

Strategic and Operational Real Options in Area Development Projects: Reflections on the Finnish Background

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Abstract

Area development projects are multi-million euro construction projects that aim for relatively large areas to be constructed in a concentrated time frame. Finnish municipalities have tended to favor area development projects due to the related normally positive indirect cash flow effects for municipalities, e.g., positive tax income effects, and the fact that they speed-up the municipal development. Area development projects, however, also cause risks to the municipalities in the form of possible changes in the population demographics in the developed areas, which in turn may cause negative cash flows. As most municipalities in Finland are facing tight financial times (AD 2008) they may be very risk averse. This may cause reluctance to favor the start of new area development projects, which again delays municipal development, and may even delay growth in the aggregate level.

This paper will describe the traditional (present) policy models for Finnish municipalities, vis-à-vis area development projects, and the creation of new policies through an analysis of high level (strategic) real options available to municipalities to change their role in these projects. The extension of the municipalities' involvement in the area development projects and active tracking of the available real options reduces municipalities' risks and enhances returns.

Keywords: Area Development, Municipalities, Real Options, Risk Management, Decision Support

1. Introduction

1.1. Background

Area development projects are multi-million euro construction projects that aim for relatively large areas (within municipalities) to be constructed in a concentrated time frame. Finnish municipalities have tended to favor area development projects due to the related normally positive indirect cash flow effects for municipalities, e.g., positive tax income effects, and the fact that they speed-up the municipal development. The projects can most often be divided into three separate phases according to the conducted activities: planning and zoning, construction, and post construction.

Planning and zoning phase is the first part of the area development process that includes the investment of unzoned land to the project (ear marking the land for the project), planning the area to be developed (architecture, municipal engineering & infrastructure plans etc.), and zoning of the area. Construction starts after the zoning is ready and the construction permits are valid, the phase includes the construction of the municipal engineering & infrastructure into the area (roads, pipelines ecc.) and the construction of the buildings themselves. Post construction phase starts after the construction of the buildings are ready, the phase includes the "owning" of the buildings and maintenance of the municipal engineering and infrastructure constructs. For municipalities the post construction phase also includes service provision obligations for the inhabitants of the developed area, e.g., kindergartens, schools etc.).

Area development projects cause risks to the municipalities in the different stages of the projects, most importantly in the post construction phase, in the form of possible changes in the population demographics in the developed areas. Demographic changes may cause negative changes in the municipalities' earnings in the forms of, e.g., increase in the need of, very low or negative profitability, municipal services (municipal child care, healthcare, seniors' services) and diminishing personal income tax yields from the area (adverse selection of inhabitants). These risks may cause a cash bleeding effect for the municipality that cannot easily be remedied.

Area development in Finland started in large scale after the mid-1960's, when unprepared cities, mainly in the South of Finland, experienced a wave of job related migration. It became critical to be able to offer the migrants that were coming to work in the cities, new housing fast. This need boosted the start of a number of large scale area development projects in Finnish cities (Eerolainen, 2005). Some of the largest of these projects are still, 40 years later, partly under construction. As times have changed and most municipalities in Finland are facing tight financial times (AD 2008) they have become more attentive to economic risks and may be very risk averse. This may cause and probably has caused reluctance to favor the start of new area development projects. This reluctance delays municipal development, and may even delay growth in the aggregate level.

Data from the Finnish Association of Municipalities (Kuntaliitto, 2008a) shows that more than 70% of Finnish municipalities' spending is used on social & health services and educational & culture services, and that the the spending (costs) of municipalities have risen in the last ten years on average at about a 5% per year rate. At the same time and average of about 25% of

municipalities operational (service provision) costs have been covered by operational income and the rest has been financed from income from different municipal taxes (personal, corporate, and tax on land) and from state subsidies. The average solidity of Finnish municipalities has remained at a relatively high level, but the average indebtedness has slowly increased (Kuntaliitto, 2008b).

When a new area is developed and constructed within a municipality it is, in the light of the available statistics, likely that the income received by the municipality from the area will not be able to fully cover the operational costs arising from the area without the subvention from other municipality income, or external financing. Furthermore, the growing burden on municipalities from the rapidly aging population (municipalities are obligated by law to furnish certain services) will be likely to cause new stress on the municipalities' economy, which will leave less room for large infrastructure investments in the future; this will be likely to reflect negatively on area development projects that require large investments from the part of the municipalities.

The averages do not reveal the whole truth, as there are municipalities with booming economies and less problems in sight, but on the other side of the coin there are municipalities that are much worse off than the average. In Finland the division between the well-off and worse-off municipalities is mainly between large population centrals doing better (with some notable exceptions) and more sparsely populated municipalities, mainly situated in the North and in the East of Finland, doing worse. The tendency to avoid further risks and large investments (binding of capital), brought by, e.g., area development projects, is probably already the prevalent state in many of the worse-off municipalities. What, however, remains the same for all municipalities is the possibility of risks from area development, and the fact that if risks start materializing it will be highly likely to cause a slowdown in area development within the municipalities.

We feel the risks of area development to municipalities are, to a large extent, caused by the traditional (and presently used) policy models of involvement of Finnish municipalities in these projects. Because the risks are caused by a policy (choice), and not by the inherent nature of area development projects themselves, we feel that by changing the policy (choice) the risks can be managed, reduced, and even fully covered. In the re-evaluation of the municipalities' policies, the mapping of strategic real options available to municipalities' involvement in area development projects plays a pivotal role. Before we go to the mapping of real options in area development, let us first present the traditional policies municipalities have adopted vis-à-vis area development projects in Finland.

1.2. The Traditional Role of Finnish Municipalities in Area Development Projects

The most active involvement of Finnish municipalities in area development projects has traditionally been quite concentrated on the *planning and zoning phase* of the projects. Municipalities have traditionally been involved as the owners of un-zoned land, partly or fully making the basis for the to be developed area and as the zoning authority. The municipalities have also traditionally carried the bulk of the responsibility of the planning of the area development projects, especially for the part of planning the municipal engineering and infrastructure. The actual architectural planning has not often been done by the municipalities, however, they have been the acting regulating authority also for the architecture. Finnish

municipalities are the zoning authority in their own territory, this means that the municipalities have a zoning monopoly.

From the point of view of the Finnish municipalities the planning and zoning phase is usually not cash outflow intensive, as the municipalities are owners of (part or all of) the land allocated for the project and will invest the land to the planning and zoning phase (i.e. we consider the planning and zoning phase as a stage in the investment process that is the whole area development project). The planning and zoning cost cash flows for the land owned by the municipalities themselves are usually relatively small from the point of view of the whole area development project. By zoning land the municipality takes on the responsibilities of building the municipal engineering & infrastructure and the furnishing of the municipal services.

It is usual, especially in larger population centres that the municipalities are buying all the unzoned land they can purchase. Furthermore, the municipalities in Finland have a law given right to redeem private lands for their purposes (zoning), however, this right is very seldom exercised. The purpose of the law is to prevent speculation with land value and by speculation hindering municipal development. At the end of the planning and zoning phase the Finnish municipalities most often select to sell or to lease their (now zoned) land and will exit from the ownership position in the area development process (policy of exercising of the option to abandon).

When zoning other land owners' unzoned land municipalities have (after a change in the Finnish Law) been able to prioritize zoning of areas where the land owners agree to a contract on land use (Fin: Maankäyttösopimus). These contracts most often stipulate that the land owners' whose land is zoned agree to pay for the costs of the obligations that municipalities have on building the municipal engineering & infrastructure to the zoned area. This means that land owners who do not agree to contracts on land usage will not see their land zoned, because, the municipalities cannot afford to pay for the building of the municipal engineering & infrastructure on such lands (Eerolainen, 2005). Effectively this means that municipalities can force costs of municipal engineering & infrastructure on land owners, who are the actual beneficiaries. When zoning their own land the costs are transferred in the sales or leasing price of the municipalities' land.

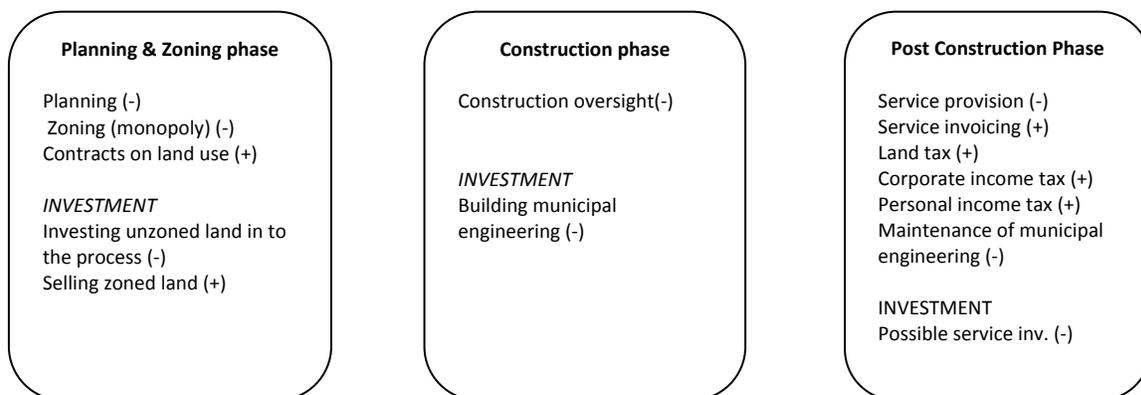


Figure 1. The three phases of area development with the traditional type of Finnish municipalities' involvement at each stage. Cash flow information -/+ at each stage for Finnish municipalities and required investments.

Traditionally the *construction phase* of area development projects has included the municipalities investment into constructing the municipal engineering & infrastructure to the zoned area and acting as the construction oversight authority (building permits etc.). The municipalities very seldom act as contractors to building, however, building of facilities for municipal services (schools etc.) are the exception to the rule. In the *post construction phase* the municipalities will act as the provider of municipal services, for which they will obtain some fees, it is previously noted that the services' fees cover on average about 25% of the municipal service provision. The municipalities receive tax income from the developed areas in the form of municipal tax on personal income (in 2008 rates vary between 16,00 and 21,00, with the average at 18,00% on taxable income (Verohallitus, 2007)), the municipalities portion on the tax on corporate income collected by the state, and the municipal property tax (in 2007 rates varying, depending on the type of property and set yearly individually by municipalities, between 0,22 for residential housing and 2,20% for nuclear power plant properties (Verohallinto, 2007)). The tax income is used to finance the municipal economy, i.e., including the gap between municipal service provision in the developed areas and the maintenance of the the municipal engineering, including the infrastructure investments (roads etc.). In case there is the need to build new service facilities, or to make other new municipal investments, in the developed area in the post construction phase the municipalities have, more often than not, ended up paying for these investments fully. The traditional involvement of the Finnish municipalities in area development projects, phase by phase, is illustrated in figure 1.

Finnish municipalities have traditionally required a very low return of the invested capital in the area development projects (municipal engineering & infrastructure investments), close to the risk free rate, or sometimes even so that no actual return on the investment has been required. The investments have often been realised based on the assumption that tax income streams are risk free, which has been reflected on the discount rates; if economic analysis has been made on the return from these investments.

1.2.1. Some Identified Economic Risks in the Traditional Involvement of Finnish Municipalities in Area Development Projects

The area development projects are not riskless to the the municipalities, even if they tend to require very low (riskfree) return on their investments into these projects, on the contrary: a number of economic risks can be identified in the traditional policy of involvement of the Finnish municipalities in area development projects. The risks are can mostly related to the accuracy of expectations about identifiable future cash flows, which is positive, as the sources of the most important financial risks can be identified (*ceteris paribus*, non-identifiable risk would be even worse). The problems with estimation inaccuracy are accentuated by the fact that area development projects are long-term projects with very long economic lives and with long planning and construction times. Probably the most important risks will come in the form of the difficulties to estimate the costs of municipal engineering & infrastructure: cost overruns in infrastructure investments in general are notoriously well-known. For some examples on spectacular cost overruns on public infrastructure investments see, e.g., (Flyvbjerg, Bruzelius, & Rothengatter, 2003). Flyvbjerg also presents and models how risks can be assessed in public projects.

Starting on the risks in the temporal order of the area development projects we concentrate first on the municipalities' economic risks in the *planning & zoning phase*. On the revenue side the uncertainties (financial risks) concentrate on the income that can be received after the zoning by selling or leasing the land municipalities own. This risk may not be very "important" as zoned land value tends on average to rise constantly in Finland (Tilastokeskus, 2008a). The risk on not receiving the payments agreed on in land use contracts is relatively low, due to the fact that there usually is consensus on the matter, and it may not be in any of the parties interests to litigate. Furthermore, the payments may be required partly in advance, which further lowers the risks involved. On the cost side the risks are not very significant as the planning and zoning costs are not very large in relation to the size of the area development projects, or even in absolute numbers.

	Revenue Related Risks	Costs Related Risks
Planning & Zoning Phase	Sales price of zoned land not as expected (2) Contracted land use payments not as expected (1)	Planning cost not as expected (1) Zoning cost not as expected (1)
Construction Phase		Municipal engineering & infrastructure cost not as expected (5)
Post Construction Phase	Personal municipal tax income not as expected (4) Municipalities' part of the tax on corporate income not as expected (3) Service revenues not as expected (2)	Service provision (need) costs not as expected (4) Maintenance costs not as expected (3) Possible unexpected municipal investments to the area (4)

Table 1. Some identified risks from the traditional type of Finnish municipalities' involvement in area development projects. (Importance of risk estimated by the author in parenthesis on a scale 1-5; where 5 most important)

Risks in the *construction phase* of the area development projects tend to be larger than in the *planning & zoning phase*, this is caused by the need to invest in the construction of municipal engineering & infrastructure and the ensuing risks of cost overruns. The risk of cost overruns is very tangible, as the costs of municipal engineering & infrastructure tend to change constantly, and the speed of change varies (Tilastokeskus, 2008b). This means that when area development is planned, the actual construction of infrastructure may still be years away. If the pricing of the municipalities' zoned land for sale or for lease, is done, e.g., years before the actual construction begins there is a risk that the income obtained will no longer be able to cover the construction costs (as usually has been the basis of the pricing). This means that any costs over the budgeted (perhaps years before) may cause a negative result from the point of view of the municipality. Naturally such costs can be contracted in advance, however, it is not very likely that contractors are ready to enter into forward agreements regarding construction years ahead. So the risk faced with the municipal engineering and infrastructure costs is coming from estimation inaccuracy and as a result, erroneous pricing and from the possibility of unexpected cost overruns even on top of the higher than expected market price of construction.

Post-construction phase risks on the cost side include the costs of municipal services reaching unexpectedly high levels, caused, e.g., by unexpectedly high wage increases, maintenance costs of the municipal engineering & infrastructure investments being higher than expected and from the possibility of an unexpected need for new municipal investments into, e.g., infrastructure or service facilities (e.g., schools, kindergartens etc.). The services' unexpectedly high costs of operation and higher than expected maintenance costs may not be a very large risk on a yearly basis in absolute numbers, however, accumulated over the economic life of the project they may

be considerable. The risk of additional, unexpected, investment into more services capacity, e.g., in the form of buildings and hiring more service staff, is an important risk, as these investments may be relatively large and especially if they cannot be carried by the income from the area.

On the revenue side the risks include the possibility of lower than expected fee income from municipal services provision and lower than expected tax income from the different forms of taxation. The municipal property tax income is the least risky source of income, as it is on buildings and land that cannot be transported away from the municipality. Income from the municipal tax on personal income and the part of corporate income tax allocated to municipalities may vary, depending on area demographics changing. Service fees may also face variability that is caused by demographics, variability that may be out of sync with the costs of providing the same services (fixed costs remain constant). The post-construction phase risks can materialise as extremely negative from the point of view of the municipalities, because in cases of negative demographical changes many, even all, of the post-construction phase risks may be realised simultaneously. Examples of such demographic changes exist, e.g., in areas constructed relatively long ago, where the inhabitant basis has changed from upper middle class rather senior people with no children to lower middle class families with families. In such cases the need for kindergarten and school services has grown from the demographic change causing extra investment needs into buildings and services, with simultaneous tax income drop from the same area. Such "demographic shocks" may cause an area to become cash-flow negative. If the planning has been made to reflect a zero economic result and no buffers have hence been collected the overall result may end up being negative from the point of view of the municipality. This will lead to pressures of implementing, e.g., higher fees and taxes.

Table 1 summarizes some of the financial risks that face municipalities in their traditional way of involvement in area development projects.

In short, the blueprint of the traditional involvement policy of the Finnish municipalities from the area development projects has been (is) the following :

- i) Invest and buy unzoned land
- ii) Do the planning and the zoning of the unzoned land / require contractual payments based on the land use agreements
- iii) Sell the zoned land (partly or fully) to cover the planning and zoning costs and the expected costs of municipal engineering, and partly the cost of service facilities construction (pricing of the zoned land or the zoning charges to match these costs, often no profit requirement, or very low required return)
- iv) Act as the inspecting authority in the construction phase and construct the municipal engineering (municipality being the cost carrying party)
- v) Receive personal municipal tax, municipalities' part of the tax on corporate income and municipal land tax cashflows from the individuals, companies, and buildings located in the developed area, use the tax income to finance partly the services provision and maintenance of municipal engineering. Receive lease payments for the land not sold.
- vi) Provide services and receive some cash flows as payment for the services (prices usually set to be lower than the cost of provision)
- vii) Maintain the municipal engineering, receive some cashflows for the maintenance

The municipalities' traditional policy objective is that the whole "chain of involvement" (i-vii) should result in the development of the area according to the plans with a close to a neutral overall, long-run financial result (no gain, no loss) from the projects to the municipality.

The risks associated with the presently used traditional policies of municipalities involvement in area development projects are found in all stages of the projects, however, the *most important risks* within the present involvement policy seem to be concentrated in the construction phase and in the post-construction phases. In the construction phase the risks can materialize in the form of possible cost overruns of municipal engineering & infrastructure construction and in the form of unexpected and costly investment needs and lower than expected income from taxes and services. The risks in the post-construction phase can be caused, e.g., by a demographic change in the area.

Before we go ahead with mapping of the policy options Finnish municipalities have (to change their traditional involvement policies), we will do a short review on selected articles that discuss real option valuation in land valuation and infrastructure investments.

1.3. Review of Selected Articles on Real Options in Land Valuation and Infrastructure Investments

Focus of the research on real options with a direct connection to area development has mainly been in estimation of option value in land prices, the real options premium, and in use of real option valuation in the optimal timing of development projects. Staging of investments is also an issue that is relevant to area development and it also has been researched in connection to real estate. As zoning and other regulatory issues play a role in the value of the options embedded in the value of vacant land the effects of regulation in option value have also been studied. In the following a selection of six research papers are presented to illustrate the previous research on real options on topics close to area development and discussed to underline some relevant points to the Finnish area development projects.

In the first reviewed paper (Titman, 1985) presents a two-period binomial model where he views vacant land as an option (to develop). The development will increase the value of the land (and will enable a payoff), however, the development also means costs. The development costs are modeled to be at least partially irreversible. The paper finds that, as there are irreversible costs and there is uncertainty, the option to wait that the landowner has is valuable. This situation can be modeled as an option where owning the undeveloped land gives the option, the developed land (price) is the underlying asset, and the development cost is the exercise price of the option. In the paper Titman does not include a maturity for the option, which however, in real life may be finite. The paper concludes that as the possibility (real option) to wait is valuable, this value should be reflected in the (sales) price of undeveloped land. The model presented in the paper returns results that indicate that the market price of undeveloped land is (real option value) higher than the price of a developed property, development costs deducted. The paper presents a numerical example for illustration. The starting situation presented in the paper, from the point of view of Finnish municipalities means that the land is already zoned, i.e., the zoning gives the land-owner the right to develop (construct) on the land. This means that as Finnish municipalities

often are owners of un-zoned land, they actually have an option to zone that gives the option to construct. As the Finnish municipalities have the lawful right to redeem un-zoned land the maturity of the real option to develop is finite for Finnish land owners, however, it may be considered infinite for the Finnish municipalities as land owners.

In the second paper (Williams, 1991) presents a model that illustrates the optimal time to develop land and the optimal time to abandon land (abandoning meaning here selling, or terminating a lease / rental agreement). The model takes into consideration the (stochastic) change in development costs (building cost) and the advantages from development; these affect the optimal time of starting development. The model also considers the building density and the amount of total land that is developed. What is also considered is the possibility of changes in the risk level, by taking into consideration the possible changes in the speed of price changes (costs / revenues). The findings of the paper include the observation that a lower zoning density has the tendency to slow down starting of development and that high density seems to generally add to land value, except for some special circumstances. Finnish municipalities should pay attention to making the zoning such that it increases the chances of obtaining the expected price for the zoned land and by considering the optimal timing of land sales for maximizing of profits. Optimal timing is also discussed in, e.g., (Benaroch & Kauffman, 1999).

The third paper, (Quigg, 1993) investigates 2700 land sales and 3200 developed site sales in the Seattle area (USA) in the later period of the 1970's with a model that assumes stochastic (GBM) changes for the development cost (exercise price) and the value of developed land (underlying asset). The model resembles the model from (Williams, 1991) with some extensions. The paper discusses the estimation of the development (how the type and size of the construction is to be estimated), and uses hedonic estimation (hedonic pricing). This method estimates the price of the developed property with a formula that takes into consideration a number of characteristics of the developed property, e.g., land area, building age, distance from public transportation etc. The hedonic method structure resembles, and has some analogy with the structure of the arbitrage pricing theory. The paper discusses the variance (yearly) of property prices and discusses some previous results; variation of prices for the data between 18-28% and comparison to previous results of ~15% variation. The finding of the paper is that most properties would not be developed at the observed levels of variation, if the developers calculated the value of the real options correctly, i.e., the option value of in the land would be so high that it would prevent development due to the high volatility. However, if the volatility was assumed to be zero, then development would start immediately, naturally indicating NPV positive construction. In the data studied the value of the option premium has a mean of 6% of the land value.

The fourth reviewed paper (Yamaguchi, 2000) examines the real option premium in Japanese land prices by using a model adopted from (Quigg, 1993), i.e., they also use the hedonic estimation method to estimate the price of developed land (that would be developed on the vacant land); adopted for Tokyo. The dataset is of 754 mostly residential observations from Tokyo from the mid 1980's and early 1990's – the periods are very dissimilar as in the mid 80's Tokyo land prices were in a boom and in the early 90's there was a period of stagnancy. The authors express an interesting point (in presentation slides) that the option premium value can be understood as the inverse of the landowners willingness to develop the land, i.e., the more option value there is the less willing are the landowners to develop the land. The volatility that the

authors find for the different periods, boom and stagnancy are interesting, at the boom time the volatility is markedly higher ~37%, but in stagnant market the volatility is about half, ~19% (these results significant at the 1% level). The interesting finding is that the results show that real option premium is over 18% for both periods of observation, i.e., same level of premium even if the volatility is different. This implies that landowners seem to value the optionality in a similar fashion in different times, indicating rational behavior.

From the two papers using the hedonic estimation for pricing of land, one could pick out an interesting issue that has a real options focus for the Finnish municipalities. It would be interesting to see by using a hedonic scoring how land destined for an area development should be zoned. The municipalities have a zoning monopoly and have the power to decide about the zoning, i.e., hold the zoning real options; the zoning could be optimized in a way that it would maximize the land value. Naturally some constraints would have to be taken into consideration in the process, however, this kind of optimization and exercise of the real option to change zoning could prove to be a valuable tool for municipalities. The papers also indicate municipalities could force the land buyers to develop faster by contracting the land sales in a way that they take out the buyers' option to wait. This is something that is also done in Finland. Issues having to do with real options in zoning are also discussed in (Capozza & Li, 1994a; Capozza & Sick, 1994b).

A fresh example of a paper exploring the option value of land is (Ooi, 2006) that investigates the real option value embedded in the price of plots of land via comparing land auction prices with and without restrictions to the development of the land. They exhibit and draw conclusions from a sample of 165 public land auctions and 105 private sales of land in Singapore; where the publicly auctioned plots are basically stripped of real options, and where the privately sold land includes the real option value. The findings of the paper are that as the plots are very similar in both, the public and the private auctions, *ceteris paribus*, about 45% of the value of the private sales (higher sales price) can be attributed to the value of real options. The paper has also investigated the explanatory power of the research (the issue of real options really attributing for the value/price of the plots), and found that the option value explains the price / value increase for over 90% - this indicates that the finding is reliable. The premium caused by real options seems to be high when we compare with other results, however, this can most likely be attributed to the specific location (Singapore) and the time of the study. In Finland there are instances where municipalities sell zoned land in auctions, however, this applies to cases where the auctioned land is sold in small plots, and usually in areas where the zoning is for individual residential buildings, i.e., villas. In the Finnish area development auctioning is not the usual way to sell land, even if there may be bidding competitions between constructors, but in these cases the bid is not for the land alone, but usually for the realization of a whole project, and the selection is made based on a number of issues, like quality and soundness of the plans, not only the price.

The paper by (Rocha, 2007) approaches the options in land use from the perspective of having the option to stage development of larger areas (sequential development), in contrast to developing all-at-once. Their paper can actually be understood as describing an area development situation. They illustrate with a case from Brazil, and the paper discusses the situation within the context of emerging markets that carry high risk. The point of the paper is to

show that under high uncertainty, especially high in developing countries, it may be beneficial to use the option to wait after a first stage development, due to sudden violent swings in the market. The discussion is directly applicable to any properties market as the sub-prime crisis in the USA has shown (not only developing countries' properties markets experience sudden large swings). The paper presents a case from the Rio de Janeiro that illustrates a situation where it is beneficial to postpone the second investment phase. The effect on the risk of the project is shown (the downside is more limited). In the paper changes in the variance of prices that have been observed in some previous publications, e.g., (Quigg, 1993; Yamaguchi, 2000) have been ignored. The paper offers useful insights for the Finnish area development projects, especially regarding the construction phase of the area development projects.

In the following section of this paper we will look at the strategic (policy) level real options Finnish municipalities have at their disposal regarding area development projects and discuss the possibilities they offer. We will also map the real options within the different area development project phases and discuss if, and how, Finnish municipalities could use them to optimise their situation and for risk management purposes.

2. Mapping the Real Options Available for Finnish Municipalities in Finnish Area Development and Managing the Risks

2.1. Mapping the available Real Options

In area development projects municipalities have both, strategic level (policy) options and operational level (project) options available to them. The strategy options include the options the municipalities have to move from one project phase to the next, i.e., postpone (timing) entering a phase, abandonment of the deliverables from a phase (zoned land / buildings; sale / lease), and the options to continue in the development project to the next project phase (~growth). The operational level options include the options within the different project phases, e.g., the options to stage investments (zoning, construction, etc.) and options that can be built to the constructed buildings (different standardizations that allow, e.g., spaces to be used in different ways etc.). All of these strategic real options are private for municipalities, which means that there is either a long maturity or indefinite maturity for them, operational options are also private to the municipalities, however, their realistic maturity is limited. The cause of the strategic options being private to municipalities is in the power the municipalities have as the zoning authority, and further expanded in situations where municipalities are land owners.

Figure 2. maps the identified strategic and operational real options available to municipalities. They are listed and discussed in the list below according to the indications in Figure 2.:

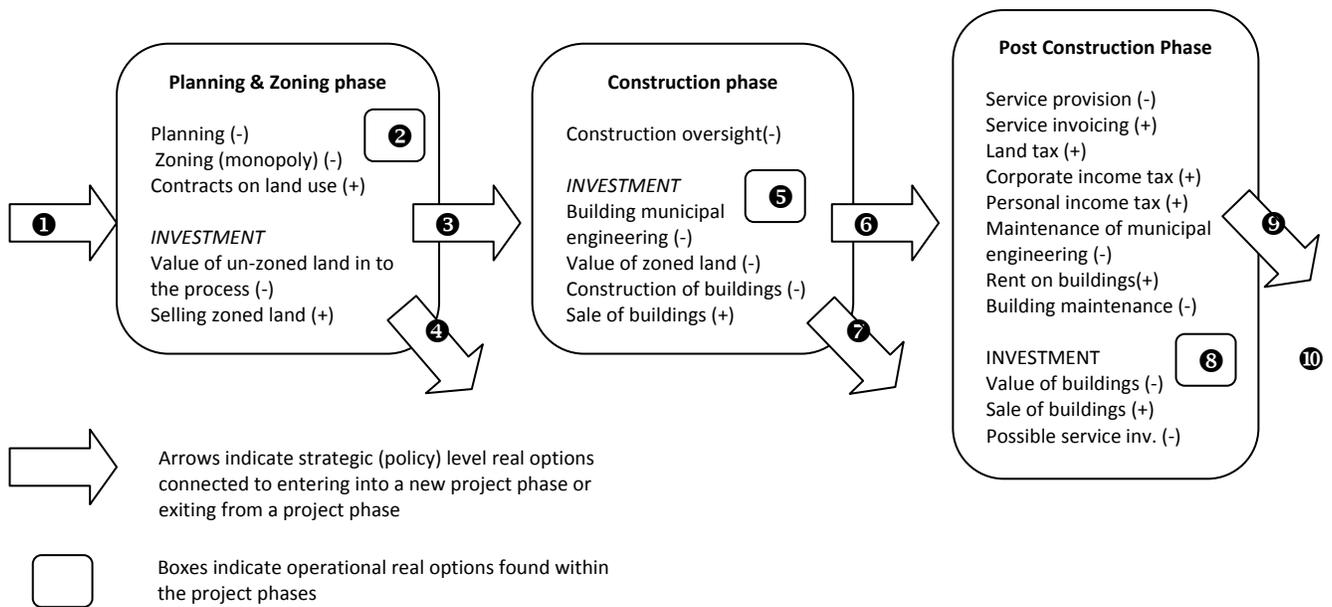


Figure 2. Strategic and operational level real options available to Finnish municipalities when entering area development projects, with cash in- (+) and out-flow (-) information for each of the three project phases.

- ① *Strategic level timing options* to time the zoning of land, both in the ownership of the municipalities and also optimal timing of zoning of land held by private land owners. Optimization of timing of privately held land may, e.g., be contingent on the market situation (in a positive market it may be easier to reach consensus on contracts on the use of land discussed above in section 1.3.). Municipalities have the zoning monopoly so the timing options are relatively market independent and private to the municipalities. Sometimes utilized by Finnish municipalities.
- ② *Operational level options to stage and optimize the zoning* of land areas according to the market conditions, private to the municipalities. Sometimes utilized by Finnish municipalities at present. Applications of the hedonic model presented in (Quigg, 1993; Yamaguchi, 2000) may be applicable.
- ③ *Strategic level option to develop*, by continuing to the construction phase, exercisable by the municipality investing the zoned land. Strategic level option to postpone the investment into the construction phase. Restricted possibility to postpone the construction of municipal engineering & infrastructure. Very seldom utilized by the Finnish municipalities, with the exception of some larger cities, and when municipalities allocate some housing for rental at preferential city rates (social policy). Similar to what is presented, e.g., in (Titman, 1985). Opens the options indicated by ⑥, i.e., sequential option.
- ④ *Strategic level real option to abandon the zoned land*, including timing of abandonment. Often utilized by Finnish municipalities in the form of selling the zoned land, also utilized in the form of leasing land (and effectively leasing the real option to construct). Similar to what is presented, e.g., in (Williams, 1991)
- ⑤ *Operational level real options to stage the construction* of municipal engineering & infrastructure and the construction of the buildings. Similar to what is presented in, e.g., (Rocha, 2007). Also different real options related to how infrastructure and buildings are built, i.e., modularity for flexibility of use etc.
- ⑥ *Strategic level option to receive rental income*, by continuing to the post-construction phase, exercisable by the municipality investing the developed land (with buildings). Conditionally available only by having entered ③. Seldom utilized by the Finnish municipalities, except for when done for social policy reasons, i.e., not utilised in large scale to promote cash in-flow from renting as a business.
- ⑦ *Strategic level real option to abandon the buildings and the underlying land*, including timing options on the abandonment. Not used by the Finnish municipalities, with very few exceptions. Finnish municipalities do not act as building contractors for profit.

- ⑧ *Operational level options within the use of buildings, e.g., changing the size of units, conditional on having built real options into the facilities at ⑤*
- ⑨ *Strategic level real option to abandon the buildings and the underlying land, including timing options on the abandonment. Same as in ⑦, available if entered in ⑥*
- ⑩ *Strategic level real option to re-zone the land used in the area development. Similar to what is presented, e.g., in (Capozza et al., 1994b). Re-zoning is sometimes done, but almost always on the basis of requests from private land owners on their land (contracts on land use apply) (Eerolainen, 2005).*

The above mapping of strategic (policy) level real options and operational level real options available for Finnish municipalities in area development projects can be used to describe new policies (that use the real options) that may help in managing the risks that are apparent with the traditional involvement of Finnish municipalities in these projects.

2.2. Extending the Role of Finnish Municipalities in Area Development – Using the Available Real Options for Risk Management

In the section 1.2.1. we have mapped and described the identified real options available to Finnish municipalities in area development projects. What we have found is that there are multiple strategic and operational level options available at each of the three stages of the area development projects. We have described in the section 1.2. the traditional role of Finnish municipalities in area development projects and seen that the most important risks within the traditional role come from the possibility of cost overruns in the municipal engineering & infrastructure construction and from the inability of municipalities to pro-actively (in other forms than tax or fee increases) affect the income from a developed area, due to the fact that the municipalities traditionally are no longer owners of the property, land or buildings (other than service facilities, which are rather a liability than an asset). When comparing the traditional involvement of the municipalities and the real options available we can see that municipalities are not taking advantage of all of the available real options to manage their risks in area development projects. The relevant question to ask is if this is the result of careful analysis, or a situation that is caused by "doing things the way they have always been done"? It is the view of the author that the situation is a result of the past, and not the result of an economic analysis of the optimal involvement policy. If this is the case, will remain open, however, let us investigate how the available real options could be used in the risk management of municipalities involvement in area development projects.

Table 2 presents the risks that we have observed in the different phases of the area development projects, including some "new" risks that originate from municipalities' possible enlarged involvement in all the three stages. In Table two the different available identified real options are mapped against the risks in the different phases and possible risk management uses of the real options are suggested. New involvement policies, suitable for each individual area development project and market situation, can be designed with the help of the available mapping of real options. Issues like creating a fixed income source for the municipalities by exercising the option to receive rental income, by entering the post-constructin phase as a land and building owner will decrease the risk from the fixed costs that municipalities have from developed areas.

	Revenue Risk Management with Real Options	Costs Risk Management with Real Options
<p>Planning & Zoning Phase w. risks</p> <ul style="list-style-type: none"> • Sales price of zoned land not as expected (2) • Contracted land use payments not as expected (1) • Planning cost not as expected (1) • Zoning cost not as expected (1) 	<p>① ② ③ ④</p> <ul style="list-style-type: none"> • Using the option to postpone the start of the project • using the option to postpone the land sale to manage risk • staging the zoning and land sales to optimise timing • using the land to enter the construction phase • entering the development for extra income (reduces risk of overall negative) 	<p>①</p> <ul style="list-style-type: none"> • Using the option to postpone the start of the project
<p>Construction Phase w. Risks</p> <ul style="list-style-type: none"> • Municipal engineering cost not as expected (5) • <i>Construction cost not as expected (5)</i> • <i>Income from sale of buildings not as expected (4)</i> 	<p>⑥ ⑦</p> <ul style="list-style-type: none"> • Using the option to postpone the abandonment (sale) of buildings to optimize income • In case the market price of buildings does not warrant sale the option to receive rental payments can be exercised as the first step in the process of waiting for "better times" – the return on the rental income may even be, per se, acceptable 	<p>⑤</p> <ul style="list-style-type: none"> • Staging construction to find out if the contracted constructor causes cost overruns; keeping the option to change the construction company
<p>Post Construction Phase risks</p> <ul style="list-style-type: none"> • Personal municipal tax income not as expected (4) • Municipalities' part of the tax on corporate income not as expected (3) • Service revenues not as expected (2) • Service provision (need) costs not as expected (4) • Maintenance costs not as expected (3) • <i>Rental income not as expected (1)</i> 	<p>⑥ ⑦ ⑧ ⑨ ⑩</p> <ul style="list-style-type: none"> • Entering the post-construction phase will enable the municipality to get a continuous stream of rental income that includes a market level return on the investment; this will bring more steady income to the municipalities and hence act as a counterweight to fixed cost • Operational options within buildings make it easier to maximize rental incomes • If rental incomes are insufficient it is possible to abandon the buildings by selling them on the markets • If the area as a whole turns out to become a highly negative cash flow problem for the municipality the option to re-zone and re-develop the area is possible 	<p>⑧</p> <ul style="list-style-type: none"> • Operational level options to change the functionality of constructed buildings may enable the change of purpose of use, which may make change of purpose an alternative to new, larger, greenfield building construction investments

Table 2. Economic risks facing Finnish municipalities in each of the three stages of the area development projects and possible uses of available identified real options to manage the risks. New risks caused by a possible higher level of involvement in *italics*.

Entering the construction phase as a contractor may be used to generate a new source of income for the municipalities that generates substantial income. At the present this income is reaped by private construction firms and this has aroused some interest in the market situation of rapidly rising property and condominium prices; why have the municipalities played themselves out from this obvious source of income? The answer may be in the "that is how it always has been done" dating from the first area development projects in the mid 1960's; it was then in the best interest of the municipalities to allow constructors build fast and reap profits to ease the large cities' housing shortage – times change...

3. Summary and Conclusions

We have presented Finnish area development projects as multi-million euro long term construction projects that can be divided into three phases according to the activities conducted, and presented each one of the phases: planning & zoning, construction, and post-construction. We have discussed the Finnish situation from the point of view of the involvement of the Finnish municipalities. We presented the present situation, i.e., the traditional policy of involvement of Finnish municipalities in area development projects and discussed it from the point of view of identifying the risks and rewards from the policy. We further discussed the risks and their causes in each of the project phases. Then a short preview of selected articles on real options in land valuation and infrastructure investments was presented. Then we mapped and identified the, for municipalities, available strategic and operational real options in area development projects and discussed them in detail. We compared the available identified real options with the risks of the projects and discussed ways in which the real options can be used in managing the risks. We suggested some examples of new policies for Finnish municipalities' involvement in area development projects. We conclude that by using the available strategic and operational real options Finnish municipalities can decrease their risk level when entering in area development projects.

On a closing note we want to observe that as area development projects are large, multi-million euro projects that have long construction times and very long economic lives, even the fundamentals of the economy may change during the economic lives of these projects. The characteristics of area development projects fulfill the definition of giga-investments presented in (Collan, 2004) and, therefore, can benefit from the use of fuzzy logic as inputs into the modelling of these investments and may benefit from the existing models specially created for giga-investments. If fuzzy logic is used for the inputs then fuzzy real option methods can (should) be adopted to treat the information consistently, this applies also for valuation of real options. Fuzzy real option valuation is a rather new development in the valuation of real option and is presented, e.g., in (Carlsson & Majlender, 2005; Collan, Carlsson, & Majlender, 2003).

The author has been involved in a research project that maps new policy options for Finnish municipalities involvement in area development projects and builds decision support systems for the task of evaluation of these projects. The prototype systems built include NPV and real option analysis functionalities and calculate profitabilities for all the major players in the area development projects, i.e., municipalities, private land owners, and outside developers. The present system prototype includes some 120+ different inputs that are used to get analysis for a total of twenty-one different end scenarios for the post-construction phase, not including the abandonment alternatives. The system will be put to use by a nationally operating financial institution for supporting municipalities and public private partnership projects ex-ante planning of area development projects.

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