

# Failures in Urban Capital Markets and Consequences for Project Funding

by

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**Abstract.** Public authority interventions are a justified means to remedy market failures. We apply this idea in the context of urban development projects by analysing the three main market imperfections, namely external effects, imperfect competition and incomplete information. For (combinations of) the three types of imperfections, we derive whether funding is appropriate at all and which are suitable types of funding – either grants or success-dependent measures. Depending on the sensitivity to the respective imperfections, we categorise a range of urban development projects which are suggested to be chosen for Urban Development Funds under the JESSICA initiative. Finally, we suggest a procedure for the general screening of regions suitable for funding through Urban Development Funds.

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## 1 Introduction

As urban areas are nowadays the engines of economic growth for the whole region, politicians rivet more and more on problems connected to urban development. Most importantly, the question of how projects which enhance urban life should be funded raised concern. The European Commission reacted to this topic by the introduction of the JESSICA (Joint European Support for Sustainable Investment in City Areas) initiative for the 2007-2012 Programming Period of their Structural Funds. Within this initiative, resources can be invested in so called Urban Development Funds (UDFs) which should pass the money on to projects eligible for funding. In contrast to traditional grant financing, the JESSICA instruments (loans, equity, guarantees) have a revolving character. As the Commission launched the initiative only some years ago, research on the advantages of the new instruments and their appropriateness for several project types is notably absent up to now. The most reliable sources in these fields are evaluation studies carried out for the European Investment Bank (EIB) for regions of various member states. These studies are conducted by consultants from different organisations and do often not have a scientific research background. Hence, the results give interesting insights into possible projects suitable for the implementation of JESSICA, but they need to be carefully questioned. This will be covered by the paper at hand.

Of course, the analysis of policy interventions not specifically connected to urban development is prevalent in the literature. One branch studies market failures in several public policy fields (Bator, 1958, Baumol, 1965, Fisher and Rothkopf, 1989, Bartik, 1990, Cowen, 1999). All these approaches reveal that intervention through politics should aim to reduce market failures in order to (re)establish normal market functioning. Hence, situations where market failures are the reasons for unwanted development need to be separated from those which are unwanted by, e.g., politicians but represent normal market functioning in an overall welfare sense. Another interesting branch of research considers government failures from wasteful governance or omitted intervention as a reason for inefficient policies (see, e.g., Shepsle and Weingast, 1984, as well as Le Grand, 1991). In addition, the evaluation of both failures has been studied by, e.g., Datta-Chaudhuri (1990) and Winston (2006). However, for the rest of this paper, we will assume that government failures do not exist and concentrate on market failures, as this is the focus of JESSICA. Nevertheless, it is worth to be

mentioned that a successful implementation of JESSICA can of course be hindered by government failures.

This paper is structured as follows. The next section introduces capital markets for urban finance. Afterwards, Section 3 presents the reasons for market failures in these capital markets and reveals suitable intervention measures. Section 4 offers insights into possible urban development projects suggested by the EIB evaluation studies and analyses their relation to market imperfections in order to determine the appropriate funding types. Section 5 reveals the implications of our approach. Finally, Section 6 concludes by summarizing the results.

## **2 Definition of urban capital markets and its actors**

A capital market is a place where financial instruments are traded, in contrast to a goods market where real goods are relevant. This paper examines capital markets for urban finance also denoted as urban capital markets. On these markets, financial instruments such as grants, loans, equity, or guarantees are traded to finance urban development projects. A capital market is always defined by investment needs, supply, and demand as demonstrated in Figure 1 for the urban case. More details and similar figures are part of the report of the Department for Communities and Local Government (2007).

Investment needs arise when urban areas are neglected and undesired development takes place. Then the participants on the demand side recognise these specific needs and set up project ideas to overcome the problems related to the respective urban area. These participants are either public or quasi-public or private bodies. Finally, the project ideas only come to an implementation stage if actors from the supply side are willing to provide financing for it. However, for many European areas we see that there is a need for urban development projects, but they are not initiated. The reasons for this omission of project initialisation will be analysed in connection to market failures between the demand side and the supply side actors in the remaining parts of this paper. Thus, in the following, we assume that needs are automatically transformed into demand and we will only take a look at situations where public interventions are necessary to match supply and demand, as this is the prevalent topic in connection to the JESSICA initiative with its different financial

instruments. But it is of course also advantageous to strengthen the transformation of needs into demand by increasing the awareness to urban topics with the promotion of JESSICA.

### **3 Reasons for market failures and intervention opportunities**

With the help of the net present value (NPV) method, an investor can decide whether the investment, i.e. a project, is profitable for him. However, certain assumptions are to be true. Those are met under perfect capital market conditions and lead to a decision which can be based on the NPV without consideration of subjective preferences (Fisher, 1930) and different financial instruments (Modigliani and Miller, 1958). The investment payment and discounted future cash flows are summed up to determine the project related increase in value. A positive value reveals that the investment should be realised by rational investors. But in the case of a negative NPV, the question of whether interventions such as subsidies might be able to correct some market failures by increasing the value and thereby initiating the project rises. In the following, we consider three main market imperfections which lead to a negative NPV and the omission of an investment which would be made under consideration of overall welfare. We will always refer to the overall welfare valuation in a situation without failure or imperfections by the notion of  $NPV_{tot}$  and the project value for a private investor will be defined as  $NPV_{proj}$ . Eventually, we will see that in the presence of market imperfections, different financial instruments are not equally suitable to correct market failures.

#### **3.1 General reasons for market failures**

The three main reasons for market failures in general are external effects, imperfect competition and incomplete information. All three aspects also have an impact on the initialisation of urban development projects, as they yield to omission under certain circumstances. This selection seems to describe the most important reasons for the omission of projects and conforms to the perception of market failures which justify political interventions (see Fritsch et al., 2003). Each market failure will be described in one of the following subsections and afterwards the connection to intervention opportunities becomes obvious in Section 3.2. However, there might be more but less dominant barriers for project initiation, some of which are mentioned in Section 3.3 for the sake of completeness.

### 3.1.1 External effects

There are two types of external effects, namely external costs and external benefits. External costs – caused by negative externalities – are those costs arising with the production of goods for uninvolved parties. For urban infrastructure projects which increase, e.g., the traffic number for a hub, this could be the costs for better window insulation for residents caused by augmented noise exposition – the negative externality. External benefits describe the positive utility connected with the production of goods for uninvolved parties (and are thus caused by positive externalities). One example for urban development projects with external benefits is a public car park. Shops that are located nearby may gain new clients and thus have higher sales without having paid for the car park, as it is public. This is an example for one subgroup of external benefits, which plays an important role in the context of urban development, namely public goods. They are characterized by the fact that nobody can be excluded from using them – non-excludability – and the good cannot be easily exhausted – inexhaustibility – (see Brown, 2001). This is, e.g., the case for public areas and roads.

Including external effects via  $NPV_{\text{ext}}$  in the net present value calculation (from an overall welfare point of view) helps to identify market failures and intervention possibilities for public authorities. The overall value  $NPV_{\text{tot}}$  then is

$$NPV_{\text{tot}} = NPV_{\text{proj}} + NPV_{\text{ext}}, \quad (1)$$

following the notation of Breuer (2012). Figure 2 shows the cases arising in the decision problem on project initialisation under consideration of external effects. Negative external effects produce costs and thus have  $NPV_{\text{ext}} < 0$ . If now the mere financial project value  $NPV_{\text{proj}}$  is higher than 0, two cases for the total value  $NPV_{\text{tot}}$  are possible. First, the overall welfare can be augmented ( $NPV_{\text{tot}} > 0$ ) by project implementation. In this case, private investors should be interested in the project and they directly support the overall welfare maximising solution (a). In the second case,  $NPV_{\text{tot}}$  is smaller than 0, but the project is favourable for private investors. The project will thus be financed via (private) capital market actors despite the overall welfare destroying character, due to negative external effects, resulting in a market failure (b). However, if in addition to negative external effects, the mere financial project value is negative, too, an implementation is not profitable for capital market actors resulting in the omission of the project which is in line with the overall welfare optimum (c).

Now, turning to positive external effects, the situation is analysed analogously. If the project value  $NPV_{proj}$  is positive, the overall value  $NPV_{tot}$  including both external effects and financial consequences is positive as a result. Therefore, this leads to project initialisation representing the overall optimal solution (d). Otherwise, if  $NPV_{proj}$  is negative, we have to distinguish two cases. In the first case,  $NPV_{tot}$  is positive and although the overall optimum would be the implementation of the project, it is not initiated by private market actors without public intervention, thus describing a situation of market failure (e). In the second case, where  $NPV_{proj}$  and  $NPV_{tot}$  are both negative, the project is not implemented and the optimal solution is met (f).

Thus, two situations of market failure exist with the consideration of external effects. First, projects are implemented in spite of being welfare destroying from an overall societal point of view (b). Second, projects are not implemented despite their overall welfare augmenting character (e). While the first market failure can be only addressed by other regulations accounting for negative effects via, e.g., taxes, the second is an interesting case for urban development project funding to compensate for external benefits. The following should hold true for (e):

$$\text{Value}_{\text{Subsidy}} \in \left[ - \underbrace{NPV_{proj}}_{<0}, NPV_{ext} \right] \quad (2)$$

Thus, it would be acceptable for public authorities to subsidise at least the difference which renders the project value  $NPV_{proj}$  positive and at most the full amount equal to the positive external effects.

### 3.1.2 Imperfect competition

There are mainly four types of imperfect competition with a highly diverging number of supply side and demand side actors. In the case of monopoly or oligopoly, only one respectively very few providers of a certain good or service exist, whereas monopsony and oligopsony refer to a market with only one or few buyers (see Burkett, 2006). The problem of such incomplete competition situations is that the small number of actors can set the prices (to a certain degree) in contrast to being price takers under perfect competition. In the urban context this could be a transport infrastructure monopoly which is prevalent in some European Member States and regions.

Assuming the existence of perfect competition leads to a value of a project which we will further denote  $NPV_{tot}$ , because no participant can exploit others due to his power and – in the absence of any market imperfection –  $NPV_{tot}$  can be understood as the overall welfare value any without market failure. In contrast, we will now take a look at the value  $NPV_{proj}$  for the decision on the implementation of a project by an investor under the assumption that one of his suppliers has too much power and acts as a price maker. This case certainly is one of the main problems with project implementation under imperfect competition. The project value would be influenced by, e.g., investment costs which are higher than necessary due to the (positive) premium  $\Delta I$  the price maker adds to the proper investment sum  $I$  defined as the amount in a perfect competition environment. With expected returns from the investment of  $E(m)$  and the discount rate  $i$  the following holds true for a simple two-period model:

$$NPV_{tot} = -I + \frac{E(m)}{1+i} > -I - \Delta I + \frac{E(m)}{1+i} = NPV_{proj}. \quad (3)$$

As the premium  $\Delta I$  is positive, only three cases are to be considered (analogue to  $NPV_{ext} > 0$  in Figure 2). First,  $NPV_{proj}$  is higher than 0 and so is  $NPV_{tot}$ . This directly leads to a social welfare augmenting investment decision. Thus, the market does not fail. Second, when  $NPV_{proj}$  is negative as well as  $NPV_{tot}$ , no investment is made reflecting the social welfare solution. Third,  $NPV_{proj}$  is negative, however,  $NPV_{tot}$  is positive. In this case,

$$NPV_{tot} = \underbrace{NPV_{proj}}_{<0} + \Delta I > 0 \quad (4)$$

is valid, which shows that the monopolist renders  $NPV_{proj}$  negative only by his premium  $\Delta I$ . If the monopolist is aware of the premium – as he adds it deliberately – he would harm his own interests, because the project will not be initiated at all. He would thus be better off by only setting the premium to the maximum value which still leaves  $NPV_{proj}$  positive and by siphoning off these profits. However, if the monopolist simply produces inefficiently and therefore does not add the premium deliberately, a substitution via public authorities is only reasonable in the case where the behaviour is not easily adaptable and the overall welfare still is higher due to some externalities coupled with the monopolist. This is the case for, e.g., natural monopolies in the infrastructure sector where the supply of goods could not be guaranteed otherwise. In such a situation, some kind of external effects may lever the

overall welfare value  $NPV_{tot}$  and public authorities could compensate the negative  $NPV_{proj}$  by adding subsidies, which again leads to a subsidy value of

$$\text{Value}_{\text{Subsidy}} \in \left[ - \underbrace{NPV_{\text{proj}}}_{<0}, NPV_{\text{ext}} \right] \quad (5)$$

As already seen in the last section, it would be acceptable for public authorities to subsidise at least the difference which renders the project value  $NPV_{proj}$  positive and at most the full amount equal to the positive external effects (see (2)). This reveals that it is not possible for the monopoly to exploit the public or private beyond the value of the positive externalities, even if the minimum required subsidy value is higher than the one in Section 3.1.1.

As a conclusion on incomplete competition, we can state that this market failure only needs to be addressed for specific branches of projects with a high probability of monopolism such as the transport infrastructure sector (a natural monopoly). Nevertheless, an intervention via subsidies is only necessary if there are some external effects justifying those cost intensive measures. Otherwise, monopolistic-based market failures should not be eliminated through subsidies, but less costly interventions are more appropriate. Of course, it is possible that the monopolist (deliberately) siphons the subsidies given by public authorities as compensation for the external effects. However, this does not seem to be the major issue in urban project initiation with competition problems, as siphoning subsidies by the monopolist is only possible to a certain degree and goes along with other positive effects which outbalance the drawbacks. Further, the subsidies can prevent the inefficient project developers from trying to become more efficient. But again, this is only possible to a certain degree and the developer harms himself as he could have higher profits by improving his efficiency. So, even if we cannot distinguish the two cases of adding premiums deliberately and without awareness, public money can only be exploited to the extent it in turn delivers positive externalities. We will now refer to the next kind of market failure, which can analogously be analysed.

### 3.1.3 Incomplete information

A typical example of incomplete information for (urban) development projects with consequent cost overruns and benefit shortfalls are again transport infrastructure projects (see, e.g., Flyvbjerg, 2005). Market failures due to incomplete information generally occur,

because investors are typically not able to assess all available information, as there are no scale effects and thus those (transaction) costs exceed the respective benefits. As they are aware of this problem, they include the insecurity in their investment decision by changing the indicated values. We will first consider the case where  $NPV_{proj}$  is underestimated by an investor, because of the uncertainty of the project quality (even though it is a good project). As the investor does not know whether the considered project is of good quality, he can only prudentially estimate the investment  $\hat{I} = I + \Delta I > I$  and benefits  $\hat{E}(m) = E(m) - \Delta E(m) < E(m)$  where  $\hat{I}$  and  $\hat{E}$  represent the average values when considering projects of all qualities available. The overall project value then is

$$NPV_{tot} = -I + \frac{E(m)}{1+i} > -\hat{I} + \frac{\hat{E}(m)}{1+i} = NPV_{proj}, \quad (6)$$

which can also be written as

$$NPV_{tot} = -I - \Delta I + \Delta I + \frac{E(m)}{1+i} - \frac{\Delta E(m)}{1+i} + \frac{\Delta E(m)}{1+i} = NPV_{proj} + \Delta I + \frac{\Delta E(m)}{1+i}. \quad (7)$$

This results in the same situation as described in Section 3.1.2 with simply a larger additional term instead of just  $\Delta I$ . A market failure arises in the case where the project value is negative, but the overall welfare value  $NPV_{tot}$  (without information problems) is positive:

$$NPV_{tot} = \underbrace{NPV_{proj}}_{<0} + \Delta I + \frac{\Delta E(m)}{1+i} > 0. \quad (8)$$

However, in contrast to the monopoly case in (4), the new “premium” comes from the supplier of capital (the investor) due to missing information and is not (deliberately) set by the demander of capital (the project promoter). Now, the project is not going to be initiated only because of the overly cautious estimates by the prospective investor. The promoter of the project can influence the investor’s financial assessment if he can give him more and credible information, which will increase  $NPV_{proj}$ , because of more accurate estimates in the calculation. So, if there are informational asymmetries which hinder project implementation and which can easily be eliminated by the project promoter, he would harm himself if he does not credibly signal the information he has in order to convince the opposite partner of the project qualities. Such a signal could be a share of self-financing as mentioned by Batabyal and Beladi (2010), which reveals whether the project promoters (and/or

developers) belief in its success, as they are then also dependent on the outcomes. If they are not able to finance sufficient parts of the project by themselves, then they would not agree on bad financing conditions to compensate for the premium charged by the less informed investor and instead refrain from the completion of the project. Now, as a second case, in contrast, a bad (high risk) project profits from the average value calculation, if it is worse than the average. A promoter would directly accept the respective financing conditions which a promoter of a good project denies. This leads to adverse selection as introduced by Akerlof (1970). However, as the investors anticipate this selection, they will not provide any capital and the market will fail. Any kind of intervention should help by improving the information for the investors, because information asymmetry is the reason for this market failure.

If the promoter (or developer) cannot signal on his own, but the public authorities are interested in the initialisation of the project due to some external effects, then subsidies are appropriate as long as they help to signal the general project quality. Otherwise, a subsidy independent of the project quality would just fill the financial gap, but the investor will still be aware of the uncertainty and will not be willing to finance the project. In the case where signalling is possible and external effects are coupled with the initialisation of the project, a subsidy in the range of

$$\text{Value}_{\text{Subsidy}} \in \left[ - \underbrace{\text{NPV}_{\text{proj}}}_{<0}, \text{NPV}_{\text{ext}} \right] \tag{9}$$

is appropriate for the same reasons as explained before for (2) and (5). Hence, similar to the case of imperfect competition, subsidies are restricted to situations where informational asymmetry coincides with the appearance of external benefits when the project is realised.

**3.2 Public interventions to overcome market failure**

As we have now introduced all three major reasons of market failure and appropriate subsidy values, we will further analyse the possibilities of intervention to overcome them. First, we will describe public/policy intervention means in the case of market failure in general, before concentrating on the range of actions connected to UDFs within the JESSICA initiative, which will help to decide on the specific type of subsidy.

### **3.2.1 Public interventions in the literature**

In general, for each of the three market failures analysed, several policy intervention possibilities arise (see Borrmann and Finsinger, 1999, Wied-Nebbeling and Schott, 2005, and Fritsch, 2011). Figure 3 summarises them briefly.

For external effects, a major kind is defined by the group of regulatory interventions, such as the limitation of market access, or liability laws. The second group consists of subsidies to support positive externalities or taxes to hinder negative ones. These groups apply for imperfect competition as well, but in addition, there is a third group of pricing or quality regulations. However, subsidy interventions are only mentioned in combination with external effects and for this reason they are marked in brackets. The interventions for the third market failure – incomplete information – are connected to rights, quality requirements, subsidies (again in combination with externalities), and information provision for general issues (national accounts) or commodities for a wide range of consumers by public agencies (e.g., economic research institutes). Nevertheless, as JESSICA is one specific policy instrument, it cannot cover all aspects of intervention, but concentrates on just one, which is the use of subsidies. It is important to note that the elaboration of Section 3.1 so far matches the general perception in the literature when considering subsidy intervention. We will further focus on this special kind of intervention in the following to answer the question of whether the application of JESSICA-type instruments such as loan subsidies is a suitable means to overcome failures in a specific market situation or whether a grant funding is more suitable.

### **3.2.2 Public interventions in the form of subsidies for urban development**

If market failures are related to some kind of positive influence on the overall welfare as introduced in Section 3.1, the employment of subsidies is justified to compensate for the welfare gain through positive external effects. This compensation is necessary (if reasonable – case (e)), as the private sector will not be willing to pay for the external benefits because they do not include other people's welfare in their investment decisions. The same is true where a monopoly is present if its absence further reduced overall welfare, because the monopolistic supply then describes a positive external effect. In this case, public authorities should "support" the monopoly indirectly through subsidies by an amount which is not greater than the positive effect the monopoly has on the society. For informational

asymmetries, public authorities normally have the same information as private investors if they are not involved in the project (assuming that no other intervention – such as the establishment of a specific research institute for public information on urban development projects – simultaneously takes place). If the promoter does not provide enough information, he might harm himself. However, it is possible that he cannot provide the information through, e.g., self-financing to signal the success-probability. If the initialization leads to positive external effects, an intervention through subsidies is appropriate to overcome problems arising from asymmetric information, as long as they are a credible signalling device. But in this case, public authorities need to be somehow (actively) involved in the project, because otherwise they would have the same information as the private investor.

The open question still is which kind of subsidy funding – a grant or a revolving financial instrument – would be appropriate for each of the three reasons for market failures introduced, which can generally be reduced by public engagement in the investment process. As already seen before, the requirement for the subsidy differs especially if informational asymmetry is connected to the initialization of the project. In such a case, the public subsidy should in addition to the mere compensation for externalities also set a signal to the private investor that the project is of good quality and there is thus no need to excessively cautious estimates of the project value. However, public authorities have two incentives that hinder the private parties to completely trust them. First, public authorities' intention is at least partially driven by the fact that they want to spend the higher level (e.g. European Union) funding no matter whether it is necessary for a certain project, to show their need for financial support. Otherwise, they risk a reduction in subsequent funding periods. Second, public authorities may simply want to compensate the external effects and in this case, a subsidy might not be able to signal the project quality. In contrast, they are more interested in realising projects with high external effects even if their monetary outcome is not sufficient for the private investor (assuming that monetary and external effects' outcomes are not always perfectly correlated).

Breuer (2012) analysed a general decision framework of loans versus grants in the context of urban development funding under consideration of external effects and asymmetric information. Under perfect market conditions, both financing alternatives are equivalent and

in the presence of external effects, the same holds true. However, he showed that the combination of external effects and asymmetric information renders loans favourable. This change comes from the fact that in situations with informational problems, public authorities should set a signal with their funding decision. This is possible, because when they subsidize by loans, public authorities become dependent on the project quality, as the loan needs to be repaid (though at to a certain degree smaller interest rates than with unsubsidised market conditions) by the project revenues. His main assumption on the signalling properties lies in the fact that public authorities gain information on the project quality when they analyse a project with respect to the amount of external effects which are produced by the project. Takalo and Tanayama (2010) make another assumption to show the need for R&D subsidies to overcome adverse selection. In their paper, external effects and monetary outcomes are correlated and they advise the use of “pure subsidies” (meaning grants) to signal project qualities to private investors. The possibility of signalling through grants is in their case only plausible because of the correlation assumed. In this special case of correlated external effects and monetary outcomes, the strong commitment coupled through loans is not necessary as the belief in external effects indicated by the mere grant support is a sufficient signal to private parties. In general, the extent of external effects might differ from the financial quality of the project. For project financing, the analysis of this relationship is notably absent in the literature. However, the question has been investigated for decades in the context of corporate social responsibility and financial performance with very ambiguous results (see, e.g., Salzmann, 2013). Thus, even in this well established and related research area, the relationship between the two components is not clear. Hence, we will refrain from the assumption that external effects and monetary outcomes are correlated and that this fact is common knowledge. Nevertheless, the work of Takalo and Tanayama (2010) support the main idea of signalling by subsidies and it further confirms the assumption of Breuer (2012) that the analysis of external effects gives rise to information on the monetary project quality simultaneously, but with the difference that the outcomes need not be directly correlated. Another paper attesting the former aspect of general signalling by subsidies and the incentive difference is, e.g., the one of Kleer (2010). He states the adverse incentives of public and private parties in the context of R&D subsidies and reveals that subsidies are suitable to overcome private financing problems as long as they have a signalling character. Nevertheless, a distinct elaboration of specific funding

means which have these characteristics is missing. In conclusion, the results from the three papers just mentioned are the same: subsidies can help to overcome adverse selection arising from incomplete information, in the case where they are a suitable signalling means. Under our assumption (without the necessity of correlated external effects and monetary outcomes applied by Takalo and Tanayama, 2010), this is possible with loans instead of grants. In addition to the advantages of loan financing by public authorities, Breuer (2012) also mentions a drawback. The tax burden varies over time depending on the success of former supported projects. Grants are per construction never paid back and do not lead to such volatile tax needs. For this reason, grants should be employed as long as no signalling with loans is necessary. In the following, we will apply these results to the three market imperfections introduced in the paper at hand and their combinations.

Market failures caused by the *presence of (positive) externalities* do not need to be removed by measures with signalling character, because the omission of project financing from the private parties is simply based on the mere financial gap and has no connection to any kind of informational asymmetries for the monetary project outcomes. As long as public authorities close this financial gap, which indirectly increases  $NPV_{proj}$ , private investors will be willing to initiate the project if its financial value turns positive. In such a case, subsidies in the form of grants are a suitable means to launch socially reasonable projects. An alternative investment strategy via (reduced interest rate) loans does not deliver any advantages, as there is no necessity to signal the quality of external effects. Funding via a subsidised loan, in turn could lead to volatility in taxation, which is neither appreciated by taxpayers nor by politicians. To conclude, the presence of external effects can be corrected by grant subsidies to achieve a more overall welfare solution.

The same argumentation holds true for *imperfect competition* in the case where a monopoly is reasonable due to, e.g., securing the provision of goods. In such a situation, *positive external effects* arise which can be subsidised by public authorities. As long as there are no informational asymmetries connected to the project, the support through grant subsidies is more suitable than through loans (as already explained for pure external effects). In some way, the monopolistic inefficiencies are indirectly supported by subsidising, however, this is only possible to the extent of the positive external effects and the monopolist himself should be interested in reducing those inefficiencies to improve his profit. Finally, if in contrast

there are *no externalities* connected to the project, then subsidies are too costly to reduce this market failure.

*Incomplete information* can result in profits for the better informed project promoter only if these extra profits do not render the project unattractive to the private investors at all. In this case the promoter should credibly signal the information that is needed to get realistic values for the project assessment from an external point of view. Sometimes, this might not be possible without external help, because, e.g., a sufficient self-financing part of the project is not feasible for the promoter. In such a case, public intervention might be necessary if this is able to assure credible signalling. However, generally, public authorities are not integrated in the projects either and they do not have more or better information than the prospective investor. Hence, an intervention through subsidies would not be helpful to correct the market failure.

Nevertheless, the situation changes if there are market failures which arise from an *informational background in combination with external effects*. Then, public authorities are involved in the project when assessing the positive externalities. As a result, they get information which might be helpful to evaluate the financial quality as well. Thus, the interventions should be made in the form of loans. Only in very specific cases – with correlated external effects and monetary outcomes – grants might be sufficient to signal the project quality. Nevertheless, the general suggestion without further information – for all participants – on such correlations would be to employ a financial instrument in the form of loans. By using this subsidy measure payments to public authorities are also dependent on the successful development of the project. Hence, the private sector will be convinced of the project quality and will invest as well. Finally, if there is *imperfect competition in addition to the other two market imperfections* the argumentation in terms of funding means does not change.

All proposed measures of intervention for the scope of urban development funding by the JESSICA initiative and traditional grants are summarized in Figure 4. With the help of this figure, we will briefly summarize our approach. We started with the reasons for market failures, which are important in the urban context: (positive) external effects, imperfect competition, and incomplete information. We then worked out which kind of interventions might be suitable to finally overcome the resulting failures. So far, we have concentrated on

loans as revolving instruments, but the ideas are equally applicable to equity and guarantees – the other two forms of JESSICA intervention. All in all, grants are appropriate if there are mere external effects or external effects in combination with imperfect competition. If external effects arise in combination with incomplete information, revolving and thus success-dependent instruments should be employed to signal the good (financial) project quality. The same is true if in addition imperfect competition occurs. Finally, it should be noted that deviations from this suggestions are possible if the assumptions are not met, i.e. there is general knowledge about correlated monetary outcomes and external effects of projects or the public authority cannot help to overcome the informational asymmetries. In the former case, grants are appropriate for every combination with incomplete information as the drawbacks from loan financing overweight. In the latter case, grants (or loans) might help to close the financial gap, but they will not help to overcome informational problems. Other measures outside the scope of JESSICA, e.g., informational disclosure, might be an alternative, but are not the focus of the respective initiative and the paper at hand.

### **3.3 Barriers for urban actors**

Urban actors surely mention other and partially related barriers for their participation in project implementation and financing. We will briefly refer to two often mentioned barriers and connect them with the aforementioned market failures. *Regulations* might be named as one reason for the omission of projects. However, some regulations are necessary to adjust prices in order to even reduce market failures. This is the case for (negative) external effects which are normally not integrated in the calculation of future benefits and costs. Higher investment costs for a project with less negative externalities are not compensated without regulations. However, we agree that some specific market restrictions may cause problems if they are not adapted continuously. *Uncertainty* is a second barrier often stated. This is similar to the case of incomplete information (see Fritsch, 2011) and leads to estimation errors in the calculation as introduced in the other context. This barrier can be partly removed by addressing the market failures arising from an informational background.

## **4 Projects with intervention needs to overcome market failures**

In this section, we will now introduce typical urban development projects which are suggested to be integrated into UDFs and thus represent public measures with a success-

oriented character of intervention, e.g., via loans, equity, or guarantees. Afterwards, in Section 4.2 and Section 4.3, the identified types of projects are analysed regarding their connection to market failures and categorised by the capability of different means of subvention to reduce the respective market failures.

#### **4.1 Suggested projects for UDFs**

To evaluate where the introduction of UDFs in the context of the JESSICA initiative is useful, the EIB launched studies with several consulting partners in different member states' regions. Among the available studies, we selected those from the three broadly represented countries – Germany, Italy, and Poland (the chosen sources can be found in the section on EIB evaluation studies at the end of the references). Analysing all proposed projects for the implementation under JESSICA, indirectly gives rise to the situation in urban capital markets and helps to find out which kind of projects seem to be most suitable for UDFs.

From the 16 regional studies, we identified 108 potential projects and assigned them to at least one of the 15 following categories: communication, energy or transport infrastructure, retail, office or residential buildings, culture, tourism, education, research, health, business start-up, industry/business, public buildings/spaces as well as (urban) agriculture. The 15 categories were successively built to meet the project rationale and eligibility named in the studies from the three countries. Furthermore, the categories coincide with typical classifications in several (practitioners') documents. A project is classified to cover a certain category if the study's description reveals the respective topic as an important feature of the corresponding project. The distribution among these categories is displayed in Figure 5.

Figure 5 shows that 31 projects are connected to cultural aspects, 21 to transport infrastructure, 18 to energy infrastructure as well as to retail buildings, 15 to public buildings and spaces, 13 to tourism, 11 to office as well as residential buildings, 8 to each education, research and industry/business, 6 to health and start-ups and only 1 to communication infrastructure as well as agriculture. As there were only 108 projects described in the studies, some of them are assigned to more than one category. Some typical overlaps concern culture and tourism (10 overlaps), office, residential and retail buildings (6 overlaps) as well as start-up and industry/business support (4 overlaps). Table 1 in the appendix shows more details on the categorisation of the projects named in the studies. The first two columns describe the member state and region where the project of column three will take

place. The last 15 columns each show a category and markings with “x” reveal if a project covers it by the project description of the evaluation study. For each country, the project order demonstrates typical category groupings and the existing overlaps. As demonstrated by this table and highlighted by Figure 5 the overall distribution of the number of projects among the categories is slightly decreasing with an upper half quantile being covered by the first 4 categories only (with an overall of mere six overlaps in culture or transport with energy or retail). We will now take a closer look at this upper half of categories covered. A lot of projects suggested have a cultural background such as the conservation of historical buildings or the construction of cultural centres for art galleries, museums, concert halls, or sport areas. These are followed by projects related to transport infrastructure with the creation and renovation of important hubs (for trains, busses, cars) as well as car parks. Another important part consists of energy related projects (energy efficiency renovation and renewable energy installation) and retail related projects (multi-purpose buildings and renovation of shopping areas).

The reasons for the selection of the projects in the analysed evaluation studies are of organisational, legal and financial character. For the implementation of JESSICA, the project preparation needs to be in a stage where data is available and planning on future cash flows is possible. The legal requirements are set by the ERDF (European Regional Development Fund) framework. In contrast, financial requirements target to identify projects which show a gap compared to market financing conditions (typical interest rates cannot be covered by project revenues). A distinction between the types of appropriate funding means due to the market failures concerned is in general missing in the studies. Sometimes it is even directly mentioned that either EU grants or JESSICA mechanisms are at choice (see Deloitte, 2011b). Therefore, the studies do not separate projects by their suitability for grant or success-dependent (UDF) funding, but they only identify urban projects with general funding needs and eligibility. The paper at hand thus contributes to further elaborate the topic of urban development investing through appropriate financial instruments.

#### **4.2 Connection to market failures for the upper half of project categories**

Having identified which projects are generally seen to be suitable for JESSICA financing from a rather practical point of view with the help of the evaluation studies, we will now analyse typical problems connected with the most important project types in order to find out if

these projects are prone to market failures which can indeed be corrected with the help of success-dependent funding types such as loans.

The projects suggested for renewable *energy* or energy efficiency cover residential, industrial and public buildings. Brown (2001) identifies several reasons why energy efficiency projects are not realized though this may be advantageous for a society as a whole. One of these reasons are external effects as unpriced benefits. Further, Brown (2001) mentions insufficient and inaccurate information as well as incomplete markets with only few manufacturers in some branches. Hence, the general condition of existing external effects (and also imperfect competition) which justify subsidy interventions is true for this kind of projects. In addition, we see arguments connected to information problems with the need for market interventions by JESSICA-type instruments according to Section 3.2.

Regarding *transport* infrastructure one directly thinks about the few huge firms that dominate the respective national or regional markets. This indicates the potential failures arising from imperfect competition. As a lot of projects suggested aim at the renovation and installation of multi-purpose traffic hubs, the existing few huge firms need to be brought together. Thus, we identify competition problems as one barrier and cause of intervention in the field of transport infrastructure via JESSICA-type instruments. In addition, infrastructure projects generally have problems with informational asymmetries (see Flyvbjerg, 2005) and thus fulfil the second cause for success-related interventions as well. Moreover, some external effects play a role (see, e.g., Lijesen and Shestalova, 2007) and hence, the basic condition for subsidies is fulfilled.

Projects with a *cultural* background as mentioned in the studies have regular income aspects from ticket sales or rents. However, these incomes might be lower than necessary, but it is worth to initiate the projects due to positive external effects from maintaining historic buildings and heritage as well as from supporting sports. These ideas are in line with Ahlfeld and Maennig (2010) as well as Coase and Humphreys (2003). For such projects, we do not see major problems of competition and information procurement and did not find any evidences against this thesis in the literature. Thus, such types of projects seem to be better supported by success-independent solutions such as grants to compensate for the financial gap. But there is no need for, e.g., information signals to induce project quality in general.

The same arguments can be made for the redevelopment of *retail* areas. Incomes from rental activities should be at least partially sufficient to cover the investment expenses. As the know-how for the construction of shopping areas is not too specific, the absence of competition should not be a major problem. In addition, information on expected rents and costs can be gathered by benchmarking, as shopping areas exist manifold in cities. Consequently, high costs in the case of brownfield redevelopment or demolition of neglected shopping areas may be compensated with positive external effects which are found in studies like the one of West and Orr (2003). Hence, such projects should be subsidised by grants to compensate for the externalities only.

Thus, we saw that the supposed projects reveal market failures which justify government or higher level interventions. Up to now, we identified two groups among the most represented projects. The first group is defined by projects related to energy and transport investments with problems of imperfect competition and incomplete information, which should be supported by JESSICA measures (loans, equity, guarantees). The second group is mainly driven by market failures due to mere external effects and should thus be funded on a grant basis. This is the case for the construction of cultural centres and retail areas.

#### **4.3 Classification of imperfections through project types**

In the following, we will classify all suggested projects with regard to their type of imperfections. The two groups derived before will be expanded to obtain a complete structure. First, projects with success-dependent financing (such as loans) build the most important class for JESSICA funding, projects with mere financial support to compensate for external effects determine the class strongly related to JESSICA, but with need for grant funding. All other projects do not show the necessities of subsidy intervention and are thus not important for urban development support. The results are shown in Table 2.

For each project category all three reasons for market failures are listed. If a market imperfection is generally high for the considered project, it is marked by a plus. A minus stands for the irrelevancy or absence of this imperfection, whereas “o” describes a medium value of relevancy of this imperfection. If only the imperfection of externalities occurs, the appropriate funding is set to “Grant”. The same is done for a combination with imperfect competition. If external effects occur in combination with at least incomplete information, the preferred funding type is set to “JESSICA”, which means that success-dependent

measures should be applied. If only imperfections of the last two kinds (imperfect competition and incomplete information) occur, or “o” or minuses appear, then no funding through subsidies should be necessary and the omission of such projects reflects the market optimum already sufficiently precise.

The argumentation for the final categorisation of all projects can be applied in the same manner as in Section 4.2. Thus, we only very briefly substantiate the choices of plus, minus or “o” for those project categories not explained in detail before. Public buildings and spaces are a typical example of public goods and belong to external effects as explained in Section 3.1.1. The projects connected to tourism mainly cover the renovation of tourist accommodations, historic buildings and the construction of tourist centres and restaurants. Therefore, the projects are partly identical to those covering cultural aspects and otherwise with those from the field of retail buildings. Thus, we can assume that externalities are the main reasons for market failures. Education is a typical case of external effects and incomplete information (see Fritsch, 2011), as the one who finances the education cannot entirely control if the educated individual will later be at his disposition. Nevertheless, the projects categorised as having an educational character in the EIB evaluation studies mainly concern the construction and renovation of school buildings and similar centres. In such cases, the risk of informational asymmetries is absent, because only the general increase of human capital is present for these projects. There are no asymmetries between the investors and the project managers, as the educational aspects are of an unspecific kind. For this reason, there remains only the imperfection of a public good (external effects). The situation changes for specific educational and research activities. The risk of transferring knowledge to competitors is high as well as the risk of unsuccessful project outcomes. Thus, the investor depends on information about the project success probability which he usually cannot acquire on his own in new and unestablished fields of interest. The role of asymmetric information for the “education”-category thus needs to be always carefully checked afterwards. For projects with a “research” character these asymmetries are typically present. Listed projects from the next category – “industry/business” – are the creation of industry, business and technology parks. They produce positive external effects for the surrounding by attracting new firms and they can in general be seen as similar to research activities justifying the categorisation. The initialisation of projects related to health care centres suffer mainly from information problems, as the demand is highly dependent on

research in medical sciences and demographic changes which are both difficult to determine. In addition, there might be only few firms specialised on the construction and planning of health care centres. The support of business start-ups covers the same aspects as research and industry/business. In addition, imperfect competition is always a problem when funding start-ups. The reasons for the categorisation of communication infrastructure correspond to those from transport infrastructure. Finally, three types of projects are nearly free from the reasons for market failures and should be financed without public intervention if they are profitable. Those are the construction of office buildings, residential buildings and projects of urban agriculture.

Thus, a number of the proposed projects from the EIB evaluation studies are not suitable for JESSICA-type instruments from a market failure perspective, but should either be financed by the market without public interventions or should be supported by grants.

## **5 Implications**

At this point, we should come back to the assumption on informational advantages for public authorities. Signalling through public loans is only possible if public authorities learn about the project quality when they analyse the value attributes of the external effects. This might be true to a different extent for the project categories assigned to JESSICA funding in Table 2. Asymmetric information for infrastructure projects results from expensive information costs or similar effects such as the consumers' disinterest in assessing the costs and benefits connected to a certain topic (see Brown, 2001). The (expensive) costs of information should not constitute an impediment for public authorities as long as the supposed external effects are high enough to justify a costly evaluation of them and the project's financial quality simultaneously. With such an assessment, the negative consequences of asymmetric information should disappear, or at least get less impact. Thus, for infrastructure projects, a decrease of information inequalities by public authorities is plausible. The same applies for research, start-up and business/industry support. Especially, the first two deal with very sensitive data and making such information publicly available leads to a high risk of duplication through the respective competitors. Public authorities, however, can confidentially analyse the project, as they are dependent on the success for loan financing (which would be offered for good projects). Nevertheless, for information in

the context of education and the risk that the educated employee is planning to join the competitor, one might doubt that the ability of public authorities to assess this probability is indeed better, as this is a decision made for each individual separately. To conclude, projects related to educational topics should be carefully questioned with respect to the reasons for asymmetric information, before they are supported by revolving financial instruments instead of grants.

The last remark on further and individual project assessment reveals an important aspect of the analyses done so far in the paper at hand: The categorisation helps to identify potential funding types, which can be applied on a high level of consideration. If public institutions want to determine where the employment of a UDF within the JESSICA initiative is appropriate to correct the urban capital market in some cities and/or regions, indicators reflecting the respective categories reveal geographic units of special interest. Generally, for aggregated decision environments, a simplifying typing is a common approach. Hence, we suggest to use the results of this paper to conduct a screening of certain geographical units in order to determine where to establish UDFs and where the general need is not sufficient to justify such a complex investment structure, but, e.g., grants suffice to connect the demand for urban development with capital suppliers. Of course, a more detailed project analysis should follow on the level of project investing (through the UDF manager) as a supplement to this aggregated view in order to finally determine the subsidy intervention type for a specific project. If the recommended subsidy differs from the one suggested for its category, this deviation should be well explained. Finally, the aggregated analysis of project categories structures the overall decision process on both levels in such a way that it indicates a type of subsidy and then deviations in detail need separate explanations.

The selection of some regions which are suitable for UDFs based on an aggregated view depends on certain criteria such as the number of funds to be distributed, the amounts of money available, and the volume of projects. These criteria should be set up carefully according to the national or European funding conditions at the respective point of time. It is important to note that the restrictions should be rather generous, because projects may be eliminated afterwards in the detailed analysis. Conversely, a selection on the first level which is too strict may hinder the establishment of UDFs in some locations despite its suitability. Without any specifications from those responsible for JESSICA, the definition of the

boundaries remains a tedious task. We use a rather simple, but demonstrative proxy for the rest of this paper, namely the mere number of projects connected to JESSICA-type funding. In combination with the rather generous declaration of a project to be supported by JESSICA (the assumption that a project fully covers the typical project specifications if simply mentioned in the context of a category), the application for the paper is manageable and clarifying.

To demonstrate the decision process with its two steps, we take a closer look at the distribution of the appropriate funding types connected to the named urban deficits in the evaluation studies. Table 3 in the appendix shows the number of categories for each project that correspond to the different funding means; the project “Industrial and nuclear research park” in Masovia, Poland, covers the categories “research”, “business start-up” and “industry/business”, which are all representatives of JESSICA funding type. This results in the table entries 3 in the fourth and 0 in the fifth and sixth column. The next row describes the project “energy cost management for lighting (street and public buildings/areas)” with the establishment of new lighting systems in the same region. This project covers the categories “energy infrastructure”, “transport infrastructure” and “public buildings/spaces”. The first two should be connected to JESSICA-type instruments, whereas the latter corresponds to grant funding. Thus, the table entries are 2 in the fourth column for the two JESSICA-type categories, 1 in the fifth column for the connection to grant financing by the category of public buildings and spaces and 0 in the last column as there is no evidence for non-subsidy financing. This aggregation reveals those regions with a majority of suggested projects connected to JESSICA-type funding. These are Berlin, Campania, Hamburg, Mazovia, Pomerania, Puglia, Sardinia, South Poland, and Tuscany. For these nine regions, the potential for market failure correction by establishing a UDF seems to be indeed high. Nevertheless, as stated before, after this general screening on an aggregated regional level the projects need to be analysed in detail before a UDF should finally invest in them. As one example, we will now evaluate the projects for the region of Hamburg, Germany. Two projects are clearly categorized to JESSICA funding by the consideration of market failures, namely the remodelling of a bunker to a green energy supplier (“Energiebunker Wilhelmsburg”) and the energy efficient area heating (“Wärmeverteilnetz Weltquartier”). Both projects should supply the adjacent estate with overall green energy or green energy heating, respectively. This primarily leads to less impact on the environment in comparison with the traditional

supply in the areas, which is a positive external effect. The typical problems of energy infrastructure projects render loans (or equity/guarantees) favourable and as the informational asymmetries are of such a kind that they can indeed be removed by public authorities, financing the projects by the revolving instruments of a UDF can be confirmed also by a more detailed analysis. The construction of education, communication and sports centres (“Tor zur Welt”, “Neugraben-Fischbek”, “Reiherstiegviertel”) covers JESSICA-type funding by educational aspects as well as other externalities by cultural (and social) effects. The target group mentioned in the studies for “Tor zur Welt” and “Neugraben-Fischbek” are primarily pupils. For this group, there is no direct risk of abusing the relationship and informational disadvantages for the other party as would be the case for an employer who finances further training for his employee. Hence, we do not see the need of reducing informational asymmetries for this kind of educational projects. Consequently, after a detailed consideration, we would suggest to refrain from employing revolving instruments, but stay with traditional grant funding. However, the situation changes for the third educational project, because the qualification programmes are very specific and focus on adults and business innovation. The risk of information asymmetries is not absent in such cases anymore, and thus the employment of loan financing can help to overcome information gaps connected to the extent of successful training with possible higher reflows. The project “health, living for elderly and commercial centre” in “Mümmelmannsberg” is a combination with normal residential apartments, which is the major part of the project. All in all, there may be only a need for a slight support by grants as also indicated by the aggregated analysis. The reconstruction of a local trade area in “Wilhelmsburg” aims to provide flexibly usable commercial sites for local/ethical economies. The externalities coupled with the local/ethical support should be covered by traditional grants, which is in line with the results from the aggregated view. To conclude, we would argue that the establishment of a UDF is possible for the region, as three of the named projects are indeed suitable for financing by revolving instruments. Hence, a UDF would be slightly smaller than assumed by the aggregated analysis for this region, which identified five of the initial seven suggested projects to be appropriate for JESSICA. Figure 6 reveals the process of decision making, which we just applied for Hamburg, but which is generally valid.

First, for each region, the potential projects should be analysed in an aggregated way by the project categories they generally belong to. If this already leads to a very low number of

projects with potential JESSICA-type funding, a UDF will not be the appropriate means of support for the respective region (bottom part of Figure 6). In the case where the aggregated screening identifies a high number of potential JESSICA-type projects, an additional detailed analysis can help to further select those which are indeed eligible for financing through a UDF. For this, the typical categories assigned to the respective projects should be carefully questioned to their applicability in the specific context. Finally, for each region, one can decide whether to establish a UDF or not. Starting with an aggregated analysis diminishes the effort necessary as some regions might directly fall into the category “No UDF” and for the other regions the decision process is better structured by this top down approach. However, the exact conditions for the declaration of a region to be indeed a candidate for the establishment of a UDF should be defined by the responsible European (or national) authorities depending on, e.g., the amount of funding available and the volume of the projects and not necessarily on the mere number of projects as assumed for sake of clarity in this paper.

## **6 Conclusion**

This paper analysed market imperfections in the context of urban development funding and their implications for intervention of public authorities. We revealed three main reasons for market failures, namely the existence of external effects, imperfect competition, and incomplete information, which may hinder the initialisation of urban development projects. All three imperfections affect the relation of the overall welfare NPV (representing perfect conditions) to the (financial) one of the project in the actual market situation. Depending on the characteristics of these two values, situations where the welfare optimum is not met can be identified, thus representing market failures. The investigation of impact possibilities for different funding measures in each imperfect market situation led to the conclusion that grants are a suitable means in the occasion of mere external effects or in combination with imperfect competition, whereas the combination of external effects with incomplete information (or in addition imperfect competition) typically requires a success-dependent kind of funding such as loans, equity or guarantees. Hence, JESSICA-type instruments are appropriate in situations with informational asymmetries and at least the imperfection of external effects.

In a next step, we systematized projects proposed in the EIB evaluation studies for the implementation of JESSICA UDFs in the three European Union Member States Germany, Italy, and Poland. This revealed that projects related to culture, tourism, retail as well as public buildings and spaces should get grant funding, as they are mainly prone to market failures arising from external effects. In contrast, projects in the fields of transport, energy, communication, education, research, business parks, and start-ups are indeed suitable for JESSICA-type funding. Finally, some projects mentioned in the evaluation studies do not seem to be worth funding from a market failure point of view. Those are connected to the renovation of office and residential buildings, with urban agriculture as well as with health care centres.

To conclude, we can state that policy interventions in the form of funding are a solution if projects show that they are not getting financed because of a market failure. However, the appropriate funding type is crucial to not disrupt normal market functioning. Thus, the connection between the potential omission of project initialisation and market failures should always be carefully investigated before selecting funding instruments and, in addition to an aggregated screening for regional and urban funding, a project always needs to be finally approved for the respective funding type as demonstrated for the suggestions of the Hamburg evaluation study. Thereby, policy interventions help to (re-) establish normal market functioning and do not distort it by maybe even worsening the situation. However, we only analysed the intervention possibilities via JESSICA-type instruments and grants, as both belong to subsidies. It remains to carefully consider whether other interventions outside the scope of JESSICA work more effectively, if markets fail in the analysed situations.

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## Appendix

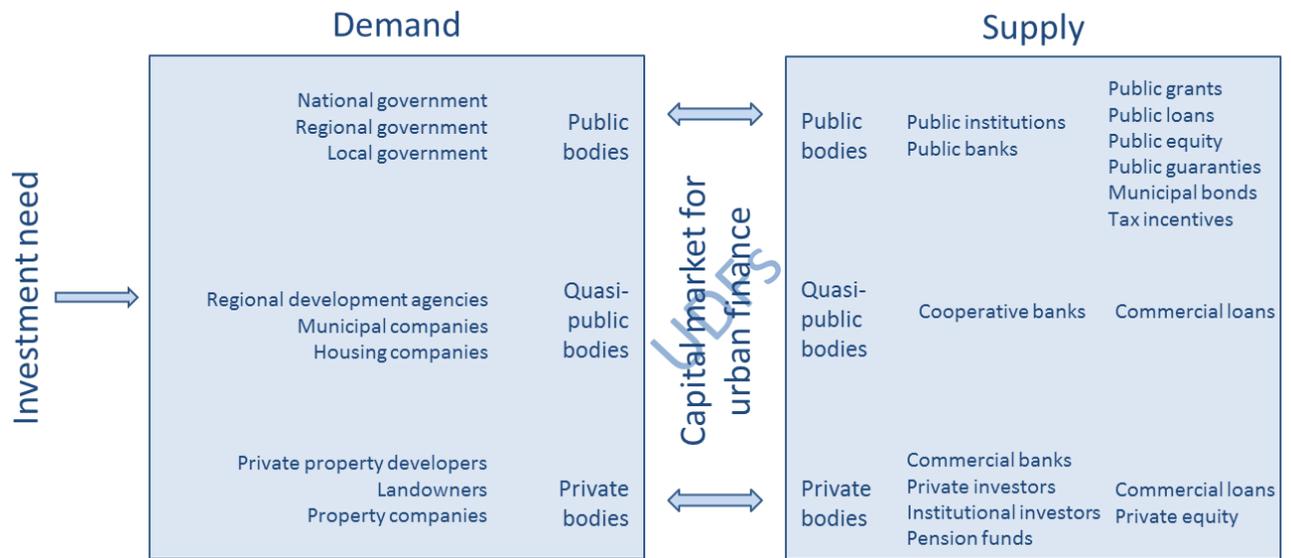


Figure 1: Typical structure of urban capital markets

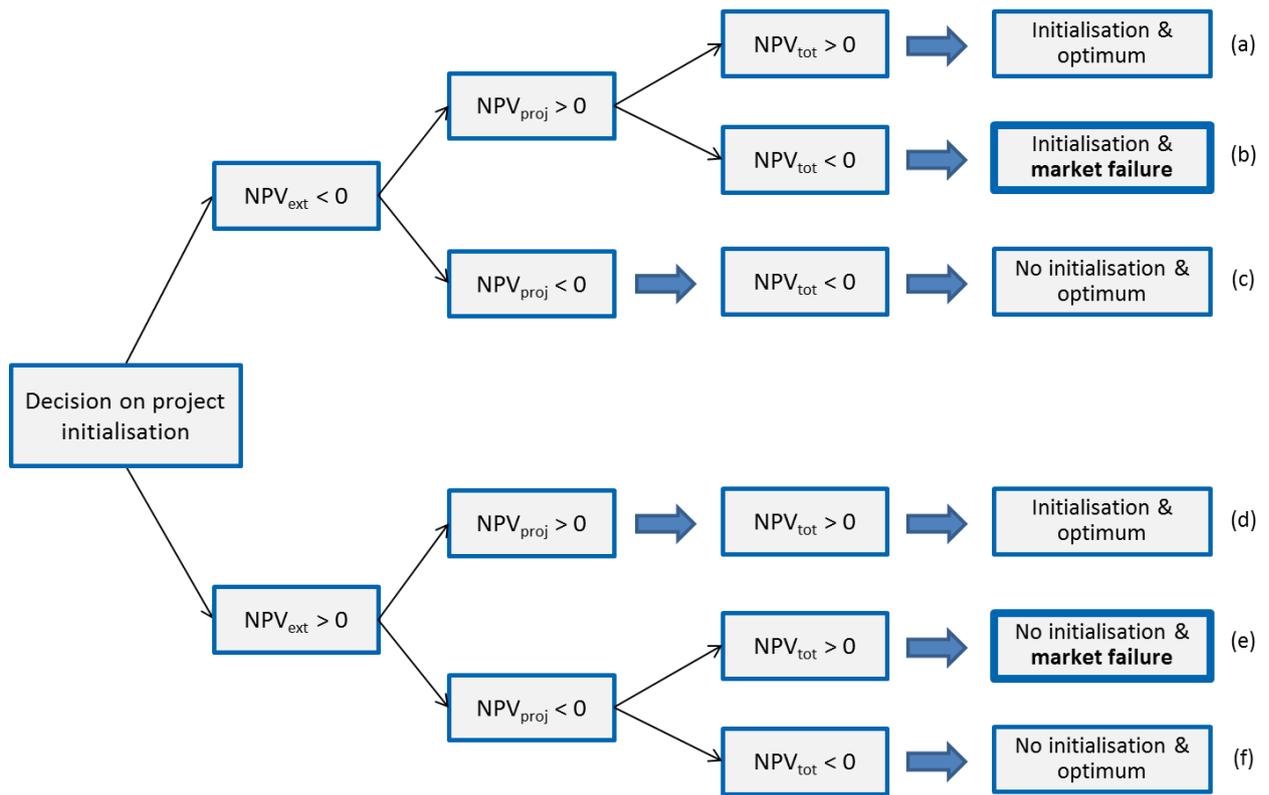


Figure 2: Decision of project initialisation with external effects under the consideration of net present value.

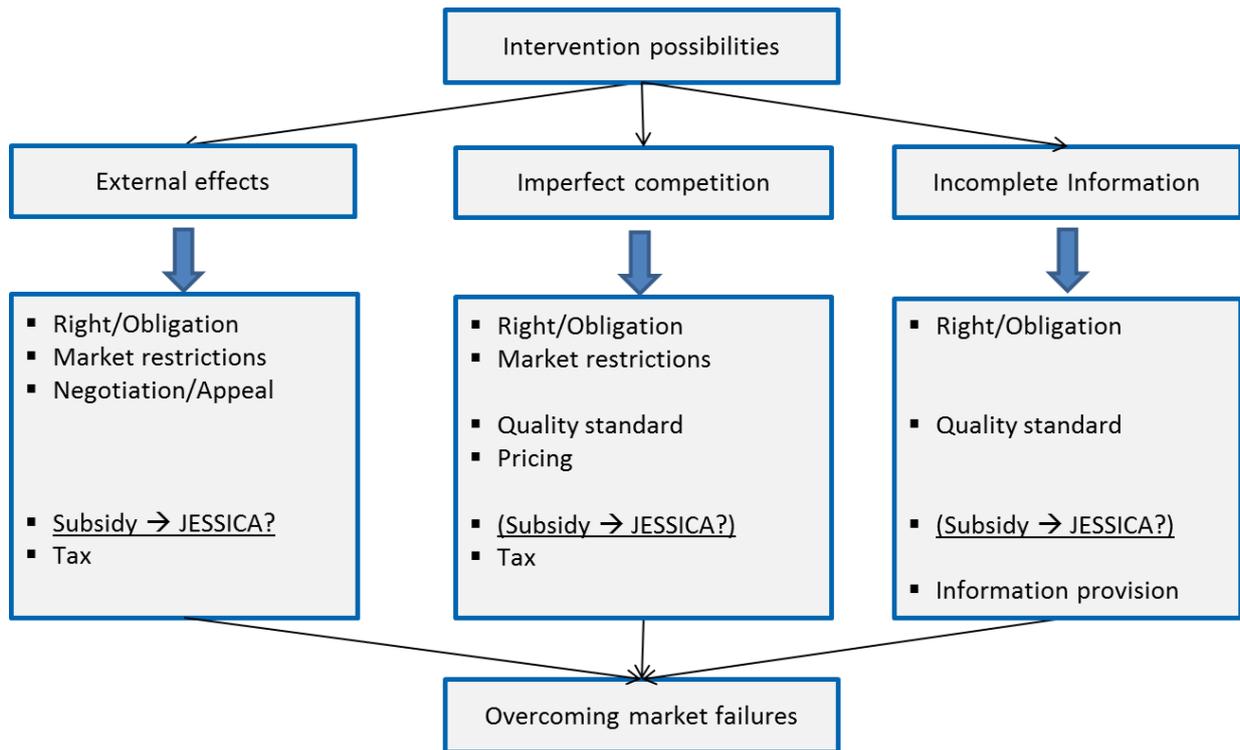


Figure 3: General intervention possibilities to overcome market failures.



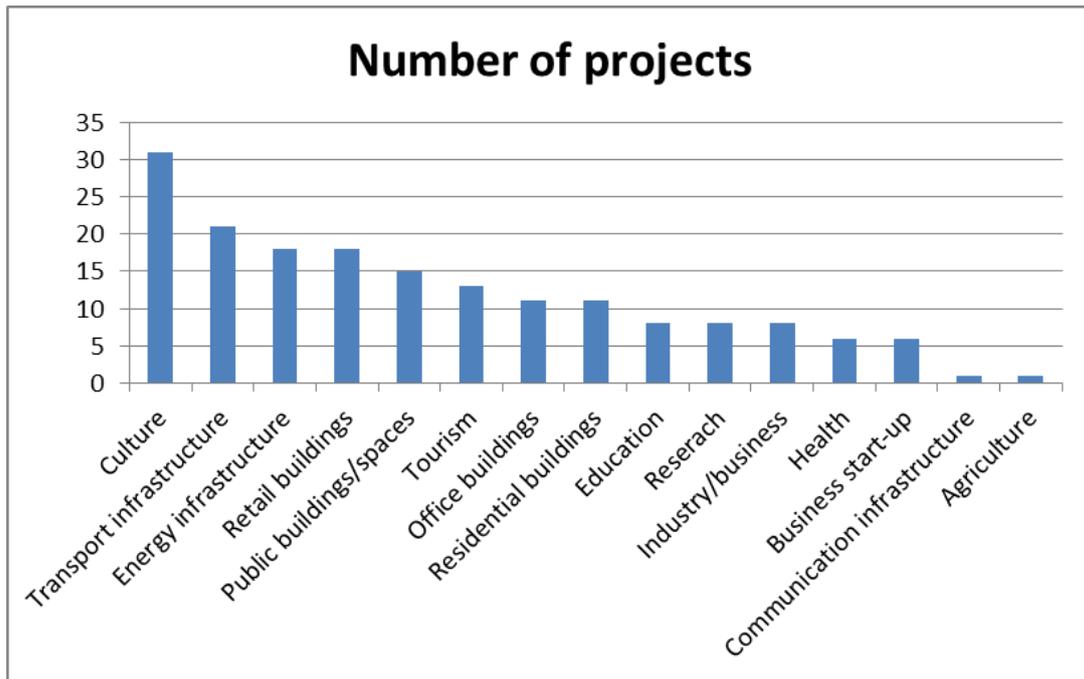


Figure 5: Number of proposed projects for UDFs per category.

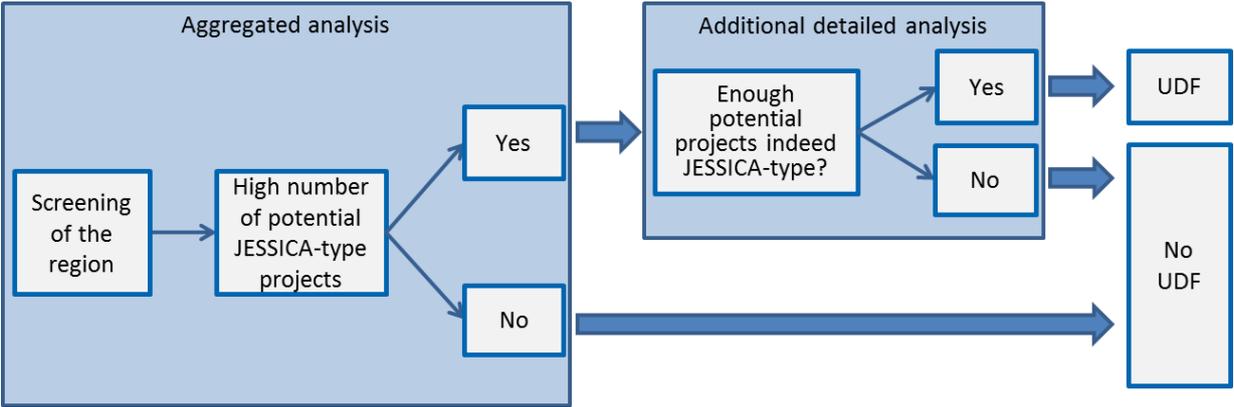


Figure 6: Decision process on UDFs for a region.

**Table 1: Projects and assigned categories from the JESSICA evaluation studies.**

The last 15 columns represent the project categories covered by the respective project if marked with an “x”.

Member state	Region	Project	Communication infrastructure	Energy infrastructure	Transport infrastructure	Retail	Office	Residential	Culture	Tourism	Education	Research	Health	Start-up	Industry/business	Public buildings/spaces	Agriculture
Germany	Saarland	renovation of historically listed restaurant building							x	x							
Germany	Hamburg	education and sports centre							x		x						
Germany	Hamburg	education centre							x		x						
Germany	Hamburg	education and communication centre							x		x						
Germany	Berlin	arts-related service area with galleries							x								
Germany	Berlin	creativ centre (galleries, architects, start-ups)							x					x			
Germany	NRW	offices at historically renovated outer wall					x		x								
Germany	NRW	brownfield development to concert hall							x								
Germany	Saarland	redevelopment of shopping street				x											
Germany	Saarland	redevelopment of retail and hotel area				x				x							
Germany	Saarland	revitalisation of retail properties				x											
Germany	Hamburg	reconstruction of local trade area				x											
Germany	Hamburg	health, living for elderly and commercial centre				x		x					x				
Germany	Berlin	redevelopment closed airport to business park				x	x								x		
Germany	NRW	land devolpment for urban mixed use (residential, commercial,...)				x	x	x									
Germany	NRW	brownfield development to retail establishment				x											
Germany	Saarland	revitalisation of public pedestrian areas			x											x	
Germany	Saarland	central heating supply for public buildings		x												x	
Germany	Saarland	(renewable) energy supply enhancement for communities		x													
Germany	Hamburg	remodelling of a bunker to a green energy supplier		x													
Germany	Hamburg	energy efficient area heating		x													
Germany	NRW	modernisation of buildings		x				x								x	
Germany	Saarland	installation fibre optic infrastructure	x														
Germany	Saarland	high standard inner city residential area						x									
Germany	Berlin	research centre for engineering and technology									x						
Germany	Berlin	health care centre											x				
Germany	Berlin	research institute for culture and information technologies									x						
Germany	Berlin	start-up centre												x			

Member state	Region	Project	Communication infrastructure	Energy infrastructure	Transport infrastructure	Retail	Office	Residential	Culture	Tourism	Education	Research	Health	Start-up	Industry/ business	Public buildings/spaces	Agriculture
Germany	Berlin	research centre for low energy										x					
Italy	Sardina	regeneration of ex-industrial building to sports, museum, library)				x			x		x						
Italy	Tuscany	music hall							x								
Italy	Tuscany	museum							x								
Italy	Marche region	revitalisation of historic centre							x	x							
Italy	Abruzzo	subsidised housing and sports area						x	x								
Italy	Sicily	concert hall and creativity centre and hotel							x	x							
Italy	Sardina	regeneration of historic buildings to socio-cultural centre							x								
Italy	Sardina	university and sports centre							x		x						
Italy	Sardina	spa							x				x				
Italy	Sicily	regenerate urban space (green, transport, buildings)			x	x	x	x								x	
Italy	Abruzzo	reutilisation of psychiatric hospital to offices and retail spaces				x	x										
Italy	Campania	multipurpose centre (offices, retail, hostel)				x	x			x							
Italy	Sicily	street regeneration for hotel restaurants, retail, residential				x	x	x		x							
Italy	Sardina	market area regeneration				x											
Italy	Sardina	commercial, offices and social housing				x	x	x									
Italy	Sardina	upgrading roads (renewable energy light)		x	x												
Italy	Abruzzo	air rail			x												
Italy	Campania	underground parking and top area reconstruction			x											x	
Italy	Sardina	hub for roads and public transport			x												
Italy	Sardina	parking basement			x												
Italy	Sardina	enhancement of movability system and heliport			x								x				
Italy	Sardina	airport upgrade			x												
Italy	Tuscany	restoration of hydroelectric power		x													
Italy	Marche region	low environmental impact industrial area		x											x		
Italy	Sicily	energy reconversion of public buildings		x												x	
Italy	Sardina	upgrading school buildings (renewable energies)		x							x						

Member state	Region	Project	Communication infrastructure	Energy infrastructure	Transport infrastructure	Retail	Office	Residential	Culture	Tourism	Education	Research	Health	Start-up	Industry/ business	Public buildings/spaces	Agriculture
Italy	Sardina	water supply system		x													
Italy	Tuscany	expansion of industrial estate area													x		
Italy	Tuscany	science park										x		x	x		
Italy	Tuscany	civic centre														x	
Italy	Tuscany	research centre										x					
Italy	Puglia	clinical care and research centre										x	x				
Italy	Abruzzo	reutilisation of old area for public spaces and services														x	
Italy	Abruzzo	reutilisation of industrial complex													x		
Italy	Campania	educational building									x						
Italy	Sicily	restoration and regeneration of waterfront to new tourist port															
Italy	Sicily	hospice											x				
Italy	Sardina	park and gardens														x	
Italy	Sardina	conversion into agricultural land															x
Italy	Sardina	student and tourist accommodation in regenerated buildings						x		x							
Italy	Sardina	research centre										x					
Poland	Mazovia	revitalization of station area and historic building		x					x	x							
Poland	West	ex-industry building conversion into culture centre							x								
Poland	West	regeneration of post-military into sports area							x								
Poland	Pomerania	culture centre							x								
Poland	Pomerania	construction and redevelopment of sports area							x								
Poland	Lodzkie	renovation and reconstruction of historic buildings into bars, bowling etc							x								
Poland	Lodzkie	revitalisation of post industrial districts for tourism etc							x	x							
Poland	Lodzkie	renovation and construction for residential, sports etc areas						x	x								
Poland	Mazovia	redevelopment into sports and recreation area							x								
Poland	Mazovia	revitalization of theatre and other cultural areas with ist surroundings							x							x	
Poland	Mazovia	revitalization of urban green areas for culture, sports and recreation							x							x	
Poland	Mazovia	construction of hotel and sports areas							x	x							

Member state	Region	Project	Communication infrastructure	Energy infrastructure	Transport infrastructure	Retail	Office	Residential	Culture	Tourism	Education	Research	Health	Start-up	Industry/ business	Public buildings/spaces	Agriculture
Poland	Mazovia	reconstruction of public spaces for education and sports							x		x					x	
Poland	Mazovia	renovation of socio-cultural centre							x								
Poland	Mazovia	revitalization of historical areas							x								
Poland	Mazovia	revitalisation of city passage and creation of parking area			x	x	x										
Poland	West	regeneration of quarters (retail, office, housing)				x	x	x									
Poland	Mazovia	adaption of catering spaces				x				x							
Poland	Mazovia	energy cost management for lighting (street and public buildings/areas)		x	x											x	
Poland	South	rail, bus, road hub station renovation			x												
Poland	South	underground car park construction			x												
Poland	West	railway station regeneration			x												
Poland	Pomerania	regeneration of sites around railway station			x											x	
Poland	Pomerania	transport enhancement			x												
Poland	Pomerania	regeneration of port			x												
Poland	Mazovia	bridge for motorists (traffic and tourism)			x					x							
Poland	Mazovia	modernization of rail station			x												
Poland	Mazovia	modernization of rail trail			x												
Poland	Mazovia	construction of a car park			x												
Poland	Lodzkie	energy efficiency		x													
Poland	Mazovia	modernization and extension of heating network		x													
Poland	Mazovia	renewable energy supply		x													
Poland	Mazovia	installation of solar collectors on public buildings		x												x	
Poland	Mazovia	thermomodernization of schools		x							x						
Poland	South	establishment of economic activity zones												x	x		
Poland	Mazovia	industrial and nuclear research park										x		x	x		
Poland	Mazovia	adaption of office spaces					x										
Poland	Mazovia	creation of business and technology park												x	x		
Poland	Mazovia	tourist information centre								x							

Table 2: Types of imperfections and suitable means of funding.

Project category	Externalities	Imperfect competition	Incomplete information	Funding type
Transport infrastructure	+	+	+	JESSICA
Energy infrastructure	+	+	+	JESSICA
Education	+	–	+	JESSICA
Research	+	–	+	JESSICA
Industry/business	+	–	+	JESSICA
Business start-up	+	+	+	JESSICA
Communication infrastructure	+	+	+	JESSICA
Culture	+	–	–	Grants
Retail buildings	+	–	–	Grants
Public buildings/spaces	+	–	–	Grants
Tourism	+	–	–	Grants
Office buildings	–	–	–	None
Residential buildings	–	–	–	None
Agriculture	o	–	–	None
Health	–	o	+	None

**Table 3: Appropriate funding means for each project.**

The last three columns represent the number of project categories covered by the respective project that correspond to JESSICA, grant or non-subsidised financing as identified in Table 1.

Member state	Region	Project	JESSICA	Grants	None
Italy	Abruzzo	air rail	1	0	0
Italy	Abruzzo	reutilisation of industrial complex	1	0	0
Italy	Abruzzo	subsidised housing and sports area	0	1	1
Italy	Abruzzo	reutilisation of psychiatric hospital to offices and retail spaces	0	1	1
Italy	Abruzzo	reutilisation of old area for public spaces and services	0	1	0
Germany	Berlin	creativ centre (galleries, architects, start-ups)	1	1	0
Germany	Berlin	redevelopment closed airport to business park	1	1	1
Germany	Berlin	research centre for engineering and technology	1	0	0
Germany	Berlin	research institute for culture and information technologies	1	0	0
Germany	Berlin	start-up centre	1	0	0
Germany	Berlin	research centre for low energy	1	0	0
Germany	Berlin	arts-related service area with galleries	0	1	0
Germany	Berlin	health care centre	0	0	1
Italy	Campania	underground parking and top area reconstruction	1	1	0
Italy	Campania	educational building	1	0	0
Italy	Campania	multipurpose centre (offices, retail, hostel)	0	2	1
Germany	Hamburg	education and sports centre	1	1	0
Germany	Hamburg	education centre	1	1	0
Germany	Hamburg	education and communication centre	1	1	0
Germany	Hamburg	remodelling of a bunker to a green energy supplier	1	0	0
Germany	Hamburg	energy efficient area heating	1	0	0
Germany	Hamburg	reconstruction of local trade area	0	1	0
Germany	Hamburg	health, living for elderly and commercial centre	0	1	2
Poland	Lodzkie	energy efficiency	1	0	0
Poland	Lodzkie	renovation and reconstruction of historic buildings into bars, bowling etc	0	1	0
Poland	Lodzkie	revitalisation of post industrial districts for tourism etc	0	2	0
Poland	Lodzkie	renovation and construction for residential, sports etc areas	0	1	1
Italy	Marche region	low environmental impact industrial area	2	0	0
Italy	Marche region	revitalisation of historic centre	0	2	0
Poland	Mazovia	industrial and nuclear research park	3	0	0
Poland	Mazovia	energy cost management for lighting (street and public buildings/areas)	2	1	0
Poland	Mazovia	thermomodernization of schools	2	0	0
Poland	Mazovia	creation of business and technology park	2	0	0
Poland	Mazovia	revitalization of station area and historic building	1	2	0
Poland	Mazovia	reconstruction of public spaces for education and sports	1	2	0
Poland	Mazovia	revitalisation of city passage and creation of parking area	1	1	1
Poland	Mazovia	bridge for motorists (traffic and tourism)	1	1	0
Poland	Mazovia	modernization of rail station	1	0	0
Poland	Mazovia	modernization of rail trail	1	0	0
Poland	Mazovia	construction of a car park	1	0	0
Poland	Mazovia	modernizationand extension of heating network	1	0	0
Poland	Mazovia	renewable energy supply	1	0	0
Poland	Mazovia	installation of solar collectors on public buildings	1	1	0
Poland	Mazovia	redevelopment into sports and recreation area	0	1	0
Poland	Mazovia	revitalization of theatre and other cultural areas with ist surroundings	0	2	0
Poland	Mazovia	revitalization of urban green areas for culture, sports and recreation	0	2	0
Poland	Mazovia	construction of hotel and sports areas	0	2	0
Poland	Mazovia	renovation of socio-cultural centre	0	1	0
Poland	Mazovia	revitalization of historical areas	0	1	0
Poland	Mazovia	adaption of catering spaces	0	2	0
Poland	Mazovia	adaption of office spaces	0	0	1
Poland	Mazovia	tourist information centre	0	1	0

Member state	Region	Project	JESSICA	Grants	None
Germany	NRW	modernisation of buildings	1	1	1
Germany	NRW	offices at historically renovated outer wall	0	1	1
Germany	NRW	brownfield development to concert hall	0	1	0
Germany	NRW	land devolpment for urban mixed use (residential, commercial,...)	0	1	2
Germany	NRW	brownfield development to retail establishment	0	1	0
Poland	Pomerania	regeneration of sites arouns railway station	1	1	0
Poland	Pomerania	transport enhancement	1	0	0
Poland	Pomerania	regeneration of port	1	0	0
Poland	Pomerania	culture centre	0	1	0
Poland	Pomerania	construction and redevelopment of sports area	0	1	0
Italy	Puglia	clinical care and research centre	1	0	1
Germany	Saarland	revitalisation of public pedestrian areas	1	1	0
Germany	Saarland	central heating supply for public buildings	1	1	0
Germany	Saarland	(renewable) energy supply enhancement for communities	1	0	0
Germany	Saarland	installation fibre optic infrastructure	1	0	0
Germany	Saarland	renovation of historically listed restaurant building	0	2	0
Germany	Saarland	redevelopment of shopping street	0	1	0
Germany	Saarland	redevelopment of retail and hotel area	0	2	0
Germany	Saarland	revitalisation of retail properties	0	1	0
Germany	Saarland	high standard inner city residential area	0	0	1
Italy	Sardina	upgrading roads (renewable energy light)	2	0	0
Italy	Sardina	upgrading school buildings (renewable energies)	2	0	0
Italy	Sardina	regeneration of ex-industrial building to sports, museum, library)	1	2	0
Italy	Sardina	university and sports centre	1	1	0
Italy	Sardina	hub for roads and public transport	1	0	0
Italy	Sardina	parking basement	1	0	0
Italy	Sardina	enhancement of movability system and heliport	1	0	1
Italy	Sardina	airport upgrade	1	0	0
Italy	Sardina	water supply system	1	0	0
Italy	Sardina	research centre	1	0	0
Italy	Sardina	regeneration of historic buildings to socio-cultural centre	0	1	0
Italy	Sardina	spa	0	1	1
Italy	Sardina	market area regeneration	0	1	0
Italy	Sardina	commercial, offices and social housing	0	1	2
Italy	Sardina	park and gardens	0	1	0
Italy	Sardina	conversion into agricultural land	0	0	1
Italy	Sardina	student and tourist accommodation in regenerated buildings	0	1	1
Italy	Sicily	regenerate urban space (green, transport, buildings)	1	2	2
Italy	Sicily	energy reconversion of public buildings	1	1	0
Italy	Sicily	concert hall and creativity centre and hotel	0	2	0
Italy	Sicily	street regeneration for hotel restaurants, retail, residential	0	2	2
Italy	Sicily	restoration and regeneration of waterfront to new tourist port	0	0	0
Italy	Sicily	hospice	0	0	1
Poland	South	establishment of economic activity zones	2	0	0
Poland	South	rail, bus, road hub station renovation	1	0	0
Poland	South	underground car park construction	1	0	0
Italy	Tuscany	science park	3	0	0
Italy	Tuscany	restoration of hydroelectric power	1	0	0
Italy	Tuscany	expansion of industrial estate area	1	0	0
Italy	Tuscany	research centre	1	0	0
Italy	Tuscany	music hall	0	1	0
Italy	Tuscany	museum	0	1	0
Italy	Tuscany	civic centre	0	1	0
Poland	West	railway station regeneration	1	0	0
Poland	West	ex-industry building conversion into culture centre	0	1	0
Poland	West	regeneration of post-military into sports area	0	1	0
Poland	West	regeneration of quarters (retail, office, housing)	0	1	2