

Stagnation in Brownfield Redevelopment

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Abstract—Purpose of this paper is two-folded. At first it explains the major problems that are causing stagnation in brownfield redevelopment. In addition, these problems given the context of the present multi-actor built environment are becoming more complex to observe. Therefore, this paper suggests also a prospective decision-making approach that is the most appropriate to observe and react on the given stagnation problems. Such an approach should be regarded as prescriptive-interactive decision-making approach, a barely established branch. This approach should offer models that have prescriptive as well as an interactive component enabling them to successfully cope with the multi-actor environment. Overall, this paper provides up-to-date insight on the brownfield stagnation by gradually introducing the nowadays major problems and offers a prospective decision-making approach how these problems could be tackled.

Keywords—BR, decision-making approach, stagnation, the Netherlands.

I. BROWNFIELD REDEVELOPMENT CHALLENGES

SATISFYING the demand for the urban land can be addressed (e.g. redevelopment) without expanding into the greenfield. However, to do this, regional representatives needs to be aware of redevelopment benefits. In any case, the capacity to redevelop is mandatory. That is not an easy task.

In the last decade, the scope and scale of urban redevelopment projects increased [1]. For instance, in the Netherlands approximately 35% (27,500 hectares) of the industrial areas, the most spread type of the brownfield [2], are obsolete [3]. As an additional European example, there are 128,000 identified hectares in Germany, going up to the figures of 800,000 and 900,000 hectares respectively within Poland and Romania [4].

Numerous authors [5]-[7] argue that the restoration and redevelopment of a brownfield can provide a range of economic, social, and environmental benefits. Leaving them unmanaged brings the losses of the economic opportunities to the community in which they are present. Some of the benefits are better environment quality, provision of land for housing or commercial purposes, creation of employment opportunities, and especially the reduction in the pressure on urban centers to expand into greenfields.

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The complexity of a brownfield redevelopment is formed out of various physical, legal and financial issues underlining the involvement of numerous parties on various levels. The necessity to deal with these often complex issues for a given property may explain why brownfield problems are not easily resolved.

A. What is a Brownfield?

Several different *definitions* are provided in literature until now. This paper refers to the following: “A brownfield site is any land or premises which has previously been used or developed and is not currently fully in use, although it may be partially occupied or utilized. It may also be vacant, derelict or contaminated. Therefore, a brownfield site is not available for immediate use without intervention.” [2] The cited definition also summarizes existing definitions in Europe [8], [9] and address US examples [10], [11]. Therefore, this definition is regarded as the most adequate.

The brownfield *classification* as any other classification constitutes a fundamental technique for assessing and understanding situations and also it improves decision-making [5]. These authors developed a brownfield classification support system that groups cities into nine different categories based on two key characteristics (e.g. BR effectiveness and BR future needs) and responding criteria. This classification support system helps policy makers on the national level to have better insight and make better decision concerning cities’ policies.

Also, authors [2] in their paper showed an interest in brownfield classification. This classification is based on the characteristics within the previous brownfield definition that are distributed in the following aspects: (a) first, physical aspects such as site conditions; (b) then those non-physical aspects that are partly socio-economic and partly associated with the perception and image of a site that relate to matters such as a developer confidence and influence of the policy. The idea is to create a generic classification that incorporates all users’ perspectives.

As a third example, [8] developed a three-category classification based on two characteristics: market land and property value after the redevelopment and redevelopment costs. These categories are named A, B, and C. They reflect the cost-benefit ratio starting with the most favorable option and ending with the least one. For example, the category B projects are on the borderline of profitability, therefore these projects tend to be funded through public-private partnerships that assume the collaboration between these two parties. Where the first party should be mostly responsible for non-capital interventions (such as a legal framework, favorable

land-use policy, fiscal policies, etc.) and the later one supports the redevelopment project with the capital.

With the previous reference examples, it is clear that the classification can be conducted in many ways. Depending of the criteria, characteristics or aspects, method, goal, and perspective of a classification, the outcome can vary significantly.

Brownfield redevelopment process: Broadly, this paper refers to a redevelopment as any intervention granting the land to be utilized again [2]. Still, the brownfield redevelopment is a specific type of area (re)development and the brownfield definition need to be consulted to properly define the brownfield redevelopment. Consequently, a brownfield redevelopment would be an intervention on a site that is not available for immediate use without intervention. In addition, a brownfield redevelopment could be as well seen as a process where the phases separately and jointly define the redevelopment in more details.

In general, any area development project consists of several successive phases [12]. Further, each phase exists of a final product, defined process and actors that have different interest. For example, in the initiative and land acquisition phase the key actors such as market parties, users, and governmental representatives are identified, as well as their properties: internal organization, constraints, demands and power to influence and affect a development process. In the first two phases of the redevelopment, the process forwards certain market knowledge to an idea. Together, the products of the phases can support the assessment of the risks and opportunities in the redevelopment process mainly related to the program in brief and location analysis.

Finally, it is important to mention that a phase besides indicating various involved actors, processes and its products, a phase dictates the decision that actor needs to make within the given market.

B. Multi-Actor Environment in Urban (Re)development

A traditional linear planning process from the government to the building industries has been replaced by public-private collaborations. The interdependence between the actors (e.g. municipality and developer) emphasizes the necessity to collaborate in order to achieve results. This demands new approaches to conceptualize mutual relations by giving attention to mechanisms that coordinate and integrate actors to extent cooperation. Because of that, many scholars showed an interest in the application of the network steering in urban development projects providing a new stream in literature [13]-[17].

In current development projects many actors groups are involved. This involvement is different in each project. The most important actors are municipalities, landowners, end-users, and investors. Furthermore, there are additional actors involved. They either can be seen as sub-groups of already mentioned groups such as independent development companies, contractors or completely new groups with different goals such as designers, consultants, environmental groups and citizens. Urban development cannot proceed

without commitment of these actors because the decision processes are interdependent. Therefore, one actor cannot determine the outcome of the development process. This has changed the behavior of the actor groups. Their interactive involvement plays now the major influence in the urban development processes [18].

II. MAJOR CAUSES OF STAGNATION IN BROWNFIELD REDEVELOPMENT PROJECTS IN THE NETHERLANDS

The brownfield literature reviews a broad range of different definitions, classifications, and phases separation. Adopting a certain combination of these elements ultimately leads to the indication of a variety the stagnation causes. In addition, the presence of various actors in the observed built environment made isolating a cause of a problem even harder. Therefore, it appears that every of the previous elements need to be addressed properly.

Because a cause of a problem may lay on a legal issue in brownfield redevelopment, and legislation can vary nationally, this paper addresses stagnation problems only in the Dutch context.

As supported by the scale figures mentioned previously, there is a serious need for redevelopment of a large number of brownfield areas. This is also the case in the Netherlands. Restoration and redevelopment of a brownfield can provide a range of economic, social, and environmental benefits, including restoration of the environment quality and provision of land for many purposes. Still there are numerous problems in the brownfield redevelopment process mainly caused by a large stock of brownfield with high vacancy rate, alternative opportunities for development, information gap for example due to the stigma of a contaminated soil and finally the complexity of development process due to the multi-actor environment. This chapter underlines each of the mentioned causes in the following subsections and reveals why the brownfield redevelopment process is slow.

A. Large Stock with High Vacancy

The service oriented economy has lead many companies increasingly decide to establish their business on industrial areas [19]. Consequently, the companies started redeveloping them. In the Netherlands, two main factors that cause enlargement of the industrial brownfield stock are fast development and rapid obsolescence [20] eventually leading to high vacancy rate.

Local governments like municipalities eagerly develop new industrial areas as an economical stimulus but also because of creating a competitive regional environment. The resulting amount of new industrial areas leads to a lack of occupancy on existing ones, finally creating a high vacancy rate. Olden [21] has described the process more detailed and named it "a vicious circle of Dutch industrial area market".

Other Dutch authors [22] proposed four different processes of obsolescence: technical, economical, social, and spatial. Technical obsolescence occurs when an area does not satisfy original user needs due to the lack of building and road maintenance. In economical obsolescence, initial need of a

user changed over time. Social obsolescence starts with the stricter environmental legislation. Finally, a spatial obsolescence appears when surrounding area changes over the time. These changes represent a new land use. The conflict is caused by the differences of the old inner land and new surrounding land use. Any of described obsolescence leads to abandoning the site and again influences the high vacancy rate.

B. Alternative Opportunities

Brownfield vs. Greenfield: There is no specific definition of the term greenfield. Frequently, local authorities have their own interpretation often according to the present-day circumstances. Although there are numerous interpretations, a general understanding is "... any land which has not been previously developed, nor is despoiled by mineral extraction or contaminated by waste disposal. [9]"

Relating to the brownfield definition it is easy to conclude that most criteria for a brownfield do not apply for a greenfield. The only thing they do have in common is the vacant land. Therefore, both are suitable for development thus making them competitive at the same time. For developer, a greenfield is beneficial to develop since this is the land without contamination or complicated landownership and all related risks. This lowers the needed expertise and consequently leads to the lower number of actors thus making a greenfield development more straightforward. Therefore, wherever possible from investors' point of view, a greenfield development is in the most cases preferable.

Although brownfield redevelopment may be financially more challenging and complex, it serves a much broader scope than just satisfying the market demand for the space. Therefore, some mechanism(s) that supports the brownfield development assuming the equal spread of risks and benefits among public and private actors seems reasonable.

Other investment opportunities: Concerning the type of a brownfield the source of investment can vary as explained previously in the preferred classification [8]. Given these conditions, it is important to understand the other investment opportunities that private investor seeks in their real estate portfolio, here we will consider just "green" alternatives.

Doing good and doing well has been a phrase used to describe that an investor can make the profits even though they contribute to a better physical environment. There are numerous actions and movements promoting this idea. Among them, responsible property investments (RPI) represent application to the real estate industry of a widely used investment strategy known as a socially responsible investing, which numerous individuals and institutional investors have been applied to their investment choices [23]. Emerging concerns of volatile energy prices, and global warming have pushed green and energy efficient buildings toward daily practice. Besides brownfields, today there are investment funds focused on green buildings, affordable housing, urban revitalization, historic preservation, and other strategies that have social and environmental merit while also generating competitive returns. Although the RPI concept promotes

sustainability, it seeks beyond the smart growth or green building by integrating them into the investment practices.

Still there are many challenges in attracting these investments. The same authors [23] identified three capital challenges of starting the capital flow toward RPI: (a) lack of comprehensive definition; (b) instituting a system that can benchmark the level of commitment of a property or a portfolio to social and environmental standards; (c) creating investment alternatives that will facilitate the matching of RPI capital with appropriate investments. Since brownfields are one of the core investments addressing RPI, the previous challenges should be addressed as well. Logically, overcoming these challenges in any brownfield redevelopment project augments the chances that the RPI capital flows in this direction.

C. Brownfield Information Gap

Over the time, local communities have had a difficult time understanding the scope and scale of their brownfield situation. Partly, this is due to the lack of information that has resulted in part from the property owner reluctance to reveal contamination potential because of liability fears [24]. As a consequence, "...failure to inform creates a debilitating stigma effect, where properties and entire neighborhoods are avoided because of suspected but unknown contamination potential" [25].

In order to suppress the asymmetric information issue, the same author suggested a combination of formal and informal tracking records. Where formal information could be environmental or non-environmental related provided by national or European agencies and informal information is one not found in a government agency. Such a database of combined sources should be followed by developing a brownfield information system to track and assess the impact of all brownfield in one community.

D. Conflict of Interest

Shifting roles of actors: The change in the urban planning practice in general and in the brownfield redevelopment in particular relates to the collaboration between public and private development organizations thus resulting in various forms of cooperative effort. This cooperative effort requires a shift from sequential to strategic, front-end decision-making approaches that allow interaction. The role of the private developer is critical in this process. This role became the *conditio sine qua non* of urban redevelopment. Simultaneously, the role of government moved from a traditional urban government role by local administration to an urban governance, in which governmental bodies and private parties collaborate more closely. Therefore, the policymaking and development as well include the roles of numerous actors present in the both public and private sector.

Nowadays, due to these changes reflected on the shared, overlapping concerns, conflicting interests and the lack of consensus amongst key actors cause the stagnation in redevelopment of a brownfield. The table below (Table I) illustrates broadly the interests of the two main groups of

actors. Original table has been modified in order to underline the most important difference in the context of this paper and to support the distinction between public and private actors.

TABLE I
 PUBLIC AND PRIVATE ACTORS' INTERESTS, [20] MODIFIED

Actors	Immaterial interests	Material interests
Public	<ul style="list-style-type: none"> • employment • vital urban economy • spatial and environmental quality • intensive and efficient use of space • sustainable maintenance and management • image of the city • contacts with companies 	<ul style="list-style-type: none"> • financial feasibility of the plan / land development • investments from companies • higher yields from property taxes • rising of land prices or ground rents
Private	<ul style="list-style-type: none"> • improvement of the urban quality (better functioning of the company) • sustainable maintenance and management (to guarantee the quality on long term) • improvement of image through a better appearance • continuity of operational management • image, quality and sustainability of developments represent a social responsibility further used as sales argument 	<ul style="list-style-type: none"> • higher value of real estate and parcel • saving in costs through a better functioning of the company • saving in costs through effective maintenance and management • returns / yields • building volume / profit • value of real estate, long-term profitable investments

Public private partnership (PPP) is a concept frequently used in a development practice although uniform definition is still lacking [26]. In most cases, a brownfield redevelopment seeks a form of partnership. This is particularly the case when circumstances are not favorable for an independent development initiative by the private parties [27]. Another important factor for forming partnerships is a limitation of the public funds that have led governments to invite private sector into various long-term arrangements for the capital-intensive projects.

Historically, the first concession was granted in 1782 to Perrier in France for water distribution [28]. From then, there are numerous examples of different public-private

arrangements under different perspectives [26], [27], [29].

In any partnership, forming principles are the same: (a) a clearly defined goal; (b) without a partnership, the project could not be accomplished; (c) partnership must be accepted by the local community; (d) there must be satisfying interest for both parties; (e) each partner contribute within their field of expertise while forming a team; (f) risks are spread equally.

If not assembled properly or according to the key principles, a partnership could be jeopardized. Risk evaluation in these cases is complex and can be looked from various perspectives [27], [30], [31]. Much of the risk of a PPP projects comes from the complexity of the arrangement itself concerning various documentation, financing, taxation, technical details, and sub agreements. In addition, as duration of the project changes the risks are changing as well. A successful project design requires attention on each of the mentioned principles. That eventually leads to the design of contractual arrangements that allocate the risk burdens appropriately.

Especially important issue here can be defining influences of a future land use that captures the supply and demand of a current property market situation [32]-[34].

Negotiation: To resolve a conflict based on different parties' interests, negotiation is one of the most successful choices where parties try to reach a mutual agreement [35]. Negotiation over brownfield redevelopment is aiming at all parties to share the risks. As in any negotiations, the parties present offers and counter-offers while their objectives and interests are often hidden [35].

Within the previous broad distinction on public and private groups of actors, there are mainly three actors involved in the funding of a brownfield redevelopment project: (a) current owner of the site; (b) prospective buyer (or developer or investor); and (c) government [36]. They all can be involved in negotiations depending on a development model [37].

No matter who are the present actors, it is methodologically demanding to analyze formally the negotiation process. On the other hand, in order to provide an adequate advice, for example in the form of a decision support tool, that formality is required.

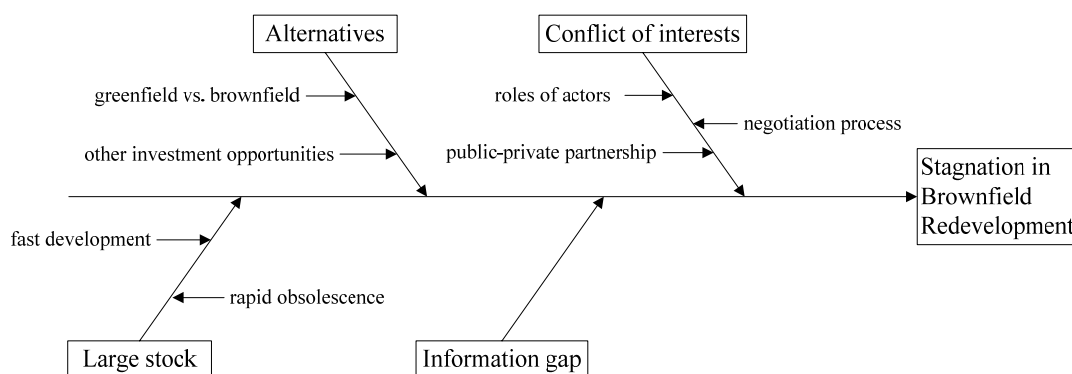


Fig. 1 Cause-effect diagram of brownfield stagnation

E. Setting a Priority

Evidently, the issues in brownfield redevelopment have

been separately addressed in many studies. This chapter summarizes them as a large stock with the high vacancy rate,

alternatives, information gap, and as a conflict of interest of the present parties. The figure (Fig. 1) is a cause-effect diagram in which the mentioned issues cause the effect of stagnation in the brownfield redevelopment process.

Having a broader view of the causes-effect relation is beneficial to approximate the impact of each of them separately. In addition, such an overview enables the selection of the most important or urgent cause to be addressed. Obviously, addressing all of them would be vast and out of this research scope. *Brownfield stock* enlargement and *information gap* are problems on the national scale. Although still present, these problems are either successfully resolved at the national level policies or extensively elaborated in existing literature. Various *alternatives* to a brownfield redevelopment exist and certainly cause partly the stagnation of redevelopment process in general. Still, the least researched cause of the stagnation is the *conflict* of involved actors. Given the context of necessity for the partnership due to the economic and political contemporary circumstances, the impact of this cause is assumed the highest, thus it is the central focus of this research.

There are many problems, but focusing on the potential conflict of interest seems the most challenging and very evident in contemporary changing circumstances [21], [35], [38], and [39]. In addition, this problem is the least investigated by the research community. This fact underlines the necessity to cope with it.

III. A PROSPECTIVE APPROACH

The multiple (public and private) actors' interests assert the changes of the nowadays established pluricentric urban development. This chapter will suggest a prospective approach to analyze these interactive processes.

That approach should help establishing the foundations for a better-planned and managed decision-making process for a brownfield redevelopment.

A. Why Decision-Making?

A decision-making in urban (re)development has generally undergone a number of important changes over the last decades. This transition represented a shift from governmentally dominated top-down spatial planning to bottom-up development [40], [41]. The new policy implies pluricentric network steering – in which several public and private actors play a role – instead of traditional hierarchical top-down governmental steering.

This demands a strategy of different present actors to handle conditions that are more dynamic. In general, there are numerous definitions and various kinds of strategies [42]. The strategy in the context of this paper addresses the systematic plan of actions that actor does based on its own perspective of the physical, legal and financial structure of the built environment while incorporating reaction(s) of other present actors.

Concerning the formal frame within the decision-making theory, negotiations are classified as interactive normative or collaborative prescriptive approach [43]. The interactive normative approach is dominated by the concepts of game theory and the other by negotiation analysis. An application of negotiation analysis studies shows how to reconcile differences and reach consensus in to brownfield redevelopment [44]. The concept of merging these two approaches is also investigated [35] and supported by qualitative and quantitative methods. Still, there is a need for further development towards more functionally beneficial tools. This research provides a model that has a base in quantitative methods and it is formulated formally as a prescriptive - interactive approach.

This research refers to the collaboration and negotiation in a multi-actor environment. The various interdependent relations between actors are investigated and modeled by van Loon for the purpose of facilitating and stimulating actor's collaboration [45]. Different methods and theories [46] are used for the same topic while the focal point is the interaction in decision-making. Evidently, that knowledge is beneficial and serves as guidance for modeling in this thesis.

This resulted in a search for scientific methods and tools enabling planners to support actors' participative decision-making [40], [41]. However, the influence of the distributional power, hierarchy, and conflict have been relatively neglected in the recent process models, although it is still a key component when studying the relation between actors involved in urban development [47]. There have been a very few attempt to analyze systematically how a relational aspect plays a role in a multi-actor decision-making. Analyses of the structures and processes of urban development projects will be effective only to the extent that they recognize the roles of both cooperation and conflict [48].

As concluded previously, the processes in urban area development have therefore changed brownfield redevelopments as well. In nowadays literature, these changes have been referred as the interaction between actors. This notion brought to attention a relatively new research branch - complex systems in the built environment. Characteristic for this branch is not a mere people's reaction on the given conditions in the built environment but also the interdependent decisions that people perform in relation to the other people. Therefore, decision-making theory has the major role in this field.

B. Descriptive, Normative, and Prescriptive Decision-Making

There are different studies covering a broad range of decision-making theory. Raiffa [43] provided the categorization of the most applied approaches (Fig. 2). In the following text, the distinction amongst descriptive, prescriptive and normative approach is made.

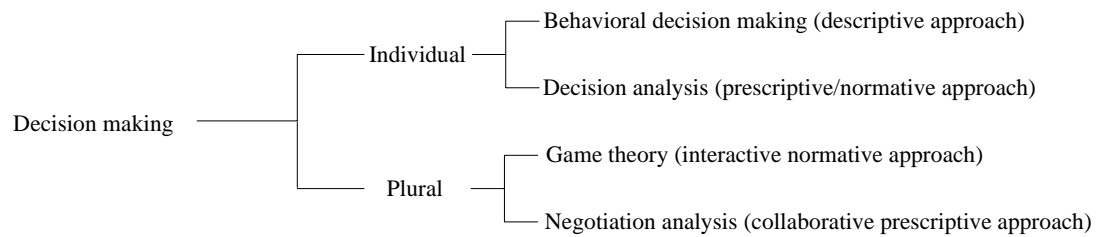


Fig. 2 Four approaches in decision-making [43]

Descriptive decision-making indicates how decisions are made, or in detail, how and why individuals think and act the way they do. This approach is dominant in behavioral decision-making mostly studied by psychologists. Their work is empirical and depends largely on clinical studies. The outcome of such studies in general does not suggest any modification, influence or moralization of human behavior, but is providing descriptions without interpretation.

Normative decision-making investigates how decisions should be made. The benchmark of normative approach is complete rationality of an intelligent decision maker. This is at the same time the biggest critic since this approach abstracts the environment and possibilities of the real people. Scholars dominating this field are applied mathematicians and mathematical economists. Their work is mainly theoretical and underline how humans should behave although they might do not. Most of the game theory work has this normative component although there is also a relatively new field of experimental game theory that tries to overcome the problematic abstraction of a real human.

Finally, the prescriptive approach focuses on how decisions could be made better. The idea of this approach is to provide usable outcome such as novel perspectives, decision aids, conceptual schemes, analytical device, etc. Therefore, this approach is not concerned with conceptual ideas but rather with the pragmatic value provided to the end user. Perspective analysis should be based on descriptive and normative theories [43]. As an additional illustration, one may say that scholars in this field play a role of problem solving engineers while scholars in the normative scene are the analytical scientists.

C. Prescriptive-Interactive Decision-Making Approach

Above brief overview suggests the increasing popularity and applicability of quantitative normative or prescriptive approaches (e.g. individual choice models). Although these approaches can provide the insight in aggregated opinion of separate groups, their interaction between groups might lead to the changed individual preferences thus reducing the precision of methods in these decision-making approaches.

Therefore, this paragraph illustrates the game theory application in studying the mentioned interactions in the context of a brownfield redevelopment. This theory emerged from the attempts to study the games such as poker or chess in beginning of the last century. Assuming that players have to think ahead and devise strategy based on expected countermoves of the other player(s). This strategic interaction

has many applications in various economic environments. In addition, it can be useful in analyzing interaction in brownfield redevelopment. The advantage is in its abstraction about players' payoffs and strategies resulting in the outcome based on the concept of equilibrium [49]. Classified as an interactive normative approach [43], game theory has the same assumptions as any normative approach. As mentioned, game theoretic models are abstract representations of real life situations and depend on formal mathematical expressions of these situations. Additionally, "...decision makers pursue well defined exogenous objectives (they are rational) and take into account their knowledge or expectation of other decision makers' behavior (they reason strategically)" [50].

Contrary to classical game theory, its experimental extension tends to diminish the problem of depersonalized, rational players thus leading to approach that is more prescriptive. The advantage of straightforward modeling of game outcomes remains. This is an advantage compared to its alternative plural approach negotiation analysis that provides vaguer answers.

Even more rewarding approach that would tackle the complex environment in urban (re)development processes could be a certain combination of the previous approaches in decision-making. For example, it could be regarded as a combination of the individual prescriptive and interactive normative approach. The idea of merging these two approaches could also lead to the development of a hybrid model. If the model performs well, the result can be regarded as a proof for establishing a new approach. Therefore, it would be further called the *prescriptive interactive approach*.

As was already stated, a comprehensive model that captures the complexity of both the brownfield area itself and the interaction between involved actors is lacking. Therefore, a prescriptive interactive approach based on quantitative methods is suggested as a promising option.

IV. CONCLUSION

This paper provided a brief literature review of the brownfield redevelopment notion by introducing its definitions, classifications and processes. Secondly, it introduced the present conditions in the built environment defined by the multi-actor interactions. This insight helped establishing the most important causes that influence a stagnation in brownfield redevelopment. It is worth to underline one message of this paper: by adopting a certain combination of definitions classifications and development

phases a researcher can identify very differently what cause a stagnation in brownfield redevelopment.

Furthermore, through the existing brownfield definitions, classifications, redevelopment processes and its economical and special benefits this paper established a research ground where the multi-actors' interactions occur. Similar as choosing a certain combination of elements that described a brownfield (project), with observing the different actions of actors a researcher can bring out in even bigger detail on a problem that causes a stagnation in brownfield redevelopment.

To be able to tackle the complexity of what is considered as a problem causing a stagnation and who is the "owner" of a problem an appropriate decision-making approach addressing multi-actor interactions in brownfield redevelopment is needed. In that regard, a brief review of decision-making approaches was provided. The two most promising approaches are further elaborated. These are individual normative/prescriptive approach (e.g. individual choice models) and interactive normative approach (game theory). Although very successful in urban development applications an individual prescriptive approach lacks the interaction feature.

Finally, this paper suggests that combining these two prospect approaches would be the most beneficial to study a complexity related to the brownfield redevelopment issues. Such an approach can be regarded as quantitative, *prescriptive-interactive* decision-making approach, a barely established branch.

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