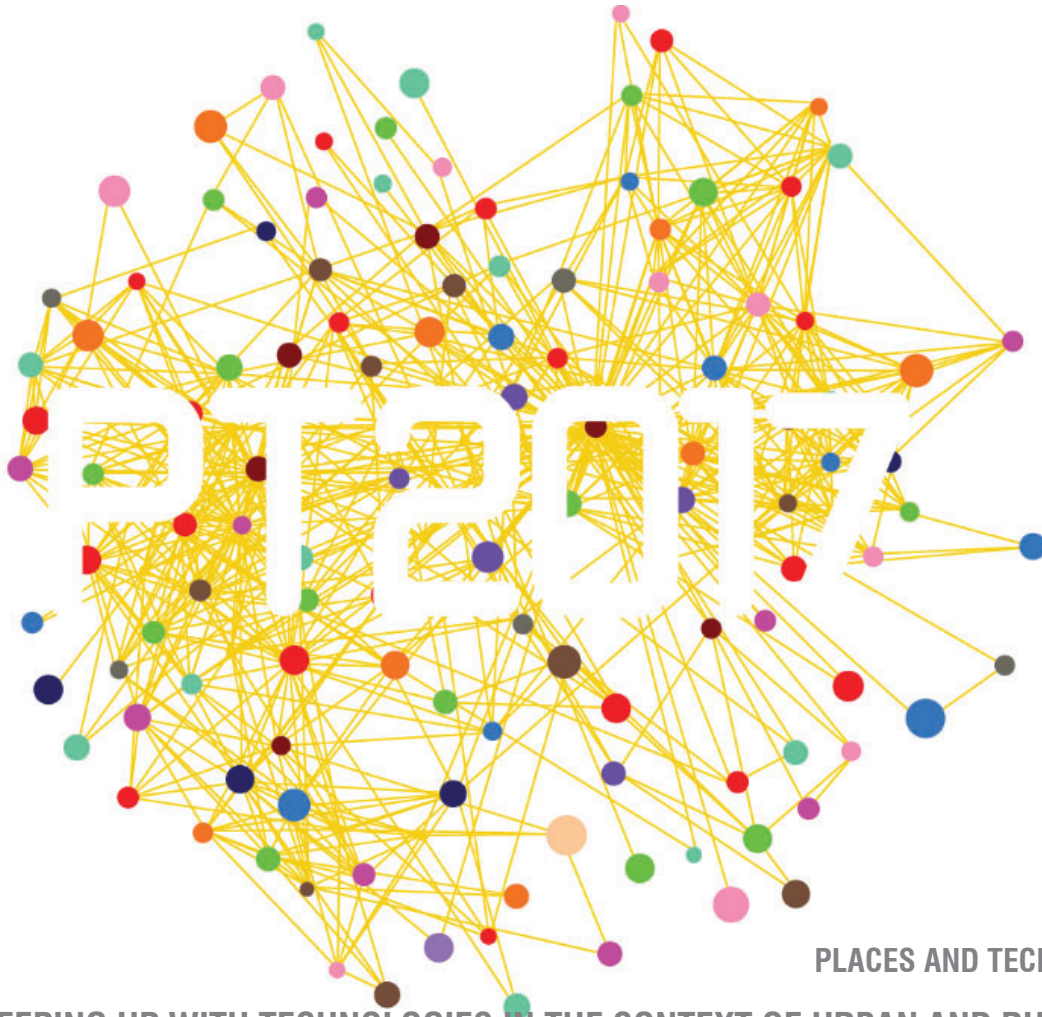


4th International Academic Conference



PLACES AND TECHNOLOGIES 2017
KEEPING UP WITH TECHNOLOGIES IN THE CONTEXT OF URBAN AND RURAL SYNERGY
Book of Conference Proceedings

Sarajevo, Bosnia and Herzegovina, June, 08th - 09th, 2017

4th International Academic Conference
PLACES AND TECHNOLOGIES 2017

KEEPING UP WITH TECHNOLOGIES IN THE CONTEXT OF URBAN AND RURAL SYNERGY

08 & 09 JUNE

SARAJEVO

BOSNIA AND HERZEGOVINA

BOOK OF PROCEEDINGS

PLACES AND TECHNOLOGIES 2017
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SYNERGY

BOOK OF CONFERENCE PROCEEDINGS

Editors:

Dženana Bijedić, Aleksandra Krstić-Furundžić, Mevludin Zečević



Sarajevo, Bosnia and Herzegovina

Title :

**PLACES AND TECHNOLOGIES 2017 - KEEPING UP WITH TECHNOLOGIES IN THE CONTEXT OF URBAN AND RURAL SYNERGY
BOOK OF CONFERENCE PROCEEDINGS**

For publisher:

Prof.Mr.Sci Mevludin Zečević

Chef editors:

Prof.Dr Dženana Bijedić, Prof.Dr Aleksandra Krstić-Furundžić, Prof.Mr.Sci Mevludin Zečević

Editorial board:

Prof.Dr Eva Vaništa Lazarević, Prof. Dr Aleksandra Djukić, Dr Milena Vukmirović

Publisher:

Arhitektonski fakultet Univerziteta u Sarajevu

Year of publishing:

2017

CIP - Katalogizacija u publikaciji
Nacionalna i univerzitetska biblioteka

Bosne i Hercegovine, Sarajevo

711.3/.4(063)(082)

INTERNATIONAL Academic Conference Places and Technologies (4 ; 2017 ; Sarajevo)

Keeping up with technologies in the context of urban and rural synergy [Elektronski izvor] : book of conference proceedings / [4th International academic conference] Places and technologies 2017, Sarajevo, June, 08th - 09th, 2017 ; editors Dženana Bijedić, Aleksandra Krstić-Furundžić, Mevludin Zečević. - El. zbornik. - Sarajevo : Arhitektonski fakultet, 2017. - 1 USB fleš memorija

Sistemski zahtjevi: Nisu navedeni. - Nasl. sa nasl. ekrana

ISBN 978-9958-691-56-0

COBISS.BH-ID 24131590

CONTENTS

ORGANIZATION	ix
ABOUT	xiv
TOPICS	xiv
KEY NOTE SPEAKERS	xv
WORD OF THE P&T_2017 CONFERENCE DIRECTORS	xvii
OPENING AND SPECIAL PAPERS' TOPICS	1
URBAN AND RURAL CONNECTION BETWEEN GLOBAL AND LOCAL – BETWEEN ROLE AND REALITY. WHAT DESIGN CAN DO TO ACHIEVE THE SYNERGY?	3
SPACES OF LOW AND HIGH-INTENSITY CHANGES	4
DECENTRALISING CITIES: TECHNOLOGY, THE NEW CLIMATE AND THE FUTURE OF PERI-URBAN GROWTH	13
TOPIC I: IMAGE, IDENTITY AND QUALITY OF PLACE	27
LIGHT AND ARCHITECTURE IN THE CASE OF ADIL BEY AND KUWAIT MOSQUE IN SARAJEVO	28
THE HOMEOSTASIS AND THE SYNERGY IN THE CONTEMPORARY AND FUTURE LANDSCAPING	38
PRINCIPLES OF ARCHITECTURAL REGIONALISM AS MEANS OF BUILT FORM IMPROVEMENT IN BOKA BAY, MONTENEGRO	48
INVESTMENT OPPORTUNITIES IN SERBIA: KIKINDA CASE STUDY	57
FREE ZONE IN KIKINDA	64
DEVELOPMENT CONCEPTS OF <i>UrbRur</i> AREAS	68
COMPLEX PATTERNS OF SYNERGY BETWEEN URBAN AND RURAL SPACES	77
THE IMPORTANCE OF IDENTITY AND QUALITY OF LIFE, THE CITY OF BANJALUKA	88



SELF-ORGANIZED PATTERNS OF RURAL SETTLEMENTS VS. PLANING AND DESIGNING THE BUILT ENVIRONMENT	96
KNEZ (PRINCE) MIROSLAV SQUARE IN OMIŠ (CROATIA)	105
IMAGE, IDENTITY AND QUALITY OF <i>CVJETNO NASELJE</i> HOUSING DEVELOPMENT IN ZAGREB.....	115
THE SMALL-SCALE APPROACH AS A GENERATOR FOR URBANITY INCREASE OF BANJA LUKA CITY	126
SPATIAL, TECHNOLOGICAL AND STYLISTIC PATTERNS OF PRODUCTION OF THE BUILT ENVIRONMENT IN BOSNIA AND HERZEGOVINA	135
TOPIC II: URBAN AND RURAL PLACES TOWARD HUMAN COMFORT, HEALTH AND INCLUSION	144
THE EXPERIENCE OF SMART CITY IN LIGURIA, ITALY. THE CASE STUDIES OF THE MUNICIPALITIES OF LA SPEZIA AND SAVONA	145
HEALTHY URBAN ENVIRONMENT AND DESIGN: THE OUTDOOR SPACES	155
TENDENCIES IN NEWLY-BUILT MULTI-FAMILY HOUSING IN SERBIA: OUTLOOK OF URBAN EXPERTS.....	169
DECODING URBAN FRAGMENTATION: MORPHOGENETIC PROCESSES IN THE SHAPING OF A SUBURBAN TERRITORY IN LISBON'S METROPOLIS.....	180
RETHINKING ARCHITECTURE AND RELATED ENERGY EFFICIENCY IN WESTERN BALKAN CITIES “Case study of the housing developments in city of Sarajevo”	189
THE ZONE OF TRANSITION: BETWEEN CITY AND LANDSCAPE	204
INNOVATIVE APPROACHES IN THE PROOCESS OF RE-INTEGRATION OF CITY AND VILLAGE.....	215
PERSPECTIVES THAT ARISE FOR PREVENTIVE MEDICINE FROM THE SYNERGY OF URBAN AND RURAL AREAS.....	227
WATER PROTECTION IN URBAN AREAS	236
RELATION BETWEEN PLANNING AND REALIZATION OF OPEN SPACES IN NEW BELGRADE SUPER-BLOCKS: CASE STUDIES OF BLOCKS 45 AND 70	244
IMPACTS OF EARTHQUAKE ACTIONS ON URBAN AND RURAL AREAS	253
TOPIC III: SUSTAINABLE COMMUNITIES AND PARTICIPATION.....	263
THE ARCHITECTURE OF GARDEN AS NEW RECREATION FIELD OF EVERYDAY URBAN LIFE	264
THE SCIENCE OR ART OF MAPPING? - ELABORATING THE PROCESS OF TIS CREATION IN CITY OF NIŠ.....	273

THE ROLE OF SOCIAL MEDIA IN THE PROCESS OF ENHANCING COMMUNITY PARTICIPATION THROUGH BOTTOM-UP APPROACH IN THE CONTEXT OF URBAN REGENERATION.....	284
CREATIVE CITY CHALLENGING CONCEPT “ALL FOR ONE – ONE FOR ALL”	295
HOUSING QUALITY OF SOCIALLY VULNERABLE CATEGORIES AND AFFORDABILITY OF CURRENT SOCIAL HOUSING PROGRAMMES.....	304
TOWARDS SUSTAINABLE REGIONAL DEVELOPMENT THROUGH SOCIAL NETWORKING – „NEGOTINSKA KRAJINA “CASE.....	312
COOPERATIVE GIS PLATFORM FOR IMPROVING RESILIENCE TO HOUSEHOLD RISKS – CASE STUDY OF ADA MEDJICA ON SAVA RIVER IN BELGRADE.....	323
MULTILEVEL GOVERNANCE INSTRUMENTS FOR ACHIEVING BALANCED URBAN-RURAL DEVELOPMENT	332
SMART CITY CONCEPT IN THE STRATEGIC URBAN PLANNING PROCESS. CASE STUDY OF THE CITY OF BELGRADE, SERBIA	341
INTEGRATIVE AND LOCALLY SENSITIVE APPROACH TO THE COMMUNITY PLANNING IN SERBIA.....	350
THE “DYNAMIC EDGE”: RE-CONCEPTUALIZATION OF THE URBAN FRINGE	359
TOPIC IV: ARCHITECTURE AND BUILDING TECHNOLOGIES.....	370
SUSTAINABILITY IN HIGHER EDUCATION AND RESEARCH: THE ROLE OF THE ARCHITECT	371
INTEGRATION OF SOLAR THERMAL COLLECTORS INTO THE BUILDING ENVELOPE OF THE MULTIFAMILY HOUSING BUILDING IN BELGRADE	379
TESTING THE MOST OPTIMAL SCENARIO OF IMPROVING ENERGY PERFORMANCES OF RESIDENTIAL BUILDINGS IN SERBIA, CONSTRUCTED IN THE PERIOD OF 1971-1980.....	389
DAYLIGHT AND ENERGY ENHANCEMENT WITH VENTILATED FAÇADE SYSTEMS FOR RENOVATION PROJECTS	399
INTEGRATED DESIGN IN THE PROCESS OF ARCHITECTURAL EDUCATION	408
EVALUATION OF WALL THERMAL PERFORMANCE FOR VEGETATION WALL.....	417
MONOCULTURE FACTORY BUILDING PROJECT - Facility relaying on energy efficient technologies in order to prevent abandonment and decay of rural communities in Vojvodina	418
NEGOTIATING SUSTAINABILITY IN URBAN DEVELOPMENT: THE ROLE OF TECHNICAL BUILDING EQUIPMENT AT DAS ECKWERK, BERLIN	427



TOPIC V: ENVIRONMENTALLY FRIENDLY MODES OF TRANSPORT AND COMMUTE... 438

WEARABLE DEVICES HELP THE WALKER TO EXPLORE THE CITY 439

EXPLORING THE CITY WITH THE BICYCLE AND TECHNOLOGY HELP TO IDENTIFY HAZARDS MET THEREBY 445

AIRCRAFT TECHNOLOGY ENHANCING ENVIRONMENTAL PROTECTION WITHIN URBAN AREAS 455

CARSHARING – USING INSTEAD OF OWNING 461

CONCEPT OF THE REGIONAL PUBLIC TRANSPORT SYSTEM DEVELOPMENT 470

TOPICS VI: CLIMATE CHANGE..... 477

ENERGY SAVING POTENTIAL OF THE REFURBISHMENT OF BUILDING ENVELOPE OF THE EXISTING SINGLE-FAMILY HOUSES IN URBAN AND RURAL AREAS OF BOSNIA AND HERZEGOVINA..... 478

(R)URBAN SYNERGY RECONSIDERED: THE ROLE OF INFORMATION NETWORKS IN CLIMATE CHANGE ADAPTATION AND MITIGATION..... 489

TOPICS VII: GEOGRAPHY AS DEVELOPMENT FACTOR 499

ROLE OF TWIN CITIES AND SATELLITE TOWNS IN INTENSIFYING REGIONAL DEVELOPMENT 500

SMALL URBAN CENTERS AS DRIVERS OF DAILY MIGRATIONS AND AGENTS OF TRANSFORMATION OF RURAL BACKGROUND: EXAMPLE OF BLACE MUNICIPALITY 512

TOPIC VIII & IX: CULTURAL PATTERNS AND SENSITIVITY; SUSTAINABILITY LESSONS FROM VARNICULAR ARCHITECTURE 525

USING SPACE SYNTAX MODEL IN TYPO MORPHOLOGICAL STUDIES - UNDERSTANDING THE TRANSFORMATION OF URBAN FORM AND URBAN LIFE OF THE EDGE BLOCKS OF NEW BELGRADE 526

THE FUNCTION OF GREENERY IN A SKYSCRAPER: THE PLACEMENT AND ITS INFLUENCE 536

Moshe Safdie 539

THE IMPORTANCE OF THE APPLICATION OF CO-DESIGN WITHIN THE REDESIGN OF THE CULTURAL CENTERS IN B&H 544

LEARNING FROM THE TRADITIONAL MEDITERRANEAN ARCHITECTURE: MICROCLIMATIC AND LIVEABILITY CONDITIONS IN INTERMEDIATE OUTDOOR SPACES..... 553

SUSTAINABILITY AND RESILIENCE IN TRADITIONAL BOSNIAN AND HERZEGOVINIAN ARCHITECTURE - LEARNING FROM TRADITION FOR BETTER FUTURE 563

TOPIC X: TOURISM FOR URBAN-RURAL SYNERGIES 572

FLUIDITY: NETWORKED CONTEXT AND CONTEMPORARY METHODOLOGIES OF ARCHITECTURE IN TOURISM	573
ICT POTENTIAL FOR ENTREPRENEURSHIP IN RURAL AREAS	582
FOOD TOURISM CONCEPT - CREATING SYNERGY BETWEEN URBAN AND RURAL PLACES - CASE STUDY OF MAGLIČ, SERBIA	582
STRATEGIES FOR RURAL TOURISM DEVELOPMENT IN NIŠAVA DISTRICT IN SOUTHEASTERN SERBIA AS MAIN HUB FOR URBAN AND RURAL SYNERGY	608
TOPIC XI: RESILIENCE OF PLACES	624
APPLICATION OF ICT FOR URBAN REGENERATION, ENVIRONMENTAL PROTECTION AND SOCIAL EQUALITY IN SCOTLAND	625
METHODS AND TECHNIQUES TO SUPPORT COGNITIVE PROCESSES OF TERRITORIAL RESILIENCE IN DEVELOPING COUNTRIES – CASE STUDY OF SERBIA	634
CONTINUOUS PERFORMATIVE LANDSCAPES FOR RESILIENT CITY OF SKOPJE	644
AGILE METHODS IN FORMATION OF METROPOLIS NEIGHBOURHOOD	654
REVITALIZATION OF VAST CITY SPACES THROUGH THE MEANS OF SOUND	663
“URBAN RENEWAL UNDER THE SCOPE OF SECURITY ISSUES” - CASE STUDY OF BELGRADE – GLOOMY PARTS OF THE CITY	669
DISASTER RISK REDUCTION IN URBAN SETTLEMENTS – COMBINED MORPHOLOGICAL ANALYSIS AND SYSTEM DYNAMICS APPROACH	681
COMBINED GMA AND SD DISASTER RISK REDUCTION MODEL	688
TOPICS XII: HISTORY AND PHILOSOPHY OF TECHNOLOGY AND PLACES	694
REDESIGNING COMFORT	695
TOPICS XIII: BIOMIMICRY AND SMART INNOVATIONS TO HUMAN CHALLENGES	706
REVERSE BIOMIMETIC ANALOGIES IN DESIGN OF ARCHITECTURAL STRUCTURES	707
TOPICS XIV: PARTICIPATORY AND CRITICAL DESIGN IN URBAN DECISION-MAKING PROCESSES	718
MODERN SPATIAL CONCEPTS, PROGRAMMES AND TECHNOLOGIES AIMED AT SUSTAINABILITY OF HISTORICAL NUCLEI – THE CASE OF THE TOWN OF BUJE	719



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ORGANIZATION

Organizers:

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TOPIC IV:
ARCHITECTURE AND BUILDING TECHNOLOGIES

NEGOTIATING SUSTAINABILITY IN URBAN DEVELOPMENT: THE ROLE OF TECHNICAL BUILDING EQUIPMENT AT DAS ECKWERK, BERLIN

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ABSTRACT

Whether or not the buzz is justified, the technophilic concept of the smart city and its promise of unprecedented resource efficiency became *the* central urban paradigm of today. However, with a few notable exceptions - mostly in the form of prestigious smart or green buildings - the day-to-day praxis of local urban development carries forward its struggle to negotiate the expectations of the triple bottom line. While the advancement of eco-innovative technologies outpaces itself, the way buildings are planned, built, used and demolished has not changed significantly in recent history.

Drawing on experiences from the planning of Das Eckwerk, a major bottom-up urban development initiative in Berlin, it is suggested that the bottleneck to sustainable urban development is not a lack of innovative technology but rather the linearity of value chains in real estate and architecture, which often disincentivize the most sensible solutions. With a focus on technical building equipment, this paper reports on the lessons learned of 'developers by circumstance' in quest of enabling investment and innovation.

In line with the intellectual lineage of the performance economy, the adopted approach at Das Eckwerk is outlined in four stages: (a) a contextual analysis of locally available resources and capacities, (b) the reversal of the demand and supply logic, (c) a recognition of technologies in their life cycles of innovation, and (d) the early involvement of manufacturers in the planning process. Lastly, the structural implications this approach might entail, including a shift in professional roles from producers to service providers, are outlined.

Keywords: sustainable urban development, performance economy, technical building equipment, case study

⁸⁷ Corresponding author

INTRODUCTION

Technology and the messy reality of local urban development

Whether or not the buzz is justified, the technophilic concept of the smart city and its promise of unprecedented (resource) efficiency became *the* central paradigm of present-day urban development politics. Cities have begun to deploy innovative technologies, sensing, regulating and monitoring their activities and flows - from energy to traffic. Simply put, we are heading towards urban space “at the convergence of bits and atoms” (Ratti & Claudel, 2016, p. 162). At the opposite end of the scale, an increasing number of smart and green buildings see the light of day - some of which deploying a vast array of the latest technologies (BIM, IoT, patch cable-LED, DC, PV, CHP, etc.).⁸⁸

However, with a few notable exceptions, the vast majority of local urban development projects carries forward a struggle to depart from conventionality and to negotiate the expectations of the triple bottom line.⁸⁹ While the advancement of innovative technologies outpaces itself, the way buildings are planned, built, used and demolished has not changed significantly in recent history. Criticism comes even from within the industry, “We are still building as if it were the Stone Age” (Rhombert, 2015, p. 55). What are the reasons for this apparent contradiction? Cutting-edge technologies being purchased and deployed either city-wide or building-specific on the one hand and ancient construction methods and the sheer number of unoriginal urban development projects on the other. Neither technology itself nor a lack of availability seem to be the limiting factor.

A possible answer to this discrepancy might lie in the nature of the in-between scale of most urban development projects; a scale which is complicated, messy, and usually dependent on lengthy negotiations between many actors (of various positions from various fields). With a multitude of stakeholders come multiple interpretations of what sustainability refers to (i.e. different understandings of that, which should be sustained): profitability for manufacturers, developers, and financiers, environmental sustainability for idealists and conformists, affordability for future users and tenants, conformity and replicability for administrative and municipal staff, etc. Recognizing obstacles to the implementation of eco-innovative technologies and circular economy solutions, the EU recently established the pilot program *Innovation Deals*, whereby firms facing disincentivizing regulatory barriers are invited to chime in on legislative reform.⁹⁰ However, based on the practical experiences with the planning of Das Eckwerk,

⁸⁸ Abbreviations stand for Building Information Modeling, Internet of Things, patch cable-controlled LED lighting, direct current, photovoltaics, combined heat and power.

⁸⁹ While the widespread adoption of sustainability as one of the most dominant post-war visions reaches back to the 1972 Stockholm Declaration, its broadening into the concept of the Triple Bottom Line (environmental, social, financial) is attributable to social entrepreneur John Elkington (1994).

⁹⁰ The Government of the Netherlands had previously launched a similar program by the name of *Green Deals* with the aim of removing regulatory barriers for local sustainable projects.



TOPIC IV:
ARCHITECTURE AND BUILDING TECHNOLOGIES

the single biggest obstacle seems to be neither the availability of relevant technologies nor the presence of regulatory barriers but rather, as the next chapter shows, the linearity of value chains in architecture, real estate, and urban development.

A brief introduction to Das Eckwerk, Berlin

The recently opened Holzmarkt quarter, of which Das Eckwerk will be the northern neighbor, is a unique example of bottom-up urbanism in the center of a major Western capital. In a 2012 open tender, and to the great surprise of all parties involved, the city accepted the bid of a community of friends, who proposed an alternative to the priority envisioned glass-and-steel office development so typical of recent projects in the area: a self-sustaining urban village based on creative and cultural production. Importantly, the acceptance is not only attributable to the newly-formed cooperative having offered the highest nominal price⁹¹ but also to their willingness and ability to solve long-standing disputes associated with the land in question.

Das Eckwerk, a building complex of 40.000 m² GFA, is conceived to become an affordable place for students and entrepreneurs to work and live temporarily. Its idea is born out of an observed discrepancy between the reality of student and start-up life and local planning law. Students either live in dorms or in (arguably gentrifying) flat shares, neither of which encourage (let alone permit) a start-up life. Although Das Eckwerk dramatically contrasts the Holzmarkt village with its massing, it is equally ambitious to set new standards for property development; especially in the fields of user-centric development, sustainable construction methods and planning regulation.

This five-part paper focuses solely on the topic of technical building equipment. The second chapter recounts our lessons learned and introduces what we came to identify as the critical issue. The third part then situates the practical reflections in their intellectual tradition and wider context. Chapter four describes the ambition and approach we are following at Das Eckwerk. The fifth and last part then outlines some structural implications of said approach and comments on the wider applicability of this experience report. We should emphasize that we are no typical project developers, no architects, let alone consultants for technical building equipment. Rather, the reflections on common practice, the lessons learned, and the adopted approach are results of 'developers by circumstance' asking naive questions. Regarding technical building equipment, the guiding question has always been, "What kind of energy-consuming technology does one need to create which kind of spaces?"

REFLECTIONS ON COMMON PRACTICE

⁹¹ More precisely, Swiss pension fund *Stiftung Abendrot* purchased the land and granted the Holzmarkt team leasehold rights.

Absurdity of linear value chains

In quest of identifying good practice in the field of sustainable development, we noticed a tendency of convenience: *a narrow and inward focus of property development*. Among other projects, we visited Elbarkaden, a 2013 addition to Hamburg's HafenCity and headquarter of Greenpeace Germany. Developed by Green Office Development, the double-gold-certified building complex is lauded for its use of highly efficient energy solutions including photovoltaics, pellet stove, geothermal energy, ground source heat pumps, and rooftop wind turbines. While all these technologies are commonly understood as 'being sustainable,' we noticed that many HafenCity projects were conceived of, designed, and developed in isolation. Developers were wearing convenient blinders, forgoing potential synergies and efficiencies of scale, which may offer more efficient results at lower cost. We further stumbled upon the absence of LED lighting at Elbarkaden, a technology we had expected to be a staple. The wind turbines were on hold, too; apparently due to high maintenance costs. Lamenting in luxury? Maybe. What these observations allude to, however, are unexpected results of conforming to linear value chains in property development.

When researching high-rise office developments, we learned about another trend: *demolition over renovation*. A significant number of high-rise office towers are torn down instead of upgraded, often years before their theoretical end of life. A study by real estate investment management company Jones Lang LaSalle (2014) analyzing the situation in Frankfurt/Main (Germany's high-rise capital) confirms that the average lifetime of a highrise office tower is between 30 and 35 years and thus considerably less than its constructive use life. In the study span between 1988 and 2014, out of 90 towers, ten were demolished and 35 renovated. Reminiscent of mobile phones' inbuilt obsolescence, ways must be found to facilitate and incentivize the upgrading of technical building equipment.

Two years into the planning process of Das Eckwerk, we learned of yet another tendency: *peak-demand driven over-equipping and oversupply*. Before accepting the preliminary design stage as submitted by architects and technical consultants, we took the time to re-examine whether the proposed plan was still in line with its founding objectives, e.g. a decidedly low-tech approach. We concluded that it was not and consequently adjusted the design so that the necessary technical space got halved despite almost identical program and floor area. If these adjustments are valid (as all parties have now verified), why were they not proposed earlier? Part of the answer might be the direct correlation of fees to overall project cost. The more expensive the project, the higher the revenues of architects and technical consultants. For another example, we had entered a partnership with a green energy provider to identify the most sustainable solution for district-wide energy supply. Conflicts of interest arose quickly since the client (us) aimed at higher resource efficiency while the provider was caught in a calculus of economic optimization, which rewards the sale of maximum volumes. Schmidt-Bleek puts it as good as many others, "only those who conserve resources can be truly green" (2015, p. 210).

Need for new business models



TOPIC IV:
ARCHITECTURE AND BUILDING TECHNOLOGIES

Innovative technology has undoubtedly a vital role to play in the design and creation of sustainable places. Based on above experiences, however, we find ourselves in an environment, which promotes a number of inhibitive tendencies: maximized resource consumption, inflexible, isolated solutions and technological over-equipping. It is against this background that we had to ask, “What are favorable conditions for the implementation of innovative technologies, where do they make sense, and at what cost?”

Arguably the bottleneck to developing smarter, greener and more sustainably is not the availability of innovative technologies but rather the linearity of value chains in urban development, real estate and architecture, which often disincentivize sustainable solutions to be deployed. Consequently, there is a need for new business models, which reverse present day linearity and incentivize circularity. These models need to identify ways to recoup prohibitively high capital outlays necessary for eco-innovative technologies, which currently hinder small and medium-sized manufacturers to bring their technologies to market and which hinder developers to depart from conventional solutions.

INTELLECTUAL ORIGINS AND CONTEXT

Early thinkers of performance over product

The origins of a performance-oriented economy are rooted in the broader concept of the *circular economy*, whose first applications to industrial processes (then called *closed-loop*) date back to the 1960s (e.g. Boulding, 1966; Stahel and Reday, 1976). A good thirty years ago, industrial analyst Walter Stahel began to develop the notion of an economic model, which specifically prioritizes product performance and utilization over the product itself and its production. His theories are referred to as the *utilization-oriented economy* (1986), the *functional economy* (2005) or the *performance economy* (2006, 2010), respectively. The innovators of this new economic model, the “avoidance engineers” (1986, p. 191), recognize that sustainable operations do not continuously increase production volumes but reduce system operation cost over a given system lifespan. Stahel (2005, p. 121) defines the functional economy as

one that optimizes the use (or function) of goods and services and thus the management of existing wealth [...]. The economic objective [...] is to create the highest possible use value for the longest possible time while consuming as few material resources and energy as possible.

Combining Stahel's analysis with Womack and Jones' (1996) waste-reducing business logic of *Lean Thinking*, management theorists Hawker, Lovins and Lovins (1999) developed a similar concept, the *economy of service and flow*. Hawker et al. argue that closed loops and greater resource productivity increase service quality for longer periods

while reducing materials and cost. A point, which gains relevance with shortening product life cycles and rising energy and resource prices. Their message to companies is straightforward (p. 134):

Instead of selling the customer a product that you hope she'll be able to use to derive the service she really wants, provide her that service directly at the rate and in the manner in which she desires it, deliver it ever as efficiently as possible, share as much of the resulting savings as you must to compete, and pocket the rest.

What makes these and similar economic strategies compelling is the hope to have found a way to serve all three pillars of sustainability. The strategy of selling and procuring use, performance or results incentivizes and rewards resource productivity for all three sides (Hawken et al., 1999; Stahel, 2005; Russo, 2008). By retaining ownership of the product and providing a service, firms have a strong incentive to invest in innovative technologies, to extend life cycles, to innovate continuously, and to adapt to both changing needs and technological progress.

Avoidance pioneers in the field of technical building equipment

Long before the European Commission released its *Action Plan for the Circular Economy* (2015) to help businesses transitioning, early adopters of performance economy principles developed economic models that begin to transcend the distinction between product and service. In 1990s metropolitan France, Hawken et al. report, millions of buildings are heated by chauffagistes, i.e. firms selling *warmth* instead of oil or gas. Clients pay a certain cost for a certain amount of floorspace to be within a specified temperature range during certain hours. How much materials or energy is used to reach this condition is secondary or even irrelevant to the client. To be sure, the fewer materials and energy is needed to achieve the result, the more profitable the chauffagistes, who are incentivized to invest in more efficient technologies and better building insulation. In contrast to the aforementioned green energy provider, Gothenburg's municipal utility company recognized, "the most environmentally friendly kilowatt hour is the one that is not used" (Göteborg Energi, 2017). Today, some major utility companies across Europe are providing heat (and increasingly also cooling, ventilation, electricity, and water) in a similar manner.

The same logic was applied to the service of *coolth* by early adopter Carrier, a leading US air-conditioning manufacturer (Russo, 2008). Motivated to capitalize on efficiency and reliability of their products, Carrier first offered to lease coolth as a commodity to its customers while retaining ownership of their machines. In collaboration with other service providers, Carrier later expanded this concept to one of leasing *comfort*. This conceptual twist allowed traditional manufacturers to have a joint financial interest in upgrading customers' buildings in a broader sense so that they ultimately consume less energy.

To the best of our knowledge, one of our collaborators was among the first to adopt the performance principle to the service of *light*. Faced with customer difficulties to invest in efficient lighting solutions (despite long-term savings in operating costs), manufacturer and SME Lichträume launched a service in 2010 to provide a certain light quality in



TOPIC IV:
ARCHITECTURE AND BUILDING TECHNOLOGIES

certain spaces at certain times. More recently, a collaboration between manufacturer Philips and consultancy Turntoo markets essentially the same model as Pay-per-lux (2017).

STRATEGY AND NEGOTIATION

Ambition

Emerging out of the experiences with above-described customary practice (and before tracing the intellectual origins of this topic), developed the ambition to *enable investment and innovation*. This objective hinges first and foremost on the creation of the conditions, in which eco-innovative technologies can materialize while avoiding a narrow focus, which precludes recognizing neighborhood potentials. We thus plan and budget only for strictly necessary technologies (e.g. emergency power system or XFMR) but identify ways to enable investment into innovative technologies (e.g. LED lighting or smart monitoring) outside of conventional cost estimations. Further, close ties to the neighboring Holzmarkt quarter and open communication with project developers of surrounding projects present an opportunity (and perhaps a responsibility) to identify technologies and solutions that benefit from clustering effects extending a single building.

For reasons of flexibility in use, affordability, and aesthetic preference, another ambition is to develop a *distinctly low-tech building with visible installations*. Besides architectural solutions minimizing the need for mechanical ventilation, this enterprise requires engagement with the fundamental question of how we want to live. The decision to radically plan for temporary and affordable living from a user-perspective allows for the exclusion of certain use cases/situations from the outset: individual ownership of energy-intensive appliances (shared freezers and washing machines), a room temperature beyond a reasonable range, or the tactile pleasures of a light switch (mobile switches or automation).

Approach

In quest of enabling investment and innovation, leveraging neighborhood synergies, and building low-tech, we first embarked on a *contextual analysis of locally available resources and capacities*; an investigation of the environment, into which we plan to build. Where are we? Who else is here? And, perhaps more importantly, who will be here? As an urban infill project, spearheaded by people who had priorly occupied the plot for interim cultural use, the process was partly intuitive. This analysis helped us, among other things, to better understand the sustainability gradient of certain technologies in given context. For example, the sustainability of a decentralized CHP station graded on a curve may depend on the size of the unit, the cost of land, the proximity to and the kind of alternative sources, etc.

The wider understanding also proved helpful for the *reversal of the demand and supply logic* as regards energy provision. Rather than customizing systems and services to meet assumed peak usage requirements of Das Eckwerk, we are working with energy providers, patrons of existing building stock, and fellow project developers to put to good use the amount of energy, which can be optimally produced by a given system. In short, optimal supply defines demand. While heating is the most obvious application for this holistic approach, others services such as cooling and even fire protection (high-pressure water mist systems) can be optimized, too.

Further, we *recognize technologies in their life cycles of innovation*. As has been established earlier, a building's lifespan is all too often determined by its most vulnerable component - technical equipment. Decoupling the shorter innovation cycles of technology from the longer maintenance cycles of buildings is arguably a precondition for performance-oriented business models to take hold. For example, a leasing contract of mobile lighting units that are independent of switches and miles-long copper cables allows for quick adjustments to kind and intensity of use or for the possibility of upgrading or replacing the units at their end of life.

Any of the above benefits from an *early involvement of manufacturers*, whose products and technologies might set boundary conditions for the planning process. For example, before concluding the preliminary design stage, we decided to deploy capillary tube mats for heat and coolth distribution from a particular manufacturer at an agreed-upon price. Not only did this decision contribute to a more reliable cost projection, but it also became a guideline for architects and consultants, who incorporate the system (and its associated digital models) into their planning. The involvement of industrial partners commonly occurs at a stage in which it unavoidably triggers some form of plan adjustment (presumed the developer troubles herself to depart from conventional solutions in the first place). From the architects' and planners' perspective, the inclusion of industrial partners and service providers in the design process required getting used to.

CONCLUSIONS

Experience gained while analyzing good practice and developing Das Eckwerk led us to believe that radical change towards an eco-innovative revolution in urban development may only be feasible if the inhibitive linearity of relevant value chains is broken. Manufacturers are producing higher qualities and efficiencies whenever the entire product lifecycle lies within their responsibility. Equally, developers invest in higher quality solutions if they find ways to profit off resource savings in the long term. Despite principles of the performance economy gaining traction, they have not yet arrived in the day-to-day operations of our partners. Nonetheless, architects, consultants, manufacturers, and investors involved at Das Eckwerk are receptive to exploring new business models using the project as a large-scale testing ground.



TOPIC IV:

ARCHITECTURE AND BUILDING TECHNOLOGIES

Outsourcing technical building equipment, enabling longer lifecycles, transcending the boundaries between the sale of crude utilities, the provision of services, and the feeling of comfort all entail certain structural changes on the social, cultural and organizational level. The roles we play as producers, service providers, developers, architects, consultants, and consumers are recast. Technology producers take on the responsibilities (and opportunities) of service providers or even investors. Tenants are becoming co-producers, yet need to adopt to predefined frameworks. The challenge is to make the unsustainable uncomfortable. Despite a level of site and context specificity of Das Eckwerk, the questions, lessons and partly precedential solutions being developed here are expected to be of high relevance to urban development projects grappling with issues of profitability, sustainability, and affordability.

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