PLACES AND TEHNOLOGIES
08-09.06.2017

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

Benjamin Scheerbarth[1]
Eckwerk Entwicklungs GmbH, Holzmarktstr. 25, 10243 Berlin, Germany, benjamin@eckwerk.com

Eva Vaništa Lazarević
Faculty of Architecture University of Belgrade, Bulevar kralja Aleksandra 73, Beograd, Serbia, eva.vanistalazarevic@gmail.com

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

[1] Corresponding author

1. 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. Provocatively 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 cabel-LED, DC, PV, CHP, etc.).[2]

However, with 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.[3] 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" (Rhomberg, 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 developers and financiers, environmental sustainability for almost everyone, 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.[4] However, based on the practical experiences with the planning of Das Eckwerk, 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.

---

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

[3] 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).

[4] 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.

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 priory envisioned glass-and-steel office development so typical of recent projects in the area: an urban village based around creative and cultural production. Importantly, the acceptance is not only attributable to the newly-formed cooperative having offered the highest nominal price[5] but also to their willingness, offer, and ability to solve long-standing legal and political disputes associated with the land in question.

Das Eckwerk, a building complex of 40.000 m^2 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 four-part paper focuses solely on the topic of technical 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. We should emphasize at this point that we are neither typical project developers, nor architects, let alone consultants for technical equipment. Rather, the reflections on common practice, the lessons learned, and the adopted approach are results of 'developers by circumstance' asking questions. Regarding technical equipment, the guiding question has always been, "What kind of energy-consuming technology does one (really) need to create which kind of spaces?"

2. Reflections on Common Practice

Absurdity of linear value chains

In quest of identifying good practice in the field of sustainable urban 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

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

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 arguably allude to, however, are unexpected results of conforming to linear value chains in property development.

While 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 installations 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 economical approach as regards technical equipment. 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

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 disincentivizes sustainable solutions to be deployed. Consequently, there is a need for new business models, which reverse present day linearity and capitalize on circularity. These models need to identify ways to recoup inhibitively 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.

3. 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 and 70s (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. 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 providing a service while retaining ownership of the product, 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 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, on 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 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).

4. 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 (e.g. 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 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.

5. 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.

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.

REFERENCES

Boulding, K. E. (1966). The Economics of the Coming Spaceship Earth. In H. Jarret (Ed.), *Environmental Quality in a Growing Economy, Essays from the Sixth RFF Forum on Environmental Quality* (pp. 3-14). Baltimire: The John Hopkins Press.

Ellen MacArthur Foundation. (2013). *Towards The Circular Economy: Economic and Business Rationale for an Accelerated Transition*.

Göteborg Energi. (2017). Energy Services. Retrieved from http://www.goteborgenergi.se/English/Products/Energy_services

Hawken, P., Lovins, A. B., & Lovins, L. H. (1999). *Natural Capitalism: The Next Industrial Revolution* (2010 revised ed.). London: Earthscan (Routledge).

Jones Lang LaSalle. (2014). Abriss nach durchschnittlich 35 Jahren - Lebenszyklen von Frankfurter Bürohochhäusern [Press release]. Retrieved from http://www.jll.de/germany/de-de/presse/1447/lebenszyklen-von-frankfurter-buerohochhaeusern

Philips Lighting. (2017). *Nieuwe Businessmodellen voor enn Circulaire Economie.* Eindhoven.

Ratti, C., & Claudel, M. (2016). Dimensions of the Future City. In O. Nel-lo & R. Mele (Eds.), *Cities in the 21st Century: Academic Visions on Urban Development* (pp. 162-177). London, New York: Routledge.

Rhomberg, H. (2015). *Bauen 4.0: From the Ego Principle to the Lego Principle*. Hohenems, Vienna, Vaduz: Bucher.

Russo, M. V. (2008). *Environmental Management: Readings and Cases* (2nd ed.). Thousand Oaks: Sage.

Schmidt-Bleek, F. (2015). The Green Truth. In H. Rhomberg (Ed.), *Bauen 4.0: From the Ego Principle to the Lego Principle* (pp. 208-239). Hohenems, Vienna, Vaduz: Bucher.

Stahel, W., & Reday, G. (1976 (1981)). *The Potential for Substituting Manpower for Energy*. New York: Vantage Press.

Stahel, W. R. (1986). Product Life as a Variable: The Notion of Utilization. *Science & Public Policy, 13*(4), 185-193.

Stahel, W. R. (2005). The Functional Economy: Cultural and Organizational Change. *International Journal of Performability Engineering, 1*(2), 121-130.

Womack, J. P., & Jones, D. T. (2003). *Lean Thinking: Banish Waste and Create Wealth in your Corporation* (2nd ed.). New York: Free Press (Simon & Schuster).