solutions raise year after year until, in case of an architect, his thesis' design proves his ability to design a building by himself.

The architectural studio is one of the oldest project-based learning format and roots back to a tradition of arts and crafts. The teaching is based upon a 'master-apprentice-relationship' (Dooren et al. 2013) under which the master craftsman, artist, or architect supervise his apprentice or student working on a project. The master acts both as a supervisor but also as a client. As a client, he defines a clear design brief, for example, the number of residential units a housing project must incorporate, and as a supervisor, he evaluates the student's proposal.

The student will either find an architectural solution based on previous experience or by imitation of studied references (Dooren et al. 2013). This reference is often the work of the master architect. The process of solving and learning is trifold: experimenting, discovering and deciding. Most studios are individual work or partner work. Architectural design is a creative, personal process (Dooren et al. 2013).

The planning project has arguably evolved from the architectural studio but must be understood as an opposing model. Urban planning programmes in Germany emerged not only in a phase of critique towards modern urban design but also in times of significant societal change. Traditional authorities were questioned which led, for instance, to the abolishment of 'hats and gowns' at universities. While this may only be a superficial change, the re-conception and reorganisation of universities were radical, questioning the authority of professors.

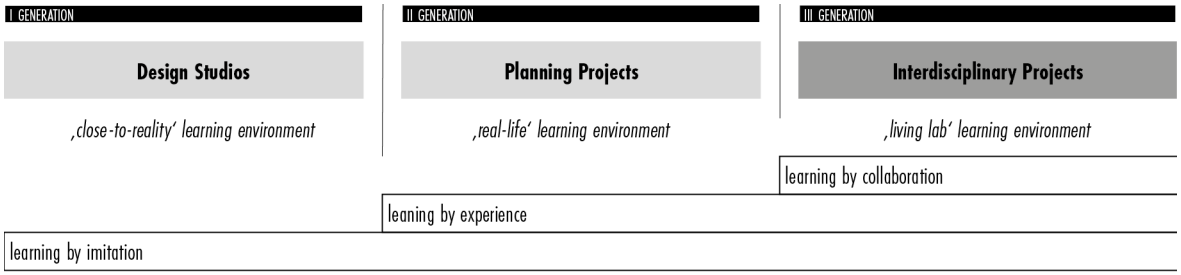
Planning projects originate from the student's wish to work on actual social and environmental issues for which professors do not have answers.

The master-apprentice-relationship did not fit with the reform-oriented spirit of universities at that time. Students asked for working independently on issues that they identified to be relevant. The pedagogy shifted from learning by imitation to 'experiential learning' (Rosier et al. 2016). Groups formed spontaneously with the aim of engaging with actual planning issues instead of close-to-reality design tasks. This new bottom-up project courses became an integral part of new study programmes such as urban planning. For a long time, projects were not subject to grading, which in some universities just recently changed with the introduction of the ECTS. Nevertheless, the core of planning projects remains to be that groups of students work independently either on self-chosen or given 'real-life' tasks. Professors are no masters in case of planning projects. The role of teaching changes towards the advice of an experienced colleague (Shephard & Cosgriff 1998). Projects are almost always group work. Projects are not about the individual learning process of designers, but about the organisation of a discursive process and the inter-subjective results. Hence, the work process is more structured and organised in comparison to a studio. Implicit knowledge of each student must be shared explicitly (Dooren et al. 2014).

The institutionalisation of planning as an independent discipline has led in parts to a re-adaptation of the master-apprentice-model.

The high ambitions of planning projects go along with challenges. Especially in the beginning of programmes, student lack of experience and knowledge for self-organisation and self-selection of topics. Therefore, it is often necessary to guide students more rigorously as the role of a collegial advisor suggests. The more problematic challenge lies with the process of disciplinary socialisation. The underlying communicative planning theory assumes that the best planning solutions are the result of an intersubjective discourse. In practice, the discourse is complex, manifold, and characterised by conflicting interests and values. The longer students study, the more their studies influence their value set. Students adopt professional ethics and principles because they share similar experiences and are exposed to the same experts. So, while values and interests in practice are increasingly diverse, planning students learn within homogeneous learning groups. This is not particular to planning, but part of the formation of a professional community. The difference is, however, that inter-subjectivity requires in contrast to objectivity the plurality of arguments. If this plurality gets lost, planning is at danger of reproducing its own established normative ideas with little social and technical reflection.

(Own Graphic) Three Generations of Project-based Learning Fig. 29



Potential of Interdisciplinary Projects 4.3.2

Interdisciplinary projects pick up the original ideas behind planning projects and enable collaborative learning by managing the composition of student groups.

Interdisciplinary projects (IDP) come as part of various institutional arrangements. They are a key component of interdisciplinary master's programmes, but can also be joint courses of multiple study programmes (e.g. Arefi & Al-Douri 2016). Hence, IDPs can also complement mono-disciplinary projects and studios. The main differentiating feature of an IDP is the heterogeneous group of participating student. It is the primary purpose of IDPs to bring students of multiple disciplines together, not just because students of different disciplines have undergone different socialisation

for inter-subjective reasoning, but for an exchange of deeper understandings of disciplinary knowledge and the resulting innovative potential.

If we look back at the formation of planning degrees as part of a reform movement renewing universities, we see similar initial ideas. Student groups that formed in order to work collaboratively towards resolving real-life challenges were initially not confined to a singular planning programme. Planning degrees in Germany emerged as a reaction to a new transformation-oriented movement that wanted to work on issues of society instead of learning from an architectural mastermind. While first planning projects were spontaneously emerging IDPs, educators use IDPs with similar real-life ambitions as a pedagogical tool deliberately, today.

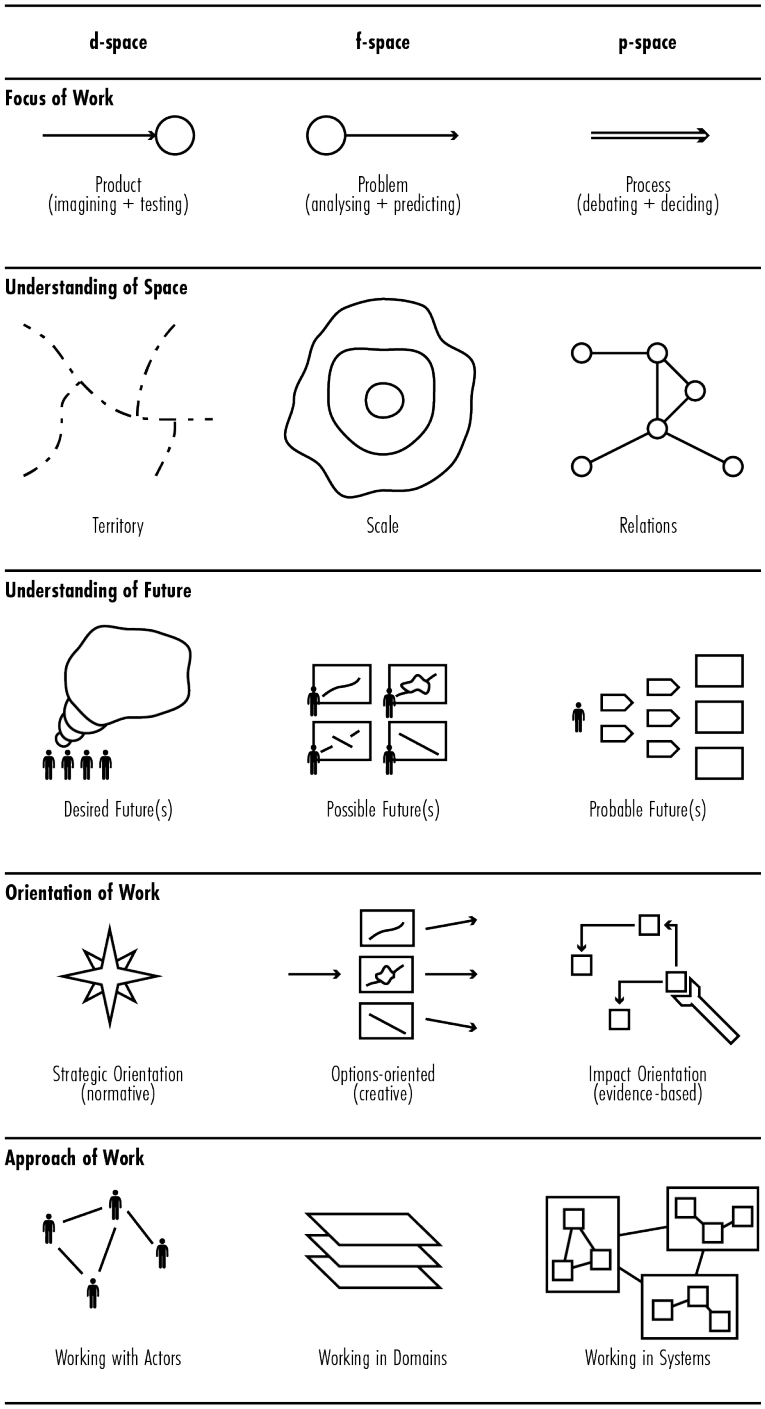
> *'The biggest change in the urban design pedagogy is the way in which the 'urban design studio' teaching and the project conceptualisations and execution are now part of a growing 'living labs' format' (*Butina Watson *2016: 546).*

The transformative dimension is an integral part of interdisciplinarity because the underlying motivation to work interdisciplinary is based upon the assumption that disciplinary approaches cannot provide answers to systemic challenges of society. The involvement of actual stakeholders is a pedagogical measure that educators explore (Ritchie et al. 2015; Frank & Sieh 2016; Roberts 2016) but is not regarded as a necessary precondition for the transformative orientation by all educators.

Fig. 30 illustrates how the competencies of three types of spatial experts can work in collaboration. The graphic has been developed for a separate publication subsequently to a conference session on project-based learning in regional development in 2016 (Förster et al. 2016). The presented example works with three archetypical expert types, which do not exist as such. D-space knowledge is scattered among architects, landscape architects, and engineers. Sociologists, economists, and ecologists hold valuable f-space-knowledge. And, p-space knowledge is part of the disciplines of law, administrative studies, and management. The following paragraphs simplify this complexity to three d-, f-, and p-space-experts.

Potential Contribution of Different Experts to Interdisciplinary Collaboration
(Own Graphic)

Fig. 30



D-space experts such as architects and engineers are product-focused (Arefi & Al-Douri 2016; Johnson & Gore 2016). Ultimately, architecture and engineering are about the resulting physical structure, and whether it fulfils the purpose, it promises to deliver. The spatial understanding is based on the concept of scales. When looking at an entire city, important physical features may be the topography and the network of infrastructure. On an intermediate district scale, architects concern themselves with block sizes, road width, and the distribution of green spaces. And on smaller scales, the design of buildings and their interior becomes important. On each scale, various domains or layers are developed, for instance, from the form and texture to function. The future is for d-space-experts a series of options and possibilities that could be developed.

F-space experts look at conditions identifying problems and areas that require intervention without necessarily knowing what these interventions can be. Space is not a hierarchy of scales but rather a system of interrelations, which translates in the popularity of employing systemic approaches. Non-spatial conditions such as the economic prosperity relate to spatial conditions such as the location of real estate investment. Futures are not subjective options, but the result of probability. Futures are forecasted or analysed as a result of the impact of interventions.

P-space experts such as project managers are concerned with implementing interventions and steering the development process (Olsson & Haas 2014). His work is largely communicative based on the relations of actors (Arefi & Al-Douri 2016). His understanding of space results from territorial responsibilities and powers. He concerns himself with a strategic decision: What has to be done when to achieve a wanted result? He does not envision or predict futures; he desires futures.

The developed graphic exemplifies what the combination of PK can mean for urban development. Obviously, the differentiation between each type of expert is not as clear-cut as presented, but there is, for instance, a clear tendency of planers to think in terms of territories simply as a result of jurisdictional competencies. If we combine the understanding of what planning can enforce within a territory with the knowledge of what that means in relation to other territories, policymakers can make more informed decisions regarding urban development.

Providing students with boundary objects can facilitate co-learning.

The potential that arises from bringing all three perspectives together becomes easily evident. P-space experts can identify desirable futures. F-space experts can differentiate the possible ones from the impossible. And, d-space experts provide actual options for the possible and desirable future. However, interdisciplinary collaboration is not only a potential but also a pedagogical challenge (Banerjee 2016). Bringing together experts of different disciplines is difficult due to different ways of thinking and doing. It starts with the different use of vocabulary, different method, and different forms of presenting results. The work conceptualises these challenges as boundaries between disciplinary communities (see section 3.2.2).

The easiest is cross-boundary collaboration in cases where disciplines regularly interact. This is, for instance, the case in urban design competitions during which it is often mandated that architects, landscape architects, and planner collaborate. The collaboration of sociologists, economists, and other social scientists can also be easy in certain cases as some of the empirical methodologies is familiar to all those disciplines. Regular 'boundary interactions' (Wenger 2000) shape mutual understanding. The principle of 'practice makes perfect' holds in parts also true for interdisciplinary collaboration. Nevertheless, the innovative potential is the biggest in cases of no regular interaction. In these cases, new methods and theories must be developed that can facilitate interdisciplinary collaboration and help to overcome even contradicting disciplinary theories. Facilitating interdisciplinary collaboration needs specific methodological approaches and regular training. Regular interdisciplinary projects are a necessary first step. Boundary objects can further facilitate interdisciplinary collaboration beyond simple learning-by-doing repetition (Carlile 2002).

In my own work as a lecturer at the Technical University of Munich (TUM), my colleagues and I experimented with different boundary objects as part of different formats of teaching. One boundary that much of the work deals with sits in between urban design and transport planning. Bertolini's (1999) node-place-model (NPM) stood out as a particularly promising pedagogical tool. The NPM introduces two indicators. The indicator 'node' describes the centrality of a location within a public transportation network. This may be the number of trains stopping at a station. The second indicator 'place' describes the level of activity at a location. This may be the number of residential units, the number of jobs, or the physical density in its surroundings. Bertolini and

his colleagues claim that the functionality as a node and as a place should be balanced, which means that locations that are well served by public transport should be developed with higher densities than locations that are less well-served (Peek, Bertolini & Jonge 2006). Both our students and we as educators had the feeling that the model's simplicity is an ideal starting point to think urban design and transport planning together. However, our evaluation (Gilliard et al. 2018) shows that simplistic models such as the NPM are based on too many preconditions and are as such rather non-transferable boundary objects. Under certain conditions in rail-dominated countries, it is a useful tool, but it does not work for car-based mobility systems.

The second boundary object that we experimented with is a trends analysis based on Vester's (2015) cross-impact sensitivity model. Vester concerned himself with methods that would allow the analysis of complex interrelations. His approach is of systemic nature modelling all the relations between all elements of a system. As urban development is a future-oriented endeavour, our approach utilises trends that describe economic, social, financial, political, technical and environmental changes of our society and cities. Students of various disciplines are asked to discuss how each of these trends interacts with all other trends. Does, for example, the diversification of lifestyles have an impact on the de-funding of local government?

The purpose of employing Vester's sensitivity model is not to model complex interrelation as accurately as possible. The idea is that multidisciplinary student groups engage with knowledge of different disciplines, discussing the interrelation of their disciplines, and establish a conceptual model for their task based on established disciplinary knowledge. As teachers, we feel that students can, thereby, overcome the danger of reproducing normative urban concepts, although the necessary time investment should not be underestimated

The trends analysis is a discursive tool that is, however, based on evidence in each of the relating fields. The trends are validated by disciplinary analyses beforehand. The overall course pedagogy involves a three-step process that employs the underlying ideas of the communities of practice literature (cf. Pharo et al. 2014). At first, students are allocated to disciplinary groups that analyse the applicability of the trends of their discipline for the study area. The second phase employs the trends analyses as an interdisciplinary discursive tool, followed by a third interdisciplinary design phase. This three-step pedagogical design follows the same logic as the interdisciplinary master's programmes. Disciplinary teaching

and learning pre-runs interdisciplinary teaching and learning. Other interdisciplinary pedagogies such as Johnston's (2015) 'CitySection' adhere to the same logic.

Capacity of Academia for Innovation 4.4

The potential of interdisciplinary teaching for socio-technical innovation becomes evident from the previous look at knowledge and pedagogy. The innovative potential is greatest if students obtain PK, but also practice cross-boundary collaboration as part of IDPs. The following section looks at how different institutional structures help or hinder interdisciplinarity. As empirical bases, I combine data from the presented curricular analysis with data from a separate study on the implementation of transformative education in urban development.

The separate study was conducted on behalf of the Förderkreis für Raum- und Umweltforschung e. V. (FRU), which was interested to know to what extent the study of the WBGU (2011) on the 'Great Transformation' had informed planning education. The Great Transformation does not refer to Polanyi (1944) but to current efforts transforming development towards sustainable patterns. The study looks at all three traditions of planning education as well as interdisciplinary master's programmes. The set of analysed programmes differs due to the particular interest of the FRU.

List of Analysed Study Programmes as Part of the FRU-Study Table 11

No	Degree	Programme Title	University	Department
Master's Programmes for Planners				
deHCUmonoP	MSc	Urban Planning	HafenCity University Hamburg	*not applicable / no departmental structures*
deUNIKmonoP	MSc	Urban and Regional Planning	University of Kassel	Department of Architecture, Urban and Landscape Planning
deTUKmonoP	MSc	Urban and Regional Development	TU Kaiserslautern	Department of Spatial and Environmental Planning
Master's Programmes for Geographers				
deUBTmonoG	MA	Human Geog.- Urban and Regional Studies	University of Bayreuth	Department of Biology, Chemistry, and Geoscience
atVIEmonoG	MA	Urban Studies	University of Vienna	Department of Geoscience, Geography, and Astronomy
Master's Programmes for Architects/Engineers				
deTUMmonoA	MSc	Architecture - Architectural Urbanistics	Technical University of Munich (TUM)	Department of Architecture
deHNEEmonoE	MSc	Spatial Development and Nature Conservation	Univ. of Sustainable Development Eberswalde	Institute for Land Use and Nature Conversation
Interdisciplinary Master's Programmes for Planners, Geographers, and Architects				
deSTGinter	MSc	Planning and Participation	University of Stuttgart	*Jointly run by departm. of architecture, geography, and law*
deHCUinter	MSc	Ressource Efficiency in Arch. and Planning	HafenCity University Hamburg	*not applicable / no departmental structures*
deLULinter	MA	Sustainability Sciences	Leuphana University Lueneburg	Department of Sustainability

4.4.1 Departmental Structures

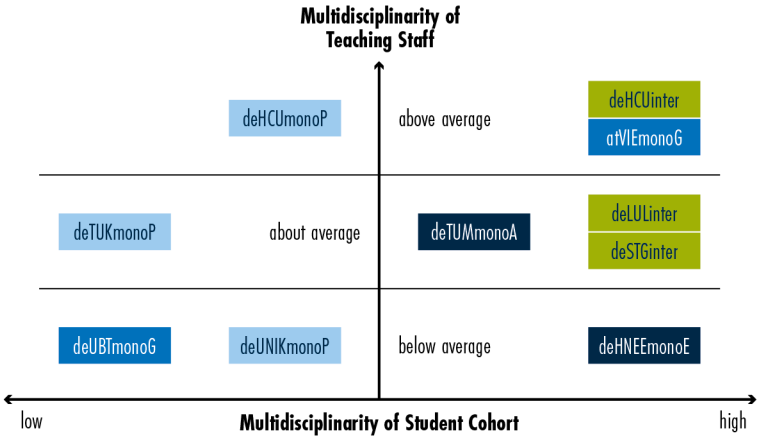
If we look at the data set of the curricular analysis, we see that the three traditions of planning education are not represented equally in terms of institutions (see Table 9 and Table 11). Dominant institutional structures are departments of architecture and geography. Planning is always almost an annexe to a larger department. As an annexe, it is, however, of such importance that it is usually part of the name and often forms a kind of a sub-department. Its structures can, therefore, be analysed similarly to departmental ones.

The FRU-study evaluates, among other things, how transdisciplinarity (interdisciplinarity and transformativity) is implemented. I look empirically at multidisciplinarity as a precondition for interdisciplinarity and discuss with the responsible programme directors, how multidisciplinarity is used as part of project-based learning in order to achieve transdisciplinary education. Multidisciplinarity is differentiated into two categories: the multidisciplinarity of the teaching staff and the multidisciplinarity of the cohort of students. Both are analysed on the programme level and for individual modules.

Planning programmes have lost its innovative potential due to its institutionalisation and subsequent homogenisation of the student cohort.

The multidisciplinary mix of students of independent planning master's degrees is unsurprisingly low. It is in the nature of consecutive programmes that the cohort of students remains largely homogeneous, partly because universities feel obliged to serve its own students first before taking in new ones (Knieling 2018). Some planning degrees try to overcome this natural barrier to multidisciplinarity by offering modules for multiple programmes. The HafenCity University in Hamburg has, for instance, developed a wide set of different interdisciplinary learning formats, and the University of Kassel teaches planners, architects, and landscape architects together for the first year. Nevertheless, the data reveals that the resulting amount of multidisciplinarity remains rather low (see Fig. 31)

Fig. 31



Multidisciplinarity of Staff and Students in Different Types of Departments
(Own Graphic)

If we have a look at the teaching side, we have in parts an opposite picture. Staff in planning sub-departments is, to a great extent, multidisciplinary. Not only the group of professors comes from various disciplines, but also research and teaching assistants of a single professorship are often of different disciplinary background. Planners themselves are often just a marginal group among many others. Planning is, in this case, subject to the tension between the thematic need for interdisciplinarity, and the preference of academic reputation systems for specialisation (Röbken 2014). Departments appoint professor based on high impact publications and the acquisition of third-party funding. This means specialised professors are preferred over all-rounders, but within a professorship, its ordinario is thematically forced to employ assistants across different relevant fields.

Programmes that conform to the tradition of social sciences fall within two subcategories: programmes that are largely homogeneous in terms of students and teachers, and programmes that are heterogeneous in both regards. The first ones are geography programmes. Geography is unlike planning a more established discipline. Not only the cohort of students but also the body of teaching staff is mostly homogeneous. The core of geography is the ability to analyse social, economic, and environmental issues spatially. Before the spatial turn of social sciences in the 1990s (Löw 2015), spatial analyses were largely exclusive to geography. Since then, sociologists, economists, and others have developed their own methodological approach to spatial issues.

The second category is a new mix of spatially oriented social scientists, including sociologists, anthropologists, cultural scientists, and economists, to name just a few. This multidisciplinary approach to understanding socio-economic dynamics spatially forces geography departments to a couple of changes. More and more experts from other disciplines get appointed as professors because they have access to the latest PK in one of the relevant fields of factual knowledge besides their newly acquired spatial skills. Geography seems to see the same need for disciplinary specialisation and interdisciplinary collaboration in research as planning departments. The role of geographers as an all-rounder is increasingly in question and specialises on complex numerical spatial analysis that goes beyond the general abilities of other disciplines.

Programmes that are among the tradition of engineer-like planners such as architecture are more open to students from other disciplines but operate with a more disciplinary set of staff. An underlying reason may be the strong d-space focussed perspective on cities that prolongs within large parts of the urban development community (Höing et al. 2014). While it is largely acknowledged that cities are

co-produced by different actors and disciplines, many highlight the particular importance of architecture and infrastructure. Thus, it makes sense to equip students of other disciplines with a basic understanding of the physical qualities of space. The annexation of planning to architectural departments also comes into effect by keeping the number of architects as educators high. A committee of architects appointing a new professor is more likely to choose another architect than an independent planning department

Architecture is an established, but in many ways, unique discipline. Working in collaboration with architects is particularly challenging for academics of other disciplines. While most disciplines like planning and geography share similar forms of scientific work and documentation, scientific papers and dissertations are rather exceptional to architecture. Architecture as an academic discipline cultivates a strong connection to architectural practice. Architecture professors are often also practising architects. Distinguishing criteria are not necessarily academic achievements such as holding a well-received doctoral degree, but rather the built and unbuilt oeuvre. This particularity is, however, subject to a recent dynamic of 'scientification' (Kaps et al. 2017). Traditional academic quality criteria have gained importance.

Interdiscipliary programmes gain innovative potential from the mix of students.

Interdisciplinary programmes are within all aforementioned institutional settings, but try to combine both highly multidisciplinary cohorts of students with a multidisciplinary mix of staff. On the one hand, we see that urban development being part of another disciplinary department has a negative effect on the multidisciplinarity of staff. On the other hand, we see that setting up an own department leads to a more homogeneous body of students. The problem is that departments as an institutionalised structure of academic communities define themselves by the body of staff and students. Own staff and students grants departments the freedom to set its own research and teaching agenda. If a department would, for instance, only teach on the master's level, it would be dependent on other departments preparing students for their courses. Hence, multidisciplinary planning departments need to admit bachelor's students, which in turn form a mono-disciplinary group of all-round students. Departmental structures are fundamentally disciplinary.

Interdisciplinary teaching happens at the perimeter of a department or as multi-departmental endeavours. Interdisciplinary programmes are concerned with the boundaries without conceptualising cross-boundary brokering as a separate boundary discipline. Unlike planning, interdisciplinary programmes do not form strong communities, but networks of individuals that are part of different disciplinary communities (Luley 2018). Urban studies and urban design are such

networks. The increasing number of master's degrees has led to the establishment of specialised journals and professional bodies. An inherent risk of setting up boundaries exists, but can be circumvented as long as no specialised departments and study programmes such as planning emerge.

Conditions for Lead-educators 4.4.2

The empirical data suggest that the greatest potential for interdisciplinarity and transformativity lies within architectural or independent planning departments due to their pedagogical focus on project-based learning as well as the regular inclusion of practitioners (Owers 2014). In addition, architectural and planning departments have developed evaluation frameworks for academic staff that allow a stronger focus on problem-based learning, because of those value practical experiences similar to academic achievements. However, those criteria are at danger due to increasing standardisation of staff evaluation with the means of indicators such as the number of published papers.

Managing collaborative learning process is not valued as much as independet research.

The FRU-study reveals that the interviewed professors would currently not recommend his or her doctoral students to pursue an inter- or transdisciplinary approach if he or she wants to stay in academia. Specialisation seems to be a more successful strategy. Lead-educators are, hence, confronted with a conflict between focusing research on disciplinary specialisation and developing interdisciplinary systemic pedagogy. Thus, it is not only the disciplinary, departmental structure that hinders interdisciplinarity but also associated frameworks for academic careers (Winkler 2018). But even if educators try to tackle interdisciplinary teaching, challenges occur.

The diversity of previous knowledge of students is an obvious challenge in interdisciplinary courses but is at the same time the potential for innovative collaboration. A good interdisciplinary project requires a diverse group of students that has access to the different fields of PK. The quality of the project's outcomes depends on the compositions of the student body, and not only on the performance of the students themselves. An interdisciplinary course with only architects cannot be an interdisciplinary course. Five very good architects will most likely produce results that are expected from a group of architects, while five average students of different disciplines may produce a more innovative solution. There are several implications attached to this finding. The assessment of individual students is not representing the performance, but also the potential of his group's arrangement. The teacher himself influences the outcomes of the student's

work. The teacher must assume a management role, managing what students work together on what kind of issues. Neither the managerial role of teachers, not the interdependencies between learning outcomes and learning groups are reflected by the Bologna Process.

Educators require a higher degree of autonomy when admitting students to their courses

The problem arises where teachers do not have effective control over the condition under which students collaborate. In most cases, the lecturer himself has no power over the composition of his student cohort. This power lies with the university administration, which is, however, more in a regulatory than a managerial role. Universities can, for instance, limit admission based on previous knowledge and qualification, but have limited tools for attracting and selecting the exact students it needs for interdisciplinary approaches. Principles of equal opportunities overrule the interest of academics to select their students. Furthermore, module-specific learning outcomes only reflect a student's individual competencies but not collaborative social learnings (Borrego & Culter 2010).

In theoretical terms, teachers do not only impart knowledge but shape the trajectories of students. Trajectories are defined as the student's change of identity (see section 3.2.2). The teacher's role is about understanding, what competencies student already hold, for what purpose the student wants to employ those, and what fellow students he needs as collaboration partners to reach a certain goal. A team that is composed under the consideration of these questions cannot only produce good course outcomes but may also be able to identify partners for socio-technical innovation in the future.

4.5 Preliminary Conclusions regarding the Hypotheses

The curricular analysis and the complementary empirical data provide a first empirical base for assessing the hypotheses. The following paragraphs summarise initial conclusions regarding each hypothesis.

(H2) *Urban planning is largely based upon contingent conceptual knowledge, which leads to a normative reproduction of existing concepts.*

Hypothesis 2 is supported.

The data is of particular value for supporting the hypotheses regarding knowledge. The curricula of urban planning degrees show a high degree of conceptual competencies as assumed. The ratio between conceptual and factual knowledge shows a clear concentration on concepts with only a brief look at the different underlying disciplinary fields. In consequence, planning concepts are either based on superfi-

cial knowledge and normative ideas or the result of collaboration with experts. Planners as brokers is a role model that is popularly described in the theoretical literature. However, there is very limited training in regards to working with other disciplinary experts. Overall, the data supports hypothesis H2.

Hypothesis 3 is not supported.

Only the collaboration of disciplinary experts provides access to powerful knowledge in all spatially relevant disciplines, which in turn is necessary for socio-technical innovation. **(H3)**

In turn, the analysis of architectural programmes shows that a more focussed disciplinary degree can provide an in-depth understanding of a particular field. Graduates of architecture programmes can access powerful architectural knowledge. However, hypothesis H3 remains in question. Looking at the list of typical degrees that are required for admission to collaborative interdisciplinary master's degrees imposes the question of whether there are enough experts from other relevant fields. The three most widely accepted bachelor's degrees are architecture, geography, and planning, of which only architecture provides powerful knowledge while geography and planning are highly multidisciplinary in terms of content. Planners based on its current practice of education are not experts of p-space knowledge, and geographers are not experts of f-space knowledge. A better in-depth understanding of these fields can only be found with sociologist, economists, lawyers, to name just a few. Additionally, architects are also not d-space experts, but rather only experts of architectural d-space knowledge. That means a truly collaborative approach to interdisciplinarity in urban development requires the involvement of many more disciplines or curricular changes to existing programmes.

Hypothesis 4 is partly supported.

The institutionalisation of urban planning as a boundary discipline dealing with urban development hinders the collaboration of disciplinary experts. **(H4)**

The institutionalisation of urban planning as an independent discipline is not per se hindering the collaboration of experts. The data from the FRU-study shows that departments of planning and even individual institutes often have a very multidisciplinary mix of researchers. However, this multidisciplinarity does not translate into the cohort of students in planning courses. The lack of planners as academics in planning departments is a good indication that this is potentially problematic. If academia believes that it needs to find disciplinary experts to work on questions of urban

development, it appears questionable why this shall not apply to plan practice. A preliminary conclusion could be that the institutionalisation of planning in not the problem, but the implementation of study programmes in planning on the bachelor's level in particular is.

(H5) *Refocussing higher education on boundaries is necessary to capture the innovative potential that lies in the collaboration of different disciplines.*

Hypothesis 5 is partly supported.

The curricular analysis does not fully support hypothesis H5 despite the potentials shown in interdisciplinary project courses. While the potential of collaboration is rather evident, the experience in organising interdisciplinary projects shows the difficulty in finding students of different disciplines that are capable of working on spatial issues. While architects have a natural affinity to urban issues, social scientists - even geographers - struggle with a methodology that puts space as an explaining variable before other possible explaining factors. The potential can often not be captured. Interdisciplinary programmes result in similar competency profiles like independent planning programmes.

Interdisciplinary teaching is particularly challenged by a lack of recognition in educational frameworks. Module descriptions set out clear learning outcomes for all students, which is difficult for interdisciplinary pedagogy. If previous knowledge is very different, learning outcomes become either generic or not universally applicable to all students. The implementation of outcome-oriented curricula has overlooked so far the possibility that courses may serve different purposes for different students. The analysis also made clear that the role of teachers changes. The academic system does not yet reflect newly emerging managerial roles. The data, hence, support the underlying thought of hypothesis H5 but also shows that many changes in educational policy still need to be implemented.

(H6) *The implementation of educational programmes that fulfil the requirements of H1 needs the full implementation of employability-based educational and labour market policy.*

Hypothesis 6 is not supported.

A key characteristic of the shift from qualification to employability is the reformulation of curricula in terms of learning objectives instead of content. Chapter 3 discusses the potential advantages. Complex systemic challenges require experts that can apply their specialised knowledge on issues that are not typically part of their discipline, for instance, a computer scientist simulating architectural interventions.

Hence, it is not about what professors teach students in the class, but how graduates can later apply knowledge on certain issues.

The problem is that educators do not necessarily know-how and for what purpose students will later use taught knowledge. When formulating learning objectives, educators think almost necessarily about typical profiles of qualification. It is relatively easy to imagine what competencies established job profiles require, but it is rather difficult if the respective job is something we do not envision yet. So if students take rather atypical paths through university, formulating learning objectives comes quickly to its limits. A course that is open to students of two or three different background may be able to reflect different learning outcomes for different student groups. However, as education diversifies further, we have to question whether the current academic framework can reflect the necessary interdisciplinary nature.

Competency-based learning objectives are, in theory, reflecting the flexibility and breadth of how knowledge can be used in different cases, but are in its implementation rigid. This illustrates well an obvious paradox of the Bologna Process. On the one hand, it is catered towards an employment market that requires a greater variety of different experts with unique profiles. On the other hand, its framework has effectively just replaced a few highly diverse study programmes with many study programmes that have more rigid curricula. The empirical data reveals that many of the new bi- and interdisciplinary programmes leading to competency profiles that students could also achieve when taking a consecutive master's course and choosing the equivalent elective courses.

Thus, hypothesis H6 must, therefore, be rejected. In its current form of implementation, the employability-based educational and labour market policy is not supporting innovative urban development practice.

Hypothesis 1 is partly supported.

Socio-technical innovation for the development of cities and regions originates not only from the interplay of knowledge of various spatially relevant disciplines, but also from the collaboration of experts of those disciplines. **(H1)**

The curricular analysis supports the critique towards currently established multidisciplinary programmes of urban planning, but it provides no evidence for any superiority of interdisciplinary approaches. Instead, it reveals the difficulties for implementing collaborative, interdisciplinary approach both in terms of missing spatially-oriented programmes in many relevant fields, as well as in terms of educational policy which frameworks do not provide the necessary flexibility.

However, the look at individual teaching experiences shows where the potential lies. It will be the task of subsequent chapters to explore how modifications to current educational approaches can support socio-technical innovation.

The Innovation Ecosystem of Practice

5

Empirical Method 5.1

Chapter five looks at the demand side of the impact model. In-depth interviews with practitioners form the empirical base. The aim is finding out whether or not students with interdisciplinary degrees are employed for socio-technical innovation and under which conditions employment can lead to actual socio-technical innovations.

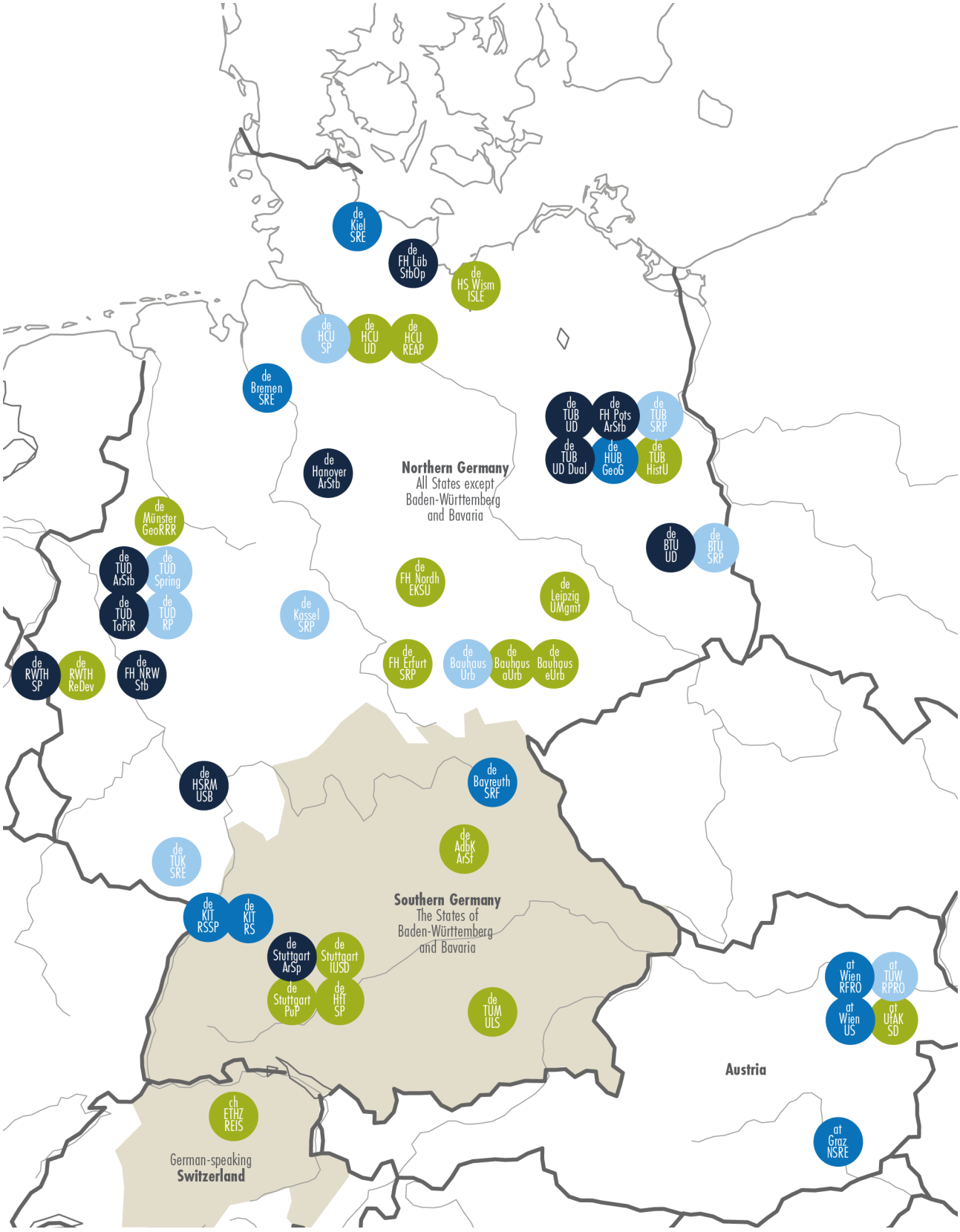
Selection of Interviewees 5.1.1

The interviewees were selected as part of a multi-step process. Graduation and school leaver's destination statistics were a starting point to limit the research to the following employment sectors: public administration (pbl), private consultancies (prv), and the development sector (dvt) including commercial, non-commercial, and public developers. All three sectors together employ roughly three-quarters of all planning graduates (Leschinski-Stechow & Seitz 2015). Universities and research institutes are another relevant employer with more than 10% of graduates. However, the data refers to graduates one year after graduation. The 10% are most likely students that continue their studies in the form of a PhD or work as a research assistant on the basis of a fixed-term contract. These graduates will eventually enter the job market for positions outside academia.

The second selection criterion is based on the analytical results of the first empirical part. The fourth chapter introduced four approaches of education for urban development (see Fig. 16). The spatial distribution of each category differs. There are no independent planning degrees in the two most southern states of Germany, as well as in Switzerland (see Fig. 32). Taking into account that most graduates in Bavaria (78.8%) and Baden-Württemberg (69.3%) find employment within the same state (Haussen & Übelmesser 2015) suggests that employers meet their demand in a different way. Interviews within the DACH-countries have therefore been split into two samples: a Swiss-South German sample, and a North German sample. A similar analysis for the UK and Ireland does not reveal specific spatial patterns. The UK, with a focus on the English planning system, serves as the third sample. I conducted no interviews in Austria and Ireland.

I selected the actual interview partners based on the recommendations by supervisors, colleagues, and prior interview partners. Twenty-two interviews were conducted between May and December 2017 – all interviews in the UK as part of a research stay at the University of Sheffield in November. The interview partners and the respective institutions

Fig. 32 Location of Universities offering Master's Programmes in Urban Development (Own Graphic)



that the interviewees work for are anonymised because of information regarding internal operational processes and staff development. Full audio transcripts are only available to the examiners of this dissertation. Table 12 shows an overview of all interviews.

List of Interviewees

Table 12

Employer	Switzerland & Southern Germany	Northern Germany	United Kingdom
Public Adminstration (pbl)	5	1	4
Consultancies (prv)	3	2	3
Development (dvt)	1	2	1
Total	**9**	**5**	**8**

Analytical Method 5.1.2

The interviews were designed as qualitative in-depth interviews. Each interview consisted of three parts (Honer 1989): a warm-up phase (10 min), a narrative biographic part (20 min), and a focus interview (30 min) (see Table 13). The first part comprised an open talk about the research and the interviewee's expectations. In part two, the interviewee was expected to describe his or her career. Based on the biographic information, the research tries to retrace the chain of impact that education had on their personal career and work processes of the institution they worked for. Furthermore, the interviewees started to connect the research interest to their own career. This connection allowed the interviewees to reflect on an otherwise very abstract topic. Part three utilises the moment of self-reflection to focus on specific aspects of the research: the institutional ecosystem, and the organisation of internal procedures and knowledge.

In-depth Interview Structure

Table 13

Phase	**Style**	**Purpose**	**Time**
Phase 1: Warm-up	Open conversation	Getting to know each other Building trust	5-10 min
Phase 2: Biography	Narration by inteviewee (No to little questions)	Understanding career structures Relating later questions to personal careers Identifying potential focus of interview	20-40 min
Phase 3: Focus Interview	Question-based Interview	Stimulating reflections on hypotheses Deepening statements of narration	20-40 min

5.2 The Role of Powerful Knowledge for Socio-technical Innovation

5.2.1 Two Practices: Urban Planning and Urban Development

A primary assumption of the previous chapter is that knowledge in urban development is widely spread across various disciplines and areas of practice. This assumption is based upon the definition of urban development as the purposeful attempt to steer patterns of urbanisation and urban transformation in order to achieve desired effects on social and economic issues, ecological issues, the aesthetics of the built environment, and individual well-being. In itself, the instruments, that experts in urban development have on hand, fulfil no purpose (SGpbl1 2017: 14'). Urban development is no public or private good. Hence, urban development practice only exists due to the purpose it is trying to achieve. Although the purpose of urban development is not fixed and may change in regards to political majorities, local power structures, and societal value systems, it must still be in existence. Hence, the thematic breadth of urban development is based on the variety of desired effects, that urban development practitioners themselves or others hope urban development practice can deliver. Urban development becomes complex and wicked in nature if many purposes are desired simultaneously (SGpbl4 2017: 39'; SGdvt1 2017: 14'; NGprv1 2017: 24'; SGpbl2 2017: 10'), which is, for example, usually the case in highly urbanised situations in the heart of cities (SGpbl2 2017: 26'). Conversely, lesser expectations in terms of the number of desired effects make urban issues rather 'tame' than 'wicked' (SGpbl4 2017: 43'; cf. section 1.2.2).

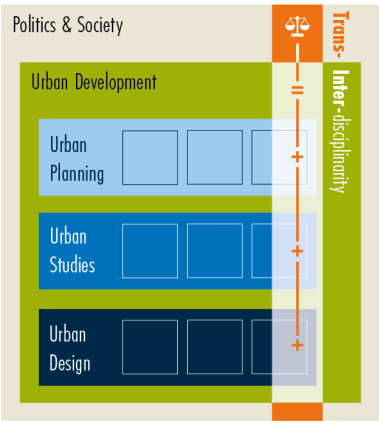
Urban development and planning exist as two separate practices.

The interviews confirm the assumed duality of planning. Planning in its narrower sense is a state-driven activity based upon various administrative rules and laws that regulates the kind and extent of land-use for a given purpose. The assumption holds true if the purpose and the prioritisation of purposes is not part of the planning process. While per definition weighing up between interests and purposes is an essential part, it is a methodologically ill-defined process (SGpbl2 2017: 21') and has been largely removed from the statutory part of planning towards informal strategic processes that sit beforehand (NGprv1 2017). Planning, in its wider sense, encompasses those strategic activities, which are, however, by no means exclusive to the community of planners. Instead, urban development as a strategic planning process is embedded in a professional context, in which architects, engineers, social scientist and many others formulate expectations that they have towards urban transformation, and in a political system, in which politician, citizens, economic actors, and

other forms of stakeholders combine expert knowledge with other forms of opinion formation (Förster 2014; see Fig. 33). Due to the multitude of actors, and thereby expectations towards urban development, practice comprises a multitude of disciplinary knowledge.

Fig. 33

The Embeddedness of Disciplines in Inter- and Transdisciplinary Contexts
(Own Graphic)



Both urban development and planning in its narrower sense exist as separate practices. While some consultancies cover both areas, others work exclusively in one of the two fields. The company of interviewee NGprv1, for instance, works primarily in the field of statutory planning (in German: Bauleitplanung). He states for this purpose:

> *We do not want to become more interdisciplinary (NGprv1 2017).*

Others such as the company of interviewee NGprv2 cover both practices. While planning tasks are primarily done by planners, interdisciplinary teams of planners, architects, and engineers are usually jointly responsible for urban development tasks. Similarly, public administration separates or integrates the strategic urban development department (in German: Stadtentwicklungsplanung) and its urban planning counterpart (in German: Stadtplanung). Strategic planning can be tied directly to the major's office (e.g. in the case of the cities of Stuttgart and Basel), be part of larger directorates, (e.g. in the case of the city of Birmingham), a separate department in itself (e.g. historically in case of the city of Munich), or being responsible for an overarching larger spatial context (e.g. in the cases of the city of Hamburg, or the Greater London Authority). The variety of knowledge in urban development makes specialisation for consultancies - especially smaller one – almost a necessity. The offices of interviewees SGprv2 (2017: 09') and SGprv3 (2017: 07') call themselves planning and design consultancies, the office of interviewee UKprv3 (2017: 14') is a housing specialist, the office of interviewee NGprv1 (2017: 05') work in the small niche of statutory planning, to just name a few examples. So, planning is a separate discipline from urban development as is urban design, housing, and so on.

The extent to which multiple fields of knowledge are relevant to urban development depends on the interrelations between those fields.

The interviewees confirm this work's attempt to categorise knowledge in urban development (see section 3.3.1). The interviewees state that different required competencies fall within the categories of d-, f-, and p-space knowledge. Depending on the practitioner's focus of work, he or she values different disciplinary aspects more than others. However, the interconnectedness of various categories is paramount at all times. Interviewee SGpbl1 (2017: 21') describes, for instance, that the settlement structure is dependent on well-designed dense architectural solutions. Good urban design would in-

crease the financial viability of projects (UKpbl3 2017: 60'; NGdvt2 2017: 37'). Creating and sustaining employment is crucial for liveable cities (UKdvt1 2017: 09'). And, legal frameworks must be seen within its local context (SGpbl2 2017: 56'). The composition of required factual knowledge depends not only on the business' focus but also on underlying value systems of the society and the practitioner themselves. For instance, interviewee SGprv3 (2017: 38') has the impression that urban development in Germany is based strongly on statutory planning practice. Before the emergence of planning as an independent discipline, urban development was more architecture-based and concerned with urban design issues (UKprv3 2017: 17'). Raising environmental concern have shifted to the focus of urban development from solving social to environmental issues (UKpbl2 2017: 23').

Understanding and shaping the interrelations of fields requires the ability to critically evaluate knowledge of each field.

In itself, each of the aforementioned interdependencies seems manageable units of knowledge. However, urban development as a strategic task – as defined before – is the multitude of various interdependencies. The various expectation towards the best composition of competencies and the analysis of chapter 4 shows that no education can cover all factual knowledge above an introductory level. Various interviewees believe, however, that this is at least problematic. If a practitioner is not able to critically reflect the opinion of an expert in a relevant disciplinary field, he has no grounds to disagree with it and suggest changes to accommodate views of other experts (UKpbl2 2017: 53'). Consequently, an all-round planner is only able to provide solutions according to the book (SGpbl5 2017: 65'). Pioneering new solutions requires an in-depth understanding that if not present within one person must be the result of working collaboratively.

5.2.2 Contingency of Conceptual Knowledge and the Need for Innovation

Urban issues are locally and temporally contingent.

The interviews further confirm the assumption that urban issues are locally, and temporally contingent. Interviewee SGpbl3 (2017: 29') states that the content of his studies has become largely obsolete. Interviewees SGpbl4 (2017: 17') and NGdvt2 (2017: 14') add that many of their competencies have been acquired by experience after studying. Topics such as computer-aided design and environmental protection had simply not existed as curricular content at the time of their studies (NGprv2 2017: 10'). The prioritisation of brownfield development came as a consequence of environmental issues and has therefore been introduced later on (SGprv1 2017: 11'). The waves of economic performance can also have a major impact on a programme's content. While economic

growth was the primary concern of the studies of interviewee SGpbl3 (2017), his first years of practice were dominated by de-industrialisation, growing unemployment, and public financial hardship. Interviewee UKprv2 (2017: 31') gained many experiences in developing urban projects in times economic growth. The recent recession required a lot of rethinking established urban concepts. The UK's move from a discretionary towards a zonal planning system will require an entire generation of planners to revisit the very fundamentals of their own discipline (UKpbl1 2017: 43'). Differing legal frameworks makes much of the understanding of urban development processes basically nationally contingent knowledge, although to some degree fundamental ideas of planning law are the same across various countries (UKprv3 2017: 16') – for instance across most commonwealth countries or between Germany, Austria, and Switzerland. But the variance of economic performance within a country also creates very different perspectives on urban issues. For instance, Scotland and the north of England have been economically under-performing for many decades – especially in comparison to London and its surroundings. While the Scottish national government has primarily remained interested in social issues, the administration for England shifted its attention to stabilising the economic success of its south, including measures to protect the environment against economic exploitation (UKpbl2 2017: 30'). Interviewee SGprv1 (2017: 03') describes similar differences with the boundaries of Germany. Especially in the immediate time after reunification, integrated concepts for transforming Eastern German cities for a free market system were a novelty to Western German consultancies. The required competencies greatly differed in the two branch offices of his company in the East and the West. The German Ministry of the Interior – also responsible for the urban development – introduced two individual urban regeneration programmes for the two formerly separate parts of Germany in 2002 and 2004. Just recently in 2017, both programmes Stadtumbau Ost and Stadtumbau West were merged. Interviewee SGprv3 (2017: 46') believes that architects primarily practice planning in Switzerland because the limited availability of land in a mountainous country requires more thoughtful use of each individual plot of property.

In addition to the spatial and temporal contingency, knowledge in urban development is also contingent to its holder. This includes the contingency of knowledge to somebody's own experience and previous knowledge, but also to the institution somebody works for. For instance, railway facilities and tracks became obsolete due to changes in operations around the millennium. Railway infrastructure companies were suddenly in possession of highly valued land in

the heart of many cities. Similarly, the end of the cold war resulted in a shrinking of the German military. Reinforced by the transition from conscription-based to a professionals-only army, many barracks become available for urban regeneration. The sudden availability of large areas of brownfield sites had a major influence on the urban development process and the required knowledge, especially for those that were working for the property owners (SGdvt1 2017: 08' & 53'; NGdvt2 2017: 07'). And, New Town agencies in the UK were equipped with such great competencies that the knowledge they required was much more holistic than in any other situation (UKdvt1 2017: 21').

Due to urban issues being locally and temporal contingent, knowledge production is also locally and temporal contingent.

Due to the contingency of issues, knowledge production and innovation is also greatly dependent on the local and temporal context. If there are no issues, no innovation will happen according to interviewee SGpbl1 (2017: 54'). The economic success of many metropolitan areas in Southern Germany, for instance, makes smaller municipalities blind towards upcoming demographic changes. The general growth in population due to domestic and international migration overshadows underlying challenges. Due to the fact that there is no requirement for pro-active strategic urban development, leaps forward in development policy are dependent on a need for action (UKdvt1 2017: 51'). Aforementioned challenges of urban redevelopment of Eastern German cities after reunification has, for example, substantially contributed to a more holistic view on urban development concepts across Germany. German Waldsterben (the dying forest syndrome) has triggered an entire academic branch of environmental sciences and Germany's position as a forerunner in terms of environmental protection.

Issues do not only motivate academia and practice to deal with them, but also spark interest with students. The engagement of interviewee NGprv1 (2017: 52') for a citizen movement during his studies of architecture shifted his interest towards environmental issues and planning processes. Various interviewees felt a strong desire to stand up for the public good (SGpbl4 2017: 06'; UKprv1 2017: 03'; SGpbl2 2017: 22'; UKpbl2 2017: 20'). Many practitioners seem to be driven by personal values and the desire to change something. Planning education, in particular, seems to reinforce this desire due to its normative nature. The interviews clearly indicate that intrinsic motivation is the key driver for many practitioners. Interviewee SGdvt1 (2017: 26') believes that it is important to enabling graduates to identify potential issues early on.

The interviewees see various challenges ahead but feel that graduates are currently not prepared for those SGprv1 (2017: 42'). Climate change, energy systems, the reduc-

tion of land consumption, societal and economic changes towards the 24h-city, the housing crises, technological change, and digitalisation are expected topics of the future, which current education anticipates only marginally. The thematic breadth of urban development is likely to become greater rather than smaller.

Importance of Interdisciplinarity 5.2.3

Urban development is not just the sum of various kinds of factual knowledge. The practitioner's expertise lies in translating factual knowledge into urban concepts. Interviewee UKpbl2 (2017: 92') believes that this is the primary challenges. Disciplinary experts may possess the required competencies in their fields, but they are not necessarily able to make those available to the urban development process. As argued earlier, knowledge with a narrowly defined disciplinary context falls into two categories: true or false. Knowledge in urban development is, however, not only spatially and temporally contingent, but it is also open for debate. When combining knowledge and perspectives from multiple disciplinary branches, inconsistencies, contradictions, and objections inevitably occur. The translation process from factual to conceptual knowledge is, hence, a normative process of setting priorities. Urban development is fundamentally a political process (SGpbl4 2017: 16'; SGpbl5 2017: 67'), for which the practitioner provides evidence.

The applicable German law code, the Baugesetzbuch, introduces the concept of consideration of all interests (German: Abwägung). Interviewee SGpbl2 (2017: 17') states that this is a methodologically ill-defined process. The law code itself defines it as such:

> *When adopting a land-use plan all interests which are of relevance for consideration must be determined and evaluated. / Bei der Aufstellung der Bauleitpläne sind die Belange, die für die Abwägung von Bedeutung sind (Abwägungsmaterial), zu ermitteln und zu bewerten. (BauGB: §2)*

The consideration process includes two parts: firstly, the determination of interests, which includes the identification and the collection of the necessary information, and secondly, their evaluation. The interviewees identify three methodological ways to support this process: the provision of evidence-based on analysis, design, and discourse (cf. analysis, synthesis, and communication).

Interviewee UKpbl2 (2017: 64') is quite firm about his statement that plans and policy must be derived from methodologically sound analysis. The practitioner must always be the best-informed person in any urban development process. Based on analytical evidence, he is able to persuade other experts, politicians, and citizens. Interview SGpbl5 (2017: 16') confirms that analytically well-supported proposals are usually accepted in Swiss plebiscites. Many projects are, however, not based on enough analytical evidence, according to UKpbl2 (2017: 66'). The sound analysis shall be a matter of good methodological competencies, as well as sufficiently allocated resources (UKpbl2 2017: 70').

Planners alone seem to be methodologically not well enough prepared (NGdvt2 2017: 24'; NGdvt1 2017: 59'). The multidisciplinary nature of urban development requires a systemic approach, according to interviewee SGpbl2 (2017: 45'). Systemic analysis in itself is already difficult and provides only an analytical understanding. However, planners must also come up with proposals (UKpbl2 2017: 60'). Even if design is just 10% of urban development (UKpbl3 2017: 04'), it is still an essential step of translating a systemic understanding into a systemic proposal. It is necessary to widen our understanding of the term 'design'. Urban design is not only the arrangement of buildings and land-use; it is fundamentally a process of making analytical results into political proposals (SGpbl2 2017: 80'). These political proposals are then up for debate. Decisions on plans and policy are, hence, based on both analysis and discourse (SGpbl4 2017: 14'). Besides sound analytical skills, communicative skills are therefore very important for both working collaboratively with other experts and debating with stakeholders and the public (UKpbl1 2017: 78'; UKpbl2 2017: 89'; SGpbl4 2017: 16'; NGdvt1 2017: 37'). This includes the ability to work in collaboratively in teams (NGprv2 2017: 52'), and managerial skills if you are in an executive role (SGpbl3 2017: 17').

The methodological combination of analysis, design, and discourse is basically a decision-making process. Urban development is a solutions-oriented practice. However, solutions are not made by any single institution. Urban development in its totality is the result of many individual actions by various actors.

A city grows instead of being planned
(NGdvt1 2017: 48').

Networks of Innovation 5.3.1

The impact model introduces two impact time lags consisting of the time between curriculum development and the time of graduation of the first students, and the time between first employment and reaching a position, in which the graduate has a meaningful impact on the processes and outcomes of his work. While some of the interviewees felt having an impact on urban development practice from the beginning, others have undergone various positions beforehand. Two factors for a short impact lag can be identified: firstly, a strong educational, research-oriented background, and secondly, leadership in companies that encourages critical thinking and innovation.

PhD graduates have a strong influence in challenging common practices.

The interviewees SGpbl1 (2017: 10'), and SGpbl5 (2017: 08') have both entered the job market holding a doctoral degree. As part of their PhDs, they developed analytical approaches that SGpbl1 used to co-found a planning consultancy and SGpbl5 to introduce spatial analysis tools to the local statistical office. Interviewee NGprv2 (2017: 06') got an executive position in the planning consultancy of his PhD supervisor before later taking over the business with other colleagues. And, interviewee NGdvt2 (2017: 05'), who started but did not finish his PhD, became employed by a state-owned infrastructure company as a planning graduate because of the research he conducted. Only interviewee UKprv3 (2017) did not directly employ her knowledge from her PhD to find a leading position in urban development. This may be because of her personal relocation from abroad to the UK, or the different nature of a PhD in the UK. The majority of German doctoral candidates are employees of the university. They have an obligation to do teaching, research, and often also consultancy work. Holding a PhD position in Germany equates to an early career position in practice. Doctoral candidates in the UK usually have the status of a student. They can focus almost entirely on their PhD research with some additional coursework, but without the obligations that come with employment. So, while a PhD in the DACH-countries may be considered as having work experience, UK graduates with a PhD are career starters.

Professors in architecture are highly influential for the graduate's work in practice.

In the field of architecture, doctoral research has always been an exception. Experience in practice is valued higher than the academic qualification. Even if people decide to work as research assistants at the university, they usually do not work on a doctoral dissertation (SGprv3 2017; SGdvt1 2017). Still, the relationship between the architecture professor and his assistants can be of formative nature. Interview-

ee SGprv3 (2017: 06') entered an international architectural practice and later became an executive based on her collaboration with the professor. Interviewee SGprv2 (2017: '04) did not work as an assistant but entered employment with his former professor directly after his diploma. Dooren et al. (2013: 54) speaks, therefore, of the master-apprentice-system in architectural education. Recent changes in German legislation (WissZeitVG: §2) may end this practice. Fixed-term contracts for researchers are no longer allowed if the researcher does not qualify during the period of employment. Although the law accepts other qualifications than a PhD, universities are unsure about the form of equivalent qualifications in the architectural field. In consequence, some universities, e.g. the HafenCity University, made starting a PhD a requirement for employment. Kaps et al. (2017) speak of a 'scientification' of architecture.

If we compare a PhD to other early career positions, the doctoral research phase – or the master-apprentice-phase for architects – is unfolding the strongest impact. A popular alternative to a PhD in Germany is a public traineeship (in German: Referendariat). The Referendariat is a two-year traineeship programme of the German federal and state governments that prepare university graduates holding a master's degree or an equivalent for public administration. The traineeship consists of work placements on the municipal and/or state level, and additional coursework. It is not a university-, but a state-led programme that still ends with an examination (in German: Staatsexamen) similar to those at universities. The Staatsexamen is required for acquiring a special status of a German civil servant (in German: Beamter). The interviewees SGpbl2 (2017: 18'), SGpbl3 (2017), and NGprv1 (2017) all describe that the Referendariat gives the academic knowledge flesh and blood. However, none of them was promoted to executive positions in public administration directly afterwards. NGdvt2 (2017: 07') describes it as a necessary step before entering public service. The Referendariat is part of a qualification-based educational system, in which education is a form of licensing to enter public service (Klein 2011: 256). It is about understanding common state-led practices. A PhD, on the other hand, is about discovering something new and has developed from a necessary qualification for entering academia to a resource of knowledge for the labour market (Alberti 2015).

Universities do not fully prepare students for practice.

In order to enter practice, various interviewees felt that university education did not prepare them properly for the processes and tasks. This feeling was shared across the different educational pathways. Interviewee SGpbl2 (2017: 19') describes the difference between university and practice as such:

> *Studying urban planning is about designing – so, how I design based on a given task. Urban planning is also about programming tasks in particular. / Original: Im städtebaulichen Studium ging es um Entwurf – also wie entwerfe ich entsprechend einer bestimmten Aufgabe. […] In der Stadtplanung geht es aber insbesondere auch um die Programmierung von Aufgaben.*

The interviewees SGpbl4 (2017: 04'), UKpbl1 (2017: 08'), NGprv1 (2017), UKprv1 (2017: 06'), and SGdvt1 (2017: 11') all describe that they did not understand what practice is about before gaining work experience. Interviewee SGpbl3 shares a similar experience. Although the introduction of independent planning programmes has widened the thematic scope of studying, universities usually still do not manage to provide an authentic, close-to-reality learning environment (SGpbl3 2017: 43'). Apart from the German Referendariat, we can identify two ways to link education and practice from the English interviews:

The bachelor's-master's-system allows students to get work experience before doing a master's.

Firstly, the UK has had a two-tier degree system consisting of bachelor's and master's programmes before the European Bologna Process. Leaving university with a bachelor's degree, gaining work experience, and then returning to university for a master's degree is by no means uncommon. As part of this two-cycle education, some students may also change the field of study, in which the interviewees UKpbl1 (2017: 56') and UKprv2 (2017) see an enormous value. The interviewee UKpbl3 (2017: '05) studied landscape planning before doing a master's degree in urban design. The interviewee UKpbl2 (2017: 06') combined a bachelor's in Geography and a master's degree in planning. According to him, geography provides 90% of the methodological abilities that are required and planning taught him general managerial skills and judgements based on values. The interviewee UKprv2 (2017: 41') describes people that come to planning later as 'more rounded, more motivated, more committed, more enthusiastic, [and] more engaging'. Even if people come from completely unrelated fields such as history or literature, they are at least as valuable with a conversion degree in planning

than regular planning graduates according to UKprv1 (2017: 39'). The Royal Town Planning Institute has also identified the potential and opened up new pathways into planning, for instance, the associated membership (RTPI n.d.c) and the apprenticeship programme (RTPI n.d.b). Furthermore, the professional body in the UK is diversifying (UKprv2 2017: 50'). The Royal Institution of Chartered Surveyors (RICS), the Town and Country Planning Association (TCPA), the Urban Design Group, and the Academy of Urbanism are just a few organisations representing professionals in the field of urban development.

The introduction of bachelor's and master's programmes should open up similar opportunities in the DACH-countries, as well. However, the value of a graduate holding just a bachelor's degree is limited because most professional bodies do not accept a three-year bachelor's degree as enough qualification to become a chartered planner (Kunzmann 2008: 17). Interviewee NGprv2 (2017: 46') describes that his company was very unsure at the beginning about the bachelor's degree. Their experience is, however, that employees that enter with a bachelor's degree become as good as those holding a master's degree after a few years of experience. The curricular analysis supports this due to the similarity of competency profiles between bachelor's and master's graduates in planning. The company of interviewee NGprv2 (2017) employs graduates of bachelor's programme on the basis of a lower initial salary and additional on-the-job training. The best of them still return to academia for a master's degree, but others are valuable employees. It seems that even a decade after the introduction of the two-cycle degree system in Germany, the employment market and the professional body need to adjust to changing qualifications (Dopheide et al. 2015). For instance, the German professional body representing planners has still a rather strict qualification-based entrance scheme.

Traineeship programmes can link the graduate's education to practice.

The second way that UK-based employers try to link education and practice has similarities to the wider German education system. A large English public authority introduces, for instance, a traineeship programme similar to the Referendariat (UKpbl1 2017: 27'). The programme combines in-house training with the opportunity to take a part-time course at the university. The RTPI apprenticeship programme goes beyond the post-graduate traineeship by introducing a dual system of vocational training. Entering the apprenticeship requires no previous university degree. Apprentices will work part-time in one of the participating public adminis-

trations or private practices and studies at an associated college. Currently, the programme qualifies participants only as planning technicians. Full RTPI chartered membership will be available as part of a more advanced apprenticeship starting in September 2018 (RTPI n.d.b).

Introducing innovative practices as a young professional is based on the support of the leadership.

The interviews confirm the hypotheses that education needs to balance innovativeness with preparing for the status quo. In addition, innovation is not only the result of education. Aside from a strong educational background, leadership in the hiring company can facilitate a graduate's impact on internal processes and knowledge. Interviewee UKpbl2 (2017: 17') , for instance, received great intellectual freedom, when he challenged the common practices of slum renewal as a young professional in England. Interviewee SGpbl2 (2017: 56') confirms that especially innovative solutions require the support of leading figures in local administration. Interviewee UKpbl1 (2017: 09') benefited from his employer's guidance and support before, during, and after his master's with the consequence that he is currently introducing the above mentioned new traineeship programme. Similarly, SGprv3 (2017: 09') and NGprv2 (2017: 05') felt strongly influenced by her employer but received quickly afterwards great responsibilities with the company. Interviewee UKdvt1 (2017: 09') takes her time working for a New Town development agency as an example for an encouraging period of continuously developing new ideas.

The Balance of Innovation and Employability
(Own Graphic)

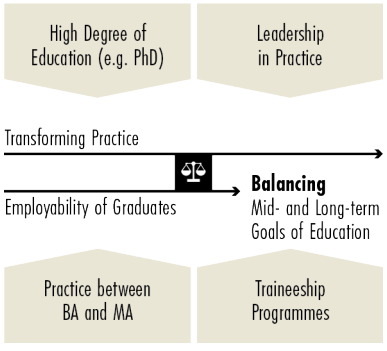


Fig. 34

Interviewee UKpbl2 points out that the graduate's ability to persuade the leadership is based on sound analysis which in turn is based on proper training, but also available resources (UKpbl2 2017: 70'). Hence, a successful lead-practitioner cycle is based on both well-educated, research-oriented graduates and leadership facilitating innovation in practice (see Fig. 34). Both factors combine for the career of interviewee NGprv2 (2017). His career pathway is rather simple: After graduating with a German diploma degree in planning, he continues his studies as a doctoral researcher. At this time, his supervisor founds a planning consultancy and subsequently hires various former PhD students. As the company is quite small at first, the interviewee begins in a leading position. Later, ownership of the consultancy is taken over by the former PhD students who have built up the company form the beginning.

5.3.3 Generalists vs Specialists

Regarding the required degree of graduates, the interviewees have no common view. The positions range from 'it doesn't matter what they have studied' to 'we only take graduates from these universities'. Interviewee UKprv1 (2017: 29') puts it this way:

> *Urban planning is not an exact science. So, we do not need an exact education (UKprv1 2017: 29').*

A studium generale is highly contested. Generalist planning studies are, however, seen as beneficial.

The interviewees UKpbl2 (2017: 86') and SGpbl3 (2017: 30') believe that the ability to think freely and acquire new competencies independently is more important than learning the tools. Currently available tools may quickly outdate. Interviewee SGpbl2 (2017: 35') believes that familiarising students with important theorist is of great importance. Those statements are in line with a labour market study showing that vocation-specific training provides diminishing benefits over time and even turns into a disadvantage in comparison to general education for higher ranking end-of-career positions (Hanushek 2011). Hence, this could be a plea for a studium generale (in English: general studies). The interviewees NGprv2 (2017: 42') and NGprv1 (2017: 33') disagree. A generalist degree must still be focussed on urban issues and train working spatially. Konieczek & Wilke (2015) identify the need to balance the academic interest to educate generalist with specific requirements of the labour market. Independent planning degrees in the sense of 'inner-disciplinary interdisciplinarity' (UKpbl1 2017: 31') appear to be helpful for connecting knowledge from different 'sub-disciplinary' branches (SGpbl5 2017: 19'; UKpbl2 2017: 21'; UKprv2 2017: 10'). Interviewee SGprv2 says:

> *Urban planning is on the one hand very cross-sectional, but at the same time a high specialisation on the cross-sectional orientation (SGprv2 2017: 42').*

In other words, urban development education requires a generalist approach, that is, however, focussed on the issues and tasks that are concerning urban development. The interviewees NGdvt2 (2017: 04') and NGprv2 (2017: 07') believe that a generalist planning degree must be taught in close organisational proximity to other relevant disciplines. The split-up of the integrated department of architecture, civil engineering, and planning of their own alma mater regard both

as a mistake. A problem with the generalist approach is that a small department struggles to cover the thematic breadth of urban development. Most planning programmes put an emphasis on certain fields of expertise as a consequence, according to interviewee NGprv2 (2017: 21').

Employers have a decreasing insight into the range of programmes in the field of urban development.

Hiring is, in many cases, based on the employer's impression of various university programmes. Employers often have a dedicated view, especially on local universities. Architects from the University of Stuttgart, for instance, have a strong planning perspective (SGprv2 2017: 15'). Planners from the Technical University of Kaiserslautern lean more towards administrative instruments, while planners from the Technical University of Cottbus are design-oriented (NGprv2 2017: 17'). The company of interviewee hires graduate only from a list of the top eight planning programmes in the UK (UKprv2 2017: 03'). However, the rapid diversification of the educational market has, however, made it much more difficult to determine what degrees mean in terms of acquired competencies (NGprv2 2017: 49'; Danielli 2013).

Generalist planning education may be too ambitious.

The analysis of chapter 4 does, for instance, not necessarily reveal a lack of thematic width in the planning programmes of the HafenCity University Hamburg or the Technical University of Vienna. The analysis does, however, show that planning programmes struggle to teach the thematic breadth due to the limited timespan of bachelor's and master's programmes. The cognitive abilities of planning graduates do usually not exceed the level of understanding in the various disciplinary fields. The interviewees NGdvt1 (2017: 59') and UKpbl2 (2017: 66') describe planning, hence, as too value-laden. Planning students have to focus on certain areas regardless of the department's size.

Multiple interviewees constitute that no programme will be able to cover all necessary competencies for urban development practice. The list of missing competencies is manifold. The interviewees NGdvt1 (2017: 59') and UKpbl2 (2017: 66') see a lack of methodological skills, interviewee UKdvt1 (2017: 55') believes that planners need to learn more about finances and management, and the interviewees SGpbl3 (2017: 40') and NGprv1 (2017: 35') see that planning graduates did not obtain enough basic administrative and legal knowledge for the statutory tasks of planning – at least in comparison to people that have passed through the Referendariat. The recent postulation that planning should re-focus on the physical qualities of space (Höing et al. 2014) and the immediate counterargument that planners need to cover all aspects of urban development (Altrock et al. 2014) is, hence, just a symptom of the general over-extendedness of the curriculum as the underlying cause of critique. Dalton (2001) suggests, therefore, to shift the debate. Instead of discussing the im-

portance of different kinds of curricular content, she proposes a focus on the knowledge's application and ability to shape urban futures.

Educational pathways into urban development practice should be diversified.

In the light of these quite diverse views on planning education, it seems necessary for interviewee NGdvt1 (2017: 62') to give up the claim of universality of planning education. Various interviewees (NGdvt1 2017: 12'; UKprv2 2017: 48') believe that current planning education is focussed on the needs of public administration – although the two aforementioned interviewees that see a lack of administrative skills may disagree. Interviewee UKpbl1 (2017: 44') believes that different educational approaches are required for a variety of jobs in the field of urban development. Interviewee SGprv3 (2017: 56') adds that multiple educational approaches may also be beneficial because each approach would question and be questioned by one another, which would lead to much more reflective practice. The interviews reveal a minimum of four alternative routes into urban development practice that are in high demand: firstly, a more management-oriented pathway (NGdvt2 2017: 23'; UKprv2 2017: 53'), secondly, the route via an architectural education (NGprv2 2017: 40'), thirdly, an infrastructure-oriented engineering approach (SGprv2 2017: 51'), and fourthly, an administration-focussed degree that actually covers enough administrative and legal knowledge. The Royal Institute of Chartered Surveyors (RICS) offers a more management-oriented route into planning and development which has become increasingly popular with employers other than public administration in the UK.

The BA-MA-system should provide more flexibility to get into urban development.

Another reason for opening up different pathways into planning might be the observation of several interviewees that students do not always know at the beginning of their studies, what they want to do after graduation. Many architects, for instance, develop an interest for urban development issues during their studies (SGprv3 2017: 04'; UKpbl3 2017: 23'; NGprv1 2017: 52'). The interviewees SGprv2 (2017: 58') and SGdvt1 (2017: 12') suggest using the two-tier BA-MA-system to make pathways into urban development practice more flexible. Currently, many of those alternative educational routes are not recognised by the professional body (NGprv1 2017: 33').

The professional body remains important as a mediator between education and practice, but needs to diversify in order to represent the greatly different needs of various kinds of employers.

The interviews could only partly confirm that regulations of the professional body hinder hiring people from other disciplines. German interviewees state that membership in the architectural chamber is generally no criterion for employment (SGpbl1 2017: 47'; NGprv2 2017: 38'; SGprv1 2017: 31'). Most employees with suitable qualifications will become members because of the monetary benefits package that comes with it (NGprv1 2017: 31'; NGprv2 2017: 35'). Planners are a much smaller group than architects within the

chamber. Planning issues are, hence, greatly under-represented (SGprv2 2017: 48'). Therefore, the interviewees see only a marginal benefit of being a member. RTPI membership is generally regarded as more valuable in the UK. Being a chartered town planner is the 'gold standard' (UKpbl1 2017: 47'). Statements of RTPI members come with greater authority, which is at least of value if planning decisions are subject to legal procedures (UKpbl2 2017: 83'; UKprv2 2017: 18'). Therefore, employment in the UK requires often at least having qualification of an accredited programme (UKpbl1 2017: 51'). Others in both Germany and the UK also value the exchange of knowledge and regard the professional body as a form of quality control (SGprv2 2017: 47'). However, there are also people in the UK that see limited value in the services of the RTPI, think that the administrative requirements are too high, believe that the thematic focus is too narrow, and hence, do not ask an applicant for membership (UKprv3 2017: 20'). So, while membership itself is of lesser importance for employment than expected, there is still a dynamic of employing people from accredited programmes. As explained previously, the diversification of the educational market gives employers a lesser understanding of what they can expect from graduates. As a result, many of them hire from known accredited programmes because they know what they get (UKprv1 2017: 33'; NGprv2 2017: 49'). Interviewee NGprv2 (2017: 37') adds that this approach may be common practice right now, but not made to last. The current qualification based accreditation system lacks in recognising educational pathways with different bachelor's and master's degrees. However, jobs in urban development become increasingly fluid, according to interviewee UKpbl3 (2017: 04'). Chartered town planners do not bring along all competencies that are required in practice. An apparent lack of financial knowledge has been closed by the alternative RICS route into planning (UKprv1 2017: 37'; UKprv2 2017: 53'). Others organisations that do not accredit qualifications such as the Urban Design Group in the UK, or the Vereinigung für Stadt-, Regional- und Landesplanung (SRL, in English: Association of Urban, Regional and Territorial Planning) become more important (SGprv2 2017: 47'; UKprv2 2017: 54'). The professional will have to diversify, according to interviewee UKprv2 (2017: 50').

The availability of labour is locally contingent, but planners are hard to substitute by other disciplines.

German and Swiss interviewees state that at the time of their studies, no generalist planning degrees existed. The analysis of chapter 4 shows that generalist planning degrees are still not in place in Switzerland (see also Pfister, Pedrina & Delcourt 2014), and the two most southern states of Germany. Interviewee SGprv2 (2017: 07') explains that the two branch offices of his planning and design consultancy in the north and the south of Germany have, hence, a very differ-

ent structure of employees. While the employees in the north are roughly half and half urban planners and architects, the southern office employs almost only architects. Interviewee NGprv1 (2017: 41') confirms that members of the professional body in the southern states of Germany are mostly both a planner and an architect. The lack of people that have been educated as planners results in hiring many Germans and other foreigners in the case of Switzerland (SGpbl5 2017: 52'; SGprv3 2017: 37'). Interviewee SGprv3 (2017: 46') believes that the overwhelming majority of architects and lack of people that are trained for larger scales has led to the situation of increasing spatial sprawl over decades in Switzerland. According to interviewee SGprv1 (2017: 29'), it is hard to substitute planners with graduates of other disciplines. However, the interviewees NGprv1 (2017: 42') and NGprv2 (2017: 41') do not think that architects with an additional qualification or experience in planning are any worse than full planners. The reason might be that the ability to synthesise sets both planners and architects apart from other disciplines (SGpbl3 2017: 38'; NGprv2 2017: 41'). Planners and architects are valued as highly employable graduates by most interviewees, while for instance, geographers seem less employable. Interviewee NGprv2 (2017: 45') also identifies as problematic that most geography degrees do not directly refer their knowledge to urban issues. The programmes are too general with too little insight into the challenges of urban development. Architecture is, on the other hand, at least about construction that is inevitably linked to its urban context (SGdvt1 2017: 21').

Practice feels the need to incorporate specialists, but values universality of graduates higher.

Many companies hire people also from other than the aforementioned disciplines. Engineers are becoming more and more relevant as demands for resource-efficient planning and construction are growing (NGprv2 2017: 50'). Innovations in information technology, such as building information modelling, make the employment of computer scientists viable and potentially a necessity in the future (NGprv2 2017: 62'). The complex legal environment of local, national, and European planning and environmental law often requires legal competencies that only law graduates have obtained during their studies (NGprv2 2017: 17'). Management and economics graduates are demanded, especially in the private sector (NGdvt1 2017: 09'). And, other interviewees mention social scientists, landscape planners, and surveyors as valuable parts of their teams (SGpbl1 2017: 28'; SGpbl3 2017: 32').

Practice values universality of employees higher than specialisation.

The rationale for hiring graduates from other disciplines is diverse. While some companies diversify and branch out into various fields of development, others try to introduce new knowledge and perspectives to the business. Interviewee SGprv3 (2017: 33') describes that her consultancy has hired various experts – especially in the fields of building in-

formation modelling and visualisation – over the last years to complement her team of architects and planners. Interviewee UKdvt1 (2017: 32') generally only hires people for things she cannot do herself. Interviewee SGprv1 (2017: 42') confirms that graduates sometimes bring new expertise to his company. However, the universality of staff plays a more important role besides complementarity.

> *The best are those colleagues with a broad spectrum [of competencies] (NGprv2 2017: 22').*

Interviewee SGpbl3 (2017: 36' & 81') states that even if he looks for a specialised candidate, his or her interest in the wider field and his willingness to also do other tasks than those of his expertise are crucial. An ideal member of staff for urban design consultancies would be somebody that is proficient in both architecture and planning (SGprv3 2017: 32'). The company's size also plays an important role. Smaller businesses require employees to be able to do all standard tasks. For instance, in the case of the company of interviewee NGprv1 (2017: 36'), all employees must be able to do a statutory zoning plan (German: Bauleitplan). The higher the flexibility of graduate, the better they meet the business requirements (UKpbl1 2017: 71'). The flexibility of staff is regarded as an important measure to make the own business more resilient to changes in the economic situation and shifting demands.

Interdisciplinary thinking is key criterion for employment. Experienced applicants are regarded as more suitable.

The interviewees also believe that besides a wide range of competencies, the general ability to think into new topics will become more important.

> *There will be more interdisciplinary thinking required in the future. This will require more proactive thinking by each employee (SGpbl5 2017: 75').*

Interdisciplinary thinking has already become a key criterion for promotion for the employer of interviewee UKpbl1 (2017: 90'). Members of staff that are not willing to provide this level of flexibility are slowly becoming replaced by a younger generation, for which working across disciplinary boundaries is a matter of course. In the UK, this process has been greatly accelerated by many terminations of labour contracts as a consequence of the recent financial crises and recession. But also German interviewees describe that narrow-mindedness and single-sided specialisation is becoming rare. A generational change has already happened. Hence, graduates are not regarded as more suitable for interdisciplinary thinking as those with experience.

You need somebody with experience so that he has insight into the different fields of planning. Rookies are hardly able to cover everything (SGpbl5 2017: 77').

Hiring only experienced people has led to a generational gap of mid-aged professionals with minimal experience

Various interviewees share this opinion that interdisciplinary thinking requires experience (NGdvt1 2017: 10'; SGprv3 2017: 31'; SGdvt1 2017: 52'; UKdvt1 2017: 39'). Experience is valued higher than recent education as part of the hiring process. For some employers, experience is even a necessity (UKdvt1 2017: 39'; SGpbl4 2017: 18'; SGdvt1 2017: 52'). Hence, it has been rather difficult for graduates to enter the labour market in the recent decade (UKpbl1 2017: 23'). A reason has been the wave of redundancies in the UK that had made hiring only experienced people even possible for entry-level positions (UKpbl1 2017: 23'; SGpbl3 2017: 30'). The interviewee SGpbl3 (2017: 30') sees also decreasing abilities in interdisciplinary thinking with graduates. He thinks that this can be explained by the increasing regimentation of university programmes with little to no flexibility in choosing courses for the students. The consequence of exclusively hiring experienced people is an ageing employment structure with a lack of potentially good successors and overall increasing labour costs (UKpbl1 2017: 24' & 34').

There is a need to train people, but we are not thinking about it (UKdvt1 2017: 45').

The already mentioned graduates programme of the employer of interviewee UKpbl1 remains an absolute novelty, so far. Most employers are currently experiencing a labour market that is described as 'hot' (UKprv1 2017: 35'; UKprv2 2017: 47'; NGprv1 2017: 66'; SGprv2 2017: 30'). The economy is doing well, but there are many empty positions due to the fact that there are basically only people without experience left.

Continuous learning in urban development is largely based on experience, but still regarded as absolutely fundamental.

Experience, professional training, and continuous learning are regarded as extremely important in urban development. Many interviewees state that they have acquired many of their competencies during their career, in many instances in the form of learning by doing (SGprv1 2017: 12'; SGprv3 2017: 11'; SGdvt1 2017: 06'; UKdvt1 2017: 30'), but also by deliberate attendance to conferences, and other offers of further education (SGprv1 2017: 38'; SGpbl3 2017: 44'; UKpbl1 2017: 27'). However, systematic training is often only available for specialised knowledge, for example, new legal regulations, but rarely for general skills such as interdisciplinary thinking (SGprv2 2017: 29'). Small companies also struggle to provide any form of institutionalised training –

especially for those employees that are not from the business' core discipline (UKprv2 2017: 56'). Many new competencies are acquired due to the interdisciplinary work environment itself and the constant knowledge exchange between colleagues (SGpbl3 2017: 33'). Hence, the professional body requires for initial membership work experience as the first form of further qualification (SGprv3 2017: 56'). Seminars of the professional body that are in some cases obligatory for staying member are primarily regarded as a duty, not as helpful means of further education. The interviewee's observation is that the competencies that they acquired during their studies become of only marginal relevance after years of employment (SGpbl1 2017: 19'; SGpbl3 2017: 26'; SGpbl5 2017: 19'). Good technical professionals will get into managerial positions (UKprv2 2017: 13'). While some interviewees in the development sector have additional management qualifications (NGdvt2 2017: 15'; SGdvt1 2017: 12'), those are usually absent in public administration and consultancies. Interviewee SGpbl5 summarises his job as the following:

> *My task as office head is not knowing everything, but it is bringing a good mixture of employees together (SGpbl5 2017: 17').*

Leadership in practice is of similar nature as leadership in innovative education. Lead-educators and lead-practitioners require a strong managerial role steering the set-up of interdisciplinary collaboration.

5.4 From New Public Management to Managed Urban Governance

5.4.1 Changing Employment Structures and New (Public) Institutions of Innovation

The number of planners in public administration has decreased significantly in the last 30 years. Many competencies have been lost in local government.

Among most interviewees, there has been general agreement upon the fact that public administration alone is not able to manage the process of urban development. The administration has been thinned out over decades (NGdvt1 2017: 15'). Various competencies have been lost with the departure of staff, other competencies have never been accumulated in public authorities in the first place. Public administration has especially been hit hard by waves of redundancies in the UK. Numerous lay-offs have resulted in a general lack of knowledge and skills, especially among smaller authorities (UKdvt1 2017: 38'). Although German labour law makes major lay-offs practically impossible for public employers, a

general trend of structurally simplifying and shrinking local authorities can be observed. The number of employees for cities and municipalities has decreased from over 2 million in 1991 to about 1.36 million in 2010 in Germany (BIB 2017). While there is a slight growth in employment in Germany since 2010, the number of employees in British local governments has been cut by almost one third between 2010 and 2018 (ONS 2018). According to the interviewees, planning departments have been affected by those cuts disproportionally (UKdvt1 2017: 51'). Savings have more easily been possible in areas of practice, which are not statutory by law. Most personnel in planning departments remains in areas such as building applications or statutory plan-making. Tasks that are analytical, pro-active, and strategic become a luxury that falls victim to spending cuts.

Consultancies in Germany and Switzerland are significantly smaller, often so-called microenterprises. Internationalisation, changes in legal policy, and an increasing demand for business diversification will most likely lead towards the growth of larger consultancy firms.

Shrinking public administration has created an environment in which the sector of private consultancies has grown over the decades. While in 1982 only 15.8% of planning graduates of the Technical University of Berlin worked in the private sector (Benninghaus et al. 1982), this share has grown to 34.1% in 2007 (Meier 2008). Statistics by the Technical University of Dortmund show that the share of graduates that works for consultancies grew from 17.6% in 2007 (Greiwe, Kreuzer & Terfrüchte 2008) to 28% in 2015 (Leschinski-Stechow & Seitz 2015). As discussed in section 5.3.1, consultancies tend strongly to specialisation. This is supported by the fact that 67% of all urban planning consultancies organised in the federal chamber of architects (in German: Bundesarchitektenkammer) have less than five employees (Reiss 2016: 3). These microenterprises are inevitably structurally incapable in developing a diversified field of expertise. In comparison, only 28% of consultancies questioned as part of the 2016 UK Planning Consultancy Survey (Geoghegan & Wilding 2016) have less than four chartered planners employed resulting in an average of roughly 14 chartered town planners per consultancy. The largest employer of chartered planners is Savills with 167 RTPI members. The RPS group employs 796 people in its planning department, of which 108 are RTPI members. The overall number of employees of the RPS group is circa 5 000 and of Savills 30 000. Similar figures are present for at least another dozens of companies operating in the UK. Reiss (2016: 5) notices that only larger German consultancies are significantly growing and hiring. Interviewee SGprv2 (2017: 39') also predicts that planning services will become more and more integrated into larger consultancies. International firms such as SWECO become increasingly active in Germany buying smaller consultancies. Interviewee (UKprv1 2017: 19') believes that diversifying a consultancy is important for business resilience.

While most projects will still be run by separate disciplinary departments within a company, larger firms benefit from the ability to have various experts on hand if needed because it enables them bidding for larger, more complex projects without the need for external cooperation (UKprv3 2017: 39'; NGprv2 2017: 24').

Multidisciplinary business models require a critical size in order to maintain disciplinary branches that are financially sustainable on their own.

A challenge of having a multidisciplinary business is the difference between how services are paid, which translates into a difference in wages. The wage gap between civil engineers, planners, architects, and landscape planners – in order of decreasing average salary – can create conflicts within a firm. Interviewee NGprv2 (2017: 29') tries to implement an equal pay policy within his consultancy, which makes it difficult to find engineers. Public administration that is bound to a labour agreement faces the same challenge. While wages in public authorities are highly competitive for architects and planners, the private sector pays much better for civil engineers (SGpbl5 2017: 57'). In order to circumvent situations, in which employees with similar qualification have very different salaries, the companies of interviewees (UKprv1 2017; UKprv2 2017) create companies within companies.

Interdisciplinary cooperation is required for creating innovative ideas.

Smaller companies substitute the internal width of expertise by cooperating with other consultancies (SGprv3 2017: 13'; SGdvt1 2017: 26'). The advantage of external cooperation is that common practices are questioned with every new constellation (SGprv2 2017: 59'; SGpbl1 2017: 38'; UKprv1 2017: 22'). Teams can furthermore be set up for the specific needs of each task, and local project partners can provide insight into a spatial context that would otherwise be hard to understand (SGprv3 2017: 27'). Urban development is increasingly the result of multidisciplinary networks of firms (Meyhöfer 2011). However, cooperation is not exclusive to small companies. Large consultancies are not bound to work collaboratively within its own office. The firms of interviewees UKprv1 (2017: 17') and NGprv2 (2017: 59') regularly cooperates with other consultancies, even if the competencies would be available in-house. Cooperative processes are necessary for innovation, according to interviewee NGdvt1 (2017: 47').

Interdisciplinary cooperation within and across consultancies requires additional effort that needs to be demanded and paid by public authorities.

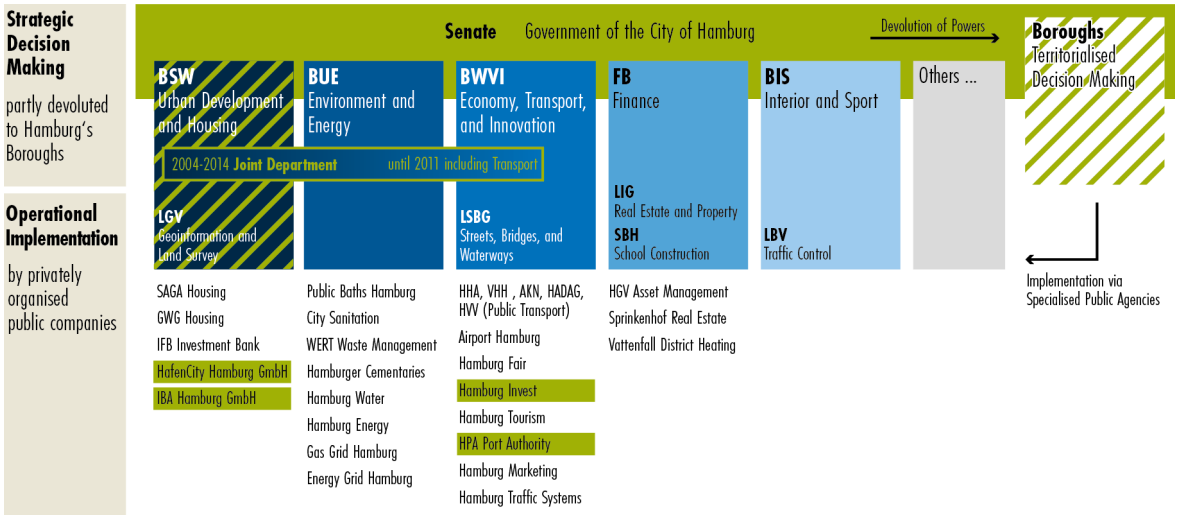
Cooperation between multiple consultancies is often based on requirements issued by the public administration. If multiple departments of a public authority cooperate, then they usually also require partners of private businesses to do so (NGprv1 2017: 29'). However, cooperation is hindered by multiple factors. The de-funding of planning departments has led to overall smaller project budgets. Costs of coordination between project partners are often not covered (SGprv3 2017: 58'). Larger consultancies with the capability of offering everything in-house benefit. Legislation in various areas

of urban development has also created processes in which certain topics are non-negotiable. While this may ensure, for instance, a minimum of environmental protection, it requires legal expertise to such an extent that environmental issues become externalised and solved separately – effectively hindering any form of innovative solution (NGprv1 2017: 11'). While the separation of processes keeps in many cases, complex projects manageable (SGpbl4 2017: 57'), it can produce major inefficiencies, and raise problems itself. Urban design and statutory planning, for example, have become increasingly separated (NGprv1 2017: 17'). Design competitions are often held before the formal process of plan-making. It is then the planner's task to translate the design into a legal code. As part of this translation, the planner is obliged to conduct the consideration of all interests. If the process of consideration raises significant concerns regarding the design, the projects have to be referred back to the design process, which can lead to an absolute standstill. The same dilemma can occur the other way around, if the statutory planning code is so strict, that architectural ideas become basically impossible (NGprv1 2017: 19').

As a consequence, well-thought-through processes of cooperation are rare. The public administration's own restriction to its statutory task has also reinforced the thematic division of its departments. The traditional hierarchy has proven suitable for routine tasks, according to interviewee SGpbl2 (2017: 71'). As a result, even larger authorities are increasingly less able to identify issues early on, to think pro-actively, and produce innovative, interdisciplinary approaches (SGpbl1 2017: 49'). Smaller authorities have always struggled with the aforementioned tasks and have come further under pressure due to austerity policies (SGpbl5 2017: 56').

Competencies are outsourced into public commercial agencies and re-concentrated on the metropolitan, regional, or national level.

Fig. 35 Increased Thematic Division of Public Administration due to New Public Management (Own Graphic based on Bruns-Berentelg 2019)

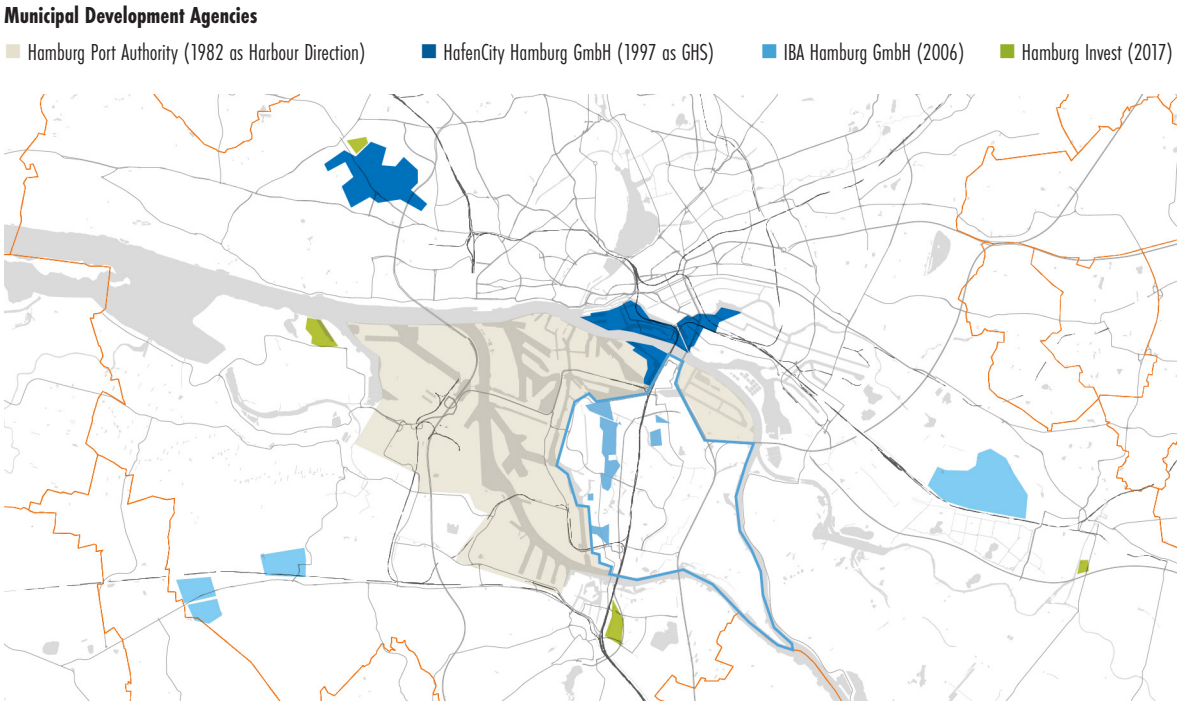


Part of the misery, but also potentially a way out is the establishment of pubic competence centres. Various city administrations have outsourced parts of their responsibilities to independently acting agencies. Reasons are manifold. Some municipalities hope for more cost-efficiency based on business-oriented managerial models. Others merge units from multiple departments to simplify decision-making processes and concentrate necessary competencies. While this process has reduced the in-house capabilities of public administration (NGdvt1 2017: 17'), it has also provided a new accumulation of knowledge and skills. Various 'quangos' (quasi-autonomous non-governmental organisations) emerged as part of new public management (NPM). NPM theory advocates for a separation of strategic decision making and operative implementation. A big portion of quangos falls within that category. The City of Hamburg has, for instance, founded a plethora of specialised agencies from street and bridge building to the promotion of creative industries (see Fig. 35).

Public authorities make increasingly use of large-scale projects in order to create an innovative momentum for urbanism practice.

However, not all quangos are of specialised disciplinary nature. Public urban developers are specialised on integrating the necessary disciplinary fields of urban development in a leaner structure than public administration. Public urban developers are companies such as the London Docklands Development Agency and the former New Town agencies. Hamburg has four such companies developing major parts of the inner city (see Fig. 36).

(Own Graphic based on Bruns-Berentelg 2018) Managed Urban Governance in Case of the City of Hamburg Fig. 36



It often requires major development projects within a city, so that various department of public administration and multiple planning consultancies come together. Hence, Häussermann & Siebel (1993) recognise a 'festivalisation' of urban development. Various interviewees describe how significant learning effects for themselves have been the result of working on major projects of the past (SGpbl3 2017: 17'; UKpbl2 2017: 33'; UKdvt1 2017: 10'). The city of Hamburg has identified the potential, and has repeatedly initiated exceptional projects over the last 20 years, for example, the HafenCity and adjacent projects since 1997, the International Building Exhibition (IBA) from 2007 to 2013, the two failed applications for hosting the Olympic Summer Games in 2012 and in 2024, and the Science City Hamburg Bahrenfeld in 2019. The increase of major development project and corresponding organisational structure creates potentially an environment, which demands a higher level of interdisciplinary cooperation.

While the aforementioned organisations work on a locally defined context, the UK government has experimented with various national agencies such as Local Partnerships and the now-defunct Commission for Architecture and the Built Environment (CABE). The basic ideas behind both organisations are the provision of competent advice to local authorities based on the centralisation of knowledge and skills (UKdvt1 2017: 34'; UKpbl3 2017: 39'). CABE, for instance, ensured that investments by the central government in the built environment of local communities were used to provide quality urban environments. The national Ministry of Housing, Communities, and Local Government (MHCLG, formerly known as DCLG) does also have the right intervene directly into local policy as it is currently inclined to do in order to react to the housing crises (UKpbl4 2017: 16'; UKpbl1 2017: 73'). Various interviewees regard the work environment at the national level as highly beneficial for their personal development, the exchange of knowledge across disciplines, and the success of managed projects (UKpbl3 2017: 46'; UKpbl2 2017: 35'; UKdvt1 2017: 09'). Germany's federal government has not assumed a similarly active role, so far. The constitutionally guaranteed autonomy of local authorities has kept state intervention minimal. The interior ministries of each German state as well on the federal level are restricted by law to voluntary measures such as additional funding for exemplary projects. The federal structure of Germany does, however, not rule out the establishment of advisory agencies. State development agencies (in German: Landesentwicklungsgesellschaften) such NRW.urban assume

such an advisory role. Voluntary inter-municipal cooperation, for instance, in the case of metropolitan regions, are equally present.

Public administration needs to re-grow its base of employees and competencies on the metropolitan level.

Despite the success of specialised agencies, many interviewees believe that a reasonable regrowth of competencies in local authorities is required. This confirms the assumption that lead-practitioners are not only dependent on lead-educators, but lead-clients that welcome innovative proposals (see section 3.2).

> *Successful advice can only be given to clients that hold competencies themselves (UKdvt1 2017: 22').*

Interviewee UKdvt1 (2017: 46') believes that combined authorities could be the right spatial scale to regrow administrative capabilities instead of hiring on the level of individual municipalities. Combined authorities are local government entities introduced by the Local Democracy, Economic Development and Construction Act of 2009 in the UK. A combined authority is currently responsible for local transport and economic development across multiple authorities. It has been established nine times across England, always as cooperation of major cities with its metropolitan hinterland. Thereby, it is closing the gap between individual municipalities and regional administrative structure based on functional interrelations and the willingness to cooperate. Combined authorities are not comparable to German counties that are more often based on the historical context and split functionally interrelated metropolitan areas into multiple administrative parts. The German counterpart are rather city regions that have been established in various organisational forms, for example in Hannover, Stuttgart, or the Ruhr area. While the process of metropolitanisation of local authorities has been moving rather slowly, the United Nations (2017) has recently identified strengthening sub-national and local government as a key cornerstone in sustainably managing urban development. Hence, a growth of administrative personnel should be supported by governance rescaling (Lingua & Balz 2020).

Collaborative Processes in Urban Development Practice 5.4.2

Socio-technical innovation is the result of bringing together knowledge across disciplinary boundaries. Bruns-Berentelg (2019) argues that the varieties of governance' are an important factor for the success of urban development. Designing institutional set-ups that combine mul-

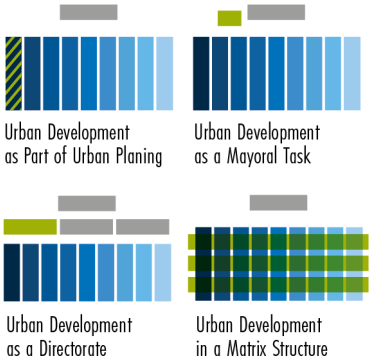
tiple communities or facilitate cross-boundary collaboration is, hence, an important task for urban development practice (Alexander 2005; 2006).

Urban development as a boundary practice can take various institutional forms in public administration.

Disciplinary boundaries and boundaries between communities of practice do not necessarily align. Boundaries in practice come in two forms: institutional boundaries between departments and consultancies and disciplinary boundaries that can sit within practices. Both types of boundaries separate groups of people, and associated activities of knowledge production and skills development. The community of urban design, for example, is an interdisciplinary community in itself. Design consultancies hire both planners and architects, increasingly those that hold a specialised master's degree in urban design which are consecutive to both planning and architecture bachelor's programmes (cf. section 4.2.3). Communities such as urban design are sometimes referred to as a boundary practice (Wenger 2000). Boundary practices are specialised on facilitating the exchange of knowledge and skills across a specific disciplinary boundary. This transfer can be so effective that both architects and planners will identify themselves as urban designers after years of practical experience. The institutionalisation of a boundary practice – in this case, as specialised urban design consultancies – creates new institutional boundaries. Architects within the urban design community get access to newly developed urban design knowledge, for instance, by attending meetings and congresses about urban design, and become urban designers. Architects remain architects or join a different community. Hence, boundary practices are both very effective in bridging disciplinary boundaries and building new boundaries that limit the exchange of knowledge.

Fig. 37

Urban Development (green) in Public Administration
(Own Graphic)



The planning community and planning departments have in many cases taken over both the role of a boundary practice as well as being a constituting disciplinary community itself. This duality of planning has been discussed in various sections of his work before. The advantage of such an integrated approach is that the boundary practice creates one less institutional boundary. There is also potentially a synergistic effect between urban development and planning. In practice, this synergy may be the authority to issue directives. If the head of the planning department takes responsibility for both urban development and planning, he is able to appropriate statutory planning regulations for the purpose of urban development. The downside of such an approach is that the planning department has no authority over other relevant departments, e.g. property and transportation. The duality of the planning discipline is, therefore, broken up into separate administrative units in many cases. Urban development units often report directly to the mayor's office, while urban plan-

ning remains a separate department. The urban development unit is then equipped with the mayor's authority but has to bridge many institutionalised boundaries. A disadvantage of this model is that administrative units under the direct guidance of the mayor are to a great extent subject to political processes and are often not long-lived. A third model in public administration is the attempt to achieve a higher level of integration in general. This could mean a reduction of the number of departments, or subordination of department under the umbrella of directorates. Directorates are, however, large hardly manageable units of administration, and counteract the entire purpose of departmentalisation. Interviewees SGpbl4 (2017: '36) and SGpbl2 (2017: '60) believe that administrative structure would ideally be more flexible. However, the experience shows that matrix- or project-structures greatly increase effort for routine tasks. The approaches across various cities and municipalities vary greatly. De-funding local government has, in many cases, led to a higher level of institutional integration, however, often without the integration of tasks, responsibilities and competencies. While first routine tasks have been outsourced to private consultancies, an increasing externalisation of integrative tasks can be observed, too.

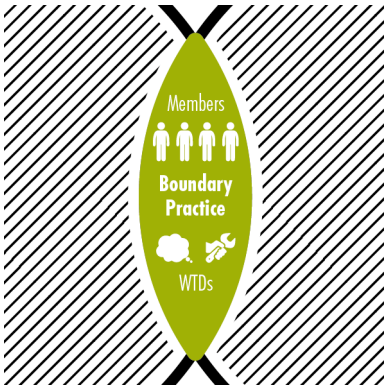
Independently run public agencies and private consultancies assume more frequently the role of urbanist integration.

This trend falls in line with the institutionalisation of specialised agencies (cf. section 5.3.3). Local Partnerships, for instance, is a joint venture of the British financial department (the HM Treasury), the Welsh Government, and the Local Government Association representing 435 local authorities across England and Wales. The organisation combines technical expertise with the competency of creating financially viable proposals for municipalities across the UK. On a local level, the HafenCity development agency integrates conception and realisation of Hamburg's waterfront district including the necessary disciplinary competencies. With the externalisation of urban development tasks, opportunities for integrative services open up to private businesses, too. Urban development will become a more relevant product for private consultancies, which many already experience as higher demand for integrative services such as 'from design to delivery' (UKprv1 2017: '12). The effect of establishing specialised agencies and businesses is, firstly, improved management of associated development processes, but also secondly, the externalisation of a boundary practice, and its related processes of knowledge productions. This externalisation can become critical if boundary practices are temporary. Competencies that have been gained potentially diffuse after closure as happened in the case of CABE. While individuals still hold valuable experiences, these must be re-institutionalised for the

individual's new employment. Temporary boundary practice, therefore, require either a process of internalisation or permanent consolidation.

Fig. 38

Boundary Practices
(Own Graphic)



The consolidation of boundary practices (see Fig. 38) as independently-run units may be favourable for a couple of reason. Urban development is not in contrast to planning a public task per se. Development is the result of decisions made by various actors. Sustainable and just development requires the action of various actors including but by no means exclusively public administration. The imagination that the actions of private actors are steerable by administrative regulations alone must be abandoned. Development is not steerable but the result of a co-evolutionary process as argued before. This does not mean that an attempt to influence this process is bound to fail. Plans and policies provided by public authorities set a framework for investments and the appropriation of space. However, it is important to acknowledge the fact that a climate of low or high investment also shapes our public policy. Practitioners can, therefore, assume many roles working for public authorities, and consultancies that provide their services primarily to the public, but also private businesses, non-governmental organisation, and local citizen groups. Urban development is a practice that exists in itself independently from government.

The predominant employment in public administration produces from time to time situations of conflict, for instance, when analytical findings of the practitioner diverge from the results of a political process. These conflicts are not less likely with regards to other employers. They are perhaps even more likely when commercial interest clashes with the normative values of a planner. The dispersion of practice across the public and the private could, however, ensure a free competition of ideas and thought. While these are not only fundamental principles of a democratic system, competitive environments are a key cornerstone to innovation and quality. Interviewee NGdvt1 (2017: '58) believes that practitioners must have a degree of entrepreneurial freedom in order to deliver good results. The principle of competitiveness is already key to areas such as urban design and should at least to some extent, be transferred to urban development practice. This position is surely contested and raises various questions of accountability. Still, it is undeniable that private actors have become increasingly interested in various aspects of the urban environment. The provision of quality public space has gone hand in hand with its privatisation. Urban design, in particular, has been identified as a vehicle for shaping cities based on the interests of private investors. Under these conditions, urban development sits independently from both the public and the private and is accountable to both.

Boundary Encounters

(Own Graphic)

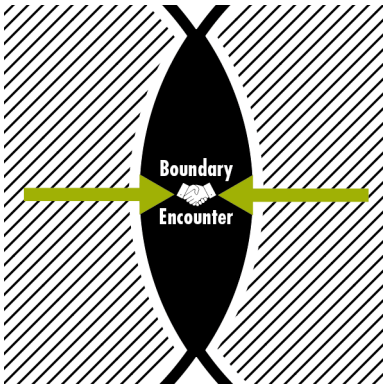


Fig. 39

Often, the institutionalisation of a boundary practice either is not viable or creates greater boundaries than it bridges across. And, smaller municipalities will never be in a situation, where they can afford such 'specialisation on integration'. Interdisciplinary work will need to find processes that work within given institutional forms. The most informal process are boundary encounters. Every community will eventually come in contact with another community. These encounters often need no additional management. The exchange of knowledge, skills, or just basic information works especially in the situation of no conflict just fine. The openness under which experts go into these encounters is a matter of work culture, communicative skills, and the willingness to learn from each other. While the rivalry between departments and prejudice against other disciplines exists, interviewee SGpbl3 (2017: '33) feels that these have become significantly reduced over the last decades. A generational change has already happened or is about to happen. Boundary encounters (see Fig. 39), however, only emerge out of necessity.

Boundary Brokers

(Own Graphic)

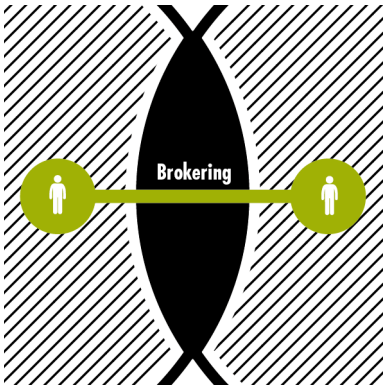


Fig. 40

Keeping in mind that working across boundaries goes along with additional effort, many executives will avoid too much cooperation. That is why brokers (see Fig. 40) are of special importance. Brokers are individuals that continuously mediate between communities. Brokers can come in various forms. Interviewee SGpbl2 (2017: 56'), for instance, had a colleague in the legal department who was very interested in issues of urban development. Together, they were able to develop innovative legal approaches that enable urban developments that would have been otherwise failed. Various other interviewees share the opinion that personal contacts into other disciplines are both helpful for somebody's personal development and for well-functioning work environment (SGpbl3 2017: 79'; UKprv2 2017: 36'). This is especially the case for people in executive positions (SGpbl4 2017: 59'). The company of interviewee UKprv3 (2017: 33') organises, therefore, team activities such as shared lunches and field trips on a regular basis to facilitate semi-professional relations.

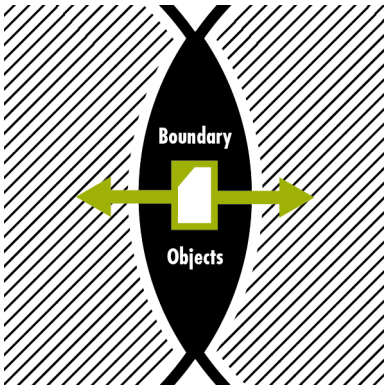
If boundary encounters have to happen repeatedly as part of a specific project, temporary project teams may be established (SGpbl5 2017: 64'). Projects are boundary objects, and project teams are temporary boundary practices. The disadvantage is that the limited time frame of the project limits the innovative potential. After the end of the project, there is also the risk of knowledge diffusion as for larger boundary practices. The advantage is, however, that team members often remain also responsible for other tasks. Project teams are, therefore, less likely to build strong new boundaries. This effect is also mitigated by having different member each time a team is formed. The project team can be made up of experts

that are specifically required for a project (SGprv2 2017: 24'; UKprv1 2017: 17'). Working project structures are, however, more difficult in small institutions. Projects often require co-operation with experts of other organisations, which is not only consuming more time and effort but also decreases the level of collaboration (SGprv2 2017: 19').

Fig. 41

Cross-boundary collaboration can also come in the form of boundary objects (see Fig. 41). Regular cooperation between communities is not only required as part of projects but in many instances also for regularly occurring tasks. Shared process, procedures, resources of knowledge, and documents are equally important boundary objects. Many organisations have, therefore, established internal processes that determine how communities engage with each other. Boundary objects include forms of consultation, task descriptions, tender documents, file formats, meeting schedules, to name just a few.

Boundary Practices
(Own Graphic)



The effort that is required to work across disciplinary boundaries greatly differs between the involved communities. While architects and planners are commonly working together in many practices, geographers, and engineers are harder to integrate (UKprv2 2017: 24'). The interviewees SGprv2 (2017: 12') and SGprv3 (2017: 21')name differing culture of work, as well as interpersonal competencies as potential reasons. Interviewee NGprv1 (2017: 22'), for example, describes urban planners as creators while environmental planners are preservers.

In summary, newly emerging institutions of innovation act as (temporary) boundary practices that enable a new strong form of integration that administrative processes cannot deliver. Integration in administration is often only based on routine processes via boundary objects and irregular encounters. Extraordinary innovation is often only possible due to semi-professional personal brokering networks.

5.5 Preliminary Conclusions regarding the Hypotheses

Before presenting recommendations for higher education that I derive from the empirical findings, the following paragraphs focus on the findings of this chapter. The hypotheses guide the following discussion.

(H2) *Urban planning is largely based upon contingent conceptual knowledge, which leads to a normative reproduction of existing concepts.*

Hypothesis 2 is supported.

While chapter 4 shows that urban planning programmes are largely based upon conceptual knowledge, the interviews support the argument that conceptual knowledge is highly contingent in terms of time, location, and the underlying disciplinary knowledge. Some also support the argument that this leads to a normative approach in planning if it is not backed up by rigorous analysis.

Hypothesis 3 is partly supported.

Only the collaboration of disciplinary experts provides access to powerful knowledge in all spatially relevant disciplines, which in turn is necessary for socio-technical innovation. **(H3)**

The interviewees also feel that collaboration is an essential part of urban development. However, it becomes quickly evident that the collaborative aspects do not have to be based on face-to-face cooperation. Many processes of urban development are sequences of operations that are handled consecutively. Each step is often done by separate public departments or private companies. The transfer of information and decisions from one to another actor can be either formalised or informal. The interviewees gave examples that highlight the importance of what the academic literature would call boundary objects. A well-functioning public administration has set up specific boundary objects that broker between different departments on day-to-day bases. However, individual efforts of brokering take up a significant additional portion of success. Institutionalising these efforts of brokering requires new forms of urban governance. The chapter introduces multiple possible institutional forms which all constitute a higher level of project-based integration. So, while the collaboration of disciplinary experts does not have to be the norm, it can facilitate innovativeness where needed.

Hypothesis 4 is not supported.

The institutionalisation of urban planning as a boundary discipline dealing with urban development hinders the collaboration of disciplinary experts. **(H4)**

On the surface, planning is a highly collaborative task in practice. The interviews show that planners rarely work alone. It is the constant effort of planning to connect to other spatially relevant disciplines. The departmental silos of municipal and state administration is a difficulty to be overcome by integrative planning approaches. In theory, this would require planning to sit horizontally conveying between other departments. However, planning is a vertical depart-

ment as any other department in practice. People who are not planners have prejudices towards planners as towards any other discipline.

An exception are urban development groups that sometimes directly report to the head of administration. This separation of urban development and urban planning in practice poses the question for which position urban planning programmes prepare. The interviews reveal that the vertical urban planning departments are mostly working on the statutory aspects of planning, while urban development groups are concerned with more strategic questions. While urban planning departments primarily look for graduates holding a planning degree, urban development groups hire more openly. The narrower focus of planning departments seems to be supported by a professional body. The institutionalisation of urban planning as a separate academic discipline is, hence, not distracting from interdisciplinary collaboration. Firstly, urban planners work collaboratively on day-to-day bases cooperating with other public departments as well as other stakeholders. Secondly, planning departments fulfil specialised services such as the preparation of legal land-use plans. More strategic tasks are often the task of interdisciplinary urban development groups that exist in addition to planning departments. Urban planning has to be regarded as an own essential community among others for urban development.

(H5) *Refocussing higher education on boundaries is necessary to capture the innovative potential that lies in the collaboration of different disciplines.*

Hypothesis 5 is partly supported.

The empirical data from the interviews reveal both potential and danger of curricula focussing on boundaries. As argued just before, it comes down to a particular task, whether it is rather strategic or specialised. Planning departments and consultancies seem to prefer planning education because it provides certainty that the graduate has obtained the necessary knowledge in statutory plan-making. Some of the interviewed employers of architecturally-oriented offices similarly favoured architecturally-trained graduates due to their specialised knowledge. However, employers that engage in rather strategic tasks, on the other hand, see the limitations of typical qualifications. Interdisciplinary, collaborative competencies and educational pathways of multiple disciplines are highly valued.

Hypothesis 6 is partly supported.

The implementation of educational programmes that fulfil the requirements of H1 needs the full implementation of employability-based educational and labour market policy. **(H6)**

Those interviewees that are interested in alternative approaches to educating experts for urban development welcome the shift from qualification to employability. Professional accreditation is of limited value to them and in some instances seen as a barrier for innovation. There is however no clear position to whether the amount of newly established programmes is beneficial or not. On the one hand, there are networks of practitioners and academics that share certain positions. In these cases, newly established programmes that take a certain approach to urban development are welcomed. On the other hand, many interviewees also argue for a more open, individualised way of studying that they do not see reflected by current curricula.

Hypothesis 1 is partly supported.

Socio-technical innovation for the development of cities and regions originates not only from the interplay of knowledge of various spatially relevant disciplines, but also from the collaboration of experts of those disciplines. **(H1)**

In summary, the empirical data of this chapter indicates support for the main hypothesis. Innovation - especially on a strategic level - benefits from the direct collaboration of experts of different disciplines. However, interdisciplinarity can also be achieved by organisational structures and the implementation of processes that employ boundary objects. Planners can, hereby, play the role of brokers between other departments as well as experts for plan and policymaking.

Interdisciplinary urban development is not necessarily a matter of face-to-face collaboration, but socio-technical innovation is.

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Towards Transformative Education for Urban Development

6

Synthesis of Research Findings and Implications 6.1

The sixth chapter develops recommendation based on the presented empirical findings on how to improve the educational offer in the field of urban and regional development. The first section summarises the empirical findings on how innovation comes into urban development practice. The second section develops recommendations for educators on how to design curricula and employ different pedagogical environments. The third section looks at the systemic framework and develops advice for different kind of policymakers. At last, the chapter revises the initial hypotheses. As the presented work is of explorative nature, the initial hypotheses are neither validated nor disproven. Instead, the hypotheses are developed further.

Processes of Innovation and Dissemination 6.1.1

Socio-technical innovation in urban development is based upon interdisciplinary collaboration.

The empirical data supports the hypothesis that socio-technical innovation in urban development appears when experts of different spatially relevant disciplines collaborate (see chapter 5). Many firms and public departments hire personnel from various disciplines and utilise different forms of cross-boundary collaboration. Many interviewees can identify retrospectively innovative projects as those that were the result of exceptional interdisciplinary cooperation (e.g. the English New Towns).

The curricular analysis provides a theoretical explanation. The data demonstrate that graduates with a generalist education cannot acquire enough competencies to cover the breadth of all relevant topics. Generalists only receive brief insights. They understand the basics, but they do not reach the ability to critically apply and evaluate disciplinary knowledge for the holistic purpose of urban development. Innovative urban development practice requires access to powerful knowledge, so the ability to critically evaluate and develop the latest new knowledge of a relevant discipline. Setting up the codebook for analysing curricula reveals that there are at least nine relevant domains of factual knowledge (see section 3.3.1). There are in most cases specialised disciplines associated to those domains of knowledge – e.g. architecture that covers knowledge on buildings, landscape architecture that covers knowledge on the open space in-between buildings, civil engineering for infrastructures, to name just a few. An innovative urban development team requires a member of each discipline ideally. Innovative urban development is, hence, a practice of large project teams, including additional effort interdisciplinary work means.

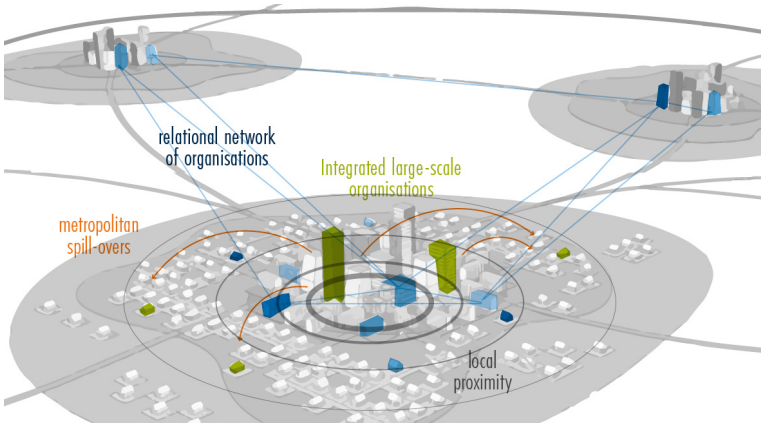
Innovations are disruptive moments in the course of the routine of practice.

The sheer number of necessary experts shows why socio-technical innovation cannot appear in every urban development project. Most day-to-day tasks cannot involve project teams of nine or more experts. Individual planners or small teams of maximum a handful of experts are usually responsible for projects. Hence, it is necessary to find the balance between the interdisciplinary collaboration of highly specialised experts for strategically important projects, and more generalist approaches for routine tasks.

The data shows that there is no significant difference between public and private employers. Disciplinary specialisation and its implementation in the form of communities such as administrative departments or specialised companies have proven to be most efficient in resolving routine issues. Routine is based upon low contingency. Routine tasks feature a generic set of problems, stakeholders, and development goals. This allows generalists to develop ideas based on previous experience and existing urban concepts.

In contrast to routine tasks, projects of strategic importance require an approach that is as interdisciplinary as possible. Generalists would most likely reproduce existing concepts and not contribute to the development of new innovative ideas. The interdisciplinary collaboration of experts is capable of combining new specialised knowledge in its current context to develop new concepts in urban development, that then become applicable for upcoming routine tasks. Instruments such as the International Building Exhibitions (IBA) in Germany, large scale urban redevelopment schemes such as Hamburg's HafenCity, the English New Towns, and strategic urban and regional plans are all projects of potential strategic importance. These projects require our special attention, which includes greater ambitions and significantly better funding than routine tasks.

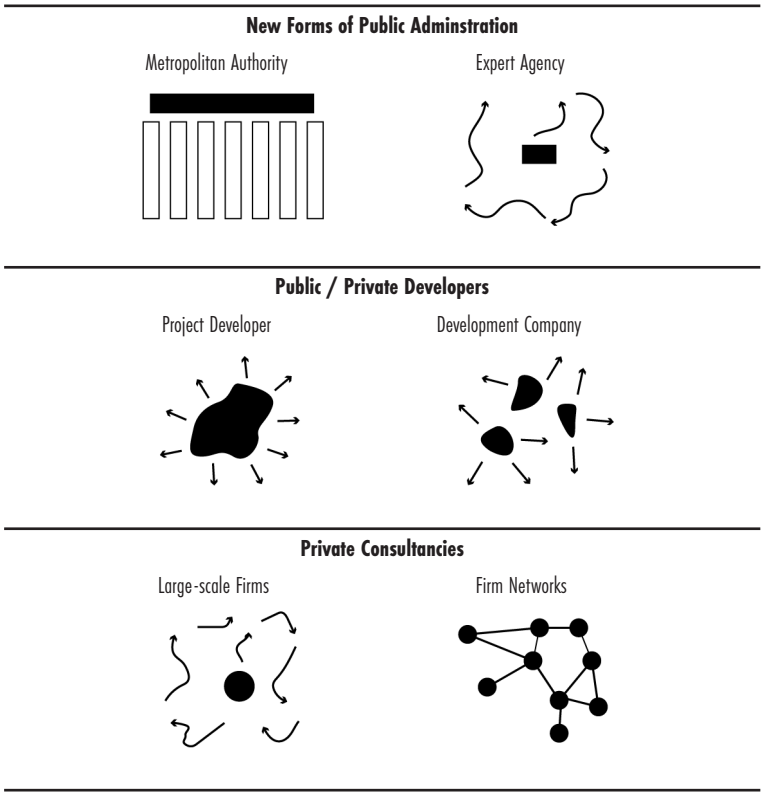
Fig. 42



Organisational Integration, Local, and Relational Proximity as a Precondition for Socio-technical Innovation in Urban Development
(Own Graphic based on Alaily-Mattar 2016)

Innovative urban development occurs under conditions of organisational, local, and/or relational proximity of powerful knowledge.

Aforementioned examples illustrate that strategically important projects require a critical size and temporal extent in order to develop enough momentum for processes of innovation. The required manpower of such projects allows employers hiring experts from various relevant fields. Small municipal administrative structures and smaller practices have a natural disadvantage for taking part in such a project due to the limited resources available to them. Smaller organisations that do not have the capacity to be multidisciplinary must be in physical or relational proximity to other companies (Boschma 2005). The renewal of conceptual knowledge happens primarily in larger urban and metropolitan areas, or within larger organisations (see Fig. 42). The organisational form may vary. Fig. 43 illustrates a variety of different organisational forms, including metropolitan or regional public authorities, national or regional public expert agencies, public or private single- or multi-site project developers, and large (multi-national) consultancies or consultancy networks. These competency holders of urban and regional development do not require a generalist educational approach but rather a set of specialised approaches that complement each other and also function in close collaboration.



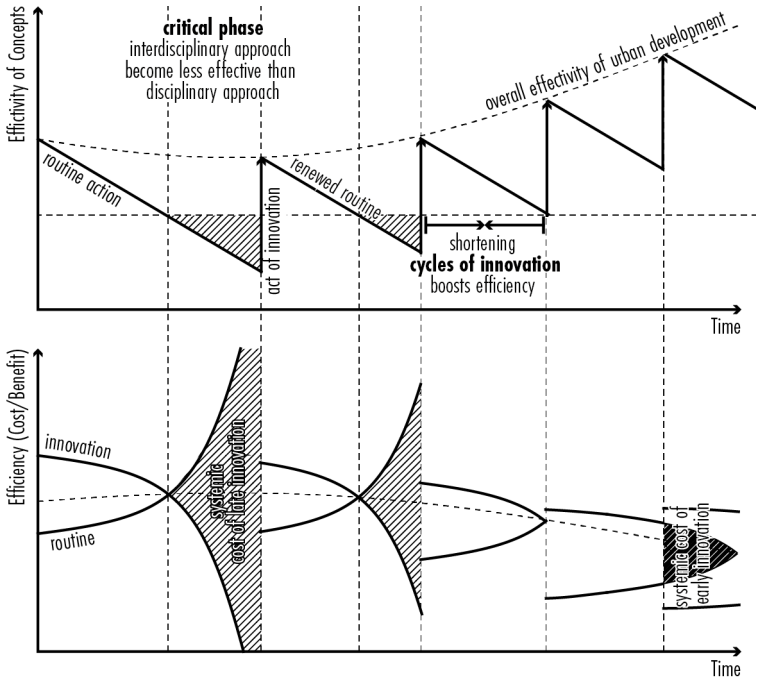
Competency Holders for Socio-technical Innovation
(Own Graphic)

Fig. 43

Urban development requires regular innovation along the time axis.

Strategically important projects and routine tasks interact along the time axis. Fig. 44 shows the effectivity of urban development concepts over time. As argued earlier in section 3.3.2, conceptual knowledge loses validity over time, when the spatio-temporal context of concepts changes. An urban concept is most effective in the moment of the invention when the underlying knowledge is up-to-date. Over time, concepts lose relevance due to changing normative goals and socio-economic settings, and newer more recent knowledge in one of its underlying disciplines. Keeping urban development concepts relevant requires acts of innovation. The more regularly innovation happens, the greater the overall effectivity of urban development is. Innovative urban development is part of strategically important projects and requires a greater amount of funding and personnel. So while more regularly appearing acts of innovation increase effectivity, the benefits of innovation may not outweigh the associated additional cost of taking an interdisciplinary approach.

Fig. 44



Cycles of Innovations, Effectivity, and Efficiency of Urban Development
(Own Graphic)

Increasing the innovativeness of urban development is a matter of improving the cost-benefit relation of interdisciplinary collaboration. Fig. 44 illustrates the effect of both early and late innovation. Making every urban development project a strategically important one is not only unviable but

also unreasonable, because it creates enormous systemic cost. Resources put into urban development cannot be put into other domains. On the other hand, doing without socio-technical innovation can lead to high systemic costs, too. For example, establishing an urban housing strategy in coordination with other aspects of urban development seems incredibly important right now. The effects of building housing estates without the proper infrastructure, social amenities, and access to the labour market have proven to be highly problematic in the past (Ley 1987). However, spending too much on developing a strategy without actually building any housing maybe even worse.

Private investment in spatial qualities illustrates the underlying economics. The reduction of funding for public administration and public tasks has partly been compensated by private investments. Privately funded urban design in the economic urban centres of the globalised economy illustrates that (Nase, Berry & Adair 2015). Private companies determine that they can boost their economic activity more effectively by investing in urban qualities instead of investing the same amount of money in other factors of production (e.g. labour). Similar entrepreneurial activities can be found as part of civic engagement. Movements such as urban gardening compensate for the lack of public investments in public green spaces. Activists determined for themselves that investing their time into urban gardening is more fulfilling than other activities. Investing in urban development fulfils for each of us a purpose, which economically could be phrased as the formation of capital. Fig. 45 shows how various factors of capital formation compete for investment.

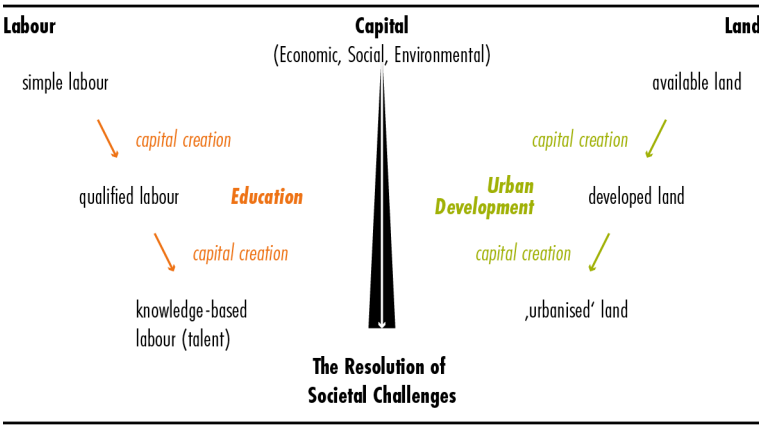
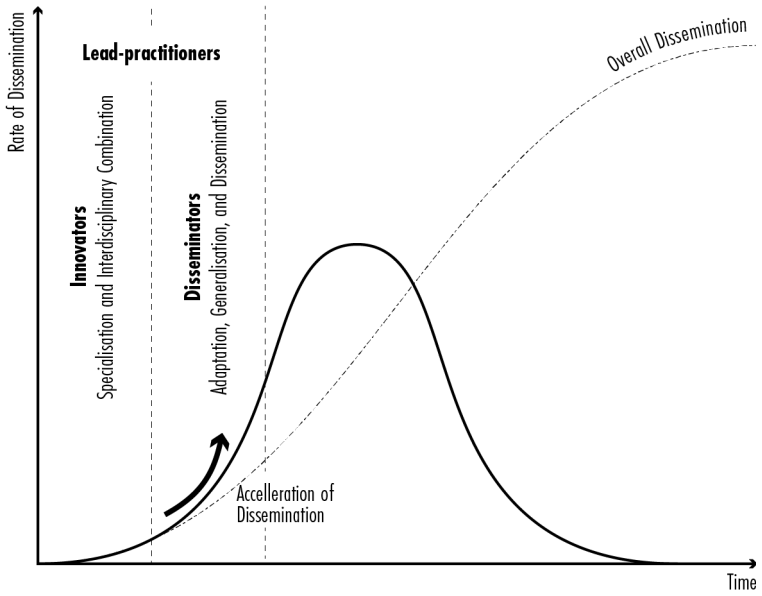


Fig. 45 The Role of Urban Development for Solving Societal Challenges in a Knowledge-based Economy
(Own Graphic adopted from Audretsch 2015, in: Bruns-Berentelg 2019)

Public administration needs to determine as any other actor, how much investment in urban development is too much and too little, whether to innovate or to routinely tackle a challenge, and whether or not to prioritise urban development over other public tasks. Fundamentally, these decisions are subject to market dynamics. The demand for innovation, but also the price to which education can provide graduates for innovation are decisive factors for how innovative urban development practice is. These market dynamics are subject to the condition under which lead-educators and lead-practitioners work.

The dissertation is based on the argument that the demand for interdisciplinarity is currently increasing due to the challenges and expectation that urban development faces. The interviews support that resolving the enormous environmental, social, and economic challenges requires more than before interdisciplinary approaches. If the cost for interdisciplinary approaches can be reduced, the rate of innovation could be increased significantly. Higher education can play a decisive role in reducing the cost of interdisciplinary approaches in practice. For instance, higher education can reduce the necessary number of experts for innovative urban development and can increase the effectivity of interdisciplinarity by providing knowledge on boundary interaction and objects as I demonstrate later in this chapter.

Fig. 46



Dissemination of Innovative Concepts
(Own Graphic adopted from Rogers 1983: 243)

Increasing innovativeness is also a matter of increasing the rate of dissemination of innovation.

However, higher education should not only focus on innovation. The act of innovation is not instantaneous. In reality, innovation is subject to a process of dissemination. It needs time until practitioners hear of new innovation and adapt it for their own practice. The average effectivity of urban development, including routine tasks, is dependent on the rate dissemination. Rogers (1983) illustrates the process of dissemination with the help of the bell curve arguing that dissemination starts slowly with the help of a few early adopters before the majority adopts a new innovation (see Fig. 46). The average innovativeness of urban development is, hence, not only the result of how often strategically important projects appear but also how quickly routine practice adopts innovative practices through networks of dissemination (Grabher 2004). The higher education system must cater to both the act of innovation and dissemination.

Diversified Profiles of Competencies 6.1.2

The previous section argued that market dynamics determine that only some urban development projects are subject to innovation while most others are part of the day-to-day business routine. Routine tasks benefit from innovation if innovative urban concepts disseminate quickly into ordinary practice. Whether or not a project is subject to innovation is based upon the contingency of a project. Projects of strategic importance are usually larger projects with a unique set of challenges that cannot be sufficiently tackled by established conceptual knowledge. Routine tasks are of generic nature.

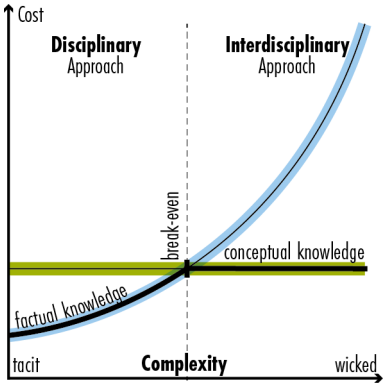
Tasks of low complexity are most efficiently dealt with disciplinary approaches. High complexity requires interdisciplinarity.

Apart from the level of contingency, projects can also be differentiated by the level of complexity. The empirical data of the interviews show that a great part of urban development practice is subdivided into 'sub-practices'. Many processes in practice are specialised processes. A transportation department, for instance, is concerned with traffic, an environmental agency tries to protect natural habitats, and a planning office may only aim at achieving planning consent. New Public Management (NPM) intensified this division of labour by separating strategic decision making from the operational implementation (Promberger & Rauskala 2003). Today, urban development is co-created by many highly specialised agencies (see section 5.4.1). This level of specialisation can be beneficial because specialised agencies can optimise efficiency, but also produce new powerful knowledge within their domain. NPM is basically a simplification or 'tame-ification' of complex problems on the operational level. The im-

pact of NPM only becomes problematic, if the strategic level becomes de-funded and exchange between different domains of specialisation is hindered.

Fig. 47

Cost of Interdisciplinarity in Relation to Complexity
(Own Graphic)



Tasks of low complexity are best being worked on with disciplinary approaches (Brophy & Alleman 1991). A task of low complexity deals with tame problems. Tame problems are those that have a clear formulation of goals that do not contradict each other or compete for the same resources. Complex problems, on the other hand, require the process of weighing up between different interests, expectations, and goals.

Fig. 47 shows the relationship between a task's complexity and the required use of factual and conceptual knowledge. The horizontal axis represents the complexity of development tasks from tasks of low complexity that deal with tame problems to tasks of high complexity that deal with wicked problems. The vertical axis shows the amount of knowledge that is required for resolving associated problems. The figure shows two graphs. The blue graph represents how much factual knowledge is required to resolve a problem, and the green graph represents how much conceptual knowledge is required. Both graphs intersect when the growing complexity of a task makes the interdisciplinary use of conceptual knowledge more efficient than tackling the challenges with factual knowledge from various disciplines. The amount of conceptual knowledge is basically constant. Regardless of a task's complexity, a conceptual idea remains only one conceptual idea even if it tries to resolve complex problems. However, if problems are resolved on the basis of factual knowledge, complex problems require factual knowledge from various fields, while tame problems only affect a limited amount of fields. Hence, the greater the complexity of a task, the more factual knowledge is required to resolve it. This means that resolving complex problems is more efficient based on an interdisciplinary approach while resolving tame problems is more efficient based on a disciplinary approach.

Complexity is not only based on the nature of the task itself, but is the result of the task's ambitions.

Whether or not a problem is regarded as tame or wicked, is not only based on the nature of the problem itself but also the expectations towards the urban development process. For instance, the current European housing crisis has put political pressure on the planning and real estate system to deliver more housing in a shorter amount of time. In consequence, the primary concern of planning has become providing planning consent, increasingly neglecting previous principles such as the protection of green belts. On the other hand, we also observe growing expectations towards urban development as a driver of economic prosperity in an urbanised economy and as the key field of transformation for a sustainable future. Hence, it is largely a political decision if urban

development should be used as an interdisciplinary field of action working on various challenges that cities and regions face, or just as a by-product of decisions taken by various disciplines separately. In order to make a point for understanding urban development as a key field of action, it must prove to be effective, which is also based on the way it is working.

Innovation requires interdisciplinary collaboration. Dissemination requires interdisciplinary generalists.

Fig. 48 shows the relationship between a problem's contingency from generic tasks to unique ones and the amount of knowledge that is required in order to resolve it. If the task is rather generic, factual knowledge can be substituted by conceptual knowledge. As argued earlier, a generalist is not able to resolve all urban development challenges sufficiently. Ideally, experts of all relevant fields would work together. However, this has shown to be impractical as the cooperation of many experts across various disciplinary boundaries creates huge frictional losses, and would require immense resources for each problem resolving process.

Value of Collaboration in Relation to Contingency

(Own Graphic)

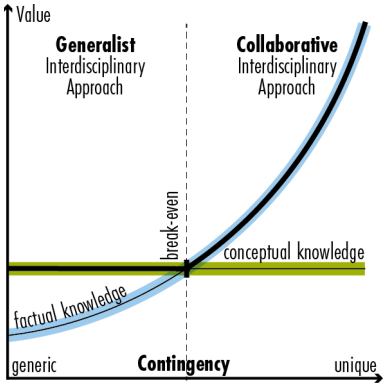


Fig. 48

Generally speaking, innovation demands graduates, who hold powerful knowledge from fields that are relevant to urban and regional development. The process of interdisciplinary collaboration also requires procedural knowledge that is appropriate for interdisciplinary collaboration (boundary interactions and objects). The interviews reveal that current urban development practice relies on people with great experience. Students are currently not trained to work collaboratively across disciplinary boundaries (Ellis, Morison & Purdy 2008) because universities conceptualised programmes for urban development as a separate discipline called urban planning. A generalist is able to work across thematic boundaries by himself. A specialist is not asked to work across boundaries. Individuals that hold both specialised and interdisciplinary competencies are rare because they have acquired those based on extraordinary biographies and extensive additional learning in university and practice.

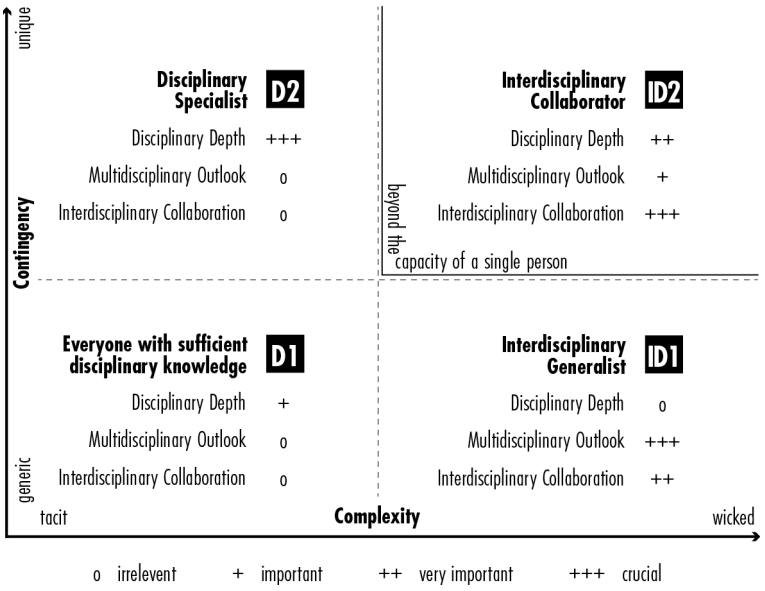
While university education alone cannot substitute years of experience, reducing the practical learning period reduces the cost associated with interdisciplinary work. This means that any disciplinary course in academia is not enough. Graduates for innovation must gain the experience to work in interdisciplinary teams and the required competencies such as systemic analysis, holistic design, and discursive methods. Innovative urban development practice needs a combination of disciplinary and interdisciplinary education.

Specialists with interdisciplinary education complement the generalists that take over the day-to-day routine. The quality of routine tasks is dependent on how fast the newly developed concept diffuse into ordinary practice. Generalists play a crucial role in adapting and disseminating new thought. Generalists will not only be required in public ad-

ministration but increasingly in various private industries. Developers, companies, and citizen groups are decisive actors in co-creating urban and regional development. Disseminating knowledge into a variety of stakeholders in urban and regional development requires a range of different generalists that are suitable for the respective work environment. Most importantly are those generalists that are lead-practitioners. The earlier they adopt new thoughts; the faster other generalists will follow.

In summary, the empirical analysis shows that urban development is not a clearly defined task, rather a variety of different tasks. Fig. 49 differentiates these tasks into four categories based on the level of complexity from tame to wicked and the level of contingency from generic to unique. For each category, a different set of knowledge and respective experts is required. Wicked and unique tasks require the interdisciplinary collaboration of specialists, wicked and generic task requires interdisciplinary generalists, tame and unique tasks require disciplinary specialists, and generic and tame tasks require anyone with sufficient disciplinary knowledge.

Fig. 49



The Influence of Complexity and Contingency on Required Experts
(Own Graphic)

Fig. 49 differentiates the competency profile of all four experts by three indicators. The disciplinary strength describes the amount of factual knowledge an expert needs within one discipline. Multidisciplinary outlook stands for the breadth of factual knowledge across multiple disciplines. And, interdisciplinary collaboration means the expert's ability to work with other experts across disciplinary boundaries. For proposing actual curricular changes, it is necessary to trans-

Competency profiles for urban development consist of three characterisics: disciplinarity, multidisciplinarity, and interdisciplinarity.

late the abstract criteria into learning objectives and adequate workloads. The criteria of the knowledge dimension are of particular interest because it is possible to deduct learning objectives in regards to factual and conceptual knowledge.

Factual knowledge, as defined in section 3.3.1, is the basis for most disciplines. Disciplinarity is, hence, based upon sufficient factual knowledge in one field of expertise. Multidisciplinarity is also based on factual knowledge, but in multiple fields. In other words, an architect must have sufficient competencies on architectural d-space factual knowledge, while a multidisciplinary urban designer must have competencies in architectural, but also landscape, and infrastructural d-space knowledge. On the other hand, interdisciplinarity, as defined in sections 2.2.1 and 3.3.1, is not just the multitude of disciplines, but the conceptual knowledge that results from a systemic view on multiple fields of expertise. Hence, interdisciplinarity is based on conceptual knowledge. In regards to workload, my assumptions are based on the analysis of architecture programmes in chapter 4. A well-trained architect has at least 12 ECTS points per cognitive level on architectural d-space knowledge. As a rough assumption, we define 12 ECTS per cognitive level as a benchmark for acquiring the desired competency to an excellent degree and 6 ECTS per cognitive level as minimal adequacy. In other words, disciplinary experts who operate with respective competencies on day-to-day bases should be very familiar. Multi- and interdisciplinary experts that may only occasionally need certain competencies are fine with familiarising themselves with those if needed. It is important to remind ourselves that students must acquire previous competency levels in order to achieve higher cognitive levels. So, if a D1 expert requires the competency to apply factual knowledge of a specific field, it will take three times 12 ECTS to teach this competency.

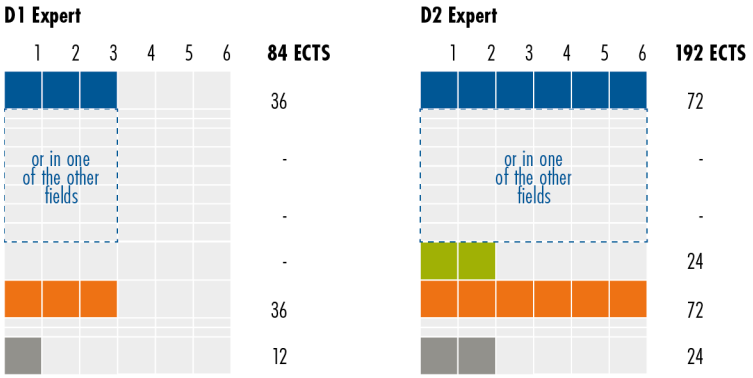
Disciplinarity and interdisciplinarity also have a methodological dimension meaning that procedural knowledge is of great importance besides factual and conceptual knowledge. Procedural knowledge, as defined in section 3.3.1, consists of three categories: analytical, synthesising and communicative methods. While most academic disciplines are analytical in nature, engineering disciplines try to synthesise, and planning is largely a communicative task (see section 4.3.2). Hence, disciplinary D1 and D2 experts require sufficiency in one of the aforementioned categories. Again, as a rough assumption, a sufficient workload seems to be 12 ECTS per cognitive level. Multidisciplinary ID1 experts require the competency of applying in all three fields. Interdisciplinary ID2 experts need to be able to develop new methods in an

interdisciplinary collaborative context. This includes understanding methods of all categories and being able to develop new methods in its own particular field of expertise.

Meta-cognitive knowledge, for instance, the awareness of its own role, is of particular relevance to ID1 and ID2 experts. Many scholars have argued repeatedly that urban development is of normative nature. This work conceptualises normativity as part of constructs of conceptual knowledge. Hence, dealing with conceptual knowledge should go hand-in-hand with meta-cognitive knowledge.

In summary, tame tasks generally require sufficient disciplinary education. This means that the D1 and D2 experts both require primarily factual knowledge, but also disciplinary-specific procedural knowledge (see Fig. 50). The distinguishing feature between D1 and D2 experts is their cognitive ability. While generic tasks require primarily applying and sometimes critically evaluating factual knowledge, unique tasks require the ability to develop new factual knowledge. A typical task for a D1 transport engineer may be to plan a bus route through the city. In order to do so, the D1 expert needs substantial knowledge of bus operations, network planning, and methods for assessing local demand. All of that is textbook knowledge, which a D1 expert needs to apply. A typical task for D2 transport engineers may be to provide a low-density residential area with a good public transportation service. Standard rail- and bus-based public transport system would be oversized, which means the D2 expert must develop a suitable new solution.

Fig. 50 Competency Profiles of Disciplinary Expert Types (Own Graphic)



Wicked tasks require more than disciplinary factual and procedural knowledge. ID1 and ID2 experts work with interdisciplinary conceptual knowledge (see Fig. 51). A sim-

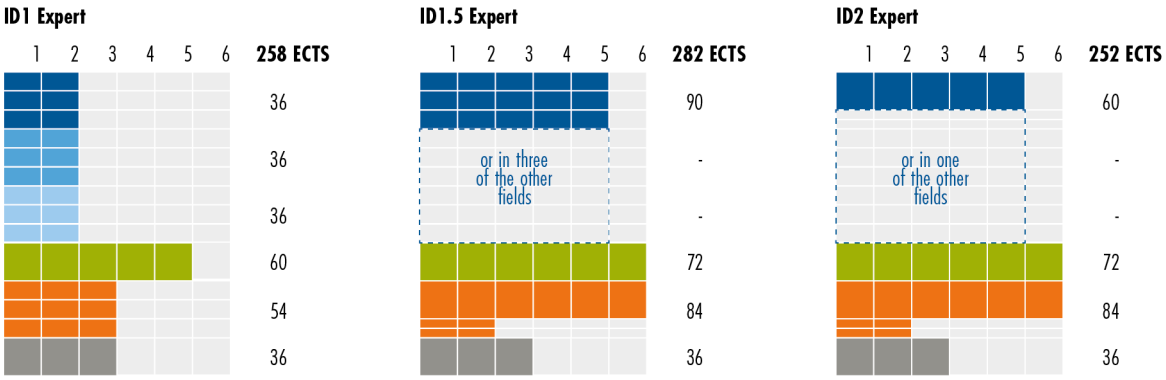
plified summary of previous paragraphs is that ID2 experts are lead-practitioners who innovate, and ID1 experts are lead-practitioners who disseminate.

ID1 experts correspond closely to graduates of boundary disciplines. The boundary discipline of planning provides students with the ability to understand factual knowledge of all relevant disciplines, apply respective procedural knowledge, and critically apply established conceptual knowledge to new contexts. Understanding D1 and D2 experts from multiple disciplines is essential to an ID1 expert as it is his primary responsibility as the planning expert to translate disciplinary knowledge for the application of interdisciplinary concepts. In contrast, ID2 experts can concentrate on one domain of disciplinary factual knowledge because he collaborates with ID2 experts of other disciplinary domains. An ID2 expert needs to be highly educated because he complements the competencies of a D2 expert with interdisciplinary competencies.

(Own Graphic)

Competency Profiles of Interdisciplinary Expert Types

Fig. 51



A Framework for Urban Development Education 6.2

From Distinct Qualification to a Continuum of Employable Profiles 6.2.1

Programme diversification is not only result of a growing body of knowledge, but also a reflection of a normative debate on the transformative capacity of academia.

The variety of competency profiles that are required in urban development suggests that higher education should further diversify. The empirical data shows that this has been the common reaction of academics in recent decades. The Bologna Process and the introduction of bachelor's and master's have enabled a rapid diversification of degrees. A single institute or professor has become able to offer a specific educational programme. There are two aspects to diversification: Firstly, diversification is the result of scientific progress and a

process of subdividing the growing body of knowledge into manageable disciplines and the respective study programmes. The disciplinary specialisation is closely linked to the production of knowledge in a knowledge-based society and ultimately serves the development of powerful knowledge. Secondly, the diversification is also a reflection of a 'pick-and-choose mentality' (Gilliard and Thierstein 2016: 42), in which professors teach what they believe to be important for today's issues rather than debating the curricular content with colleagues. The specialisation is, therefore, also part of academia's normative debate on what students need to know to resolve current and future challenges.

Diversification is in line with the intention of the shift from qualification to employability with the aim of providing graduates better suitable for specific jobs. However, it limits the graduate's potential career options. The biographic information of the interviewees shows that the interests of students change over time. School leavers are not certain about what they want to do, nor a student's aptitude is assessable at this stage. Studying at a university shapes interests and concerns and reveals talents and abilities. Education must provide some level of flexibility rather than predetermination. Further diversification of study programmes may lead to careers that are strongly dependent on the path students took when choosing a study programme. University education is at danger of losing some aspects of its universality.

In order to offer both specialised programmes and still a reasonable amount of elective courses, universities 'recycle' courses that are already offered in other programmes. The practice of 'recycling' is a sign that new programmes are not necessarily new, but often recombination and re-branding of existing courses. Re-branding increases the visibility of certain aspects and is a vehicle of expressing that universities work on the latest most pressing aspects of science and society. In times of competition of universities for student numbers and third-party funding, advertising becomes a necessity for academia. The recombination of courses is the consequence of society's demand that universities work more closely on actual environmental, social, and economic issues. The universities' response is that various disciplines are already working on relevant aspects of such issues. Bringing courses from various disciplines together combines all relevant aspects in one programme. These multidisciplinary recombinations are not exclusive to the field of urban development but are of special relevance due to the cross-cutting nature.

Recombining curricular content from multiple disciplines seems a necessity of universities. Just abandoning the recent trend of diversification and only offering the traditionally established disciplines is no answer to the demand of so-

cio-technical innovation. However, determining the combination of courses in the form of highly specialised programmes prior to student intake has created challenges that need to be tackled.

Shifting the responsibility of course selection to students can reduce the time lag of knowledge.

Defining an interdisciplinary curriculum years before graduates leave university creates a time lag between the impact educators intend and the impact on practice that actually occurs. Especially in regards to conceptual knowledge, programmes may out-date quickly. Shifting the responsibility of combining courses from the educator to the student can reduce this time lag. It also allows students to combine curricular content based on their specific interest, but also perceived need for practice. Against the background of universities having assumed a much more proactive role in the normative debate on societal issues such as urban development, putting curricular design to some extent in the hands of students is an acknowledgement that there are multiple alternative futures for how cities are going to be developed (cf. section 1.2.2).

Curricula with a greater amount of elective courses are far from new. For decades, German students had a much greater choice of courses in the former diploma system. Consecutive bachelor's and master's degrees such as the analysed planning programmes still offer much greater choice for students than non-consecutive degrees. However, these options are in most cases within their own discipline or at least department. Educators may fear that the students do not have enough insight to combine courses reasonably and will focus only on content that they like. However, increasing elective options across disciplinary boundaries does neither mean abandoning all obligatory courses nor waiving the option to set requirements for elective courses. In addition, educators should assume the role of an academic counsellor advising students to combine certain courses. The loss of specificity and the reduced visibility of programme options may be addressed with better communication of programmes, and branding of degrees based on actual curricular choices of the students. It is already common practice that some degrees specify a track or specialisation students took. Having more elective courses is in itself a characteristic that increases the attractiveness of a programme.

Reducing programme diversification can provide greater transparency to employers.

Reducing the number of overall degrees but increasing the flexibility may lead to a mismatch of the expectations of an employer from the actual competencies of the graduate. However, the great number of programme names has not provided any clarity either. Many interviewees confirmed that they struggle with understanding the specific value of specialised new degrees. The empirical data reveal that the competency profile of a student focussing on issues of urban design as part of planning degree does not differ much from a stu-

dent's one that undergoes a specialised urban design degree. Hence, reducing the overall number of programmes increases the perceived transparency of what higher education offers.

Although most interviewees state that professional accreditation plays a rather unimportant role in finding talented graduates, professional bodies provide some transparency for employers. Programme accreditation gives them the insurance that graduates fulfil at least some expectations. If the professional body is able to cater towards more diverse needs of employers and academia, they could play an important role in moderating between education and practice. For this purpose, the professional body itself must be subject to potential changes. Protecting the German professional body by compulsory membership of practitioners is hindering curricular reforms.

Reducing the overall number disciplines is about balancing the need for interdisciplinarity with the ability to produce powerful knowledge.

Higher education does not need to diversify in order to align itself with the diverse competency profiles required in urban development practice. Instead, returning to more flexible curricula of established disciplines can give university education greater amounts of universality. Flexible disciplinary education has not to be misunderstood as general studies. Students choose disciplines that are neither job-specific nor arbitrary. Based on the personal selection, graduates reach competency profiles of similar specialisation such as graduates with a specialised degree. Instead of further diversification of degrees, universities should implement a more flexible understanding of disciplinary degrees itself. This includes considering to re-merge disciplines, especially on the bachelor's level or at least in the first years of higher education. Study programmes need to balance disciplinary specificity in order to allow reaching powerful knowledge with multidisciplinary outlook that provides options in the course of study.

Increasing the number of curricular options for students gives programmes a certain level of multidisciplinarity by retaining the strength of disciplinary specificity. Based on the pedagogy of the course, taking courses from other disciplines may also train interdisciplinary capabilities. If a course, for example, requires working in collaboration with other students, the students practice boundary interactions. This improves the understanding of other disciplines in the long-term but is not a systematic approach to interdisciplinary work.

Interdisciplinarity requires more than multidisciplinary education.

The empirical analysis of curricula indicates that practical experience based on project-based learning is an essential part of spatial practitioners, including architects and planners. Project-based learning familiarises students with techniques of process organisation, communication with project teams, and potential challenges projects may encounter. Section 4.3 demonstrates that planning degrees adopted

studio pedagogy for its purposes first, but interdisciplinary programmes transformed the pedagogical approach to an interdisciplinary co-learning environment. The goal of interdisciplinary education is not to impart knowledge from multiple disciplines. Interdisciplinary projects provide an environment in which students can learn from each other, acquire techniques of boundary interaction, get to know boundary objects, and develop new conceptual knowledge for pressing environmental, social, and economic challenges.

This definition means that interdisciplinary projects have two learning objectives: firstly, enabling students to apply interdisciplinary procedural knowledge, and secondly, enabling students to develop problem-specific conceptual knowledge. The procedural nature of project-based learning may lead to the assumption that interdisciplinary knowledge consists of generic management skills. The introduction of competency-based curricula has often been misunderstood as the attempt to equip students with generic skills instead of knowledge. However, educational competencies are knowledge-based. It would be a fallacy to believe that general management could replace the interdisciplinary collaboration of spatial experts. Boundary interaction and boundary objects that make up interdisciplinary work, link specific disciplines. Socio-technical innovation is the result of boundary interaction or objects if they link powerful knowledge from relevant disciplines. Hence, urban development requires the development of boundary objects and interactions that link spatially relevant disciplines and not any discipline. The given examples of boundary objects in section 4.3 illustrate that these techniques can draw from management but must be spatially adopted.

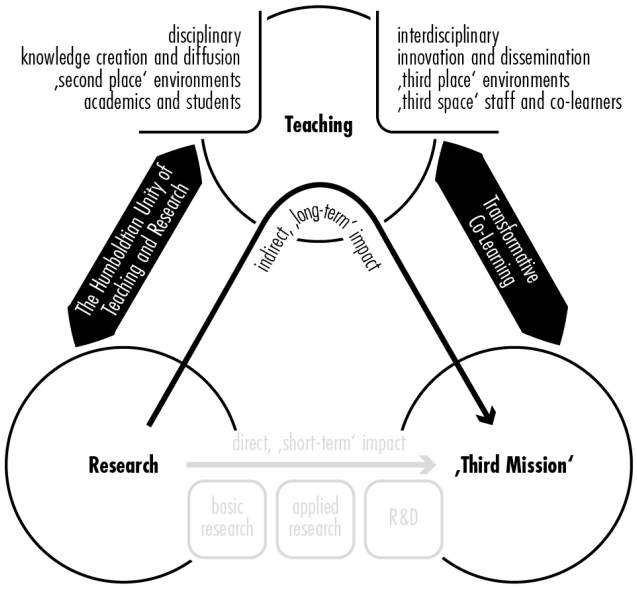
Second and Third Space Learning 6.2.2

Interdisciplinarity differs fundamentally in terms of pedagogy and required educational structures.

Interdisciplinarity is fundamentally different to (multi-)disciplinarity. Multidisciplinarity is the breadth of factual knowledge, and disciplinarity is the depth of factual knowledge. Interdisciplinarity deals with conceptual knowledge and the development of procedural knowledge for boundary interactions. This requires different forms of learning and curricular structures (Brennan, King & Lebeau 2004). Therefore, I suggest that academia requires a two-fold structure of second space and third space institutions (see Fig. 52). Second space institutions are based on disciplinary communities, while third space institutions provide an environment for co-learning and collaborative research (Schneidewind et al. 2016).

The most established subdivision of universities are academic departments. These group professors and institutes of similar fields and represent strong academic communities. The literature on interdisciplinarity often criticizes departments as academic silos whose boundaries need to be overcome (Margalit et al. 2009; Newhouse & Spring 2010; Tight 2014; Serrat 2017). While brokering between these departments is indeed the challenge that interdisciplinarity needs to face, departments or other second space institutions themselves are necessary preconditions to broker in-between them (Muller & Young 2014). Interdisciplinarity should not be seen as a new paradigm replacing disciplinarity but as a complementary branch of academia. Thus, I argue that disciplinary departments play an essential role in a collaborative approach to urban development.

Fig. 52



The 'Third Mission' in Relation to Research and Teaching
(Own Graphic)

If departments are regarded as vertical sub-institutions of universities, interdisciplinary third spaces must lay horizontally. In recent decades, universities experimented with various forms of cross-departmental schools and colleges, or interdisciplinary professionally-oriented learning units (Reichert et al. 2012: 8). A problem that occurs in many of these approaches is that disciplinary departments and cross-departmental structure disassociate. The cross-departmental structure just becomes a new form of departmental structure. This is what I call a boundary disciplines such as planning.

On the one hand, universities need to fulfil the need of knowledge creation and diffusion. Progress has been based on scientific research since the Enlightenment. Knowledge sits at the heart of our economic activities more than ever

before (Cooke 2001). The division of labour in the sense of scientific specialization, the unity of research and teaching, and the freedom of academia from only producing purposeful knowledge are essential to scientific progress. However, this established way of science has become weak at providing answers to current systemic challenges that society faces.

Departmental structures are insufficient in researching systemic relations.

Clear-cut scientific answers to systemic challenges are not reachable due to their 'wicked' (Rittel and Webber 1973) nature. Answers to systemic challenges always have a normative aspect. As long as societies share a great set of common values and a shared understanding of what kind of future may be desirable, traditional science can feed the socio-political process. The postmodern critique on the effects of technocratic solutions (Allmendinger 2002) and the realization that there are environmental boundaries to human growth on earth (Meadows, Randers & Meadows 2004; Rockström et al. 2009) has made the universal wish for constant growth and progress obsolete. Scientific expertise is used to justify various actions with limited coordination in regards to systemic changes today.

A new complementary branch of academia needs to be established that provides options for systemic development, and illustrates the impact of individual decisions on the social, economic, and environmental system. Naturally, its task is of normative nature. There is no right or wrong, but rather a competition of ideas. This new branch must be interdisciplinary and transformative, reflecting the systemic nature of societal issues (Krücken 2013). Its goal is coming up with innovation and disseminating it. Students do not learn in a traditional way, where lecturers impart knowledge. Instead, students learn from each other. The learning success is dependent on bringing the right students together. While two students of the same discipline have undergone the same process of academic socialization, students of different disciplines challenge each other in terms of terminology, presumptions, and the disciplinary ways of thinking and doing.

Third space is both an academic and a managerial task.

The role of the educator shifts from an expert to a manager (Veles & Carter 2016). He manages what kind of students work together, selects the issues that students are confronted with, and may organize collaboration with actors from practice, but also other academic departments. The problem of such a role is that it does not align with the traditional career structures of academics (Herrmann, Kempa & Osinki 2016). Managing an interdisciplinary course well is basically of no value to academic careers. Traditional career structures are based on disciplinary research, high-level publications, and raising third-party funding. Traditional teaching formats and research go hand in hand. Lectures benefit from the latest research results, and researchers benefit from stu-

dents discussing, analyzing, and evaluating research in seminars. Research and teaching in the established sense of higher education form a unity (Anderson 2004). It is, therefore, reasonable to assess academic careers based on research results. The underlying assumption is that better research leads to better education. Obviously, a good researcher is not necessarily a good teacher. A researcher may be incapable of employing adequate pedagogical skills and techniques, he may be a bad presenter, or he may value research time more than preparing good teaching formats. However, if we reduce education to the knowledge that is taught, the more a teacher knows, the more he can teach.

Third space is not about imparting knowledge, but about providing conditions under which knowledge can be created.

Interdisciplinary education is not based on the research results of the teacher. Students are supposed to learn by collaboration, not by instruction. In turn, this makes it difficult for academics managing interdisciplinary courses to align the student's activities with their own research interest. An academic that engages in interdisciplinary teaching - better called managing - can hardly produce synergies between research activities and education. The emerging inter- and transdisciplinary publication outlets make almost no difference. While these allow the publication of interdisciplinary research results, interdisciplinary research is not going hand in hand with interdisciplinary education as disciplinary research and teaching do. Instead, interdisciplinary education, as well as interdisciplinary research, have a transformative orientation. The underlying reason for interdisciplinarity is the inability of disciplinary specialization to cover the systemic interrelations of environmental, social, and economic challenges. Employing an interdisciplinary approach is, hence, closely linked to the wish of tackling those challenges. An interdisciplinary project course literally confronts students with actual or simulated, but close-to-reality issues. Good management of interdisciplinary projects is allocating the right challenges to the right group of students, similarly to a management role in practice where employers are responsible for hiring the right staff for the right tasks. Thus, educators of interdisciplinary courses can produce much greater synergies with practice than with research.

This does not mean that practitioners are the right educators for interdisciplinary courses. Managing and conducting interdisciplinary education is not just a part-time activity. It is a networking role between practitioners, academics, student groups, and the issues on hand. Data from the UK National Student Survey show, for instance, that it is more difficult to find job placements for students of interdisciplinary programmes (Harvey 2009). Hence, the formation of networks between lead-practitioners and lead-educators is important for facilitating the process of education-induced innovation into practice.

Higher education policy refers to this kind of new management role as 'third space' staff (Eisoldt & Bauer 2010; Salden 2012; Watermeyer 2015). The third space is a management role that differs from traditional management roles at universities in various respects. Most management staff fulfils administrative roles such as finances, human resources, IT administration, administrative services for students, and building and campus maintenance. All these roles are generic and can be found in other institutions and firms. There is also no link between those management roles and specific educational programmes. Third space managers are, however, directly linked to a programme's subject. For instance, selecting students for a course requires a good understanding of the issues that students will be confronted with. This requires both an academic education, but also theoretical or practical experience with the respective issues. The third space is both an academic and an administrative role (Whitchurch 2008; Berman & Pitman 2010).

Third space needs third places.

Third space staff is not entirely new to higher education. While in recent years the role of programme managers has become a frequently discussed position, university librarians have always been third space staff. A good university librarian does both managing the catalogue of books including the administrative task of ordering, sorting, and lending, as well as pro-actively identifying relevant new literature, and assisting the researchers' and students' study processes. Thus, universities have identified the library as key' third place' (Montgomery & Miller 2011; Aabo & Audunson 2012) environment for learning students and researching academics. Libraries have become a new focal point of individual and group learning in contrast to popular opinion assuming the end of libraries based on the digitalization of publications (cf. Fig. 53 and Fig. 54). Indeed, university libraries have transformed from book repositories to what I would call co-learning environments. The majority of library users is not there, because they want to get books but because they want to work in a social environment. While an obvious advantage of working in a co-learning environment is that students can help each other or in the case of the library ask a librarian for advice, a social environment can also create a positive dynamic on someone's individual work. Firms and start-ups that work in co-working spaces describe an inspiring atmosphere of which individual work can benefit despite having no interaction with other co-working space users at all (Schopfel, Roche & Hubert 2015). For example, the silent atmosphere of traditional reading spaces in libraries improves concentration and helps students to focus. Libraries have started to complement silent learning spaces with group learning spaces, meeting rooms, and loud areas with cafés and canteens.

Fig. 53

The Anatomy Lecture Theatre at the University of Edinburgh. A Second Space Learning Environment

(Photo: Annie Caldwell; CC-BY-SA)

Besides the library, design-oriented disciplines such as architecture and planning also know the studio as a co-learning space. A studio is basically a library without books. While architects use the studio also for building physical models, planners use the studio as workspace only. The studio is supposed to create an environment in which students can learn from each other, but also just feel inspired by the working atmosphere. Studio space is often scarce in universities and is seen critically by university administration due to minimal management and maintenance. Studio spaces are usually left to students as their own space. This requires self-management, which in many cases is insufficient. Based on the experience with co-working spaces but also managed library spaces, I would argue that studios could benefit from proper management, too.

The last role of third space academics refers back to research, but not in the sense of most interdisciplinary, transformative research. Transformative research aims at providing knowledge that is relevant to issues in practice and ideally contributes to a resolution of these issues directly. In its simplest form, transformative research is widely accepted as policy advice. More radical forms such as action-research have become more mainstream, too. Third space research is, however, not transformative, but transformational. It is not necessarily the goal of a third space academic to directly influence the decision-making processes of students and practitioners but to enable those groups to come to a systemic decision at all. Boundary interactions and objects play a critical role. Successfully assuming the role of an interdisciplinary manager requires understanding and developing techniques of boundary interaction and methods of employing boundary objects.

Fig. 54 Students Learning in a Library at TU Delft. A Third Space Learning Environment (Photo: Frits de Jong; CC-BY-SA)

Third space cannot be institutionalised the same way as second space.

The suggested two-part structure of academia imposes the question of whether and how third space co-learning needs and can be institutionalized. Institutionalizing interdisciplinarity brings along the inherent risk of setting up new boundaries. Third space academics may form their own communities and discontinue the discourse between the disciplines it tries to broker in-between. Interdisciplinarity becomes just generalist disciplinarity in this case. The complementary third space must, hence, be of different institutional nature. It is about 'overcoming fragmentation' (Rowland 2002).

A defining feature for disciplinary communities is the shared body of knowledge. Developing this body further makes research to a discipline's core activities. This body of knowledge is from an interdisciplinary point of view factual knowledge. Boundary disciplines are defined by the boundaries it tries to bridge across. Hence, research of interdisciplinary boundary communities is not concerned with the advancement of factual knowledge, but with the development of boundary objects and interaction, or in other words, procedural knowledge. Boundary disciplines such as planning, but to a certain extent also geography focus at least some part of its attention to the development of conceptual knowledge. Having argued that conceptual knowledge is both normative, and highly contingent reveals two problems: firstly, planning research that focusses on concepts will constantly be challenged by diversifying societal values and scientific advancement in other disciplines, and secondly, it misses its role as an interdisciplinary broker between disciplines. Early planning academics understood that project-based learning in planning is not a method of traditional instruction. The academic transfers control over producing concepts to the students and accompanies the students from an advisory position. This passive role in regards to conceptual knowledge production has often been lost, partly because planning academics may

not want to assume a passive role, but also because the educational policy has framed planning as a discipline like every other discipline. An institutionalized third space must adhere to different career structures, new administrative models, and a different organizational form.

At this point, it is difficult to present a finite structure. Traditional academic institutions have formed over centuries as will third space formats. However, it seems likely that third space is a flexible platform (Thompson Klein 2013) for activities of students and academics and that the third space staff is not its focal point. Interdisciplinary research and teaching are only as good as the disciplinary students and academics that take part in (Mudroch 1992). Hence, the new complementary branch of academia is much smaller in terms of direct employees, but it will need to have a spatial presence at university campuses and an institutional framework in which interdisciplinary collaboration can happen. The framework needs to be shaped by administrative leaders in universities. Filling this institutional and physical frame is the responsibility of students and researchers under the facilitation of third space academics. Good interdisciplinary learning is subject to an interplay of good administrative framing, third space academics, and a plethora of activities of students and researchers. The institutional resilience of third space is not based upon staff numbers and the formation of an own community, but on good conditions for a variety of boundary interactions. Interdisciplinary study programmes are only one component of third space activities. Interdisciplinary research, knowledge transfer activities, or doctoral study groups can stabilize third space environments.

The third space is a second home base for students and academics. The traditional identity of students and researchers will no longer be one-dimensional. Instead, multi-membership of second and third space must become a defining feature of academia that wants to contribute to socio-technical innovation in order to resolve pressing societal challenges.

Necessary Qualities of Higher Education for Urban Development 6.2.3

In summary, higher education for urban development has to fulfil certain qualities in terms of knowledge, process, and organization. Based on the previous arguments, I suggest nine quality criteria: disciplinarity, multidisciplinarity, interdisciplinarity, flexibility, transparency, prospect, connectedness, establishment, and resilience. The following section briefly explains each criterion.

Knowledge Quality of Higher Education for Urban Development

Table 14

Disciplinarity	• D1 experts must obtain the ability to apply new factual knowledge • D2 experts must obtain the ability to develop new factual knowledge (PK) • ID2 expert must obtain the ability to critically evaluate new factual knowledge for interdisciplinary collaboration
Multidisciplinarity	• ID1 experts must obtain the ability understand new factual knowledge of all relevant disciplines • ID2 experts should obtain the ability to critically evaluate new factual knowledge of multiple disciplinary fields in order to reduce the number of necessary number of experts for interdisciplinary collaboration
Interdisciplinarity	• ID1 experts must obtain the ability to critically evaluate new conceptual knowledge (socio-technical innovation) in the light of new factual knowledge (PK) • ID2 experts must obtain the ability to develop new conceptual knowledge in collaboration with other ID2 experts with the help of boundary objects and interactions

The knowledge dimension: disciplinarity, multidisciplinarity, and interdisciplinarity.

There are three criteria for the knowledge dimension: disciplinarity, multidisciplinarity, and interdisciplinarity (see Table 14).

Disciplinarity describes the depth of knowledge that students can acquire within one discipline, including both a high cognitive level and an adequate workload. Disciplinarity is important for D1, D2, and ID2 experts. D2 and ID2 experts require substantial amounts of disciplinary knowledge because they shall produce powerful knowledge and evaluate it in the context of urban development. D1 experts require enough disciplinary knowledge to apply it in routine practice.

Multidisciplinarity describes the width of disciplinary knowledge, meaning the number of disciplines someone has knowledge of. Multidisciplinarity is of particular importance to ID1 experts. As generalists, ID1 experts must be able to understand disciplinary knowledge from all spatially relevant disciplines. ID2 experts would benefit from having a basic understanding because it may help in developing a common language as part of the interdisciplinary collaboration. In addition, ID2 experts are of special value if they acquire

depth in more than one disciplines. The reason, therefore, is that it reduces the required number of experts in an interdisciplinary collaboration process.

Interdisciplinarity describes the ability to deal with conceptual knowledge. It includes two ways of interdisciplinarity: interdisciplinarity as a boundary practice, and interdisciplinarity as boundary interaction. ID1 experts must be able to critically evaluate and adjust new conceptual knowledge to a local context. ID1 experts are generalists that are often responsible alone or in teams with colleagues of the same profession for development projects in daily administrative routine. They are the disseminators of socio-technical innovation. ID2 experts are the innovators. Hence, they need to be able to develop new conceptual knowledge. ID2 experts do not work alone but rather in collaboration with ID2 experts of other disciplines. Interdisciplinarity is, hence, not only conceptual knowledge but also procedural knowledge that is required for cross-boundary collaboration.

Table 15 Procedural Quality of Higher Education for Urban Development

Flexibilty	• Flexible curricula and a flexible combination of degrees shall reduce the time lag between course content selection and application in practice • Graduates shall choose to become a certain type of expert based on interest and talent, and not based on the initial choice of a study programme
Transparency	• Reducing the overall number of programmes • Alignment with professional bodies
Prospect	• Balancing today's requirements of professional bodies, and developing a unique selling point of an educational programme

The procedural dimension: flexibility, transparency, and prospect.

The second dimension of the impact model is the procedural one. An educational system for urban development should conform to the following three criteria: flexibility, transparency, and prospect (see Table 15).

Flexibility refers to the ability of a student to have a meaningful impact on his career path in the course of higher education. The increasing diversification of degrees has led to a higher predetermination of careers based on the initial study choice. Students should, however, be able to adjust their studies based on developing interests and talents. This means that D1, D2, ID1, and ID2 experts should not require four distinct study programmes. The goal should be to employ structural elements of higher education (e.g. bachelor's and master's) in such ways that students have career opportunities and multiple educational paths after receiving their first degree.

Transparency is often in conflict with flexibility because it describes the legibility of a graduate's competency profile. A qualification-based system provides great legibility

as students acquire a qualification that certain jobs require. A competency-based system is naturally less legible, but the empirical data shows that lesser diversification is a key factor in keeping the value of degrees understandable. Transparency is also increased if there is a corresponding professional body that endorses the quality of education to other employees.

Prospect describes the student's chance to find a suitable job after graduation. The term has been chosen in order to make clear that it includes both qualification and employability. Qualification and the accreditation by the professional body remain relevant because it increases transparency, but it is also regarded as a seal of quality for employers and their customers. On the other hand, long-term career prospect is no good if a degree does not provide a specific quality that adds to the qualification. Employability of a graduate is determined by its relative strength over other graduates.

Institutional Quality of Higher Education for Urban Development

Table 16

Connectedness	• Interdisciplinary education requires disciplinary education and must therefore mitigate building up new boundaries towards disciplinary communities. • Despite the importance of interdisciplinarity, ID experts must obtain a home base within a community and then trajectories to other communities.
Establishment	• Interdisciplinary approaches must align with educational policy and the university's structure in order to be establised
Resilience	• Interdisciplinarity requires an own home base in order to be resilient towards competition for resources against disciplinarity. • Interdisciplinarity becomes more resilient if third-space learning and research support each other.

The institutional dimension: connectedness, establishment, and resilience.

The third dimension is organizational in reference to the educational system. Changing the programme structure at universities is highly constrained by educational policy but also the dynamics of departments and disciplines. Hence, the following three criteria are important: connectedness, establishment, and resilience (see Table 16).

Connectedness describes how a new educational offer relates to established programmes, research activities, and institutional structures of a university and academia as a whole. Based on the introduction of the bachelor's and master's system, it is easier for small groups of educators to introduce new master's programmes. The risk is, however, that these do their own thing without nurturing a discourse with other academics. However, academia is built around the principle of peer reviewing and peer feedback. The production of knowledge is dependent on functioning discourses. Disconnection means building up boundaries that separate disciplines and communities, which stands in contrast to the efforts of interdisciplinarity.

Establishment means the ease of establishing the respective new curriculum. It is largely dependent on the university's particular structure and the general educational policy whether or not a programme is feasible. Generally speaking, the introduction of new master's programmes is easier than changing or introducing bachelor's programmes, programmes within one department are easier than cross-departmental cooperation, and a diversion from the bachelor's and master's standard is generally difficult.

After establishment, programmes need to be kept alive. Resilience describes a programme's likeliness to stay despite institutional change. Many smaller programmes disappear with the departure of an educator, the end of third-party funding, or with university reforms. There are two ways of increasing resilience. Study programmes that are based upon a disciplinary community can rely on the support of academics within universities and across an international discipline. Interdisciplinary programmes either build their own community of a boundary discipline or support their study programmes with a variety of other boundary interactions and objects. This could, for instance, mean establishing interdisciplinary research activities such as a doctoral research group, holding regular academic conferences, or creating a particular interdisciplinary dialogue with practice partners. Interdisciplinary programmes may also increase resilience if they fit within a framework of the university and align with the structure of other programmes of other departments.

These nine quality criteria are supposed to serve as guiding principles for developing interdisciplinary education. The criteria are applicable to all interdisciplinary fields. The following sections will apply these criteria to urban development.

6.3 Recommendations for Curricular Design

6.3.1 Shortcomings of Current Educational Approaches

Before providing recommendation on how to achieve the introduced qualities for urban development education, we take a look back at the currently established educational pathways. In order to simplify the plethora of pathways, I group those into four categories: consecutive planning education, planning degrees that build upon other disciplines, and interdisciplinary degrees building either on generalist planning degrees or specialized disciplinary degrees. The curricular analysis of chapter 4 forms the basis for the following argument.

Evaluation of Generalist Planning Education
(Own Graphic)

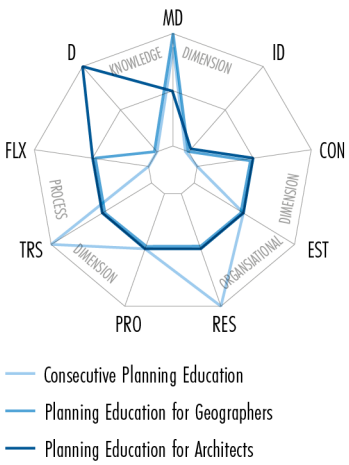
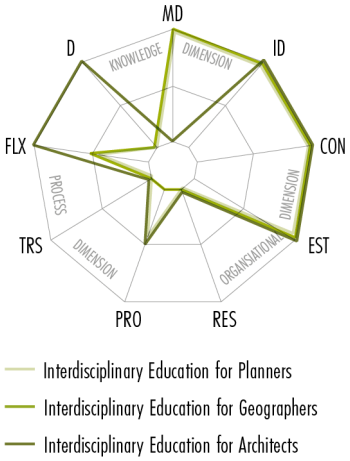


Fig. 55

The most established form of higher education preparing for urban development practice is studying urban planning. While planning programmes are excellent at providing generalists across all disciplinary fields of knowledge, their disciplinary capabilities are very limited. Even if a graduate of a planning bachelor's programme decides to specialize on the master's level, he cannot reach adequate levels of disciplinary knowledge. Selecting a planning programme after leaving school determines to a great extent that graduates will have to work as generalists in practice later on. Hence, there are two major problems: firstly, planning education primarily focusses on the supply of ID1 experts with limited employment opportunities as a bachelor's graduate, and secondly, limited flexibility for students. A third weakness of the current model of planning education is limited connectedness. Planning as an independent discipline builds institutional boundaries to other disciplines. While those boundaries are permeable in research, they are more rigid in education. This also translates in limited interdisciplinary learning. Most student cohorts are mono-disciplinary planners-only groups, including the composition of students in study projects. Although this varies from university to university, strong points of planning education are the multidisciplinary breadth, the resilience due to its own community base, and its qualification-based transparency. The employment prospect is generally good if the graduate holds a master's degree. Bachelor's degrees are often not regarded as sufficient for practice. Some of the interviewed employers see also the lack of innovative capacity. The establishment of new planning programmes is supported by an active academic community and professional body. However, it requires significant resources because planning programmes require professors from all spatially relevant disciplinary fields.

Planning degrees that are consecutive to other disciplines share some of the benefits, but also have unique shortcomings. In terms of knowledge, graduates of generalist bachelor's degrees in geography achieve a similar set of competencies. However, architecture graduates that take a planning course as their master's do not achieve the same level of multidisciplinarity and remain architects with just fragments of planner-like all-roundness. The flexibility is generally greater than for planners because students can choose whether they within their discipline or switch to planning. Many programmes are also accredited. Hence, the prospect and transparency are good. Establishing planning degrees within other departments is nothing exceptional, but comes with the risk of marginalization and competition for resources. A potential benefit is the connectedness to another discipline, although it is just one of many disciplines. Fig. 55 summarises the strength and weaknesses.

Fig. 56



Evaluation of Interdisciplinary Urban Development Education
(Own Graphic)

The second major pathway into urban development is the interdisciplinary route. In theory, it is great for the production of ID2 experts. Students obtain substantial disciplinary knowledge in their bachelor's study before practising their skills for interdisciplinary collaboration on the master's level. However, the empirical analysis of bachelor's degrees shows that spatially trained bachelor's graduates are rare. While architects and landscape architects are spatial experts for d-space knowledge, planners and geographers are generalists. Sociologists, for instance, are experts for functional aspects of urban development, but usually in no spatial manner. Hence, an innovative approach to urban development that is based upon an interdisciplinary master's degree is limited by the lack of spatially oriented, specialized bachelor's degrees. This approach also struggles with providing ID1 experts if the students are not already graduates of a generalist planning bachelor's degrees, because this would require teaching a complementary curriculum of factual knowledge from other disciplines on the master's level. Achieving complementarity is difficult if you take in students from various disciplines with various different needs. D1 experts are certainly provided based on a bachelor's degree only. D2 experts would benefit from continuing the disciplinary route instead of selecting an interdisciplinary master's programme.

In terms of flexibility, the interdisciplinary route is attractive to students. When changing from bachelor's to master's, students have a meaningful decision to make whether they want further specialization or widening the personal competency profile. The prospect also benefits from the variety of career options. However, the benefits of membership in the professional body may be reserved for graduates of the established planning pathway. In terms of transparency, the variety of interdisciplinary options and combinations with bachelor's degrees is hardly comprehensible for an employer. An interdisciplinary approach demands employers to invest in assessment strategies when hiring new employees.

Another strong point of interdisciplinary education is that it can connect educators across disciplinary boundaries without building up new institutional boundaries. The programme itself serves as a boundary object that facilitates exchange and may lead to common research activities subsequently. If a group of educators from various disciplines finds itself together, the introduction of master's degrees has made the establishment of new interdisciplinary programmes rather easy. The other side of the coin is that those programmes are almost as easy to discontinue. If individuals that initiated such a programme depart the university for whatever reason these programmes are at danger. Interdisciplinary programmes are currently providing two types of experts: ID2 specialists in

the field of architecture and landscape architecture and ID1 brokers that are ID1 generalist with the ability to partake in collaborative processes.

The evaluation shows that both consecutive and interdisciplinary programmes are in need of re-conceptualization. A key component to improving current educational practice lies within the bachelor's cycle. Firstly, it is a fallacy to think that there are already suitable bachelor's degrees for all aspects that are relevant to urban development. The lack of analytical and conceptual thinking in a spatial manner makes graduates of many disciplines unsuitable for current interdisciplinary approaches. Secondly, generalist planning degrees are too specialized in their generalist character. They highly limit the options students have after graduation. The individual talent of planners for sub-fields of urban development is thereby lost.

Fig. 57 summarises the shortcomings of current educational pathways in providing the necessary competency profiles for urban development.

Educational Profiles of Current Educational Pathways and its Shortcomings
(Own Graphic; cf. Fig. 28)

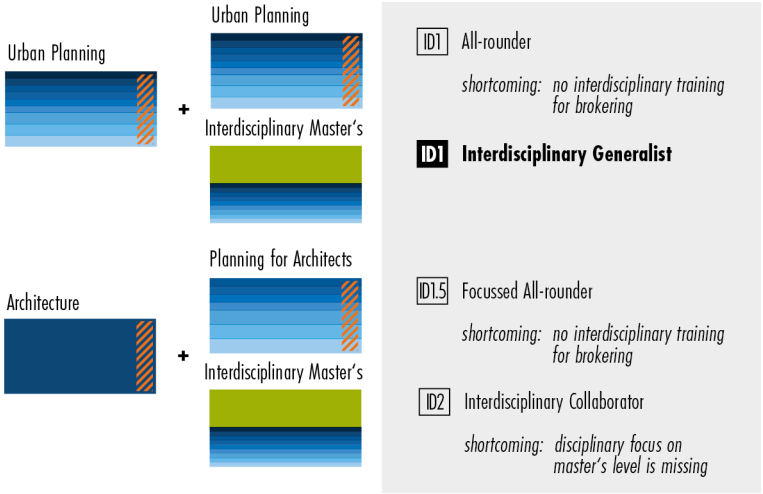


Fig. 57

New Attention to the Bachelor's Cycle 6.3.2

The evaluation of currently available educational pathways leads to the identification of the bachelor's level as a key set screw for improving higher education for urban development. On the one hand, interdisciplinary master's programmes that base upon collaborative third space learning requires disciplinary specialists that ideally cover more than just one discipline and have obtained some previous knowledge in regards to urban development. On the other hand, planning bachelor's degrees need provide more options for specialization to allow students to break out of a generalist

role for better job prospects for bachelor's graduates and potential specialization on the master's level. The following section discusses three variants of bachelor's studies tackling both issues.

The diversification of study programmes has happened primarily on the master's level. It seems, therefore, necessary to shift the attention to redesigning bachelor's programmes instead of just offering even more master's degrees. A redesign of bachelor's programmes should focus on two things. Firstly, it seems necessary to rebalance the multidisciplinary breadth with some disciplinary depth, and secondly, urban development requires a spatialization of all relevant degrees. The spatial turn of the social sciences (Löw 2015) must not only affect certain areas of research but become an important part of social science education - at least in order to cater to urban development.

Focussed multidisciplinary programmes offer generalists for a variety of employment contexts.

As the first option, I suggest more focussed multidisciplinary bachelor's degrees that do not cover all spatially relevant fields but a significant portion of those. Such programmes could be specialized on d-space, f-space, or p-space knowledge, but may also offer a mix of those. A d-space-focussed bachelor's programme may be called urban design, an f-space-focussed programme urban studies, and a p-space-focussed programme urban planning. Urban planning, in this sense, would be a programme that prepares for the administrative practice of statutory plan-making and the relation of the state to urban development. Such an urban planning bachelor's degree largely corresponds to what professional bodies often request: graduates that more purposely fit the demands of daily planning practice in public administration and planning consultancies (Alexander 2015). Bachelor's graduates of such programmes could easily access the job market as D1 experts having enough knowledge to apply it to routine tasks. Similarly, urban design graduates could hold entry-level positions in architecture, landscape architecture, and urban design practice. And, urban studies graduates could work in various research-oriented private and public institutions.

On the master's level, two options occur for graduates of focussed multidisciplinary programmes: firstly, disciplinary specialization, and secondly, interdisciplinary diversification. Due to the more focussed multidisciplinarity in comparison to planning, master's students are more realistically able to reach powerful knowledge on the master's level, which means they are able to become D2 experts. An urban design bachelor's graduate could become a full architect or a full landscape architect on the master's level. An urban studies graduate can become a sociologist. And, an urban planner may even become a general manager. On the other hand, urban planners, urban designers, and urban studies graduates

may also take a degree that widens their multidisciplinary perspectives, effectively becoming full multidisciplinary all-round planners. Lastly, students could also take an interdisciplinary degree that practices the collaborative capacity in order to become ID2 experts.

Introducing focussed multidisciplinary degrees could mean splitting up today's planning degrees in three branches. Currently, three-year bachelor's programmes in planning are largely neglected as insufficient for practice. Students do not obtain enough competencies in any field to work in disciplinary entry-level positions, and also not enough across the fields to be accepted as an all-round planner. Focussed multidisciplinary programmes provide a more purposeful D1 competency profile and improve the bachelor's graduates job prospect.

In an ideal case, universities with current planning programmes would offer all three focussed multidisciplinary branches. This allows students of multiple branches to collaborate in interdisciplinary study projects preparing students early on for innovative practice. However, this is difficult, based on the resources of just one planning programme. Having three instead of one programmes inevitably increases the required staff and teaching hours. Offering all three branches requires collaboration with other existing programmes or even universities. Hence, the presented consecutive system of focussed-multidisciplinary bachelor's degrees and both specialized and generalist master's degrees can also be viewed from the perspective of universities with no generalist planning programme in place. Universities that have various but not all disciplines relevant to urban development may want to establish focussed multidisciplinary degrees such as urban design, urban planning, and urban studies on the bachelor's level.

Joint degree programmes in the social sciences are an established form of focussed multidisciplinary programmes.

The development of focussed multidisciplinarity is also possible based on disciplinary degrees. Disciplinary programmes are neither programmes in urban planning nor in geography despite their institutionalization as separate disciplines. Their curriculum is based on a mixture of multiple disciplines. Disciplinary programmes are instead those that base their content primarily within one disciplinary tradition. Those programmes are, for instance, architecture, civil engineering, sociology, economics, law, and management. Those and other disciplinary study programmes are all potentially important bases for urban development, but limit their content to their own discipline. I suggest offering joint degree programmes.

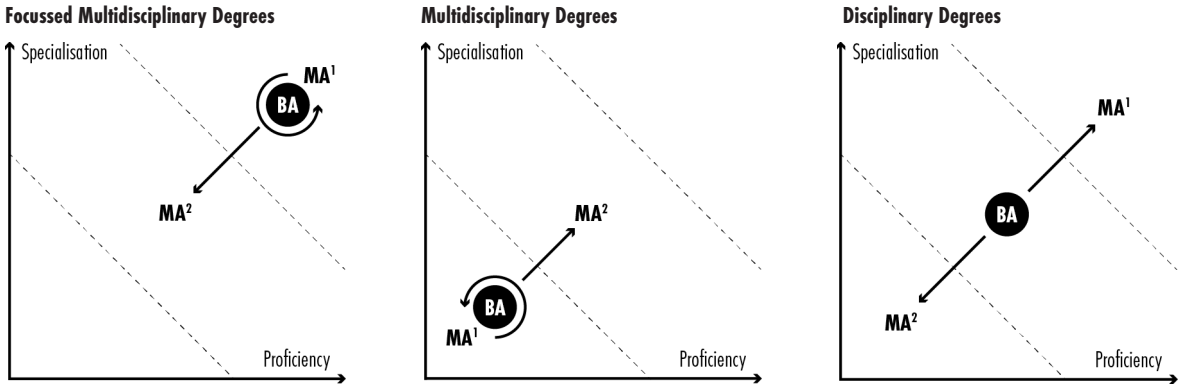
Joint degree programmes cover the content of multiple disciplines without sacrificing a significant amount of disciplinary depth. This seems possible in areas where disci-

plines share methodologies or where knowledge of two disciplines creates synergies. A joint degree in architecture and landscape architecture is possible as well as a traditional major-minor-study in economics and sociology. The advantages are manifold (Del Rossi & Hersch 2016). Multidisciplinarity can, for example, help to reflect each of the disciplines from an outside perspective and, therefore, strengthen someone's disciplinary understanding. Being knowledgeable in two disciplines also creates an interdisciplinary potential in someone's individual work. And most importantly, for urban development, reducing the number of disciplinary experts simplifies collaborative processes significantly. Collaboration can happen more frequently with fewer resources needed.

Joint degrees come in various forms. They are most established in social science and the humanities but also exist in planning and other engineering sciences in the United States (Acey et al. 2013). German, Austrian, and Swiss universities usually favour a major-minor-model, under which students study one discipline about two-thirds of the time and another discipline one-third of the time. British universities also offer half-and-half combinations as well as in some instances a 'triple' degree. A bachelor's graduate of a joint degree can choose between the same master's degrees as graduates of other focussed multidisciplinary degrees.

Both focussed multidisciplinary degrees and joint degrees make use of the consecutive division of higher education into bachelor's and master's cycle. They combine the benefits of both consecutive bachelor's and master's education in urban planning and interdisciplinary master's programmes in urban development that are based on disciplinary degrees in all spatially relevant disciplines. Instead of having either a highly specialized or a highly generalist bachelor's degree, universities develop multidisciplinary degrees that are not as generalist as planning degrees, but also not as specialist as traditional disciplinary degrees. These new bachelor's degrees lay in the middle opening options towards specialization, true generalist competency profiles, and collaborative approaches (see Fig. 58). There are major benefits to this approach: firstly, they reduce the number of experts in collaborative processes, because graduates cover multiple fields; secondly, they balance disciplinarity and multidisciplinarity in such a way that bachelor's graduates are more valuable employees without a master's degree. Thirdly, students have multiple pathways open, which they can choose based on their individual talent and interest, not based on the decision they made prior to their bachelor's studies. And fourthly, focussed multidisciplinary and joint degrees can be designed with spatial methods in mind, which is otherwise difficult to implement to all relevant disciplines.

(Own Graphic) Flexibility of Bachelor's Degrees Fig. 58



Although, I believe focussed multidisciplinarity to be a logical answer to the conflict of ongoing specialization and the resulting lack of systemic research and teaching, the wish for leading-edge specialized scientific research will hinder its implementation in many instances. It is more likely that many universities further diversify or at least protect the disciplinary structure in order to cover the growing disciplinary body of knowledge within their own department. If that is the case, I suggest thinking about urban development from the end.

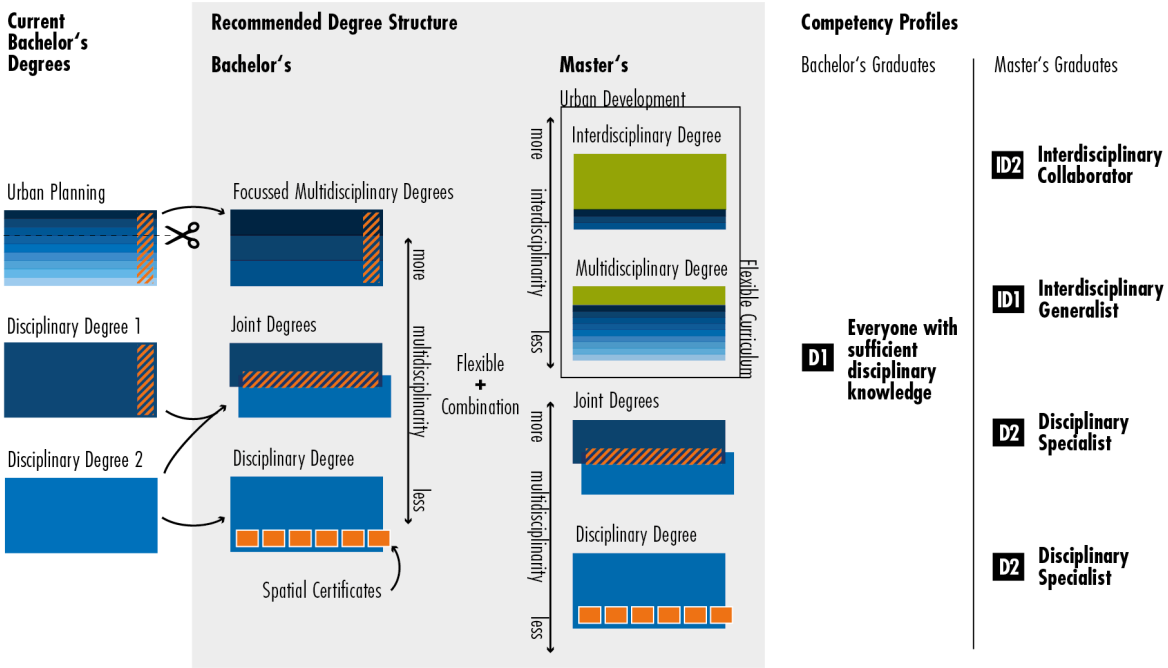
The research shows that a primary problem of multidisciplinary degrees such as urban planning and geography is that their bachelor's graduates have neither enough time to obtain disciplinary powerful knowledge on the bachelor's level nor on the master's level. The extent of a master's degree is just not big enough to replace a disciplinary bachelor's programme. A master's programme must also fulfil the purpose of preparing graduates for research and cannot consist of basic disciplinary courses as its ambition is to impart the fundamental skills of research. Graduates who take a multidisciplinary bachelor's degree will practically always end up in positions of all-rounders. In order to increase flexibility and allow students a meaningful decision after their bachelor's studies, one option is moving all-round urban planning degrees to the master's level.

The research shows that collaborative interdisciplinary degrees are not a replacement of all-round urban planning degrees. All-rounders play crucial roles as disseminators of innovation and facilitators of institutional learning in routine practice (Schweitzer, Howard & Doran 2008). All-round urban development degrees should exist alongside interdisciplinary urban development degrees on the master's level. Both kinds of programmes benefit from students that have obtained at least some experience in working spatially. This requires, as discussed earlier, interventions on the bachelor's level.

An alternative to focussed multidisciplinary programmes is a certificate-based system that grants access to a postgraduate department of urban development. Certificates are groups of modules that students can take as extracurricular training or as part of elective courses. It is, hence, open to the majority of students regardless of their programme. The urban development curriculum would be introduced to bachelor's students of various disciplines without the 'consent' of our disciplines, and without the need for reforming curricular structures. It is a kind of guerilla tactic transforming disciplinary degrees and providing a wider perspective. The certificates are of value for students because they provide provable additional competencies. An urban development department that provides education on the master's level would not need to start from scratch with students holding this certificate. The Munich Center of Technology in Society (MCTS) at the Technical University of Munich (TUM) offers such certificates (now called plug-ins) of around 20 ECTS in its field. Certificates take up to three semesters. One to two certificates are possible within the limits of an ordinary bachelor's degree. Fig. 59 summarises the suggested changes to the bachelor's level.

Certification-based study tracks can be implemented without major curricular changes as elective or extra-curricular modules.

Fig. 59 A Flexible Framework of Bachelor's and Master's Education for Diversified Educational Profiles (Own Graphic)



The three suggested variants for the bachelor's level are all concerned with balancing disciplinarity and multidisciplinarity (see Fig. 59). Interdisciplinarity is in those cases part of the master's cycle. The consecutive separation of bachelor's and master's degrees is not only based on the already existing two-cycle structure of the Bologna Process, but also due to practical reasons. Universities that implement one focussed bachelor's degree are not necessarily in a position to offer a subsequent interdisciplinary master's programme. Instead, it requires a group of programmes that cover d-, f-, and p-space-knowledge. Most universities, let alone departments, will not be able to cover all aspects of urban development. Even if a university covers all necessary disciplines, it would need great coordination in terms of curricula and structure across multiple departments. Urban development would need to be on the agenda of the university's management board. Hence, it is more likely that suitable bachelor's degrees with different focus emerge across multiple universities. Together, they form a relational network of departments like a group of interested and willing academics. Those universities are not necessarily within the same local context. Therefore, it is important that students do not just transfer from a bachelor's to a master's programmes but also from university to university. A concurrent arrangement of second and third space learning would require the spatial proximity of all relevant institutions, which is often unlikely. The consecutiveness of the proposal allows a more feasible implementation.

Focussed multidisciplinarity provides the foundation for interdisciplinary master's education.

Focussed multidisciplinary programmes, joint programmes, and a certification-based access route provide the necessary improvement of conditions under which interdisciplinary master's programmes can operate. The most important prerequisite of interdisciplinary teaching is that students have already obtained enough disciplinary knowledge. Otherwise, students are not able to bring along powerful knowledge of their discipline, and interdisciplinary learning misses its potential for innovation. The second prerequisite of interdisciplinary programmes in urban development is previous spatial knowledge. This is currently the decisive shortcoming. Interdisciplinary degrees that do not admit students from all necessary fields based on the lack of skills and experience of working will spatially fall short of the ambition to develop holistic concepts for urban development collaboratively. Hence, the implementation of focussed multidisciplinary programmes or one of the other variants is of particular importance for interdisciplinary master's degrees because it combines both disciplinary depth, limited multidisciplinarity, and previous spatial knowledge.

Alongside, interdisciplinary master's degrees, there is also a need for generalist urban development degrees. Focussed multidisciplinarity effectively limits the breadth of knowledge in comparison to planning degrees. Hence, fully all-round planners that disseminate knowledge into routine practice need programmes on the master's level. Thus, an alternative to focussing planning departments on administrative, legal, and managerial issues is their further development into urban development department offering a multidisciplinary all-round programme in the tradition of existing independent urban planning degrees and interdisciplinary urban development degrees on the master's level. Both degrees are not necessarily distinct programmes, but one educational offer that allows a spectrum of different types of graduates from all-rounders to collaborative specialists. The spectrum requires the concurrent conduction of interdisciplinary third space learning and (multi-)disciplinary second space learning.

Interdisciplinary education needs new institutional structures.

For this purpose, I propose a new type of urban development department. Today, planning departments exist next to any other disciplinary department conforming to a hierarchical structure with little to no cross-departmental activities. Reconnecting planning departments to other departments requires a re-conceptualization of how planning departments work. Firstly, planning departments should not cover the disciplinary breadth of all spatially relevant fields. Instead of multidisciplinarity, interdisciplinarity must be the main concern. That means that individual professors of a planning department must not only do research in their disciplinary field that is relevant to urban development but rather research the interdisciplinary challenges of urban development directly. The way that staff at planning departments is selected needs to reflect this.

Traditional professorships and disciplinary research are of lesser importance. Transdisciplinary, practice-based, and impact-oriented studies are core activities instead. Criteria for selecting third space academics need to be developed. Disciplinary expertise for teaching comes from collaboration with external researchers and lecturers from disciplinary departments. Similarly, the intake of students should be reorganized. Third space learning is not about a multidisciplinary mix of lectures and seminars. It is about project-based interdisciplinary co-learning environments. Students must have undergone previous education that provides value to the co-learning environment. Each student brings along disciplinary expertise and learns to utilize it in the case of urban development. Urban development departments are third places in which students of different disciplines collaboratively learn, and researcher of different disciplines collaboratively study.

Transforming Planning Departments into the H-structure for Second and Third Place Learning Environments

(Own Graphic)

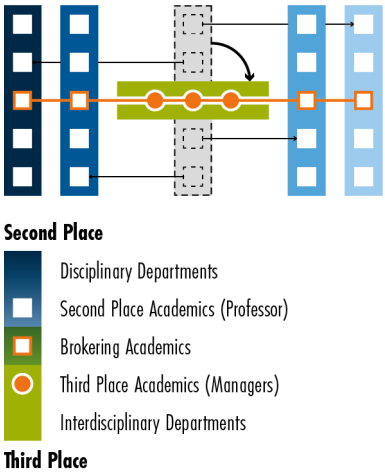


Fig. 60

The proposed changes result in a department of a new type (see Fig. 60), which sits independent from other disciplinary departments, but itself functions in a horizontal manner. The advantage of separate horizontal departments is certain independence in defining pedagogy and quality criteria for research. Furthermore, an independent unit may attract students and researchers from departments of multiple universities. This may be of particular value in cities or regions where multiple universities with different disciplinary focus exist. A challenge that arises from the institutional independence is that the third place co-learning and co-researching environment needs to be attractive to researchers and students as it competes for them with other third place environments. Hence, it is the task of third spaces to provide meaningful, transformative research and study opportunities, attractive co-learning and co-research environments, and additional incentives. Incentives for research may be of monetary nature and are subject to educational policy of the university and governing bodies.

Introducing such a structure has a direct impact on curricula. The curriculum of an urban development programme consists of three groups of modules. Modules are used as units of examination testing and documenting specific learning outcomes. As such, modules are limited in size, usually just consisting of a small set of courses. Modules are good in providing transparency on what competencies student have acquired and support the recognition of courses across universities and European countries. As building blocks for designing a curriculum, they are, however, rather small. No student becomes an architect based on just one module, and not every module provides a distinct set of competencies. Modules are naturally based upon each other. Reaching the ability of developing requires time that can hardly be pressed into a single semester-long module. Hence, every programme consists of interlinked groups of modules. Such a module group may, for instance, be multiple modules on structural issues of buildings enabling an architecture student to design sound structural constructions. This group may start with the foundational knowledge of physics and later looks at specific structural designs of exemplary buildings.

Curricular design needs to think in groups of modules, not just individual modules.

When designing a curriculum, it is important to think in these groups of modules. Just the foundational course in physics does not make a good structural designer. The physics course becomes only relevant in the context of other modules. However, the physics course can also be relevant in other contexts, too. For instance, a mechanical engineer may also need the same basic knowledge of statics. Hence, module groups are not just bigger modules. They are units of context within study programmes representing various aspects of a

degree. According to the criteria of section 6.2.3, there are at least three overarching groups of modules for urban development: a disciplinary group, a multidisciplinary group, and an interdisciplinary group. The disciplinary and the multidisciplinary groups consist of the same kind of second space modules. For example, the disciplinary group of infrastructure aims at educating a civil engineer and consists of multiple consecutive modules such as infrastructure 1, infrastructure 2, infrastructure 3, and so forth. A multidisciplinary group of urban design takes infrastructure 1 and 2 and combines those modules with architecture 1 and 2 and landscape architecture 1 and 2. The interdisciplinary group consist of third space learning modules. Those are projects, seminars, and other pedagogical formats that foster collaborative learning.

Generalist and collaborative education are the two ends of the spectrum of interdisciplinary education.

A master's programme in urban development that provides a spectrum of collaborative specialists and generalists offers both a multidisciplinary group of modules and an interdisciplinary group. Interdisciplinary modules are conducted by third space academics, while second space modules are offered in collaboration with other departments. Professors of traditional second space disciplinary departments that collaborate with the urban development department are brokers between disciplinarity and interdisciplinarity. The experience from urban development practice shows that individuals and their particular interest often shape the points of intersection between the second and third space. As an institutionalized form, I suggest jointly appointed professorships. One of several professors of an architectural department, for instance, has two roles: firstly, being a member of the architectural department taking part in the research and teaching of his academic field, and secondly, being the architectural experts taking part in various collaborative, interdisciplinary activities on urban development. Similarly, there are professors jointly appointed by the urban development third space institution, and for example, the engineering department, the sociology department, or the law department, to name just a few. Those jointly appointed professors complement the third space academics.

Fig. 61

A Mixed Second and Third Space Institution
(Own Graphic)

If a university does not cover all necessary fields, urban development departments can still resort to current practices of appointment. Assuming that a university covers most disciplinary fields except a few the third space department itself appoints experts in the missing fields (see Fig. 61). This combines the advantages but also disadvantages of a multidisciplinary planning department with those of a collaborative third space. The boundary effect of a planning department is significantly reduced due to a significant number

of professors from other disciplinary departments, but at the same time, in-house disciplinary experts guarantee that the full spectrum of disciplinary fields is covered.

A New Type of University 6.3.4

Nested Structure for Second and Third Space Institutions in Universities
(Own Graphic)

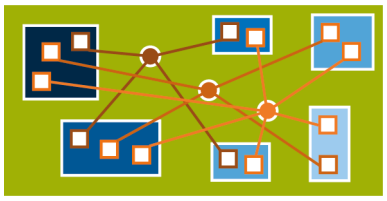


Fig. 62

All aforementioned recommendations are based upon the assumption that departments are crucial building blocks for disciplinary research and education. This is in line with the empirical findings of this work as well as the theoretical literature that sees academic communities as a prerequisite for the development of powerful knowledge, and in turn, also interdisciplinary collaboration. However, there is no empirical data on the required size of academic departments. The earlier proposal of focussed multidisciplinarity implicitly argues for larger partly multidisciplinary departments. The overall requirement for boundary work would be reduced as departments already cover multiple disciplinary fields. We have also discussed the fact that larger departments are against the mainstream, which favours academic specialization over the generalist nature of university education. So, what would happen if we embrace the trend of disciplinary specialization and make it an underlying principle of future universities?

Breaking up the Humboldian unity of research and teaching could shift the priorities of teaching from research to application.

For instance, universities could have thirty mini-departments instead of ten big ones. That would mean that the number of professors and staff would be no longer sufficient in providing full bachelor's and master's programmes. Instead, students would need to combine modules from multiple mini-departments. This proposal breaks with the core of what defines modern universities: the Humboldtian unity of education and research. It separates research-oriented, highly specialized departments from networks of education (see Fig. 62). Study programmes would no longer be associated with departments, but be administered by a separately existing third space. Third space fulfils several roles in this case: student counselling, the coordination of study programmes, but also own interdisciplinary and transformative education. The main difference to other proposals is that interdisciplinarity and transformation are not add-ons to existing structures, but become itself the core. Third space would have sovereignty over shaping the universities' structures and programmes. The mini-departments would serve as highly specialized teaching and research units within a larger systemic framework.

Potential critics of such a reversed order in academia would fear that research would only serve practical purposes (Strohschneider 2014), but perhaps the opposite would be the case. Current efforts of disciplinary departments offering programmes that are closer to practice lead inevitable

to a normative debate in research and teaching. Resolutions to systemic problems are not the result of factual scientific research, but instead, require the normative act of weighing up between interests and values. Disciplinary teaching and research are subject to political critique and increasing scepticism as a result (Campbell 2016). Separating disciplinary research from transdisciplinary education liberates research from the need of normativity, but also overcomes the fear of normativity (Baum 2015) when needed. Smaller disciplinary units can put more emphasis on research than the transfer of knowledge to practice. Implementing such an experimental structure seems unlikely, but perhaps possible in the case of smaller and younger universities. Lead-educators in urban development needs to find like-minded academics of other disciplines in developing such a structure for higher education that fits both the needs of traditional disciplinary research and teaching and the needs of transformative education.

The application of scientific knowledge requires the same academic ressources as the creation of scientific knowledge.

The German Council of Science and Humanities (German: Wissenschaftsrat) is the main advisory board on higher education policy and discusses as such the strategic development of the educational system. In 2010, it suggested 'Universities of a New Type' that supersede the existing dichotomy of universities and universities of applied sciences (German: Fachhochschule (FH)). The underlying argument is that applying science to actual conditions of society and technology requires the same scientific quality as theoretical questions (Campbell & Carayannis 2012). However, universities of applied sciences do not have the same resources as universities in Germany. Professors of Fachhochschulen usually have no assistants, nor the right to supervise doctoral students. The new type of university should have the same resources and rights as a regular university, but with special attention to the application of scientific knowledge in a particular field of practice. This suggestion falls in line with other recommendations that ask for a more transformational role of universities in resolving key challenges in regards to social and environmental justness (WBGU 2011).

In the field of urban development, there is currently one German university that has the potential to fulfil this role. The HafenCity University Hamburg (HCU) was founded in 2006 as a new type of university that is a thematically focussed on issues of the built environment (Müller-Lietzkow 2019). It is furthermore the result of a merger of programmes of a university of applied sciences with programmes of a technical university and a university of fine arts. It features both multi- and interdisciplinary learning modules (Knieling, Schubert & Wickel 2009). Other thematically focussed universities are, for instance, the Leuphana University Lüneburg and the Geissenheim University. Large departments within universi-

ties that have a rather federal structure such as the Bartlett at the University College of London are other potential homes for reversing the order of second and third space.

Policy Recommendations 6.4

University Administration 6.4.1

University admistration needs to assume an active role in shaping interdisciplinary and transformative learning and research environments.

Interdisciplinary education requires changes that reach beyond departmental boundaries. While a bottom-up transformation initiated on the level of departments is possible, it will require, in many instances, the university management to be a force of change. Management can initiate change in three ways: establishing the third space, assuming an active role in hiring new personnel, and setting a new structural framework for education.

The most important part is the establishment of the third space in terms of institutionalized structures, academic staff, and physical places. Resources need to be redirected from disciplinary to interdisciplinary research and teaching. New funds need to be raised. Administrative staff in programme administration need to be replaced by academically educated experts of urban development who hold both conceptual and administrative abilities to manage study programmes as well as teach in a transdisciplinary manner. Open, flexible learning environments that are catered towards collaboration need to be built.

Secondly, university management needs to develop a structural framework under which (multi-)disciplinary and interdisciplinary education can coexist and interact. Third space education needs enough time and space. Disciplinary departments must leave enough room for other elements of education. Reducing disciplinary content will often only be possible if targets are set top-down. Pedagogical personnel may assist departments and educators in developing new curricula and pedagogies.

The third field of action is human resources. There is not only a requirement to develop an entirely new catalogue of evaluation criteria for third space academics, but also the need to facilitate structural changes by a proactive change of disciplinary staff. Departments have, in many cases, the autonomy of appointing professors in their field. This often leads to a reproduction of ideas and the reoccupation of open posts. University management should instead insist on developing a new field of research and teaching with every new ap-

pointment. This so-called renewal by 'displacement' (Heinze 2010) requires both expertise from within a department and from outside as well as strategic guidelines from above.

6.4.2 Research and Funding Councils

Third space research requires new forms of funding that should not only depend on third party funding.

Research councils and other funding institutions have a great influence on what universities do and how they set themselves up in order to receive grants. Although the funding is primarily affecting research, it does, in turn, have an impact on education. Research councils are a primary factor in reproducing disciplinary structures because most assessment boards are rather disciplinarily homogeneous. There seems to be also no significant difference between the German Research Council (DFG) that supports research in all disciplinary fields or the seven British research councils that cover each only a part of disciplinary fields.

Funding for transdisciplinary research is instead coming from institutions of practice (Schneidewind 2016). In Germany, the Federal Institute for Research on Building, Urban Affairs, and Spatial Development (BBSR), that is part of the ministry of the interior, takes over the role of funding research on urban development. The European Union is another important provider of grants for transdisciplinary research. The difference between the DFG and the BBSR is that the research council is an academic institution. Academia itself determines what should and can be studied. The BBSR is government agency setting an agenda of topics for research. If the universities want to assume a transformative role that resolves systemic challenges based on socio-technical innovation, it needs to be able to set its own transdisciplinary research agenda. Today, transdisciplinary research is often forced to follow the latest buzz-words. While sustainable, resilient or smart cities are practically the same in research, inherent academic funding for transdisciplinary research would allow a more continuous research discourse.

Two options occur: firstly, reforming disciplinary research councils to fund more transdisciplinary research, or secondly, establishing complementary bodies of research funding that allocate grants to third space activities. The second option seems to be better because it takes into account the worries that research funding could become subject to normative debates. The evaluation of transdisciplinary research proposals requires academia to take an on normative position while traditional disciplinary research funding is mostly based on the researcher's experience and a logical ar-

gument for the relevance of the research topic and chosen methodology. New methods for evaluating transdisciplinary research are required (Moss 2016).

The restructuring or complementation of research funding is, to a great extent, a political task. Hence, it is necessary that educational policy puts a higher emphasis on interdisciplinary research and education. The current concentration of funding on technical fields and areas of the natural sciences to promote leading-edge research for technology transfers to local industries should not be at the expense of other disciplines that are important for understanding and resolving societal challenges.

European and National Educational Policy 6.4.3

Interdisciplinary education requires a renewed Bologna Reform.

The Bologna Process has been a decisive enabler for the diversification of programmes in higher education. However, it falls short in two ways in regards to promoting more interdisciplinary education.

Firstly, the pedagogical framework of the Bologna Process does not meet the requirements of interdisciplinarity. While the outcome orientation of competency-based curricula is positive in regards to a transformative perspective, its implementation in the form of law-like module description cannot reflect the individual learning outcome of students that have had very different educational pathways beforehand. Module descriptions should be replaced by individualized learning agreements which determine what level of knowledge students have prior to taking a certain set of courses, and what these courses should enable the student to do afterwards. Both the digitalization of student records as well as an academisation of study administration can help in achieving a more individualized form of curriculum.

The second shortcoming of the Bologna Process is that it does not go beyond the master's level. Doctoral studies and research, as well as the national career systems, have stayed largely untouched. However, third space requires new ways of post-master qualification. While disciplinary research careers are based upon doctoral degrees and different national pathways to a professorship, transdisciplinarity will need to evaluate both interdisciplinary research experience and transformative impact that may also be based on practical experience. Alternatives to doctoral qualification are per se nothing new. Urban planning and architecture are already paying closer attention to an applicant experience in practice. Architectural professors are often evaluated by their built and

unbuilt oeuvre. A more overarching recognition of the need for alternative ways of evaluation is, however, needed (Froese et al. 2014).

Additionally, transdisciplinarity will require permanent positions with a lower threshold of entry than professorships. Careers that comprise of periods of practice and research cannot be as streamlined as long-term academic careers. As a result, teaching at German universities, in particular, is either done by professors with long academic but limited practical experience, doctoral research associates with basically no teaching experience at all, or visiting lecturers from practice that have no research experience. Third space will require academics that are close to practice but have also developed and enhanced transdisciplinary pedagogies. This requires positions that ensure long-term employment without the need to follow the tradition tenure track. Both structural and career changes should be part of a renewed Bologna Process.

6.4.4 Employers, Local Government and Professional Bodies

Innovation in urban development requires a professional discourse.

Urban development is despite the increasing interest of private stakeholders still a field, which allows municipalities, local politics, and people to influence the fate of socio-economic and ecological challenges. Public administration remains an important employer of experts in the field of urban development, or commissions those who work for private consultancies. More and more local governments understand its important role for an innovation-based transformation of cities and regions. The research identifies integrated governance models such as territorially focussed urban development agencies, regional and metropolitan governance structures, and a more proactive role of national governments in assisting municipalities in tackling urban issues. Private consultancies are developing new interdisciplinary competencies in parallel.

The professional body could play an important role in facilitating transformative education because it could link lead-educators and lead-practitioners. Instead, the professional body often assumes the role of a keeper. Curricular advice of professional bodes is of reproductive nature. It is a summary of the state-of-the-art of practice, but not oriented towards innovation. A primary reason is the amalgamation of thematic and monetary interests. Professional organization are not only representing the professional needs of their members but provide additional monetary benefits in various ways. The most important way that professional bodies protect their area of expertise is by limiting others to offer similar services. If experts in urban development came to the

conclusion that two-dimensional zoning plans are no longer relevant as they prescribe a separation land-uses instead of mixed-use development, its abolishment would deprive chartered planners of one of their main tasks. Professional bodies would, therefore, not advocate for change but protect its own field of work (Fischer 2015). It seems, therefore, necessary to limit the power of professional bodies to an exchange of knowledge.

Revised Hypotheses 6.5

The last section of this chapter takes a last look at the hypotheses that have guided the research. Abductive research does not verify or falsify hypotheses. Instead, it is a theory-building research approach that tries to provide the best possible explanation. So, both the starting point and the findings of this research are formulated as hypotheses. However, the research has helped to improve and shape those.

The primary hypothesis suggests that innovative urban development requires the close collaboration of experts from different disciplines. The research provides both empirical and theoretical evidence for this assumption, but it does also show that there are practical limits to the extent of collaboration in day-to-day practice. Increasing the innovativeness of urban development, in general, requires both collaborative approaches and all-rounders that disseminate latest innovations into ordinary practice. The modified primary hypothesis reflects this additional learning.

H1mod

Socio-technical innovation for the development of cities and regions originates from the interplay of knowledge of various spatially relevant disciplines and the collaboration of experts of those disciplines, but requires spatially trained all-rounders in order to disseminate into daily practice.

Hypotheses H2 and H3 specify the primary hypothesis from a perspective of knowledge. While the research data supports both hypotheses in principle, it also lays open the challenges that are linked to their implications.

Urban planning graduates have limited access to powerful knowledge, indeed, due to the thematic breadth of their curricula. As long as we regard urban planning to be the main discipline responsible for steering urban development, urban development practice will lack innovative capacity. Urban planning does, however, fulfil two important roles in an innovation-oriented environment. Firstly, graduates of

urban planning as an all-round discipline (ID1 experts) are important disseminators of innovation. Reproducing existing concepts is not necessarily negative. The quality of the day-to-day practice is dependent on learning from examples and adopting innovative policy quickly. However, urban development concepts need renewal from time to time. Hereby, urban planners must play the role of specialists. Urban planning is potentially the discipline that has the best access to powerful knowledge in regards to administration, planning law, and process management (p-space knowledge). Graduates of a refocussed curriculum (ID2 experts) are an essential part of collaborative approaches to urban development.

A collaborative approach to urban development is currently hard to achieve. Interdisciplinary postgraduate degrees that build upon disciplinary undergraduate degrees provide limited benefit despite its theoretical advantages for socio-technical innovation. The primary reason is the lack of spatial orientation in most disciplines that are potentially relevant to urban development. While architects, landscape architects, and - in parts - engineers have a basic understanding of the challenges of urban development, most social scientists, lawyers, or managers have not yet get in contact with spatial issues before. The so-called spatial turn in the social sciences has only marginally transformed curricula. The spatial expert in social science remains to be the geographer, and the spatial expert in the administration remains to be the urban planner. So, inducing powerful knowledge in the urban development process is not as straight forwards as just bringing different disciplinary experts to the table. Instead, a collaborative approach requires spatially trained experts of different disciplines. Hypotheses H2mod and H3mod reflect this differentiated view.

H2mod *Urban planning is based upon contingent conceptual knowledge. It is, hence, the ideal disseminator of socio-technical innovation in urban development into day-to-day practice*

H3mod *Socio-technical innovation in urban development is the result of the collaboration of disciplinary experts with additional spatially oriented training.*

The research proposes that the process of innovation falls into two separate phases in urban development: the actual act of innovation, that is the result of collaborative approaches, and the act of dissemination facilitated by all-round planners. The institutionalization of urban planning as separate departments in academia and administration is, therefore, rather a necessary precondition than an obstacle

to collaborative approaches. However, the self-image of such planning departments must change towards a more specialized understanding (ID2 experts). While maintaining its openness to other disciplines, planning must further develop a core around administrative knowledge on how governments can influence urban development. The institutionalized departmental structure - the academic second space - suits this purpose of a rather disciplinary approach well. Planning as all-round urban development (ID1 experts) is better suited by a new form of interdisciplinary structure - the academic third space. Hence, hypothesis H4 is not entirely incorrect, but it depends on the understanding of urban planning.

H4mod

Urban development requires departments of urban planning as a specilised discipline on adminstrative, legal, and management knowledge. Interdisciplinary, collaborative approaches in urban development require the institutionalisation of new third space structures.

.

The introduction of interdisciplinary postgraduate programmes in urban development is based upon the same assumption like independent urban planning degrees that education must draw closer attention to the boundaries between disciplines. Theory and experience tell us that the potential for innovation lies in the collaboration of multiple disciplines and disciplinary experts. While the research does not contradict this assumption, it raises the question of whether the focus on boundaries in education suits an innovation-oriented practice. It seems actually more reasonable to find a balance between communities and boundaries with a stronger focus on communities rather than on boundaries. The reason is that boundaries hold only the potential of innovation if they separate communities that hold different powerful knowledge. If higher education already focusses on boundaries too early and too extensive, it reduces the amount of disparity, friction, and innovative potential of boundary interactions.

Instead of focussing on communities or boundaries, higher education must take a more individualized approach. Experts for resolving current and future challenges in urban development require both disciplinary and interdisciplinary education, but there is a continuum of profiles between all-rounders and specialists. There is not the one specific mix of competencies but rather different profiles for different roles in practice. Therefore, education should focus on curricula that enable students to concentrate on communities and boundaries to a different extent.

H5mod

Refocussing higher education on individual identities of graduates is necessary to provide the necessary diversity of education profiles for a collaborative approach to urban development.

The Bologna Process has been one of the driving forces of change in higher education in recent years. The shift from qualification to employability has opened greater flexibility for universities to offer new programmes. The underlying idea is that universities educate students more purposefully prepared for the diversifying needs of employment. While in some academic fields, the diversification of academic programmes fulfils the expectations, urban development, and other systemic practices face significant challenges. Outcome-oriented curricula require educators to predict what kind of competencies students will need after graduation. To believe that this is possible in case of urban development seems a fallacy, keeping in mind the contingency of conceptual knowledge as well as the significant time lag between the conception of a curriculum and the graduation of students.

Rather than offering employment-focussed specialized degrees, universities must open opportunities for students to acquire knowledge that seems relevant to their personal pathways and interests at the moment of studying. This reduces the above mentioned time lag significantly and captures the potential of innovation that lies within the students itself. Instead of having a plethora of programmes, universities should refocus its offer to larger, more flexible disciplinary programmes. In addition, universities should introduce a second layer of education - third space learning. Based on a relatively flexible combination of second and third space degrees, students could acquire the necessary variety of competencies profiles for employment and innovation-oriented urban development practice.

H6mod

The implementation of educational programmes that fulfil the requirements of H1 need the development of distincly new structure of higher education to serve an employability-based labour market.

Hypothesis 6 is not supported.

New Theories of Urban Development

7

Interdisciplinarity and Urban Development 7.1

The last chapter looks back at the main research interest. I discuss the validity of assumptions that implicitly underlay the work's hypotheses and draw final conclusions. Those conclusions provide answers to the two primary research question introduced in section 1.3. Furthermore, I discuss the potential implications of my findings for urban planning, urban development, and academia. And lastly, I look at the limitations of this work and arising need for further research.

The division of labour in urban development obestructs us from asking the fundamentally important questions.

The primary interest of this dissertation is to understand the relationship between interdisciplinarity and urban development. The main hypothesis assumes implicitly that urban development has to be always interdisciplinary. The empirical data shows, however, that this is not necessarily the case. Though various actors and disciplines interact as part of the development of cities and regions, a need of coordinating them just arises if the development tasks deal with wicked problems and have the respective ambition to resolve it. However, urban development is, to a great extent, not coordinated, and rather the result of co-creative processes of coincidence and restraint.

The interrelations of actors and sub-fields in urban development set a framework for individualised decision making processes. Instead of weighing up different interests, most urban development tasks are about optimising solutions within a narrow corridor of possible solutions. The framework is of both legal and economic nature but also embedded in the urban development process itself. Binding legislation in regards to environmental protection and construction standards, for instance, limits the spectrum of possible solutions. Similarly, the different extent to which public and private goods can be monetised limit possible development outcomes of the real estate market.

However, a decisive role for setting a narrow framework for possible solutions plays the urban development process itself. The process is subdivided both sectorally and temporally. There are already various departments in public administration alone that contribute to the urban development process. Transport departments have guidelines for road planning, environmental departments demand a minimum of green spaces, and social departments decide where social institutions such as schools and kindergartens go. Apart from public administration, private actors contribute to the development and transformation of cities. An urban design proposal does not materialise if a private investment does not fund construction. And, a lively city does not emerge, if companies and citizens do not use built environments.

In addition, decision making is temporally split into steps. A typical urban development process starts with political goals, continues with a site analysis, an urban design competition, and lastly a legally-binding zoning code. As part of the process, subsequent steps may review previous decisions but do not fundamentally question them. For example, the planner developing the zoning code checks whether and how the urban design can be regulated, but he does not propose major changes if the urban design is in conflict with other planning objectives.

The complex question of how cities should develop in the future does only arise as an abstract theme rather than a concrete task for most actors in urban development. The narrow working horizon before which most planners operate leads to a tame-ification of wicked problems. On the one hand, the division of responsibilities protects us against undesirable developments, but on the other hand, it retards any transformations of urban development patterns. While modernist urban design principles led to a comprehensive remodelling of many European cities towards functionally divided, car-oriented cities in the middle of the 20th century, today's transformation to more sustainable development paths lacks assertiveness and pace. Many actors are aware of the enormous ecological and social challenges that we face but are unable to leave the current development path. Progress in urban development is only incremental today.

Strategically important projects are forums of experimentation and innovation that provide objects for debates as examples of transformation.

Thinkers involved in the IBA Emscher Park, a large-scale urban renewal project in the German Ruhr area between 1989 and 1999, coined the term 'perspective incrementalism'. They thought that instead of continuous 'muddling-through' (Lindblom 1959), urban development needs some kind of orientation in order to accelerate the transformation that meets the urgency of some of the challenges that we face. The theory of perspective incrementalism concentrate on the role of visions. Hence, researchers observe a renaissance of big plans (Altrock 2006; Bruns 2011; Gilliard 2019). The assumption is that an overarching plan can formulate a common narrative that guides the action of enough stakeholders to transform development patterns within co-creative environments effectively. While a shared vision is undoubtedly important, the increasing heterogeneity of society makes it harder to achieve with just the power of visuals and narratives.

Instead of relying on the power of argumentation, it seems necessary that the transformation of urban development patterns emerges wherever possible (cf. Hirschman's 'Possibilism' in: Lepenies 2008) in 'niches' (Geels 2002). Instead of just arguing for coordinated actions towards change, the potential of collaborative urban development must be

utilised to develop socio-technical innovation that can define new benchmarks for routine practice. It is not about transforming urban development all at once and make each urban development process interdisciplinary. It is rather about changing the socio-technical regime of disciplinary routine by selectively utilising strategically important projects as a facilitator of interdisciplinary collaboration for developing innovative urban concepts that incrementally raise the general level of ambition among stakeholders (Hutter 2006).

Transformation of Socio-technical Regimes through Niche Innovation
(Geels 2002)

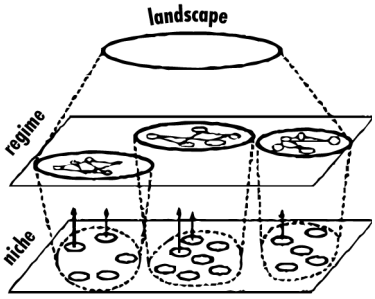


Fig. 63

Innovative urban development is neither a technocratically enacted dictate from above, nor a subversive hidden agenda from below that circumvents any public debate. It is rather about making markets for demonstrating innovation (Lord et al. 2015) that enables an informed discussion on spatial futures. It can provide contextual solutions that are fit for political purpose and adequate to time and place. Innovative urban development can be regarded as a real-life, quasi laboratory that develops and tests socio-technical innovation in urban development. Butina Watson (2016) calls these 'living labs' from an international perspective. In Germany, 'Reallabore' (Renn 2018) have emerged in recent years. Based upon those laboratory-like conditions, political and professional discussions decide upon large-scale adaptation. Thus, it is not about going back to the radicalism under which modern visions have been implemented, but rather about transforming urban development practice by small-scale, case-specific experimentation and innovation (Friedmann & Abonyi 1976).

Sciences must assume a transformative role in order to facilitate experimentation and innovation in practice.

Transformative sciences need to be understood in the same way. Most critics (e.g. Strohschneider 2014; Strunz & Gawel 2017) argue that transformative scientists utilise and exploit science to support their personal normative agenda. I would argue instead that transformative science is about developing socio-technical innovation as a demonstration of possibilities. It is about using the social dimension of scientific knowledge to inspire action in practice (Longino 2002). Taking an active role in a transformative process is also a necessary condition so that sciences that are concerned with systemic challenges of society can work empirically in a laboratory-like small-scale situation to validate whether an intervention actually has the impact that is intended (Te Brömmelstroet 2015; Olvera-Garcia, Vella & Sipe 2015). This would allow transformative sciences to counter the argument of pure normativity with a better 'practice of knowing' (Davoudi 2015). Nevertheless, the large-scale adaptation of scientifically developed socio-technical innovation remains subject to the political processes of weighing up different interests and values.

Transformative real-life laboratories require interdisciplinarity (Helming, Kopfmüller & Walz 2016) because they are about coordinating co-creative processes of urban development. An effective transformation of urban development patterns requires coordinated actions of different actors with access to different bodies of knowledge. While actors work in parallel in routine practice, they do so without coordination. Coordinating the work of multiple actors is a high potential for innovative solutions. In academic terms, routine practice is multidisciplinary. Many stakeholders of different disciplinary background contribute to the development of cities, however, without a joint approach nor agenda. Interdisciplinary urban development requires stakeholders to come together and align their strategies and methods. Hence, innovative urban development is not about actors working in parallel on urban development issues but working together to develop a joint approach.

Innovation needs to be translated into regular practice. This requires different kind of experts.

Urban planning as a boundary discipline tries to reduce the complexities of working collaboratively by educating cross-cutting, multidisciplinary all-round graduates. However, the empirical work shows that the thematic breadth of urban development is so great that even extensive university education cannot cover relevant knowledge to an adequate degree. Planners only obtain a superficial insight into different disciplines and face the impossible challenge to keep up with various streams of research that are relevant to urban development. While an all-round approach may be effective in reducing the need for collaboration, it reduces the potential of socio-technical innovation that arise from collaborative processes. Interdisciplinarity in urban development must not be conceptualised as a boundary discipline, but rather as a collaborative endeavour. Hence, higher education cannot just focus on educating all-rounders for systemic challenges such as urban development but must practice the collaboration of students from different disciplines.

However, that does not mean that urban planners as all-rounders are obsolete. Although, the routine urban development practice is largely divided into different sectoral and temporally consecutive actions which in itself requires newly focussed educational profiles, large-scale dissemination of socio-technical innovation will only work under conditions of efficiency. All-round urban planners are needed both as advocates of socio-technical innovation and urban development and as brokers between the different sectoral interests and stakeholders. The all-round planner has to adopt innovation as new standards and thereby improve urban development practice incrementally. The incremental process of improvements is accelerated by the collaboration of specialists as part of strategically important, real-life urban development labora-

tories. Interdisciplinarity for innovative urban developments requires, hence, both a generalist and a specialist-collaborative conceptualisation (see Fig. 64).

Innovation as an Addition to New Public Management
(Own Graphic)

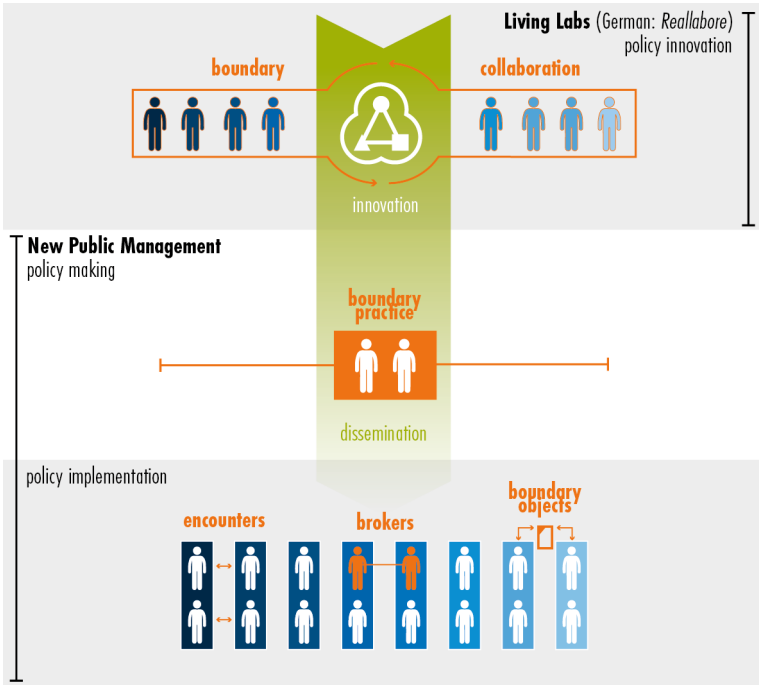


Fig. 64

Implications for Academia 7.2

The dissertation looks at the structural and pedagogical issues of a particular practice, namely urban development. It is, hence, highly specific, yet there are significant implications for multiple disciplines and overarching academic discourses. I will concentrate my conclusions on two discourses: the theory of urban planning, and the recent debate on transformative sciences.

From Urban Planning towards Urban Development Theory 7.2.1

Urban planning must transform from a distinct disciplinary community towards an interdisciplinary platform of co-creation for students, researchers, and practitioners.

Planning theory has undergone since the discipline's emergence three generational phases from rationalist and communicative, to complex planning theory. While the first two generations assume controllability of urban development, complex planning theory abandons this idea. The city is not the result of deliberate planning, but the product of co-creation. Co-creative urban development processes are so complex and full of imponderable factors (Lamker 2016) that planning is not able to anticipate, yet plan the development of cities beyond the immediate effect of interventions. Thus, contemporary planning focusses on opportunities and

puts the planning process itself to the fore. It is not about developing long-term strategic visions, but rather about the generation of long-term sustainable paths of development. Complex planning theory is less about planning in its narrower sense of defining development goals, but rather about the process of development itself and should, hence, be called complex urban development theory. This shift of focus leads to a new understanding of roles. The planner does not take part in the urban development process alone. Essentially, everybody is an urban developer (Lamker & Schulze Dieckhoff 2019).

If that is the case, the discourse on the complexity of urban development must be taken out of the disciplinary community of planners and opened up to other disciplines and practitioners. Instead of just looking at the tools of planning, urban development theory must not only look at various disciplines in an integrated manner but must emerge as an interdisciplinary understanding and not as a distinct discipline (Childs 2014). The duality of the planning discipline is a problematic notion because it assigns urban planning the role of the discipline that steers urban development. Instead, urban development must be understood as a co-creative and collaborative process that involves various spatially relevant disciplines. The theoretical discussion on urban development cannot just involve urban planners. Urban planning is not urban development as architecture is not urban development. Urban development requires a kind of meta-theory that is independent of the aforementioned disciplines.

The duality of planning is also embedded in the argument that there is a difference between theories in and of planning. Theory in planning looks at the content planning process may consist of. That includes knowledge about the physical and functional aspects of the built environment, but also procedural aspects such as planning instruments and laws. Theory of planning is what has been discussed before. It is the theory of how all those aspects come together, how they are steered and for what purpose. I contest this differentiation despite its wide-spread acceptance because it separates object and method, which is usually regarded inseparable in science. Planning is not an end in itself, but an integral part of the urban system, in which it shapes the interaction of private and public actors. Planning does not sit above other spatial aspects but is a procedural aspect of the city. Form, function and process define together cities. Planning theory is, hence, both the administrative tool-kit and process organisation as well as the interventions that are linked to it.

Urban development theory, on the other hand, must be concerned with the development paths of cities and how physical, functional, and procedural aspects interact in shap-

ing cities. It is both about the emergence and the creation of development paths considering not only the impact of planning on urban development but understanding urban development holistically as a process of co-creation.

From Science and Technology Studies Towards Transformative Sciences 7.2.2

The impact of scientific and technological progress can not longer just be an object of study, but must be a tool of trasformation.

The dissertation also has a couple of implications for the discourse on transformative sciences or more generally speaking on the relationship between academia and practice. The term 'transformative science' is closely linked to the debate on sustainability, but also has many similarities to methodologies such as action research and all disciplines that want to actively partake in shaping our society and environment. Urban planning, architecture, engineering, and so-called applied sciences are naturally concerned with shaping technical and social aspects and are, hence, closely linked to practice. While they are not part of the traditional canon of sciences and arts, engineering and the applied sciences are those disciplinary groups that have contributed most prominently to the academisation of society over the last decades (see Fig. 65). The recent academic debate criticising transformative approaches in sustainability studies discusses the fundamental relationship between academia and practice surprisingly (Grunwald 2018).

Student Numbers per Field in Germany
(Data: Destatis)

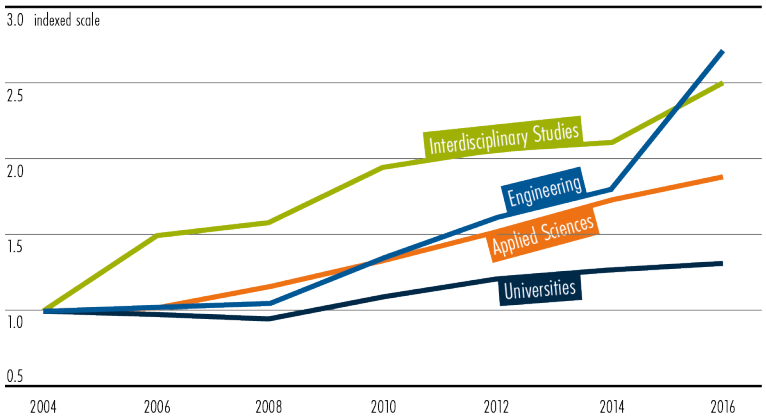


Fig. 65

Critics of transformative science accuse transformative scientists of a lack of scientific neutrality, that leads to a narrower corridor of possible interpretation and obscures potential other explanations. This argument is by no means new. The social sciences are well aware of the influence that the values of researchers have on research results. However, this does not devalue normative research, per se.

Systematic inquiry can be of great importance, even if the interpretation of multiple researchers may be different. Social questions are naturally normative, and this is precisely the reason why transformative sciences should move from the academic niche to the centre of the academic-public debate. Instead of side-lining the important questions of transformation, we need a scientifically informed discussion on how to overcome the most pressing environmental, social, and economic challenges.

The emergence of engineering was a reaction to the increasing technification and scientification of all areas of life. State-of-the-art construction of buildings and infrastructures with the ambition of resource efficiency is, for instance, no longer just a product of manual workmanship, but requires systematic, scientific inquiry and the application of knowledge in fields of engineering. Thus, the advancement of technology is regarded as a scientific endeavour (Brennan, King & Lebeau 2004). However, the relation of technology and society has largely been neglected, so far. The emergence of science and technology studies (STS) exemplifies the need to close this gap. Important STS work has also been done in the field of urban development (Latour 1993; Coutard 2007 Farias 2010; Brenner, Madden & Wachsmuth 2011). STS methods become increasingly popular with researchers in urban planning (Boelens 2010; Rydin 2012), STS often takes a critical stance towards technological progress and its effects on social and environmental justness. Main contributors to STS are 'critical' social scientists. Latour (2010) sees, therefore, a need to take a more proactive stance in actually shaping the relation of technology and society.

Technological research is an important cornerstone of the knowledge-based economy (Bonaccorsi et al. 2014) and fulfils an important part of economic policy. However, academia that criticises transformative sciences refuses to play an equally important role in regards to social and environmental issues. The increasing technification and scientification require, however, not only to look at fields of technology but also increase the complexity of systemic relations between technology and society. The emerging complexity or just complicacy of contemporary socio-technical challenges requires scientific inquires the same way as technology does (Doucet & Janssens 2011; Koch, Roitman & David 2017).

Urban development is just one case of transformative 'STS' science but exemplifies what kind of structural and pedagogical issues transformative sciences face. It is neither about a technocratisation of social policy nor about an omniscience of academia. It is rather about scientifically thought-through policy options that are developed collaboratively between academia and society and which are, in turn,

subject to the political discourse of society. The often criticised abstractness of scientific advice can only be translated into implementation-oriented options if academia takes a transformative stance towards social and environmental issues. Transformative sciences base their recommendations and transformative actions on technological as well as social research similarly to engineering that bases its work on research in mathematics and the natural sciences. Therefore, transformative sciences are naturally interdisciplinary, and in turn, always complementary to non-transformative science. Without non-transformative, disciplinary sciences, there cannot be transformative sciences.

Therefore, the work deducts the necessity of a multi-layered academic structure that consists of at least two academic spaces: second and third space academia. This structure is a preliminary suggestion that needs further formulation and development. The term 'third mission' has set out first steps towards a new transformative understanding of science, but needs to be discussed more intensely in terms of academic structure and pedagogy in more fields of academia. Instead of a fundamental rejection of transformative science, academia should shift its debate from whether to how to implement transformative science in academia. The immense challenges that society faces in terms of environmental changes, social justness, and economic prosperity can only be resolved systemically. Academia needs to contribute to a scientific understanding of systemic relations between technology and society.

Limitations of Research and Further Research 7.3

The presented work is of explarative nature that opens up various path for further research.

Despite the focus on the field of urban development and the question, how higher education can contribute to socio-technical innovation, there remain many questions to be answered. This is a typical result of an explorative piece of research that identifies more questions than it answers.

The proposed twofold structure of second and third space academia requires, for instance, more research and experimentation within universities. Although the proposal is based upon recent trends such as the increasing importance of project-based learning and collective learning environments (Mills & Treagust 2003; Brown & Lambert 2013), it is not a definitive answer to the challenges of transformative, interdisciplinary sciences. The pedagogical question that interdisciplinarity raises also requires further research. While the work provides insight into my personal experimentation as a teacher, a systematic development of pedagogical tools is necessary. Apart from questions regarding the academ-

ic system and its pedagogy, research needs to work also on questions concerning governance structure for strategically important innovation projects. While I present some examples such as the historic English New Towns, entrepreneurial approaches in case of the city of Hamburg, and also the importance of regional governance structure, more systematic empirical research is needed.

I suggest that future research focusses on four fields: (a) the institutionalisation of third space learning environments, (b) adequate pedagogy for third space co-learning including research on boundary objects that bridge across the boundaries of urban development, (c) the role of public governance arrangements for innovation and dissemination, and (d) organisational aspects of interdisciplinary work in administration and private practice.

Furthermore, I recommend that academics in urban development work towards two goals. Firstly, we need to open up the academic debate on urban development for researchers of other fields by breaking up the duality of planning. Urban planners still have a particular responsibility in actively shaping inter- and transdisciplinary discourses as they occupy the theme of urban development most prominently, today, but also because they can assume a broker role between other disciplines due to the generalist nature of planning (Oonk, Gulikers & Mulder 2016). Secondly, the newly initiated interdisciplinary urban development discourse must identify other transformative sciences in order to advocate for reforms of the academic system towards structures that facilitate both disciplinary as well as interdisciplinary research and teaching.

Appendices

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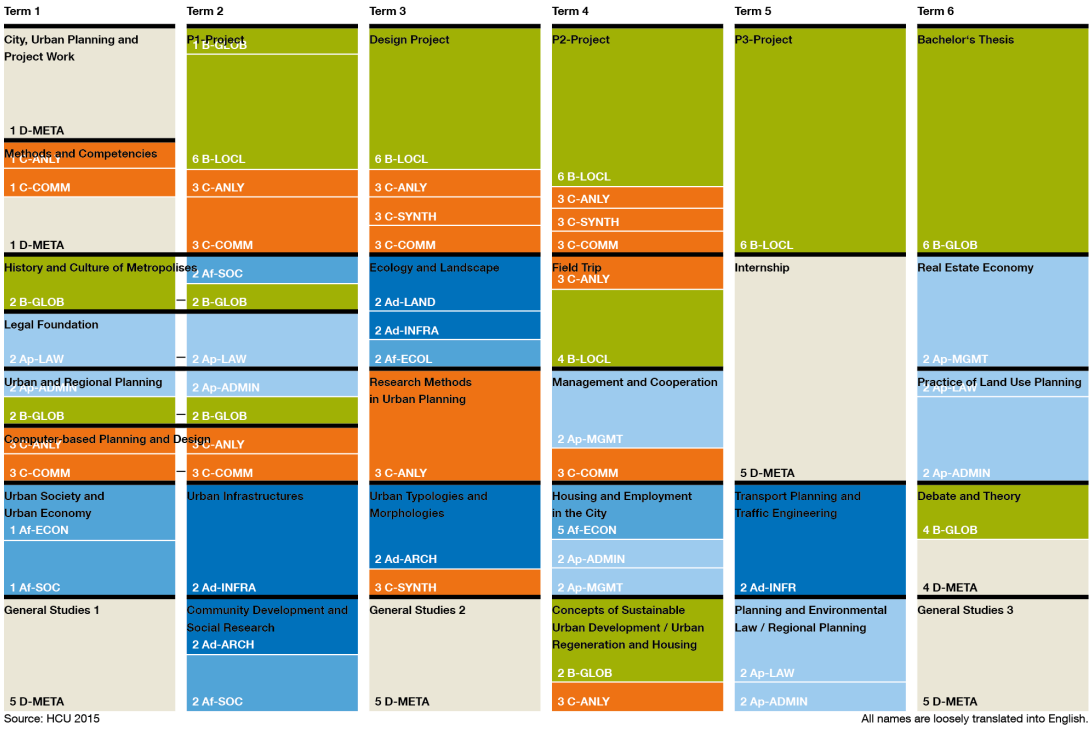
* *Interviewees are not disclosed due to sensitive data on internal work processes.*

Examplary Evaluation of a Curriculum

HafenCity University Hamburg
University of the Built Environment and Metropolitan Development

BSc Urban Planning

ARCH PLAN GEOG



Source: HCU 2015

All names are loosely translated into English.

Examplary Quantitative Evaluation of Curricular Combinations

dachPLAN + deHCUmonoP (Transport)										0.29
			1	2	3	4	5	6	SUM	Share
A			8	55.5	4	0	2	5	74.5	25%
	Ad		0	22.5	4	0	0	5	31.5	11%
		Ad-ARCH	0	3	0	0	0	0	3	
		Ad-LAND	0	3	0	0	0	0	3	
		Ad-INFRA	0	16.5	4	0	0	5	15.5	
	Af		6	7	0	0	2	0	15	5%
		Af-ECON	3	2	0	0	2	0	7	
		Af-SOC	3	3	0	0	0	0	6	
		Af-ECOL	0	2	0	0	0	0	2	
	Ap		2	26	0	0	0	0	28	9%
		Ap-LAW	2	8	0	0	0	0	10	
		Ap-ADMN	0	13	0	0	0	0	13	
		Ap-MGMT	0	5	0	0	0	0	5	
B			1	10	0	10	4	106	131	44%
		B-GLOB	1	10	0	4	4	39	58	
		B-LOCL	0	0	0	6	0	67	73	
C			5	0	48	0	0	0	53	18%
		C-ANLY	1	0	32.5	0	0	0	33.5	
		C-SYNTH	0	0	5.5	0	0	0	5.5	
		C-COMM	4	0	10	0	0	0	14	
D			4	23.5	0	2	12	0	41.5	14%
		D-META	4	23.5	0	2	12	0	41.5	
SUM			18	89	52	12	18	111	300	100%
Data in ECTS					53.0%		10.0%	37.0%		

VII Appendix II: Sample of Qualitative Interviews

Conversation Guide (in German) - Page 1

Empirical Study 2 – In-depth Interviews

Leitfaden deutsch

Allgemeines

Interviewpartner: _____ **Ort des Interviews:_____**

Datum: ___ / ___ / 2017 **Besondere Vorkommnisse: _____**

Uhrzeit: ____:____ - ____:____ **_____**

Phase 1: Offenes Gespräch / Aufwärmphase **5 - 10 min.**

Forschungsinteresse erklären

- Hypothese: Innovative, wirksame Konzepte für die räumliche Entwicklung / Innovationen in der Planung entstehen durch das Zusammenspiel verschiedener räumlicher Disziplinen. Hierzu bedarf es jedoch eines tiefergehenden Verständnisses der beteiligten Disziplinen.
- Daher versuche ich Stadtentwicklung als interdisziplinäres Arbeitsfeld zu verstehen und zu hinterfragen, welche Rolle Stadtplaner als Generalisten in Zukunft haben.
- Hierzu möchte ich verstehen, in welcher Form interdisziplinär in Praxis und Forschung gearbeitet wird und welche Kompetenzen Absolventen hierfür benötigen.
- Ziel der Dissertation ist es Vorschläge zu unterbreiten, in welcher Form die Ausbildung von Stadtplanern reformiert werden kann.

Erwartungen abfragen

- Ist das Thema als solches für Sie als Organisation interessant?
- Sehen Sie andere größere Herausforderungen, was den Ausbildungs- und Arbeitsmarkt von Stadtplanern angeht?

Phase 2: Narratives Interview **20 - 30 min.**

Möglichst wenig nachfragen! Interviewten erzählen lassen!

Persönliche Arbeitsbiographie

- Was haben Sie studiert? War das Studium interdisziplinär?
  Und was haben Sie im Studium gelernt?
  (kompetenzbasierte Antworten hervorlocken)
- Sind Sie Mitglied der Kammer / einer Berufsorganisation?
- Wo haben Sie zuerst nach dem Studium gearbeitet? Welche Kompetenzen haben Sie benötigt?
- Haben sich die Anforderung an Ihrer eigenen Kompetenzen über die Jahre hinweg verändert?
- Wie lange hat es gedauert, dass Sie in Positionen gekommen sind, in denen Sie das Gefühl hatten, Änderungen an Planungen und an der Art zu planen zu bewirken?
- In welchem Umfang sind Kompetenzen, die Sie im Studium erworben haben, in Ihrem heutigen Beruf relevant? Welche davon sind es?
- Wo arbeiten Sie heute? Was sind Ihre Aufgaben?

Phase 3: Fokusinterview **30 - 40 min.**

Makro-Ebene: Das Ökosystem der Planung

Organisation <-> Aufgaben, berufliche Herausforderungen

- Mit welchen Aufgaben haben Sie es in Ihrer Organisation zu tun?
- In welcher Form bereiten Sie Ihre Organisation auf diese Herausforderungen vor?
- Haben sich die Aufgaben und Herausforderungen Ihrer Organisation im Laufe der Jahre verändert? Inwiefern hat sich Ihre Organisation angepasst?
- Fühlen Sie sich den Herausforderungen und Aufgaben als Organisation gewachsen? Wenn nein, worauf ist dies zurückzuführen?

Organisation <-> Absolventen, Ausbildungsangebote

- Gibt es in Ihrer Organisation verschiedenen Typen von Mitarbeitern / mit unterschiedlichem Kompetenzprofil? Welche Einstellungskriterien haben Sie?
- Welche Herausforderungen haben Sie bei der Suche nach geeigneten Mitarbeitern? Bieten Universitäten geeignete Absolventen an? Was müsste anders sein?
- Welche Rolle spielt im Studium gelerntes Wissen? Oder suchen Sie nach allgemeinen, übertragbaren Kompetenzen?
- Welche Rolle spielt die Vertragsgestaltung bei der Einstellung geeigneter Mitarbeiter? Welche Freiheiten haben Sie? (Konkurrenz öffentlicher Dienst und Privatwirtschaft)

Organisation <-> Rahmenbedingungen, System

- In welchem Umfang und wofür kooperieren Sie mit anderen Organisationen?
- In welchem Maße ist Ihre Organisation von Berufsorganisationen abhängig?
- In welchem Maße erschweren oder begünstigen berufliche Rahmenbedingung interdisziplinäres Arbeiten?

Mikro-Ebene: Organisation von Planungsinstitutionen

„Communities“

- Welche Möglichkeiten haben Ihre Mitarbeiten sich in Ihrem eigenen Studienfeld weiterzubilden? Wie lernt Ihre Organisation bzw. Ihre Organisations-Communities dazu?
- Wie wichtig ist es für Ihre Mitarbeiter Kollegen zu haben, welche gemeinsame Erfahrungen und gemeinsames Wissen teilen?
- Wie ist die Leitung / Führung Ihrer Institution organisiert?
- An welche inhaltlichen Grenzen stößt Ihre Organisation bzw. Ihre Organisations-Communities?

„Boundaries“

- Mit welchen disziplinären Grenzen haben Sie es in Ihrer Organisation und über Ihre Organisation hinaus zu tun?
- Wie funktioniert die Kommunikation über disziplinäre Grenzen hinweg (Koordination, Transparenz und Verhandlungsbasis)?
- Welche Maßnahmen ergreifen Sie für interdisziplinäre Kommunikation (Brokering, Boundary Objects, Boundary Interactions oder Interdisziplinäre Projekte)?

UKprv1 [redacted]

Knowledge
Planning is an adjunct to the development industry (:07) Viability analysis to the planning system (:14) Density is not the solution for the housing crises (:15) linkage between viability and social issues (:16) It's not an exact science, so we do not need an exact education. (:29) RTPI planner couldn't do the numbers (:39) RICS planners don't need to know everything because they have experts around (:40) First thing to fix, can we make money and second, do the community support it and then the spatial expertise (:41) The advantage of RICS planner is that he can experiment with planning solutions than just knowing the numbers (:43) The role of planner has changed from long-term strategies to short term solutions (:45) The analytical work is dependent on the problems of the time (:48)

Input	Activity	Output	Outcome	Impact
	Planning degree at [redacted] (:00) including a fourth year practice year (:01) Motivation was based partly on A levels and career advice (:01)	He wanted to go in the public sector (:03)	Worked voluntarily [redacted] because of the recession in the 90s (:04) [redacted] First impression was that public listens to other ideas and private develops ideas. That was the reason to work then for the property industry (:06) As a planner for a development company I got bored because the variety of projects were missing (:09) helped to buy sites and made the planning application for that site (:10)	From design to delivery (:12) we make sure that we only get planning permission for deliverable proposals (:13) e.g. viability models (:14) Our work teams are dependent what the client was (:17) sometimes we cooperate also with others and it depends who is in the lead (:17) teams work together or alone (:18) having multiple teams is good for business resilience (:19) and we just picked them up because we worked together anyways (:20) strategic advisors not multidisciplinary (:21) It important that if you work in-house together that you need to work as good as if you work with other together (:22) Benefit with working others together brings new good ideas (:22) Delivery team is RICS (:37)

Academia	Labour Market	Practice
The perfect planners comes through the RICS route (:38)	People must be motivated for the topic (:32) And if they gone through a good course we know what we get (:33) Now employees market (:35)	Very different wages in different fields. Therefore basically companies within companies (:24) Viability is important for RICS (:26) Planners are member of RTPI or foreign equivalent (:26) we support at RTPI as our professional body (:27) but we would take also people with RTPI accreditations (:27) planning is about opinions and not about wrong and right, that's why the RTPI is necessary (:28) The RTPI gets you through the door but in the end the results count (:30) Foreigner come usually form Commonwealth states, so the system is pretty similar (:31)

Global urbanisation makes urban development a key field of policy. However, current urban development practices are insufficient for resolving pressing economic, social, and ecological challenges. A transformation of common urban development practices based on socio-technical innovation is necessary. The dissertation investigates how interdisciplinarity in higher education can contribute to making urban development more innovative and transformative. The research suggests that established formats of higher education are not suitable for the complexities of systemic urban challenges. New practice-based, collaborative learning formats for students of different disciplines are required. This is the third space.

Der Stadtentwicklung kommt aufgrund weltweiter Urbanisierung eine besondere Bedeutung bei der Lösung drängender ökonomischer, sozialer und ökologischer Herausforderung zu. Statt der Wiederholung etablierter Planungs- und Entwicklungspraktiken bedarf es der Transformation von Stadtentwicklung durch sozio-technische Innovationen. Die Arbeit untersucht, in welcher Form Interdisziplinarität in der universitären Ausbildung einen Beitrag leisten kann, Stadtentwicklung innovativer und transformativer zu gestalten. Zentrale Erkenntnis ist, dass etablierte Lehr- und Lernmodelle den komplexen Realitäten der Umwelt nicht gerecht werden. Es bedarf stattdessen praxisnaher neuer Lernformate, welche das gemeinsame Lernen von Studierenden über disziplinäre Grenzen hinweg fördert. Dies ist der dritte Raum.

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