Article Title Page

Innovation in real estate and evolutionary agendas

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Structured Abstract: Ideally, the notion of innovation enables paving the avenue of research towards evaluation of sustainability in all research areas dealing with the built environment, also real estate. While innovativeness can be understood as an extension of the current paradigm in urban real estate economics, it can also be understood as an alternative paradigm involving more evolutionary perspectives. What happens in the mother discipline of general economics is a reasonable prediction of what eventually will happen in applied disciplines such as real estate economics. However, given the vast differences between physical and asset-oriented views of real estate, it is realistic to assume inertia among real estate economists trained in neoclassical economics in adapting new concepts such as evolutionary dynamics, in which case some other discipline (economic geography, for instance) must set the cross-disciplinary agenda. This paper reviews various literatures involved in this adaption of the innovation-concept and seeks to make connections across them. It argues for the need for real estate economists to open up horizons for dialogue with other disciplines.

Keywords: Evolutionary dynamics, real estate economics, urban sustainability.

Article Classification: JEL Codes: B52, O18, Q56, R31

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1. Introduction

The concept of innovation is today understood as an extension of the current paradigm in urban real estate economics. Alternatively, innovation is understood as a paradigm involving more evolutionary perspectives. Since the 1980s evolutionary economics has begun to replace – or at least complement – neoclassical economics (NCE) as the most widely accepted framework for economic modelling (Nelson and Winter, 1982, 2002). Inertia notwithstanding, this trend in the mother discipline will inevitably also be manifested in applied fields such as real estate economics. This apparent turn is on one hand influenced by debates concerning the methodology of economics (see e.g. Rigby, 2007); on the other hand, it is a result of the incorporation of sustainable development criteria onto studies on the built environment (e.g. Ratcliffe et al.,

2010). The crucial difference between the two modelling traditions – the standard neoclassical one and more evolutionary ones – is that evolutionary approaches (including the Austrian school of economics), allow for feedback between outcome and process, and emphasize behavioural factors and complexity in business routines on top of the market outcome data employed by NCE approaches. It is to note that the version of behaviour recognised by NCE is not about *perception* – or *construction* as some social scientists would prefer to call it – beyond the rational preferences and choices that lead to a supposed equilibrium outcome. It is also to note that NCE necessary focuses on either local (i.e. micro) or global (i.e. macro) level analysis whereas evolutionary economics ties both levels together (e.g. Nelson and Winter, 1982; Dopfer, 2013).

Indeed real estate is an old topic with several specialized journals dating back at least to 1970s and a critical mass of academics existing since at least since 1960s. However, the asset view follows the outmoded NCE approach; in other words, the analysis which has justified neoliberal policies. As a consequence, the recommendations from these results then have led us to an unsustainable situation. Hence it can be argued that, despite an established research tradition, the real estate paradigm is nevertheless immature. Obviously, it is easy to find theoretical papers from the NCE based real estate research tradition to criticise, but this is not the aim here. Instead, this contribution attempts to develop a coherent theoretical alternative framework. The source of inspiration for this endeavour comes from evolutionary economics and other lines that embrace systemic properties such as dynamics, complexity, nonlinearity, feedback, variety generation, selection of the fittest and convergence (cf. Hillier, 2010; Dopfer, 2013). On a more general level the argument concerns the need of real estate economists to engage in dialogue with other disciplines (see e.g. Asafu-Adjaye, 2005).

This paper is organised in six sections as follows. After this introductory section, section 2 outlines the core concepts: innovation, sustainability and evolutionary dynamics. After that, section 3 presents the theoretical context of the research objective – urban real estate. Section 4 continues with discussion on the theoretical-methodological framework of evolutionary dynamics in analysing the extent of innovativeness in a general sense. Section 5 then connects the topics dealt with in the previous two sections – the focus is now on the extent of innovativeness in urban real estate. Section 6 in turn picks up some emerging methodological issues for further discussion. The final section (7) concludes the paper.

2. Innovation, sustainability and evolutionary dynamics

The relatively recent sustainable development debate has shown the case for incorporating the evolutionary perspective into real estate and urban economic analysis.[1] Company level sustainability has been tackled by Cajias and colleagues (2012), who purport that a homogeneously applicable sustainability agenda would generate financial benefits. According to these authors the green agenda would lead to green performance, and subsequently increased revenues and/or decreased stock volatility. In this theorization it is not enough if sustainability characteristic increase prices at the property level, but that corporate social responsibility (CSR) needs to be implemented in the agenda of real estate firms. Cajias and colleagues argue that on one hand external market conditions and competitiveness, and on the other hand, the internal requirements and economic factors define the sustainability agenda. Here also socio-cultural factors should not be neglected, these authors assert. Empirically they find that, as a result of a sustainability strategy, the risk varies (i.e. the sustainability agenda has a tendency to decrease the volatility) whereas the performance is always enhanced. Thus what is profitable will also be responsible for the future. Here the interesting idea is that sustainability is seen as a community medium in relation to a firm's strategy.

Here are issues brought up even at the level of UN. First, a shift in perceptions is apparently taking place, at last, from 'green' features to 'total' sustainability in the real estate world too. Second, risk is

[1] The prefix 'urban' is apt in this context, because investment is argued to occur in cities, 'the engines of economic development' (e.g. Malecki, 2004).

incorporated into the sustainability aspects within real estate analysis too – or more specifically, sustainability criteria are seen as involving an element of riskiness and thereby not only seen as the straightforwardly price increasing impacts. Third, sustainability is brought into the discounted cash flow analysis (cf. d'Amato & Kauko, 2012). Fourth, cross- or inter-disciplinarity is seen as a beneficial development within the sustainable real estate debate. And lastly, the extent of how real estate sustainability is pursued can be identified from best practices at corporate, portfolio and building levels. (Lützkendorf and Lorenz, 2014)

Kohler and Hassler (2002) propagate the role of refurbishment over new built to understand how to maintain the *sustainability of the building stock*. They furthermore argue that there is no help from existing modern and post-modern theory, and that we need to develop truly multidisciplinary approaches. This discussion has already moved beyond the narrow concept of sustainability that is recognized by NCE and defined simplistically in terms of the balance between costs and benefits. The present contribution discusses the emergence of sustainability analysis in real estate valuation, management and development as an evolutionary process related to learning and innovation. In the economy at large such processes relate to industrial production (see e.g. Dopfer, 2013). This literature is reviewed first, before moving towards real estate topics. In both discussions two related concepts: *complexity* and *institutions*, are dealt with as omnipresent side-issues. Thus, the paper is prepared in relation to evolutionary economics more so than to complexity economics or institutional economics.

It can be argued that certain elements are important in social economic [spatial] research in general: On the *micro*-level

- Perception (some call this 'construction').
- Cost (some assume away this element, which is an inapt mode of analysis considering the aims here).
- Risk [for example, in the sense theorized above by Cajias and colleagues (2012) and Lützkendorf and Lorenz (2014)].
- Collaboration (i.e. participation models).

On a *meso*-level

- Path-dependence (and inertia).
- Agglomeration economies (i.e. agglomeration benefits).

Innovation is embedded in all these elements, in one way or other (see e.g. Dopfer, 2013). Lastly, this paper will look at how various theory lines can capture these relationships.

3. Urban real estate – an evolving arena

Cities cannot be understood without a relation to real estate development and markets. In this context the evolutionary arguments are based on a set of assumptions of the complex mechanisms which define the trajectory of events unfolding in given urban circumstances. Depending on the time of development and the area's current image different parts of the city are likely to experience upward and downward developments in the value of their real estate stock. Any investment (or lack thereof) will either enhance the potential of that location, thereby attracting further investment and increasing the value even further, or lead to dilapidation, loss in potential, absence of investment and further decreases in the value. It should also be noted that either trend can be reversed; inappropriate structures may generate a downward trend in the price movements and development activity, or/and gentrification of a neighbourhood will lead to an upward trend. Some of the theory of housing market modelling has included these mechanisms and assumptions implicitly (see e.g. Maclennan and Tu, 1996; Kauko, 2006).

The other main theoretical apparatus here concerns urban sustainability. In most basic terms, sustainable development comprises three basic dimensions: the environmental-ecologic (*green* building/development); the social-cultural, and the economic-financial. The most common and theorized dimension is the *green* building aspect; the other two categories are considerably less developed in terms of analytical frameworks. Here it is perhaps worth noting that, despite the lack of an agreed consensus within academia, real estate practitioners in several parts of the world have been quick in picking up this framework, and this voluntarily, as a means of utilizing new opportunities rather than being imposed by a normative stance. For example, Dixon and Earnes (2013) purport sustainable transitions as a theoretical framework for urban change.

Moreover, at present even mainstream (NCE oriented) real estate economists point out that investment in sustainability considerations such as *green* buildings can have direct economic benefits (long-term cost savings or increase in employee productivity) or indirect economic benefits (reputation, retaining loyal workforce, minimizing risk by preparing for future tightening of regulations) for market based actors, or non-economic benefits (ethical behaviour) for actors with soft budget constrains (see Eichholz et al., 2009). In particular, such analyses often incorporate sustainability considerations into the riskiness of the investment. On the other hand, an implicit evolutionary perspective to real estate sustainability has recently been championed by RICS, the leading global advisory body on built environment issues (see e.g. Macintosh, 2010; Ratcliffe et al., 2010). The adoption of sustainable development principles has perhaps taken off most visibly on the housing/residential side due to the omnipresent socio-cultural and behavioural elements of the dwelling that stretch beyond hard business considerations. When contemplating this possible linkage, Støa's (2009) proposition is worth noting: that one should be pragmatic and plan in relation to what we think sustainability is, even if the concept itself is subject to obscurity and debates.

How then to define what a *sustainable city* is in a real estate context? We could, for example, look at 15th century Florence as a model. In this city innovations in the banking industry fostered investments into the built environment and consequently, as the times were peaceful in that period, all sorts of social and cultural life was flourishing too. The point here is that the success of late medieval Florence was in fact the result of investments – not planning. This is not to deny the logic of public policy possibilities as a secondary influence towards sustainability; for example, with tax incentives one could attempt to steer the land and property development patterns towards a denser urban environment that would save energy and enable better management of land use and infrastructure. Thus in an urban context, sustainability and innovativeness can be considered to go 'hand in hand'.

It is perhaps not until the current financial crisis that the real estate asset view has become topical within economic geography (Martin, 2011). It is evident that the biggest bubble and meltdown magnitudes took place in the most globalised cities that function as command centres for financial and other advanced producer services. It is also evident that some countries (e.g. Hungary) had their own crisis already long before the global meltdown begun. Such arguments in turn bring in the geographic argument. This connection is however only implicitly evolutionary at best and in fact, shares lots of common ground with the old institutional economic approach.[2] Indeed, the role of institutions cannot be overlooked when grappling with real estate problems.[3] In this vein Martin (2011) makes several valid points concerning the role of the housing bubble in revealing the uneven local geographies of the financial crisis. He shows the wide variation among US states in their magnitudes of the house price development leading up to the peak values around year 2007, thereby countering the claims made about globalization rendering geography irrelevant. Martin

[2] Martin (2012, p. 182) argues that an institutionalist view can be incorporated into the evolutionary view. Thus, if we accept that the old institutional economics is already found compatible with real estate (see Kauko, 2012), this would now imply a compatibility with the evolutionary economic perspective too.

[3] A related but more 'neoclassically' rooted line worth exploring concerns the effect of taxes on market activity. Such studies are not in abundance; one example is the econometric study by Dachis and colleagues (2012) on the negative effect of land transfer taxes on house prices and sales activity in Toronto, Canada.

also argues for imposing stronger regulatory arrangements on banks as the neoliberal mantra is shown unsustainable globally, and furthermore encourages the de-concentration of a country's financial system to more than one city in the face of the costs of uneven regional development arising from having one financial centre per country only. In doing so Martin raises issues about the scope of economic geography. Kušar (2012) applies the same idea when exploring the variation in spatial effects of the financial crisis in various micro-locations subject to real estate development (more specifically, unoccupied or partly occupied residential buildings and office buildings that were built after 2005) in Ljubljana, the Slovenian capital. Overall, this discussion shows that, from the theoretical point of view, urban real estate analysis is yet work in progress, if not anymore in its infancy.

4. The evolutionary dynamics of the economy

Commonly Evolutionary economics is traced back to the work of Nelson and Winter (1982, 2002), and build on the traditions of *Austrian School* (Josef Schumpeter, in particular) as well as *Behavioural science* (notably, Herbert Simon). The intuitive appeal of evolutionary economics is that it not only considers isolated markets such as NCE, but the society at large, in which we try, with varying success, to rationalize our choices. Economic decision-making is like other kinds of decision-making: it operates under a number of constraints. Furthermore business actions are routines, but the business environment changes; these routines might have to be changed too. However, this adjustment does not happen immediately.

Nelson and Winter (1982) developed a formal theory along these lines of argumentation. They term their approach 'neo-Schumpeterian' in so far as they see the market economy as an engine of progressive change; more importantly for this study, innovation is treated as deviation from routine behaviour as its upsets equilibrium conditions. Thus routines cannot be innovative, or innovations routinized. Later in the book Nelson and Winter nevertheless state that 'routinization' and innovation are not opposites: "Reliable routines of well-understood scope provide the best components for new combinations"(p. 131). The other line of theorizing they name is what they call the 'neo-Austrian' approach (following Kirzner in the late 70s): a theory about market processes (cf. Dopfer, 2013).

It could be suggested that, on a broad level, evolutionary dynamics is apt for explaining organic change. While the motives of the (aspatial) evolutionary theorizing by Nelson and Winter (1982) are in profit-maximization, unlike NCE this line accepts that such actual behaviour is impossible. Thus instead the goal of the profit-motivated actor is profit seeking much along the guidance provided by managerialism and behaviouralism. Furthermore, the analysis concerns an evolving system – either progress or regress – and assumes a common evolutionary philosophy across social sciences. Such a perspective would borrow the principle of 'general inheritance' from biology (see also Dopfer, 2013).

Dopfer (1994) on the other hand, traces the origins of evolutionary economics along a parallel line, namely to the works of the somewhat esoteric Kenneth Boulding (1910-93). During the late 70s and early 80s Boulding worked on theory with the goals of explaining economic phenomena on the basis of evolutionary principles. Boulding's main idea is that of mutation and selection in what would be, if accepted more widely, as the social-economic counterpart of evolution. The key here is the notion of global irreversibility of economics processes, in the sense that the economy always is embedded in broad ecological context as opposed to being rigid and mechanistic as postulated by NCE – Boulding referred to NCE as 'cookbook theory'.[4] Dopfer concludes that, Boulding's legacy is that of two points: the refutation of the mechanistic NCE, and a demonstration of the relevance of evolutionary principles in explaining economic phenomena (see also Dopfer, 2013).

[4] Besides this refutation Boulding also challenged Schumpeter's foundations of general equilibrium theory as well as J.M. Keynes' circulation equilibrium.

According to Dopfer (2014) the concepts and computations involved comprise rule-based economics, utilizing evolutionary ontology. This development is furthermore supported by parallel developments in techniques, computers and data management one hand and complexity economics and the systems approach on the other. Whereas NCE is preoccupied with economic operations in relation to assumptions of given knowledge, the evolutionary approach centres on knowledge in relation to these economic operations, Dopfer (2013) notes.

Martin (2012) revises and extends the path dependence concept so as to use it as an umbrella concept that covers several particular evolutionary theory perspectives. In doing so he argues that this concept is consistent with all theoretical models that explicitly incorporate history. His key point here is that early decisions and outcomes matter in a model that emphasizes change and continuity. Path-dependence, of course, is one of the key differences between evolutionary economics and NCE.

Martin and Sunley (2006) emphasize the theoretical aspects and add to the discussion on *path dependence* and *lock-in*. They argue that in path dependence one cannot explain decisions made deterministically – only stochastically. The occurrence of lock-ins in turn is in viewed as a result of dysfunctional practices. Martin (2012) sees lock-in as an evolutionary failure of policy or behaviour that undermines any logic of rationalist decisions. Hassink (2005) in turn purports that such failures may be unlocked by forming 'learning clusters', given necessary social capital and other favourable conditions. In a more operational sense, Martin and Sunley (2006) identify the mechanisms that lead to lock-in and de-locking processes as either global or local in character.

This should fit the real estate industry as it is an increasingly global but essentially local entity. In fact, Dixon and Earnes (2013) argue that the sustainable development of cities – via a transition in the built environment – in fact avoids the lock-ins and that this can be understood in the spirit of evolutionary, systems and complexity theorizing. On the basis of the British experience it can be argued that, developing scenarios can help us produce guiding visions towards transitions to urban sustainability – at least insofar as the ecologic dimension – via retrofit (Earnes et al., 2013; Dixon and Earnes, 2013). Furthermore, on the basis of the Australian (specifically suburban) experience, to initiate sustainability transformations will help us switch to a 'model of urban technology and property development' innovations (Newton, 2013).

While one overall is advised to exercise caution when attempting to use nature as an analogy for individual choice based processes within economic systems, "reasonable evolutionary explanations" might be worth pursuing (see Robson, 2002). Nelson and Winter (2002), in similar vein, argue that evolutionary economics has much to offer in terms of interdisciplinary results. By applying ideas from other realms in a cross-disciplinary fashion it builds bridges to other disciplines. The partial consensus claimable here is that NCE still is not interested in covering such ground (although experimental economics and game theory are promising in this respect as discussed later). This 'bridge building' across disciplines is precisely the point of the current undertaking (cf. Asafu-Adjaye, 2005).

5. Making the connection between evolutionary thought and real estate

As already discussed above, an evolutionary approach has two central elements: one is about differentiation/diversity of products and behaviour; the other is about the irreversibility in decisions being made and, as a result, irreversible changes taking place. Evolutionary frameworks are furthermore nonlinear and iterative: they take their starting point in the divergence of routines and outcomes of business activity over time, and work on the assumption that this diversification subsequently leads to a selection of the fittest mechanism. This would require heterogeneity in product ranges, which in turn is fostered by flexible and market sensitive administrative structures and is influenced by the changing tastes of consumers. In real estate economics the issue is about the way a market outcome is linked to the behaviour of actors such as developers and investors. Real estate market activity (measured in terms of indicators such as market prices,

contract rents, building volumes, transaction volumes, vacancy rates and so forth) not only follows cycles; it also follows an idiosyncratic element.[5] These tendencies inevitably trigger a certain amount of speculation as to the extent of applicability an evolutionary approach in real estate. When considering the applicability of evolutionary economics to real estate it is also worth noting that Maclennan and Tu (1996) see the link in housing market research, whereas RICS, since the late noughties, see the link in research on the built environment more widely, incorporating sustainability aspects as well as ICT (Macintosh, 2010; Ratcliffe et al., 2010).

The theoretical starting point of this contribution was that, one, *if* real estate involves innovations, two, *how* and to *what extent* can evolutionary economic analysis (including evolutionary economic geographic analysis) that centres on innovation by definition be helpful for designing a synthesized framework. The first question is as to if there is innovation in real estate. Yes, definitely, one might argue: some innovations are positive such as sustainable/*green* buildings (Lützkendorf and Lorenz, 2006; Lorenz et al., 2007) and renewal areas (Hemphill et al., 2004a,b), CSR (Bénabou and Tirole, 2009; Cajias and Bienert, 2011; Cajias et al., 2012) or the integration of ICT into real estate (Dixon et al., 2005)[6]; others are negative such as the harm caused by the financial engineering during the years leading to the American subprime crisis; and yet a third category of innovations can be seen as potentially either good or bad for the society, such as the application of valuation automata (see Mooya, 2011; Huff, 2014), or the establishment of real estate investment trusts (REITs, see Cajias and Bienert, 2011). The second question above is however more difficult to respond to, given the current state of disciplinary parapets. Perhaps we do not recognise (or even intend to recognise) the need to do any kind of explorations outside the received wisdoms. However, it can be argued that it is exactly the sustainability discourse which has created the imperative to move out of our comfort zones.

Here it can be furthermore argued that the residential rather than the commercial sector provides the most fruitful mould for ideas involving examining real estate activity through an evolutionary lens. Given this emphasis, together with the conjunction between 'evolutionary' and 'sustainability' paradigms, housing development, and thereby also the housing market, undoubtedly constitutes an important element for defining a 'sustainable place'. If the analytical logic is to follow an evolutionary theory framework based on investment as primary influence and apt government regulation as secondary influence, the question is as to how and to what extent political and administrative changes have an impact on the markets. This impact is evaluated in sustainability (or unsustainability) terms concerning one or more of the three main dimensions (i.e. environment, society and culture, and economy). This issue is by no means straightforward; this can be illustrated by an example about how risk is affected by a certain sustainability assessment. Certified buildings and other real estate sustainability are a case in point; these are likely to benefit not only the tenant but also the landlord via reduction in operating costs, improved image and security of rent assuming a market situation where the occupants vote with their feet in search of optimal packages of costs and benefits, which in turn would mean less risk for the owner (cf. Lorenz et al., 2008; Eichholz et al., 2009; Fuerst and McAllister, 2011; Warren-Myers, 2011).

Whereas the general evolutionary economics and evolutionary economic geography literatures deal with industries and firms (as opposed to households), in real estate the corresponding evolutionary perspective has been first applied on the residential/housing side rather than on the business/commercial side of the real estate market. This is due to the intuitive assumptions of dwelling being socio-cultural and behavioural. Within housing economics, Maclennan and Tu (1996), who first lament the lack of "disaggregated economic models of the evolution of local [housing] systems" before themselves setting out

[5] For example, in Manhattan Google recently bought a building site for 1.4 Billion USD, the most expensive real estate deal ever, in the middle of the deepest economic recession for ca. 80 years! (This may be a verifiable fact – or just rumour I heard in 2011.)

[6] Here it is worth noting that the Australian *Green Star* sustainability rating tool is explicit about incorporating and innovation category too (Warren-Myers and Reed, 2010, p. 204)

to tackle the issue of "the structure of a local housing system and its evolution over time" is probably to be considered seminal paper with some sort of implicit evolutionary argumentation. However, it can be argued that, since then, nothing remarkable has been developed along the lines of anything akin to 'evolutionary housing market analysis'(but see Kauko, 2007, 2013). Even considering real estate economics as the whole, that is to say, including also the commercial and office market side, the situation is much the same insofar as any mention of terms such as 'key drivers of change' or 'flexibility and adaptability' can be seen as 'evolutionary' only in the most implicit sense (e.g. Ratcliffe et al., 2010).

The question now is as to whether the core evolutionary principles of variety generation, selection of the fittest and convergence of the variety generated towards the fittest trajectory, can be applied as a support to analysis of the development of real estate prices, ideally, in conjunction with the evaluation of urban sustainability. Indeed, prices increase and decrease, but that alone is perhaps not a sufficient precondition to link the analysis to an evolutionary tradition. The main difficulty is that this discussion is preoccupied with the urban scale – not the regional scale, as is common with evolutionary approaches. However, the real estate sustainability literature to some extent overcomes such inconvenient divides; here sustainable development occurring in urban areas and regions is seen as a process connected to the property development and exchange markets, with the scale ranging from individual property to the neighbourhood, city, region and country. The novelty of this perspective is that, when the evaluation of a given site is related to a market indicator such as house price development, then part of that price change can be explained with, or at least associated to elements of sustainability and unsustainability occurring along economic, environmental, social and cultural dimensions (see Kauko, 2013). Here we also need to remember that when the evolutionary theorization begun in the early 80s the sustainable development discourse was unknown; for instance, Nelson and Winter (1982) discuss the strategies of economic agents, firmly in the context of profit-making. Since then, however, the sustainability issue has been brought to the fore strongly. Socio-technical 'systems transitions'(Geels, 2005) and sustainable 'innovation journeys' (Schot & Geels, 2008) are perhaps the best known examples of emergent lines of theorizing, where the evolutionary and complexity discourse moves beyond mere economic or production level to sustainability or social levels.

Here the complex evolutionary idea can be explained as follows. The paths how new technology contributes to sustainable development vary, and this variation is not blind but directed via niches. Strategic niche management (SMS) then becomes the key to success: this means a co-evolution of technology, user practices and government intervention. Here both internal niche developments and external factors have a role in setting up what is referred to as a 'socio-technical regime' as an extension to a mere 'technological regime' – a term coined by Nelson & Winter (1982). Subsequently a stabilised regime (i.e. lock-in) will face a regime shift. The last twist in this process is that it is not only about bottom-up, but also about meso- and macro-level influences that have the ability to open up these niches. The corollary is to propose this understanding of SMS as a solution to moving towards sustainable development transitions, when neither too modern nor too reflexive approaches lead to satisfactory results. (Schot & Geels, 2008)

6. Auxiliary methodological issues to ponder

The complexity approach

Martin and Sunley (2007) propose complexity theoretical thinking (when refined) as an alternative to more standard evolutionary economic geography (EEG). The two lines of theory work on partly different assumptions, but to some extent also share lots of similar assumptions. The complexity theory has the following differences to EEG (following Martin and Sunley):

- The assumption of a *spontaneous* order of self-organized systems goes well beyond the assumption of selection that EEG follows.

- *Markets and individual behaviour* are placed in a central role, which means that complexity thinking resembles NCE after all. It can therefore be argued that also EEG ought to focus on these elements rather than to downplay markets and emphasize only the institutional contexts.

On the other hand, the following similarities between the theoretical evolutionary and complexity approaches can be noted:

- The shared assumption of economic development being driven by *the growth of knowledge*.

- That the belief in universal (complex) systems justifies *mathematical and computer simulations*.

Martin and Sunley lastly call for an ontologically defensible framework based on the conception of an open, highly interconnected, self-organizing, emergent and adaptive system that enables research on the co-evolution of knowledge and the economic landscape (cf. Hillier, 2010; Gurr & Walloth, 2014; Gebetsroither-Geringer, 2014; Walloth, 2014). The possibility exists that the proposed linking of the real estate economy and urban sustainability fits better with complexity theory than with EEG due to its explicit employment of self-organizing features and micro-level processes (cf. Renigier-Biłozor, 2008). Such a view would definitely put this effort closer to NCE than what is the case with EEG.

On the other hand, it is not easy to define what is merely extended NCE and what is genuinely new theory with evolutionary (or complexity) perspective. To give an example of this difficulty, Carruthers and Mulligan (2012) compare the spatial variation of house values in relation to QOL differentials in the USA over several decades and find out that both personal opportunities determined by available income and the places specific QOL amenities matter. Furthermore, the latter can be enhanced via public policy, these authors suggest. Indeed Carruthers and Mulligan set out to examine income, debt and QOL changes in time and thereby include a strong historical perspective that would suggest an evolutionary inspiration. However, after reading the paper it becomes evident that its theoretical basis and assumptions are firmly rooted in the inter-metropolitan research tradition of NCE rather than any more heterodox views.

The experimental approach

Game theorists Bénabou and Tirole (2009) apply an *experimental economics* approach on how pro-social behaviour might arise from individually selfish goals and might be speculative in a harmful way. Recently, the theoretical framework of experimental economics has also been applied for sustainable real estate investment behaviour in relation to innovativeness. Bienert (2013), for instance, propagates the development of "adequate incentive schemes" for the employees of any firms engaged in operational real estate functions. Bernet and Vermeulen (2013), in turn, set out a "behavioural approach to the dynamics of property pricing" and to deliver solutions for "responsible real estate investment management" – in particular, to aid strategic decision-making of institutional real estate investors. While the difference between these two approaches is that the former is operatively oriented whereas the latter looks at the strategic level, they both share the preoccupation of corporate behaviour that go beyond merely setting regulations. The umbrella approach here is that of game theory, that is to say, an extension of NCE, rather than being an alternative line. However, the individual strive for speculative behaviour and a forward looking perspective applied leads to evolutionary and cyclical development patterns – the pattern is a spiral of progress or decline when market successes are rewarded and market failures penalised, recursively. In this mode of analysis too innovativeness and knowledge development drives the market trends; by creating truly new products or strategies or rediscovering forgotten ones at the same time as the contemporary norms are becoming yesterdays news.

The interdisciplinary view

Like Nelson and Winter (1982) the proposed research direction avoids any market equilibrium assumptions and exploits helpful broad ideas from biology for understanding economic problems.[7] This seems not too farfetched connection to make, even if Nelson and Winter did not consider real estate or housing. Furthermore the study merges several traditions that are 'evolutionary' (and complex) in the broad sense insofar as these share a mutual topic and aim towards a common topic. First, the aspatial tradition of evolutionary economics (1980s); second, the spatial tradition (i.e. the evolutionary economic geography traditions championed since the 1990s); third, the sustainable development tradition (2000s). The last of these three traditions can be split into two converging research directions: on one hand the 'urban sustainability' (or urban biased regional sustainability) literature (e.g. Wallner et al., 1996; Bitušiková and Luther, 2010; Talen, 2011; Hoornweg et al., 2011; Joss, 2011); on the other hand the 'real estate sustainability' literature (Sayce et al., 2007; Ellison et al., 2007; Lorenz et al., 2008; Eichholz et al., 2009, 2010; Fuerst and McAllister, 2011; Lützkendorf et al., 2011; Leopoldsberger et al., 2011; Cajias et al., 2012; Geiger et al., 2013). Moreover, Jones and Watkins (1996), Hemphill et al. (2004a,b), Dixon (2007), Jones et al. (2009), Prince's Foundation (2010), Raslanas et al. (2010), and Ratcliffe et al. (2010) cover elements from both traditions (and in various others) in their cross-disciplinary dealings of sustainability of real estate developments in an urban setting, as do Pareja Eastaway and Støa (2004) when combining housing and urban sustainability.

This is an eclectic collection of studies covering all sorts of methods from the most qualitative case study to econometric modelling. Nevertheless, most (if not all) of the endeavours listed emphasize diversity in their sustainability ideals.[8]

Property products in relation to social diversity

Mixed areas/developments are in a British urban regeneration context seen as sustainable by definition although some contradictions exist too insofar as we evaluate outcomes of social mixing (Jones & Evans, 2013, pp. 21-22). If the idea is about mixing different property products, and by implication, consumers of those products, the following logic is intuitively appealing.

If a potential market trend setter or other innovation in terms of quality or affordability is not recognised this will have harmful impacts for the evolution of the property portfolio (cf. Foxon et al., 2012). Thus a wide enough range (i.e. product variety generated for most apt selections to be made) of different quality and affordability levels need to exist on the market, because the drivers of sustainability: production technology, community governance as well as consumption fashions, all tend to change fast and then it is vital not to have neglected any specific property or housing package even if it may seem marginal at some stage. On the other hand, the discussion surrounding diversity does not only pertain to the built structures; it also concerns the people in the sense of 'social composition' of the block, neighbourhood and wider urban area. The role of diversity has (following Polese and Stren) become an established concept in the international urban sustainability discussion and is relevant also here. However, not all diversity is sustainable – it can be seen either as "an asset and an engine of the sustainable development of the city" or, less politically correctly, "as a liability and a source of potential tension and conflict" whenever the cultural differences between the natives and the newcomers become too wide for their peaceful coexistence (Bitušiková and Luther, 2010). In general, management of diversity in an urban area (public space together with land and housing) influences its social and cultural sustainability in two hypothetical directions:

[7] In this vein the contributions of Ludwig von Bertalanffy (1901-1972) to social science and psychology must be noted; he emphasized systems of symbols in relation to human behaviour which in his view rendered humans different to other species (Weckowicz, 1989).

[8] There are also other connecting research projects carried out on real estate matters, *inter alia*, Bramley and colleagues (2009) and Bramley and Power (2009) on housing development and social sustainability, Csanádi and colleagues (2011) on urban renewal and social sustainability, and Bryson and Lombardi (2009) on business strategies and economic sustainability.

increased diversity either is sustainable (theory) or unsustainable (practice of failures of certain immigrant groups to integrate in Western European and North American cities). As for the management procedure in itself, collaboration in urban and land use issues is today seen as an innovation that is likely to improve the eventual outcome in terms of democracy and transparency (if not for professional autonomy), although it should be noted that NCE lacks such tools in its conceptual apparatus (see Sager, 2009, 2010).

7. Concluding discussion

Here a variety of further research questions can be developed:

(1) Given that the evolutionary approach primarily deals with the behaviour of firms rather than residents, how then would developers and investors be accommodated within such an approach?

(2) Is the evolutionary approach only about regional patterns, not urban ones? If so, how would a metropolitan region fit in?

(3) Can real estate analysis be connected at least to evolutionary meta-theory, even if no strict theoretical coupling to evolutionary economic theory is possible due to the fundamentally different topical contexts. If so, in what way would the evolutionary framework provide guidance?

(4) When the EEG notion of entrepreneurship and innovation was established the topic was that of the industrial production sectors. Is it at all conceptually feasible to include long-term aspects including social and environmental issues into that body of knowledge?

(5) How much of the conceptualization on lock ins can be brought onto a sustainable urban real estate context? For example, can such dysfunctional (and by implication unsustainable) situations be corrected by reverting to a business strategy based on niche developers and niche markets?

(6) Is sustainability theory here to offer a new paradigm where environmental, social and economic interests do not conflict in the long run, or is this only the same essential connection to traditional hedonic type price theory that explains price changes in relation to changes in the balance of amenity and nuisance factors, but with a longer time frame?

In conclusion, the urban real estate economy can be approached from different angles involving concepts pertaining to innovation, sustainability and evolutionary dynamics. The inherent difficulty here is that the value of urban real estate can be seen either via the physical route related to sustainable development, or the asset route relating to economic development. The proposed research direction ties these two lines of enquiry through evolutionary (economic) theory where knowledge accumulation is the driver of the market development; in other words, the market is being ‘twitched’ towards sustainable innovations. However, we cannot rule out the possibility that the evolutionary view is poorly equipped for providing theoretical guidance to this research idea. Therefore, can we predict that other related lines are more promising in this respect (see table 1)? Here a qualification to foresee is that, while evolutionary dynamics possibly could fit the overall analysis of real estate, a particular method of data analysis might belong better to the complexity camp if it employs spontaneous individual processes. Optimistically, the potential impact of this research is likely to be notable as it will open new and important, scholarly horizons of combining different disciplinary traditions.

Table 1: To what extent does each theory line deliver in capturing the six issues brought up at the outset?

	Evolutionary economics	Complexity theory	Experimental design & game theory	NCE
Perception	Partly (place development but not sense of place)	Partly (see evolutionary economics)	Yes	No
Cost	Partly (not the most important for location)	Partly (see evolutionary economics)	Yes	Yes
Risk	Partly (uncertainty only)	Partly (see evolutionary economics)	Yes	Yes
Collaboration	Yes	No	Yes	No
Path-dependence	Yes	Yes	No	No
Agglomeration economy	Yes	Yes	No	Yes

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