

INVESTMENTS UNDER PRESSURE: A REAL OPTIONS APPROACH TO PREPARE FOR EMERGENCY ASYLUM SHELTER IN A MULTI ACTOR SETTING

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This paper presents a study to define the use of real options to be prepared for challenges that arise when faced with rapidly changing conditions, which take on characteristics of an emergency and require investment decisions. Related to time, real options can be used as a time-saving and efficiency-enhancing support for investments decisions in assets in response to fast changing situations. Related to uncertainty, real options facilitate decision makers to acquire more information about this uncertainty before having to make an investment decision. By building option pricing into a decision making framework to evaluate investment opportunities, one can add additional financial insight to the investment decision making process. Pressure on decision making with regard to investments in assets during rapidly changing situations could be reduced or mitigated when the decision maker has developed a set of options. Furthermore, use of real options supports more integral decision making and consequently allows for more focus on efficiency in decision making related to assets. Finally, time can be saved if such a situation occurs.

Keywords: asset, multi-actor decision making, real options, analysis, uncertainty

INTRODUCTION

In 2015 the Netherlands, like many other countries in Western Europe, was confronted with an unexpected inflow of asylum seekers. This flow challenged the multiple parties involved with the provision of asylum shelter to quickly respond and organize shelter capacity for asylum seekers. The government and COA (Central Agency for the Reception of Asylum Seekers) called on regional and local authorities to respond to the need for more shelter capacity and to fast-track the decision making process to build additional capacity quickly. However, the response of local authorities resulted in unrest and heavy resistance amongst inhabitants in those communities, who felt ‘pressurized’ and ‘bypassed’ in the decision making process to develop the shelter capacity. This case powerfully illustrates the “fire-fighting”-like decision making process of the government and other involved agencies to find, finance and build

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shelter for asylum seekers, when confronted with an unexpected, rapidly changing demand for shelter capacity. The aim of this study is therefore to define a framework which can be used to improve the investment decision making process for time pressured situations.

A real options (RO) approach is used to explore how investments for emergency shelter construction could be addressed when faced with time pressure and rapidly changing conditions. Applying an RO approach to decision making situations in which the context of emergency management plays an important role is relatively untouched terrain in construction management literature. Guadard and Romerio (2015) provide recent attention to decision making in emergency situations. They state that decision makers should acquire an understanding of the dynamics of emergency factors at first, followed by taking the optimal decision based on available information. RO can be used in the first phase of decision making, to study the different available options to resolve an emergency (Guadard and Romerio, 2015) and to facilitate decision making when additional information becomes available. RO has been applied in situations of natural hazards, but not yet in emergency construction management (Guadard and Romerio, 2015). Therefore, the applicability of RO to this context warrants further investigation.

The insights from the pressured arrangement of shelter capacity in the Netherlands from 2014 to 2016, show possibilities for application of RO as a financial framework for investment decision making under time pressure. Firstly, RO as a theoretical approach will be presented, followed by the application of RO in an emergency management context. Based on the description of the Dutch shelter capacity case, a new application of the RO approach is presented, particularly how it contributes to decision making on asset investment in a complex network of multiple actors who are under pressure to decide.

REAL OPTIONS ANALYSIS

In general, investment decisions are made by applying a Net Present Value (NPV) rule and a traditional Discounted Cash Flow (DCF) analysis. These are widely known to fail, because they cannot provide managerial flexibility to adapt and revise decisions in response to unexpected (market) developments (D'Alpaos, 2012). Yet, the RO approach addresses investment uncertainty in these decisions by means of flexibility (Dixit and Pindyck, 1994). The RO literature states that an option provides the right to buy or sell an asset at a previously determined price and time period. This results in financial value since it creates an opportunity to remain flexible to perform the investment for a certain amount of time (Brealy, Myers, and Allen, 2014). This financial value of decision flexibility can therefore be captured in terms of time (Trigeorgis, 2007), expansion or abandonment of existing investments.

RO analysis uses the DCF method integrated with decision trees (the binomial method) as a framework (Taneja, Ligteringen, and Walker, 2012). It then seeks to provide a consistent treatment of risk by defining operating rules (D'Alpaos, 2012). The decision trees can be used to discuss possible outcomes of investment decisions with the multiple parties involved. A critical value of the RO approach, is therefore the option for decision makers to wait and see how conditions develop and adapt investment strategies accordingly, leaving only limited sunk costs if the investment is finally abandoned (Lee and Makhija, 2009, 542). In essence, the merit of an RO approach is the inclusion of past, present and future information in the decision.

The applicability of RO has been widely studied for investment decisions in non-emergency situations. For example, Agliardi, Cattani and Ferrante (2018) demonstrate the use of RO as evaluation method by modelling the source of future uncertainty. Specifically, they applied RO to model energy price uncertainty to validate an integrated design methodology, used for the creation of additional volume on existing buildings. In addition to this, Ajak and Topal (2015) have applied the RO approach in a case study to propose a new methodology to explore the technical application of RO in mine design and decision making at the operational level. They apply a case study to demonstrate how RO can be used in designing multiple pits in multi-zone ore deposits to create a switching option between pits regarding ore grades and fluctuating commodity prices. Bowman and Moskowitz (2001) have applied RO in a case study to sum the value of information from the past to decisions in the present. They examined a case where a pharmaceutical company used RO to justify an investment in an R&D project. This case is used to highlight some of the problems associated with using RO. In essence, they noted that assumptions incorporated in most option valuation models can conflict with the conclusions reached by strategic analysis. As a result, users of a RO approach are advised to understand and adapt the quantitative aspects of RO for a customized application for each situation.

The described case studies focus on particular areas where real option application can benefit an organization. However, there are also studies that focus on the decision process. For example, in a case study on firm differences Pandza, Horsburgh, Gorton and Polajnar (2003) use RO as a means to manage capability development. Van Reedt Dortland, Voordijk and Dewulf (2013) recognize in their case study of two health care facilities, that the way in which RO is applied needs adjustments along with various multiple stakeholders, who form the coalition of an investment alternative. The different forms of RO would require customization for organizations to adopt RO (Bowman and Moskowitz, 2001). Therefore, this paper is focused on particular challenges in investment decision processes under time pressure.

Most case studies using an RO approach find the RO merit in the organizations' ability to focus on a source of future uncertainty, decisiveness in the present and the possibility to provide decision information accumulated from the past. The focus on time developments in a specific case study is used to argue the ability to assess whether real option application is suited for an organization to use for enhancing information from the past and making decisions in the present challenged by specific future uncertainties.

Real options under time pressure

On time pressure, Maule, Hockey and Bdzola (2000) state that the imposition of a deadline creating time pressure, induces a number of affective states in decision making, depending on the importance and the extent to which adaptation allows to ensure goals at an acceptable level. Time pressure of decisions is often connected to the speed of developments in a situation towards negative consequences. Kerstholt (1994) describes decision strategies in terms of the time allocated to decision phases and in behavioural indices related to information requests and actions. As time pressure increases, a general speedup of information processing increases, but the decision strategy remains constant, suggesting a decision maker is no longer able to optimally address the decision problems (Kerstholt, 1994). In essence, the decision making process is challenged by pressure when the decision maker is surprised by an emergency. In fact, being prepared for time pressured decision making could improve

the possible negatives of time pressured decision making, as shown by Fiedrich, Gehbauer and Rickers (2000).

RO has the potential to prepare decision makers for challenges that arise during an emergency situation. The key point in the RO approach is the relation between time and uncertainty (Martins, Marques, and Cruz, 2014). Related to time, RO can save time when an investment must be decided during a crisis. Related to uncertainty, RO can provide flexibility to acquire more information about the uncertainty before having to make an investment decision. By including option pricing into a framework which is designed to consider investment opportunities, one can add financial insights earlier rather than later to the asset investment decision making process (Luehrman, 1998). Only a few studies have linked RO to emergency situations. Abadie, Sainz de Murieta and Galarraga (2017) propose an RO approach to study whether an investment to adapt infrastructure is better to be decided in the present or to wait, considering the climate and socio-economic uncertainty on flood risk in the city of Bilbao. Also, RO is proven applicable to project contingencies by Espinoza (2011), who proposes a way to estimate contingency budgets with the help of RO. Tseng, Zhao and Fu (2009) present a similar approach by approaching the contingency budget from the asset owners' viewpoint. Finally, Van Reedt Dortland, Voordijk and Dewulf (2014) propose a method that combines scenario planning and RO to understand the consequences of future uncertainties in real estate investments and address the flexibility in decision making through weighing the pros and cons of flexibility measures. With regards to emergency management in the direct context of asylum shelter, Moretto and Vergalli (2009) link RO to migration policy, although not from the asset owner's viewpoint. Hence, the way in which the RO approach can guide the government with its shelter construction decisions in a multi-actor setting needs to be better understood.

RESULTS FROM THE ASYLUM EMERGENCY SHELTER CASE

For this study, the investment decisions and actions of COA with regards to the migration inflow between start 2014 and end of 2016 were analysed. COA is the agency responsible for the development and construction of shelter locations for asylum seekers in the Netherlands. As this study focused on the applicability of RO in the context of decision making under time pressure, an in-depth case study was performed through the collection of data from COA, publicly available sources and reports on particular challenges that COA faced during and after the refugee crisis of 2015. This information was used as input for a binomial RO model, for the optimal timing of investment decisions and the valuation of options on shelter capacity.

The decisions concerning shelter capacity are however not solely made by COA, but are the sum of various decisions made by various governmental bodies and agencies with various roles. The Ministry of Security and Justice is politically responsible for asylum shelter, but COA is functionally responsible to provide sufficient shelter capacity (Overheid.nl, 2015). In addition to this, the Immigration and Naturalization Service (IND), the Repatriation and Departure Service (DT&V) and Nidos (the child protection service for refugees), are involved with asylum shelter through the asylum application and shelter processes (Bosch, 2016). Moreover, COA is not empowered to open shelter locations without support from municipalities and their citizens. Every available shelter location is the result of an intensive process in which COA cooperates closely with municipalities. However, since COA is responsible as stated by law, this study used COA as problem owner for decision making concerning

asylum shelter capacity. From this perspective, the approach from COA to the multiple actors involved is also important for a successful decision making process.

For this case study, the 2015 asylum crisis is considered as a contextual factor for which a tailor-made RO approach should be developed. No formal state of emergency was declared by the national government however, the situation posed the following challenges for COA:

1. Predicting asylum flows. Estimations on asylum flows were stated in the Multiple year Production Planning (MPP) which specifies amongst others the historic realization of asylum flows to the Netherlands and the expected amount of asylum applications. The MPP was fed by input from related agencies (Bosch, 2016) and takes global politics and migration trends, identified by international organizations, into account. Due to large fluctuations in asylum flows, accurate estimations are extremely difficult to make. Because of this difficulty, COA also makes estimations of the expected asylum flow to determine the required shelter capacity. By comparing the different estimations and discussions with COA, the Ministry of Security and Justice places a capacity order at COA for the following year (COA, 2016). The requirement to compare the different estimations illustrates the unpredictable nature of the asylum flow that COA and other organizations involved in the asylum shelter are faced with.

2. Planning for stable shelter capacity. Based on estimations of the asylum flow, COA must plan the required level of shelter capacity by a system which consists of different types of shelter locations. Using a so-called portfolio approach, capacity is arranged in different ‘shelter layers’ with different ownership types and for different durations, as shown in Table 1. The core capacity consists of locations in ownership of COA for more than 15 years which have a capacity of at least 600 places per location. Typically COA develops capacity in the higher layers if the asylum flow is expected to exceed the available capacity at the lower levels. For example, if the available capacity in the flexible layers is fully occupied, COA will initiate more capacity lasting for up to a maximum of 1 year in the emergency capacity layer.

Table 1 COA capacity layers

Layer	Description of shelter capacity
1 - Crisis emergency capacity	When other capacity layers are no longer available
2 - Buffer	Developed when core, flexible and emergency layer are occupied
3 - Emergency capacity	1 year < used when core and flexible layers are occupied
4 - Flexibility layer	Flexible layer short term 1-5 years / Flexible layer long term 5- 15 years (determined in housing strategy)
5 - Core capacity	15 years > (determined in housing strategy)

Different types of real estate were used as shelter locations: vacant monasteries, barracks, recreational facilities, but also semi-permanent and new buildings (Dijk, 2016). In 2016, about 60% of the shelter locations were owned by COA and consisted of permanent locations (core capacity and flexible layers). The other 40% was rented from private parties or municipalities and semi-permanent (emergency capacity and buffer) (COA, 2016b). Over 2015, COA and other involved agencies found their capacity assignments from the Ministry of Security and Justice for the different capacity layers simply wrong: the capacity which the Ministry of Security and Justice had requested was insufficient to accommodate the asylum inflow (COA, 2016a). Additional buffer and emergency capacity had to be developed to deal with the unexpected inflow. As a result of this inflow, rental prices for shelter locations increased drastically compared to previous years. At the same time, a significant

number of shelter places were 'lost' in 2016 as contracts for accommodation ended, while the new ordered capacity was in either the realization or planning phase (COA, 2016b). This illustrates the challenges COA faces when planning shelter capacity.

3. Capability to respond quickly to new events. When the sudden inflow of refugees started, COA had to make fast decisions to provide sufficient shelter capacity since the core shelter capacity proved inadequate and a new policy and accompanying legislation had to be put in place to increase the shelter capacity (Dijk, 2016). Consequently, COA was forced to adjust its real estate portfolio to adapt to the rapidly increasing shelter demand (COA, 2016b). These efforts took too much time, caused by shortcomings of potential shelter locations, which needed investment and adjustment before the locations could be used (COA, 2013). COA then made concessions and accepted a lower shelter quality in exchange for the needed increase of capacity (Dijk, 2016).

As the demand for shelter increased rapidly, COA and the Ministry of Security and Justice had to rush to close the widening shelter capacity gap. Normally, it takes at least four months to organize the support of governing bodies such as provinces and municipalities and deal with the necessary planning procedures and building permits. However, under time pressure, formalities were dealt with within a few days or weeks instead of months or years (Teeven, 2014). As a result, citizens in the local communities were sparsely involved or even by-passed by their local governments, resulting in local unrest, frustration and demonstrations. The large inflow of asylum seekers in the second half of 2015 forced COA to find solutions which would be both cost efficient for society, to prevent the further loss of public support, and provide sufficient shelter of asylum seekers. It can only be concluded that the agency struggled to accommodate, deal with and involve so many different stakeholders at the fast pace in which the events were unfolding.

4. Shelter arrangement as a time consuming process. COA had to make decisions while considering the effects of various implications which determined the value of the investment of shelter locations and delays in construction development and formal procedures which had to be followed if COA decided to invest in shelter capacity. For instance, municipalities needed to assign a shelter function to locations in its land-use plan, which made COA highly dependent on the local approvals since the final say on the decision to construct a new shelter location rested with the municipal council (CCV, n.d.). After the decision to increase the shelter capacity, it takes time to construct and prepare the location. The more time between the need for additional capacity and the actual provision of the capacity, the less value a location has. Therefore, municipalities also depend on information provided by COA to start the needed procedures. COA thus had a critical reaction time in starting procedures for shelter arrangements.

This section addressed four major challenges COA faced during the migration crisis in 2015. The consequences of these challenges and COA's unpreparedness were primarily financial, since COA had to pay the costs resulting from troubleshooting and coordinating crisis-like solutions to ensure shelter capacity. The next section discusses how RO could address each of these challenges when investments decisions must be made under time pressure and unexpected events.

Real Options Framework for Time Pressured Decision Making

The described case identifies challenges in decision making concerning investments in shelter capacity when faced with unexpected and volatile global events. Table 2 shows an overview of these challenges.

First of all, asylum flows proved hard to predict. Also related to the unpredictable migration inflow, is that future capacity planning appeared incapable to respond to sudden changes causing planning for a stable shelter capacity to be problematic. This reveals an inability to anticipate future events.

Table 2 Challenges related to decision making

Challenge	Description	How RO could address this challenge
1	Asylum flow proved hard to predict	A timing option offers COA flexibility to gather more information
2	The capacity plan was unstable	Expansion and abandonment options offer an adaptable planning to the existing portfolio
3	COA was unprepared to cope with a refugee crisis: fast response was expensive in terms of rushing for short-time solutions	Portfolio could include permanent on-the-shelf capacity
4	Decision making processes to plan for shelter capacity are slow and delicate processes	Ongoing preparation of options by COA by preparing locations with stakeholders. A binomial model can value options when decisions must be made and time value of money can adjust value when decisions move slow

An RO approach allows for the estimation of asylum flows and planning of capacity by COA to capture the value of waiting, and hence introduce an ability to anticipate future events such as a migration crisis with the introduction of various types of options. With regard to uncertain asylum flows, an RO approach entails the creation of a timing option that captures the value of having the option to wait for more information (Trigeorgis, 2007) (see short line in Figure 1).

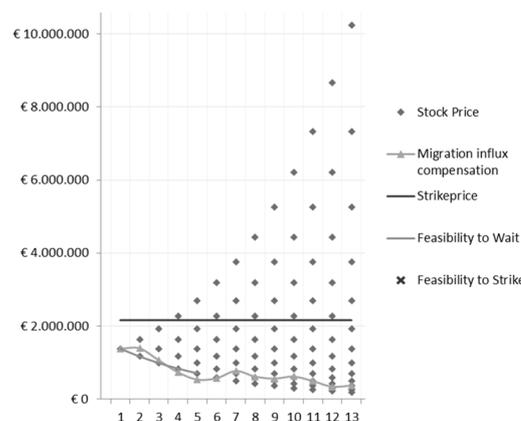


Figure 1 Example of a timing option

This type of option values the right to build a shelter location until the final date to which the option lasts. With regard to the ability to plan for stable shelter capacity, an RO approach entails the creation of a capacity expansion or abandonment option (see table 3). These options mark the value of the right to increase shelter capacity through an additional shelter location if suddenly extra capacity is needed and to abandon the capacity if it appears empty too long and too often (Brealy, Myers, and Allen, 2014).

Secondly, COA was unprepared to respond to a migration crisis as the 2015 case shows. COA showed an inability to accelerate decision making on investment in shelter locations. An RO approach allows for responding to unexpected events and emergencies by means of a permanent development portfolio through which COA can

accelerate the offering of shelter solutions. A development portfolio could provide decision makers with a real-time tracking system of assets and options owned and managed in various stages of completion: a set of assets in each phase of concept, development, construction, and in service. RO thereby provide the possibility for a development portfolio to manage the level of preparedness, considering expected migration demand on the one hand, and having an overview of the shelter development and solutions on-the-shelf, for example as a list of locations at municipalities (see table 3).

Thirdly, COA overcame its unpreparedness by enforcing and speeding up the provision of shelter solutions. This came at an expensive price for COA and partnering agencies, since the solutions were short-lived and caused a lot of public unrest in the localities which were called upon to facilitate the development of new shelter locations. An RO approach can reduce excessive costs by relieving the pressure on the required preparation time to develop new shelter locations. RO can do this by introducing an ongoing practice for COA to prepare locations and decision making with stakeholders.

The preparation of these options can include all the required activities such as permitting and community involvement before servicing the location, which helps to reduce or even eliminate the need to rush development of new shelter capacity. It also allows for time to reach agreement with partnering agencies and collect information about the fitness of the option well before the experience of pressure on these agreements.

Table 3 Examples of expansions and abandonment options

Location	Modality	Shelter Layer	Capacity	Call option value	Put option value
Municipality B	AZC	Flexible short	600	€ 350.752,12	€ 545.446,24
Municipality C	AZC	Emergency	500	€ 169.730,82	€ 1.169.288,97
Municipality D	AZC	Flexible long	864	€ 436.813,13	€ 392.993,56

Finally, COA had to cope with the slow-moving characteristics of investment decision making processes to arrange shelter locations under pressure to quickly solve the capacity shortage. This shows an inability of COA to adapt the decision-making process to the more fast-paced events of a large asylum inflow. An RO approach can adapt the timing and value of decisions in the shelter capacity decision making process (Brealy, Myers, and Allen, 2014). Timing of decisions can be adapted by means of modelling the option values in time-steps that match the formal decision moments of the deciding agency. This is referred to as the binomial option model (Brealy, Myers, and Allen, 2014) (see figure 1). The value of being able to time investment decisions to fast-paced events, can be adapted by including the development time of additional capacity. By use of the NPV of the investment and the time between the investment decision and servicing of the additional shelter, the value of the option on a shelter location can be determined. For example, if the expansion option for a shelter location in Municipality B (table 3) takes a year to build, then the call option value can be computed by servicing cash flows in a year from now.

CONCLUDING REMARKS

An in-depth case study revealed the challenges that COA faced in providing sufficient shelter capacity to asylum seekers during the high asylum inflow in 2015. Through this study is found that an RO approach can introduce changes to the decision making

processes of COA and its partners by which they are better prepared for investment decisions, when faced with fast-paced, unexpected events and dealing with external pressure.

RO allows for the creation of an infinite set of options in a development portfolio. With regard to the investment decision making process, COA could adapt the valuation of the investments in construction projects, to the reality in which the decision moments need to be fed with valuation data. However, the key to success is the connection of the investment decisions to more stable, more transparent and more insightful negotiation processes between COA and its stakeholders. The added value of this study is therefore the explicit relation that is shown between the RO approach and the empirically derived challenges an asset management organization experiences in a real-life case of emergency asylum shelter construction.

The study did not test the actual merit of having such an RO approach in operation. However, it did find plausible connections through which it has potential. A next step to prove the added value would be to develop, apply and validate the RO approach in practice. An application by COA could very well be a useful starting point.

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