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Single and Double Loop Learning in Rotterdam Makers District: The Future of Urban Development and the Resilient City

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1 ABSTRACT

“The task of education is to prepare students for a world that is not yet there”, says German philosopher Peter Sloterdijk (Van Stralen & Gudde, 2012). One could argue that urban development deals with the task of preparing the (urban) world that is not yet here. In this paper we highlight the role of learning in urban development. We take up our contribution to REALCORP2014 (Peek & Troxler, 2014) in which we applied the transition perspective to the field of urban development. Based on our research over the past five years we review that paper and propose some conditions that may foster learning in urban development.

In 2014 we advocated Urban Open Innovation Environments as a potential transitional force in the changing field of urban development from the perspective of the Smart City concept and underpinning this with some preliminary examples of these environments in the city of Rotterdam. Five years later we may look back on the actual changes in the field of urban development and its discourse (Buitelaar et al., 2014), including the rise of the Resilient City-concept (Rotterdam University & Pratt Institute New York, 2014). In Rotterdam, as in other cities, the role of areas with a regional innovation eco-system has been much debated (Clark et al., 2016). This resulted in a clearer view on the position of various urban locations where innovation is to be promoted and provided us with two cases to compare their open innovation potential (Peek & Meijer, 2016).

Our findings direct us towards the role of learning within urban development.

Keywords: quadruple helix, triple helix, learning by doing, urban development, Rotterdam makers district

2 CHANGES IN URBAN DEVELOPMENT

With the economic crisis of 2008 a new phase of urban development had started in the Netherlands. More than 50% of all persons working in the development branch lost their job and prominent real estate development companies vanished. In 2017, the total job loss in the building sector as a whole of a total of 529,000 jobs (CBS, 2018) was estimated at 85,000 (Nozeman, 2018). In 2015 vacancies in the office and retail market rose to 17 and 9 % respectively. In 2013 401,000 units, accounting for nearly 5,5 % of the Dutch housing stock, were left vacant, of which 25,000 were newly built units. And in 2015 several government subsidy programmes ended, through which from 2005 onwards in total nearly 4 billion € was invested in spatial planning and urban development (Peek, 2015).

Partly as a result of oversupply, urban developments came to a halt or were modified in terms of content or phasing. 38,000 hectares of building plans for derelict land development were postponed or cancelled (Bergevoet & Van Tuijl, 2013). In addition, a fair share of the real estate stock was ‘under water’, which meant that the value of the asset was below the mortgage amount. The impact of over-supply of real estate in purchasing power and financing had severe consequences for economic growth (Buitelaar et al., 2013).

2.1 From integrated to organic urban development

As discussed in Peek & Troxler (2014) the crisis marks a shift in the Dutch urban development approach away from large scale urban developments. These were characterised by municipalities actively purchasing land and developing it in partnership with large private property companies based on a long-term residual financial model and a ‘blue print’ master plan containing certain landmarks or iconic buildings. Buitelaar et al. (2012) show how this integrated comprehensive approach to urban development in the Netherlands proved to be vulnerable when affected by the financial crises. The comprehensive and integrated nature of urban development has created a tightly coupled system (Weick, 1976) that turned out to be susceptible to external developments, particularly shocks such as financial crises. The locked-in and tightly coupled institutions around land development based on ‘active land policy’ by local authorities became practically dysfunctional and inefficient (Buitelaar et al., 2013).

In the face of an uncertain economic and demographic environment, discourses of organic or spontaneous urban development (Urhahn Urban Design, 2010) came to the fore. A discourse is defined as ‘an ensemble of ideas, concepts, and categorisations through which meaning is allocated to social and physical phenomena, that is produced and reproduced in turn as an identifiable set of practices’ (Hajer, 2002). Peek & Troxler (2014) describe it as “room for other actors to get directly involved in real-estate development, such as local contractors, present land-owners and users and future users of an area. The involvement of these types of actors results in a more bottom-up approach and a decreased project size”. Buitelaar et al. (2013), referring to figure 1, explain that organic urban development adheres more to the ideal of a loosely coupled system and therefore is less vulnerable to shocks.

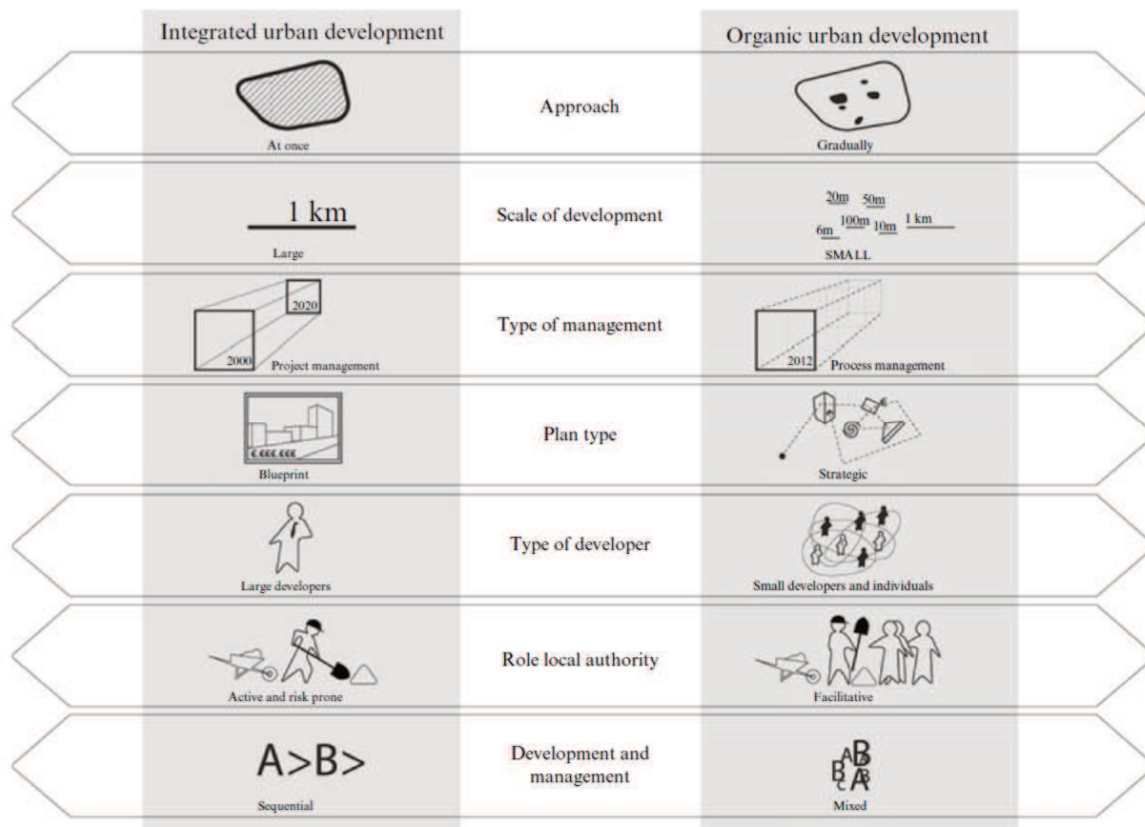


Fig. 1: Integrated and Organic urban development compared (Buitelaar et al., 2012).

In addition to the economic downturn, social developments can also be identified as influencing the practice of urban development. The rise of the ‘civil society’, technology of knowledge sharing and an increased focus on climate adaptation and sustainability in urban development stimulate ‘bottom up’ experiments. Active citizens and entrepreneurs take the lead and seek coalitions with governments, designers, knowledge institutions, investors and companies to realise projects and ‘living labs’. These developments are often to be found occupying vacant space at industrial and business estates at the city’s fringes (Buitelaar et al, 2012, Franke et al., 2015).

2.2 Present challenges

Since 2014 the Dutch economy ranks among the fast-growing economies in Western Europe, driven by a sturdy consumer trust and steady growing domestic expenditures. In 2019 the Dutch real estate market will reach its peak. Supply cannot follow demand. Of all economic sectors, the building industry shows the highest growth with a 6 % higher turnover than during the last peak in 2008. The number of job vacancies rose to 16,300 at the end of the second quarter of 2018, the highest number in almost ten years (CBS, 2018a). At the beginning of 2018 vacancies in the office, retail and housing markets were 7, 6 % and the latter close to 1 % (CBS, 2018b). Year-on-year increase of house prices grew from 2 % in 2004 to 9 % in 2018 (CBS, 2018c).

At the same time the focus on climate adaptation and sustainability has resulted in national regulation. In accordance with European regulations, all new buildings in the Netherlands must be ‘Nearly Energy Neutral

Buildings' (BENG) from the end of 2020. In 2018 the government decided that all households must be independent of natural gas by 2050. Other energy sources - preferably renewable and more local - are required.

The present debate in urban development revolves around the question whether the emerging practice of organic or spontaneous urban development has become obsolete, because it would not be able to answer the present challenges of growing demand for housing and provision of new energy systems, as Peek & Troxler (2014) argued. Present arguments are that the new approach is too gradual, too small and solemnly focussed on development within the present city limits. So, whether this new discourse will materialise as informal and formal institutions is still an open question. In practice private 'organic development initiatives' tend to clash with institutions that contradict this type of development (Buitelaar et al., 2013). Local authorities find it hard to adapt to the role of facilitator (Peek, 2015) and tend to apply a slightly modified version of the pre-crisis integrated comprehensive approach that is less dependent on active land policy. As such, institutions around land development might be less tightly coupled to this approach. Although perhaps less susceptible to crises, the question remains whether these modifications are sufficient or more fundamental changes are needed. Peek & Troxler (2014) foresaw supply chain integration - both vertical and horizontal - as key-concept for the future of urban development. Until now changes in these directions have been modest.

3 TRANSITIONAL CITY CONCEPTS

As many did, Peek & Troxler (2014) saw in the Smart City an appealing concept driving innovation in cities and urban development. Table 1 shows our interpretation of the core-aspects of the Smart City concept. Since then, the critique on the Smart City - being too polysemous and vague serving all sorts of city marketing (Tironi, 2013) and too much centred on technology serving the established institutions - is supported by more empirical evidence. In our discussions with the Pratt Institute's Programmes for Sustainable Planning & Development we developed a particular Resilient City concept (Rotterdam University & Pratt Institute New York, 2014) that incorporates a similar broad spectrum of objectives, but instead of having technology at its core, stems from system science.

<i>Why?</i>	<i>What?</i>		<i>How? (technology)</i>		<i>How? (organisation)</i>	
Sustainability	Resources	Utilising	Infrastructures	Communicating	Public	Providing conditions
Resilience	Economy	Adding value	Buildings	Producing	Private	Investing
Quality of life	Politics	Connecting	Places	Meeting	Individuals	Participating

Table 1: Core-aspects of the Smart City approach (Peek & Troxler, 2014).

3.1 Critique of the Smart City concept

Which city does not want to be 'smart', or better not be 'stupid'? The Smart City concept had a major impact on the development of cities worldwide and led to a multitude of rankings in which cities are compared based on indicators that are found to be decisive for the 'smartness' of the urban economy, ecology, mobility, population, the city government and the quality of life (Cohen, 2012). Cohen (2015) speaks of three phases in the development of Smart City. In the first phase, it is the large technology companies, such as IBM, Cisco and Siemens, that try to sell their ICT products as an apparently all-encompassing solution to cities, without showing much insight into the complex dynamics of the interaction between the city and its residents. Examples are the South Korean Songdo full of Cisco sensor technology and Masdar City, co-designed by Siemens (see also: Townsend, 2013, Van Timmeren & Henriquez, 2015).

In the second phase, progressive city administrators use ICT to improve the quality of life in their city. As examples, Cohen cites the 'disaster management' system and control centre that IBM built at the request of the Mayor of Rio de Janeiro and the more than one hundred 'smart' projects - from Wi-Fi in public spaces and public transport, the promotion of electric driving, establishing local fablabs, to the organisation of the Smart City Expo - with which Barcelona has put itself at the top of 'smart' cities (Peek, 2015). These technologies are expensive to purchase, and maintenance and privacy is at stake. Cities sell their souls to the major technology companies, which gain insight into and control over many urban processes and - once a particular platform has been chosen - can behave as a monopolist. An ICT-driven urban development runs the risk of stimulating social inequality rather than helping to reduce it (Van Timmeren & Henriquez, 2015).

In the third phase of the Smart City, public-private partnerships are not paramount, but urban dwellers are co-creators instead of recipients and consumers of services. An example is the ‘user & community-driven’ way in which Los Angeles handles Open Data (Nemani, 2015): when enough apps are developed with a released data set, it will be available and up-to-date; if not, it will be replaced by another set. The city tries to take full advantage of the knowledge of current questions in combination with the creative ability of its citizens. It quickly receives inexpensive tools in the form of ‘civic’ apps that contribute to the quality of city life and stimulates the local app industry. Communities of users arise around the apps. This last approach is much closer to the key concept of empowering ICT as Peek & Troxler (2014) envisioned the Smart City. Nevertheless, none of the phases of the development of Smart City has brought us much in terms of a more resilient approach to urban development.

3.2 The Resilient City concept

In discussions between Rotterdam University and Pratt Institute New York exploring possibilities for joint research on waterfront communities in the aftermath of hurricane Sandy a model emerged for inclusive innovation for resilience and adaptation. Figure 2 shows and builds on the community-driven approach of the third wave of the Smart City and our core-aspects of the Smart City approach (Table 1). The global changes in economy, ecology and technology are considered as context variables. The model takes a normative standpoint stating that empowerment and employment add to the resilience of a community, as do a valuable and durable local economy, feasible and radical technology and a liveable and sustainable ecology. The model links these core concepts with the terms capability, investment, impact and capacity.



Fig. 2: Resilient City concept (adaptation of the Model for inclusive innovation for resilience and adaptation (Rotterdam University & Pratt Institute New York, 2014)).

Although resilience is often used in relation to climate change the Intergovernmental Panel on Climate Change (IPCC, 2014) offers a broader definition relating it not only to ecological, but also social and economic systems. Meerow et al. (2016) conducted a vast literature study and concluded that ‘urban resilience refers to the ability of an urban system-and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity’. In our model we highlight the interrelations between all urban networks and systems. In our view, strong interrelated networks produce resilience. These networks make sure that resources are utilised, innovations are implemented and circumstances are organised. All correspond to the above normative standpoint.

In contrast to the Smart City concept, often directly translated in sector-bound ICT-solutions, technology in the Resilient City may be understood as driver of innovation, pooling investment, and as its implementation, affecting ecology, community and economy. Technology helps (local) communities to make better use of resources and circumstances by (ICT-based) innovative ways of utilisation and organisation. Cities in this

respect not only make use of technology, but are also the places where this technology is made and innovation takes place.

4 INNOVATION IN AN URBAN PERSPECTIVE

In 2014 Peek and Troxler advocated Urban Open Innovation Environments, with the examples of Living Labs and Fab Labs as a potential transitional force in the changing field of urban development. The ‘openness’ of such environments corresponds to the ‘openness’ of their key-concepts of supply chain integration and empowering ICT. Unfortunately they lack the urban scale to be the game changers in urban development. Innovation districts are more likely to lead the way.

Innovation districts emerged in the transition of capitalist countries from an industrial to a knowledge and innovation driven economy. In the knowledge economy, knowledge is seen as the driver of productivity and economic growth (OECD, 1996). The innovation economy - grounded in the creative destruction theory as initiated in the 1940s by Joseph Schumpeter – sees entrepreneurs as initiators of disruption in economic sectors (Christensen, 1997). In short, the modern innovation economy recognises knowledge, entrepreneurship, innovation and technological change as the main drivers of productivity and economic growth.

4.1 The rise of innovation districts

The transition to an innovation economy incorporates a shift in the landscape of innovation, as the innovation economy increasingly tends to cluster in urban environments. Hence, cities around the world are seeking strategies to accommodate and foster the innovation economy (Katz & Bradley, 2013). Based on the successful implementation of an innovation district in Barcelona, Boston and Medellín, among others, the innovation district model is adopted in many cities around the world. In a ground-breaking study of more than 25 rising innovation districts in North America, Brookings scholars Bruce Katz and Julie Wagner describe these districts as ‘dense and compact mixed-use urban areas where anchor institutions and companies cluster, connect and collaborate with entrepreneurs, start-ups, business incubators and accelerators’ (Katz & Wagner, 2014).

The rise of innovation districts is the manifestation of several economic and social trends in altering location preferences of companies and workers, triggered by the transition to the innovation economy (Katz & Wagner, 2014). Traditional science parks and research campuses – spatially isolated, mono-functional and accessible only by car – no longer answer the location preferences of companies and workers.

The innovation economy is increasingly characterised by open innovation. Innovation has expanded from an internal activity within companies to an activity involving many actors and driven by openness and collaboration (Chesbrough, 2003). Such an open innovation model thrives by face-to-face contacts and rapid exchange of knowledge and ideas, which is enabled by ‘super-proximity’, co-location ‘within a ten minute walk’ (Clark et al., 2016). Moreover, knowledge workers increasingly prefer to live in cities. They integrate life, work and social contacts, and for them the quality of life is understood as the proximity to urban amenities such as restaurants, bars, coffee shops and culture (Florida, 2002), eventually turning those amenities into places of productivity.

Together, these economic and social trends cause a shift in the landscape of innovation. This landscape is shifting from suburban areas such as science parks and research campuses to highly urbanised mixed-use areas as found in cities. Hence, cities are considered being the engines of productivity and growth in the innovation economy (Bettencourt et al., 2007). An innovation district seems to be a successful strategy to accommodate and foster the innovation economy.

4.2 Innovation ecosystems and districts

However, amidst all the buzz around innovation districts, we must consider an innovation district as part of a wider regional innovation ecosystem (Clark et al., 2016). Innovation districts cannot thrive in isolation from a city’s wider economic, social and political structures and resources (Mulas et al., 2015). The regional innovation ecosystem spans all actors and their relations whose goal is to foster economic growth through knowledge creation, innovation, entrepreneurship and technological change (Clark & Moonen, 2015; Jackson, 2011). Strong ecosystems produce many start-ups and a substantial number of high growth companies (Clark & Moonen, 2015). Innovation districts are a key part of a strong ecosystem. They enable

and facilitate open innovation and concentrate the impact of collaboration with super proximity (Clark et al., 2016). Innovation districts are thus produced by a strong regional innovation ecosystem and are built upon an important set of existing assets that can be leveraged. Even though districts can be catalysts for ecosystems to deepen and expand, a city does not become an innovation hub by simply promoting the establishment of an innovation district (Clark et al., 2016).

Usually, innovation districts are developed under leadership of local governments, land-owners, large real estate developers, anchor institutions or companies, or major business incubators and accelerators (Katz & Wagner, 2014). It has led to a wide variety and forms of districts. Some have organically emerged around anchor companies or institutions, while others emerged from a pre-planned strategy of a local government to foster growth of the innovation economy and simultaneously accelerate the redevelopment of an old industrial district, as was the case in Barcelona and Boston, with the redevelopment of Poblenou and Seaport District respectively. In other cases, cities give neighbourhoods an innovation district label in advance of reality (Clark et al., 2016; Katz et al., 2015). Such districts often lack the ‘critical mass’ of economic, physical and network assets that makes innovation districts really stand out. An innovation district thrives by the presence of economic, physical and network assets (Katz & Wagner, 2014). Economic assets are the district’s innovators such as companies, institutions, entrepreneurs supported by business incubators and accelerators. Physical assets are public spaces and urban amenities, referring to the degree of urbanity and mixed-use of the district. Network assets are the ties between the economic actors in the district, facilitated by formal and informal arrangements of knowledge and idea exchange and collaboration. Only with the requisite critical mass of those assets can innovation districts thrive within the wider regional innovation ecosystem.

Recently, the innovation economy and innovation districts have been criticised for contributing to gentrification and economic and social polarisation (Edlund et al., 2015; Glaeser et al., 2009). Here, we observe something of what Richard Florida (2017) terms the New Urban Crisis. Although gentrification provides also positive effects from the perspective of redevelopment of old industrial areas, it is usually associated with negative effects. A famous negative effect is that it inflates rents so that it pushes away poorer residents of an area (Smith & LeFaivre, 1984), but also the entrepreneurs (Rodriguez et al., 2015). It is widely recognised that the development of an innovation district incorporates a process of gentrification, but no policy responses to build more inclusive innovation districts have been provided (Morisson& Bevilacqua, 2018).

5 DEVELOPING THE ROTTERDAM MAKERS DISTRICT

In the light of the Resilient City concept and the innovation district model, we focus on the redevelopment of a part of the port of Rotterdam, recently branded as ‘Rotterdam Makers District’. The Makers District comprises two developments in the realm where port and city meet, both aimed at fostering and strengthening the innovation economy: RDM Campus and Merwe-Vierhavens. We describe the development process of both areas in order to relate these to the approaches as explained in paragraph 2.1. Next, we relate both approaches and the resulting innovation environments to well established models of knowledge-based economic development.

5.1 Stadshavens Rotterdam

In 2004, the City of Rotterdam and the Port of Rotterdam Authority (PoR) together announced the major ‘Stadshavens’ (City Ports) project: 1.600 hectare of inner-city waterfront development along the river Meuse. From the onset, the City and PoR decided to set up a joint development corporation (Vries, 2014). However, for a variety of reasons the development corporation was a failure, not least due to the absence of a common vision among City and PoR (Daamen, 2010). The development corporation had a strong focus on urban development, and less on strengthening the port economy, although various port areas in the Stadshavens project still made a significant contribution to the port’s operations (Vries, 2014).

In 2007, the City and PoR signed a new partnership agreement. In this agreement, the port areas that still contribute to the port’s operation remained under the PoR’s management. In the other areas, City and PoR applied a ‘port-city’ approach – instead of a traditional ‘port out-city in’ approach – creating crossover areas where the port and urban economy meet, while establishing a link with surrounding residential neighbourhoods in the process (Daamen & Vries, 2013). From the onset this new approach had a dual

purpose: strengthening the economy of city and port and increasing the attractiveness of the city's living environment (Stadshavens, 2011). In recent years, the strategy of City and PoR has focussed on the developments of RDM Campus and Merwe-Vierhavens (M4H). In 2018, RDM Campus and M4H were branded as the Rotterdam Makers District, meant as an attractive business location for the innovative manufacturing industry, which is characterised by additive manufacturing, robotisation and material science (Rotterdam Makers District, 2017). Therefore, City and PoR today aim to develop the Makers District along the principles of the innovation district model.

5.2 RDM Campus

RDM is an old shipyard of the former Rotterdam Drydock Company. In 2005, after the bankruptcy of the company and years of vacancy and decay Rotterdam University of Applied Sciences and Albeda College came up with a plan to transform the RDM shipyard into a campus for their technical education programmes. They managed to convince the PoR's management, the land-owner of RDM, to invest in campus development since it would serve the port with education and training of skilled technical workers (Vries, 2014). The development of RDM Campus started in 2007. The former Head Office and the central Machine Hall were renovated, after which Rotterdam University and Albeda College moved to RDM in 2009. The PoR also made further investments in public space and organised a water bus connection to the city centre. The renovation of the Coarse Forge, the physical development of RDM Campus is nearing completion with the very last project. Today, students, professors and researchers collaborate with companies in RDM Campus to develop technological innovations, with a strong focus on port and maritime industries.

5.3 Merwe-Vierhavens

For years, M4H was one of the biggest fruit handling ports in the world. Some major fruit and juices handling companies are still located in M4H today. However, since more and more companies started to move to other port areas where they find more space to grow, opportunities arose in M4H for new economic and urban activities. Major urban development of M4H was planned from the onset of the Stadshavens project. However, as a result of the 2008 crisis those ambitions came to a halt. In 2015, City and PoR presented a new development strategy that was not so much a plan with a linked business case, but rather an open invitation to participate in the development of M4H (Peek, 2015). Actors that could contribute to the economic, social and physical ambitions for M4H were invited to join the development process (Stadshavens, 2015). With this organic development strategy, City and PoR institutionalised a process that was already underway. During the crisis, vacant warehouses were already taken up by small companies and entrepreneurs, who were then actively facilitated and supported by City and PoR. Due to the efforts of small companies and entrepreneurs several old warehouses in the area were transformed into multiple-company buildings. They organically started the redevelopment of M4H. Companies and entrepreneurs in the area may be categorised as 'makers'. These makers embody the innovation economy, using the latest technologies to experiment with advanced materials and utilise the possibilities of digitalisation while sharing facilities, collaborating and experimenting with rapid prototyping.

With the branding of Rotterdam Makers District, the makers are put at the heart of further development of M4H. Now the housing market has recovered and more and more companies and institutions are showing interest in locating in the Makers District, the redevelopment of M4H also accelerates (Rotterdam Makers District, 2017). City and PoR aim to develop an innovation district with a 'red carpet treatment' for innovative manufacturing companies and entrepreneurs that enables them to immediately focus on learning and innovation (Rotterdam Makers District, 2017).

6 LEARNING IN THE ROTTERDAM MAKERS DISTRICT

The development of RDM Campus was arranged before the crisis and corresponds largely with the pre-crisis, pre-planned and top-down project approach of urban development. In the redevelopment of M4H an organic and bottom-up process approach has been adopted. We thus observe two distinctly different approaches to urban development and innovation that correspond to the integrated comprehensive and the organic approach to urban development discussed in paragraph 2.1. In response, these approaches resulted in distinctly different innovation environments. RDM is a campus environment for research, education and entrepreneurship. M4H is slowly emerging as a living-lab environment. Reflecting on this we find that the

combination of approach to development and the innovation environment that resulted may be seen as a cause-and-effect logic, but also that these combinations offer distinctly different opportunities for learning.

6.1 Triple Helix and Quadruple Helix

Innovation in the RDM Campus is based on the Triple Helix of university-industry-government relations as initiated by Etzkowitz & Leydesdorff (1996). In the knowledge and innovation economy, knowledge creation is seen as the driver of productivity and economic growth. The valuation of knowledge creation has led to the establishment of closer relations between universities and industries, and between researchers and entrepreneurs, facilitated or initiated by local governments (Etzkowitz, 2008; Etzkowitz & Leydesdorff, 2000). This approach for innovation is captured in the Triple Helix model, which is in action in learning and innovation in the RDM Campus, as shown in figure 3.

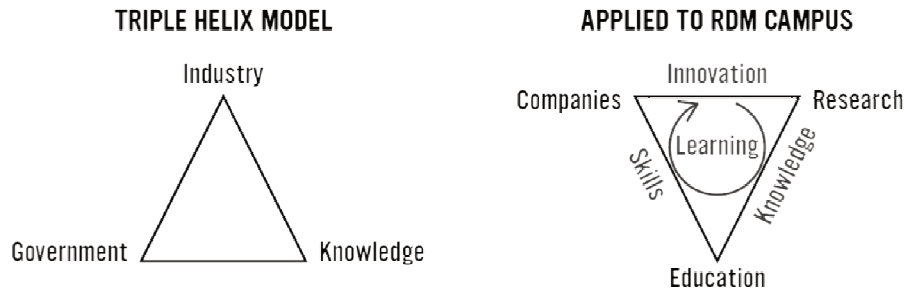


Fig. 3: Triple Helix model applied to RDM Campus (Peek & Meijer, 2016).

In M4H we observe elements of the Quadruple Helix as initiated by Carayannis and Campbell (2009). The Quadruple Helix claims that innovations from the Triple Helix do not necessarily match the demands and needs of society. Hence, the Quadruple Helix embraces the civil society to bridge the gap between innovation and society to foster even greater economic growth (Cavallini et al., 2016). Still, there is debate whether the fourth helix is just an additional helix to the Triple Helix or whether this helix is overarching the other helixes (Höglund & Linton, 2017). In M4H the civil society is, indeed, embraced in learning and innovation. Over the years, we observed how citizens and entrepreneurs take the lead and seek coalitions with governments, designers, knowledge institutions, investors and companies to realise concrete projects.

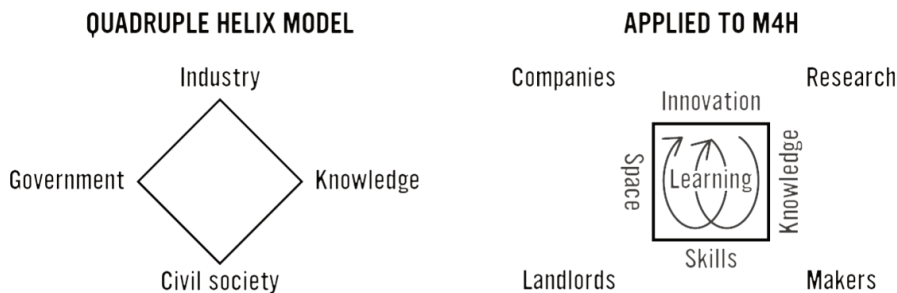


Fig. 4: Quadruple Helix model applied to M4H (Peek & Meijer, 2016).

6.2 Single and double loop learning

Both the Triple Helix and Quadruple Helix provide a flexible social system for innovation through continuous learning in close relationships (Etzkowitz & Leydesdorff, 1996; Carayannis & Campbell, 2009). It is closely linked to the notion of ‘openness’ and may be described as an open innovation process (Chesbrough, 2003). In the RDM Campus and M4H we observe the learning element in these open innovation processes as a first loop of learning. The pre-planned and top-down project development of the RDM Campus did not bring major additional opportunities for learning. One learning element in the RDM Campus may be the role of the PoR, who in the development of the RDM Campus transformed from a traditional landlord into an active developer (Vries, 2014). However, in the organic and bottom-up process development of M4H this is different. Here, City and PoR are experimenting with their changing role, new partnerships and new business models (Peek, 2015). The redevelopment is open for civil society to step in and actively participate in the redevelopment process. It has resulted in an emerging living lab environment where exploration, experimentation and evaluation bring together public, private and civil actors. In M4H,

the learning loop as observed in the open innovation process in the RDM Campus, blends with the learning loop that co-exists with an organic and bottom-up process development (Peek & Meijer, 2016). Here, we observe a second loop of learning. It is not only about the makers in the district, but also about ‘making the district’. The actual redevelopment of the area is part of innovation. The second learning loop creates additional opportunities for a larger innovation impact for city and port, and the challenge for the Makers District is to further explore the potential of this ‘double loop learning’ (Peek & Meijer, 2016).

7 CONDITIONS FOR LEARNING IN URBAN DEVELOPMENT

Reasoning from the Smart City concept Peek & Troxler (2014) came to the conclusion that Urban Open Innovation Environment area potential strong change agent for radical innovation in the field of urban development as they combine supply chain integration and empowering ICT: ‘The success of these new environments largely depends on their open character, not being part of the dominant regime of large companies and (governmental) institutions, but also not being trapped by a counter culture driven niche of grassroots/bottom-up actors that are not willing and able to leverage on their efforts’.

In this paper we provide an overview of our findings over the past five years. Instead of the Smart City concept, we find our conceptualisation of the Resilient City more helpful in thinking about transition and innovation in cities. Researching urban development in the Rotterdam Makers District we find that distinctly different approaches lead to distinctly different opportunities for learning. In this last paragraph we provide some suggestions that could foster the learning potential of urban development. We propose that learning could both help in providing ‘open’ innovation districts as well as making the urban development process more resilient; less susceptible to crises and more responsive to changing demand. This proposition will drive our research efforts in coming years.

7.1 The Resilient City is a learning city

We have learned that the Resilient City provides us with a more suitable concept as it better incorporates the notion of ‘openness’ in highlighting the interrelations between all urban networks and systems that together produce resilience. The concept is community-oriented. The local community is an integral part of the urban networks and systems. It is not so much the city that needs to be resilient, but rather the communities within the city. Innovative technology is not just about systems that better control, manage and facilitate urban networks, these networks should also be able to produce innovation. Innovation districts are urban areas that are developed to do so and add to resilience of the urban community.

The urban development process itself is an integral part of the urban networks and systems. The 2008 economic crisis proved it not to be resilient. Reasoning from the Resilient City concept more involvement of local communities should make it more resilient, as should a further supply chain integration. In the Rotterdam Makers District we saw that a Quadruple Helix approach to innovation involving the civil society is combined with an organic approach to urban development. This combination provides for ‘double loop learning’ excelling in the innovation and transitional impact. Especially, the interaction between the dominant regime of large companies and (governmental) institutions with niche players, like local makers, could lead to more fundamental changes in urban development. This double loop learning creates opportunities to come to a learning process by which we are searching for a new reference frame for area development within the context of the transitional era we are living in (Kemp et al., 2013).

7.2 Monitoring, community and attitude

The new reference frame for area development should contain a learning strategy. Now that the real estate market (in the Netherlands) is reaching its peak, and supply cannot follow demand, we are searching to combine the strength of pre-crisis integrated area development and the openness of organic area development during the crisis for an after-crisis new reference frame. This new approach should include conditions for learning. How may a learning approach be married with a more accelerated and directed way of urban development? We observe three conditions that we will further explore.

First, for learning it is crucial that we create feedback-loops, and monitor and evaluate the development process. This is not only about monitoring whether we are underway, but also during the process of creating momentums when we question what is the right way? Instead of a classic planning process where monitoring consists of checking the execution to the plan, we advocate a process of continuous learning that includes

recurring strategy checking. For this we have to develop new indicators that measure the development toward the pre-defined results, while questioning whether these are still the best and desirable results.

Secondly, as learning in this respect is a group process, it involves a diverse set of committed participants. In M4H City and PoR stimulated local community-building together by organising the 'Keiletafel', open and regular meetings to which all users of the area are invited. Besides information on the development process, participants get to know one another, can make public announcements and raise questions. At present, the new local entrepreneurs' association has taken over the organisation of the 'Keiletafel'. We view strong and active local communities as a condition for learning.

Thirdly, traditional stakeholders should adopt a 'learning attitude' and be willing to experiment with changing roles and new business models, as well as to work with smaller actors to create additional opportunities during the development process. In our view, M4H is a living lab which provides opportunities for City and Port to experiment with new ways of area development, and to foster and strengthen the innovation economy.

8 REFERENCES

- BERGEVOET, T. & Van Tuijl, M.: De flexibele stad: oplossingen voor leegstand en krimp. Rotterdam, 2013.
- BETTENCOURT, L.M., Lobo, J., Helbing, D., Kühnert, C. & West, G.B.: Growth, innovation, scaling, and the pace of life in cities. In: Proceedings of the National Academy of Sciences, Vol. 104, Issue 17, pp. 7301-7306.
- BUITELAAR, E., Feenstra, S., Galle, M., Lekkerkerker, J., Sorel, N. & Tennekes, J.: Vormgeven aan de spontane stad: belemmeringen en kansen voor organische stedelijke herontwikkeling. Den Haag / Amsterdam, 2012.
- BUITELAAR, E., Galle, M. & Sorel, N.: The public planning of private planning: an analysis of controlled spontaneity in the Netherlands. In: Cities and Private Planning: Property Rights, Entrepreneurship and Transaction Costs, pp. 248-268. Cheltenham, 2014.
- BUITELAAR, E. Sorel, N., Verwest, F., Van Dongen, F. & Bregman, A.: Gebiedsontwikkeling en commerciële vastgoedmarkten: een institutionele analyse van het (over)aanbod van winkels en kantoren. Den Haag, 2013.
- CARAYANNIS, E.G. & Campbell, D.F.: 'Mode 3' and 'Quadruple Helix': toward a 21st century fractal innovation ecosystem. In: International Journal of Technology Management, Vol. 46, Issue 3-4, pp. 201-234, 2009.
- CAVALLINI, S., Soldi, R., Friedl, J. & Volpe, M.: Using the Quadruple Helix approach to accelerate the transfer of research and innovation results to regional growth. European Union Committee of the Regions, 2016.
- CBS: Meer omzet en werkgelegenheid in bouwsector in 2017, 2018. Found at: <https://www.cbs.nl/nl-nl/nieuws/2018/08/meer-omzet-en-werkgelegenheid-in-bouwsector-in-2017>
- CBS: Omzet bouw groeit met dubbele cijfers, 2018a. Found at: <https://www.cbs.nl/nl-nl/nieuws/2018/34/omzet-bouw-groeit-met-dubbele-cijfers>
- CBS: Landelijke monitor leegstand, 2018b. Found at: <https://www.cbs.nl>
- CBS: Bestaande koopwoningen; verkoopprijzen prijsindex 2015, 2018c. Found at: <https://opendata.cbs.nl/statline>
- CHESBROUGH, H.: Open innovation: the new imperative for creating and profiting from technology. Boston, 2003.
- CHRISTENSEN, C.: The innovator's dilemma. Cambridge, 1997.
- CLARK, G. & Moonen, T.: Technology, real estate and the innovation economy. Urban Land Institute. London, 2015.
- CLARK, G., Moonen, T. & Peek, G.J.: Building the innovation economy: city-level strategies for planning, placemaking and promotion. Urban Land Institute. London, 2016.
- COHEN, B.: The top 10 Smart Cities on the planet, 2012 Found at: <http://www.fastcoexist.com/1679127/the-top-10-smart-cities-on-the-planet>
- COHEN, B.: The 3 generations of Smart Cities: inside the development of the technology driven city, 2015. Found at: <http://www.fastcoexist.com/3047795/the-3-generations-of-smart-cities>
- DAAMEN, T.: Strategy as force: towards effective strategies for urban development projects: the case of Rotterdam CityPorts. Amsterdam, 2010.
- DAAMEN, T. & Vries, I.: Governing the European port-city interface: institutional impacts on spatial projects between city and port. In: Journal of Transport Geography, Vol. 27, pp. 4-13, 2013
- EDLUND, L., Machado, C. & Sviatschi, M.M.: Bright minds, big rent: gentrification and the rising returns to skill. Cambridge, 2015.
- ETZKOWITZ, H. & Leydesdorff, L.: Emergence of a Triple-Helix of university-industry-government relations. In: Science and Public Policy, Vol. 23, Issue 5, pp. 279-289, 1996.
- ETZKOWITZ, H. & Leydesdorff, L.: The dynamics of innovation: from national systems and 'mode 2' to a Triple-Helix of university-industry-government relations. In: Research Policy, Vol. 29, Issue 2, pp. 109-123, 2000.
- ETZKOWITZ, H.: The Triple-Helix: university-industry-government innovation in action. New-York / London, 2008.
- FLORIDA, R.: The rise of the creative class: and how it's transforming work, leisure, community, and everyday life. London, 2002.
- FLORIDA, R.: The new urban crisis: how our cities are increasing inequality, deepening segregation and failing the middle class and what we can do about it. New York, 2017.
- FRANKE, S., Niemans, J., Reijndorp, A. & Soeterbroek, F.: Het nieuwe stadmaken: van gedreven pionieren naar gelijk speelveld. Haarlem, 2015.
- GLAESER, E.L., Resseger, M. & Tobio, K.: Inequality in cities. In: Journal of Regional Science. Vol. 49, Issue 4, 617-646, 2009.
- HAJER, M.A.: Discourse analysis and the study of policy making. In: European Political Science, Vol. 2, Issue 1, pp. 61-65, 2002.
- HÖGLUND, L. & Linton, G.: Smart specialization in regional innovation systems: a Quadruple Helix perspective. In: R&D Management, Vol. 48, Issue 1, pp. 60-72, 2017.

- IPCC: Summary for policymakers. In: C.B. Field et al. (red.). *Climate Change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, pp. 1-32. New-York, 2014.
- JACKSON, D.J.: *What is an innovation ecosystem?* National Science Foundation. Arlington, 2011.
- KATZ, B. & Bradley, J.: *The metropolitan revolution: how cities and metros are fixing our broken politics and fragile economy.* Brookings Institution. Washington, 2013.
- KATZ, B., Vey, J. & Wagner, J.: *One year after: observations on the rise of innovation districts.* Brookings Institution. Washington, 2015.
- KATZ, B. & Wagner, J.: *The rise of innovation districts: a new geography of innovation in America.* Brookings Institution. Washington, 2014.
- KEMP, R., LOORBACH, D. & ROTMANS, J.: *Transition management as a model for managing processes of co-evolution towards sustainable development.* In: *The International Journal of Sustainable Development & World Ecology*, Vol. 14, Issue 1, pp. 78-91, 2007.
- NEMANI, A.: *Los Angeles data talk: making data meaningful.* Seminar 'Towards Data Driven Cities?' Paris, 2015.
- NOZEMAN, E.: *Historie, actualiteit en trends.* In: G.J. Peek & E. Gehner (red). *Handboek Projectontwikkeling*, pp. 14-22. Rotterdam, 2018
- MEEROW, S., Newell, J.P. & Stults, M.: *Defining urban resilience: a review.* In: *Landscape and Urban Planning*, Vol. 147, pp. 38-49, 2016.
- MORISSON, A. & Bevilacqua, C.: *Balancing gentrification in the knowledge economy: the case of Chattanooga's innovation district.* In: *Urban Research & Practice*, 2018.
- MULAS, V., Minges, M. & Applebaum, H.R.: *Boosting tech innovation ecosystems in cities: a framework for growth and sustainability in urban tech innovation ecosystems.* World Bank Group. Washington, 2015.
- OECD: *The knowledge-based economy.* Paris, 1996.
- PEEK, G.J. & Meijer, M.J.C.: *Single and double loop learning in developing the Rotterdam Innovation District.* 15th World Conference Cities and Ports 'Crossovers', Rotterdam, 2016.
- PEEK, G.J. & Troxler, P.: *City in transition: urban open innovation environments as radical innovation.* REALCORP 2014 'Clever Plans for Smart Cities', Vienna, 2014.
- PEEK, G.J.: *Veranderstad. Stedelijke gebiedsontwikkeling in transitie: Rotterdam.* Rotterdam: Rotterdam University, 2015.
- RODRIGUEZ, H., Congdon, D. & Ampelas, V.: *The development of Boston's innovation district.* The Intersector Project. New York, 2015.
- ROTTERDAM MAKERS DISTRICT: *Visie en Strategie Rotterdam Makers District.* Rotterdam, 2017.
- ROTTERDAM UNIVERSITY & PRATT Institute: *Resilient waterfront communities: international network for inclusive innovation for resilience in delta cities.* Rotterdam, 2014.
- SCHUMPETER, J.A.: *Socialism, capitalism and democracy.* London, 1942.
- SMITH, N. & LeFaivre, M.: *A class analysis of gentrification.* In: *Gentrification, Displacement and Neighbourhood Revitalization*, pp. 43-63, 1984.
- STADSHAVENS ROTTERDAM: *Get Involved in M4H: From Port Industry to Skill City.* Rotterdam, 2015.
- STADSHAVENS ROTTERDAM: *Structuurvisie Stadshavens.* Rotterdam, 2011.
- TIRONI, M.: *Smart Cities: urban laboratories and experiments.* Sustainable-mobility.org, 2013.
- TOWNSEND, A.M.: *Smart Cities: big data, civic hackers, and the quest for a new utopia.* New York, 2013.
- URHAHN URBAN DESIGN: *The spontaneous city.* Amsterdam, 2010.
- VAN STRALEN, G. & Gudde, R.: *En denken: bildung voor leraren.* Leusden, 2012.
- VAN TIMMEREN, A. & Henriquez, L.: *Ubiquity and the illuminated city: from smart to intelligent urban environments.* Delft, 2015.
- VRIES, I.: *From shipyard to brainyard: the redevelopment of RDM as an example of contemporary port-city relationships.* In: *Retours d'Expériences Internationales*, pp. 107-126, 2014.
- WEICK, K.E.: *Educational organizations as loosely-coupled systems.* In: *Administrative Science Quarterly*, Vol. 21, pp. 1-21, 1976.