THE HOUSING LOTTERY IN SLOVENIA: E-GOVERNMENT PERSPECTIVE

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Abstract. *In this paper we describe a decision support system for selling apartments by The Housing Fund of the Republic of Slovenia to Slovenian citizens. One of the Fund's missions is to balance the demand and supply in the real estate market by offering apartments at favorable prices. Since the Fund's offer represents only a small fraction for the total supply of apartments in Slovenia, a priority ranking is used to establish the preferential order of applicants. In case when two or more applicants fall into the same priority rank, random choice is used to select a single buyer. For this reason, the whole business process is popularly called the Housing Lottery. Since its first use, the described system received tremendous media attention. It implements a complex decision policy that was adopted by the Fund's management. Besides, its main characteristics are robustness, flexibility and transparency. It also relies heavily on interoperability with other e-Government services, as for example, exchange of information with Central Register of Population.*

1. Introduction

The Housing Fund of the Republic of Slovenia was founded in 1991 as one of the requirements of the Housing Law with the intention of financially supporting the Slovenian national housing programme with the idea of encouraging housing construction, renovation and maintenance of apartments and tenement houses. The Fund acquires the essential financial assets from several sources: from state budget, from the earnings of the sales of apartments, as subsidies from local and foreign organizations and as income earned by the Fund's business activities. While in the past decade the resources were primarily earmarked for loans with favorable terms to citizens and non-profit housing organizations [1], in the last few years the Fund's financial motivation has shifted for the purpose of increasing the supply of newly constructed apartments to the housing real estate market as well as encouraging housing savings and granting subventions to young families for their first attempt to consolidate their housing status.

At the beginning of the Slovenian transition period, which immediately followed its independence in 1991, the Fund directly supported citizens' initiative in private housing building by offering them loans under favorable terms [1]. Then, after its first decade of activities, the Fund took part also in encouraging citizens for housing savings in the National Housing Saving Schema [2]. As the product was very successful, an increased demand for housing real estate capacities was expected after a period of five years, which was the shortest

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saving period in which savers could withdraw their money and invest it in housing. Therefore, the Fund began financing also the construction of apartments to boost the supply side in housing real estate market. Moreover, when the new Act in the housing was passed in the Republic of Slovenia [3], the Fund also took a major role in helping young families with subventions when buying their first housing facility [4]. So, balancing the demand and supply in the real estate market while taking into account primarily the social aspect turned out to be the Fund's most important mission in the last few years.

One of the Fund's assignments is, therefore, to construct and sell apartments to citizens at favorable prices. Its strategic goals that support these activities are the following: (1) assuring suitable quality of apartments, (2) assuring larger number of apartments offered to the market, and (3) lowering (or at least stabilizing) the prices of apartments in the real estate market. This assignment turned out to be well received by the general public and consequently, attracted considerable media attention.

In this article we present a decision support system named RSD that is regularly used at the Housing Fund of the Republic of Slovenia, public fund. The system is applied for distributing apartments under favorable prices to citizens according to their priorities. First, we explain the context and the motivation for the underlying business process. Then, we give an overview of the related work that can be found on the Internet. In the technical section we give more detailed description of the implemented decision support system. Next, we present some lessons learned from the completed tenders. Finally, we conclude with emphasizing the most important points from the paper.

2. Business process and information support

In the year 2000 the government of the Republic of Slovenia implemented the Act of founding the Housing Fund of the Republic of Slovenia as a public fund [5]. According to this Act, the Housing Fund of the Republic of Slovenia has continued with its operations as public and real estate fund regarding to the law of public funds and act of foundation. So, since 2001 the Fund operates as a public and real estate fund. Besides assuring beneficial long-term housing loans, the Fund has also shifted its focus to offer commercial apartments at favorable prices to citizens. Since the year 2002, the Fund offered for sale 1.800 such commercial apartments.

In incipient tenders for the sale of commercial apartments the Fund has treated savers of the National Housing Savings Schema (NHSS) [2] as a preferential category. In all completed tenders the inquiry for good locations and lower costs than commercial ones has exceeded the offer. According to prevalent inquiry and the applicants' analysis in later tenders, the Fund introduced additional criteria for ranking applicants. Also, the Fund's policy incorporated further social aspects as for example, the family type and the number of children. In fact, in the tender in year 2004, when the Fund offered 852 apartments, young families and other families with larger number of children were considered as high priority ones within comparable NHSS savers. The shift in the Fund's policy was justified by the reality that one of the main causes for a relatively low birthrate in Slovenia seemed to be difficult access to apartments. Next, relatively high priority was also given to young people, because it is generally accepted in Slovenia that the transition from parents' housing to individual staying is objectively one of the hardest periods in a person's life.

On its 13th plenary session in February 2006 the Slovenian Parliament passed a new updated act called "National Housing Savings Schema and Housing Grant for Young First-time Homebuyer Families Act" [3]. The Act was enforced on March 1st, 2006. In accordance with the accepted law, the Fund has remodeled preferential categories for selling commercial apartments in further tenders. As a result, young families became the highest preferential category.

The business process of selling commercial apartments consists of the following six phases. First, the Fund prepares a proposal for housing sale and publishes it the media and on the Internet. Second, interested applicants fulfill the prescribed form. Third, received applications are identified and validated by the Fund's officers. Next, all complete applications are ranked according to their priority and allowed to participate in the process of apartments' distribution. When two or more applicants fall into the same priority rank, random choice as the fifth phase is used to select a single buyer for each apartment. In the sixth phase, all the applicants are notified about the outcome of the apartments' distribution sub-process.

The whole business process is, mostly due to severe time constraints, very delicate and has to be governed with care. This is especially true for the phases three to six that are well supported by information technology; the information system that supports the business process is called RSD, which are initials from Slovene words for Tender, Apartment and Distribution (in Slovene: Razpis, Stanovanje in Dodeljevanje). Indeed, to maintain high level of credibility, the supporting information system has to provide transparent and comprehensible insight into all phases of the underlying process. Moreover, it has to incorporate several controlling mechanisms that assure the integrity and confidentiality of the processed data. Besides, flexibility and robustness with respect to changes are also desired qualities of the implemented decision support system. To participate in e-Government infrastructure, the system has to incorporate modules for achieving interoperability with other available services in order to simplify the controlling procedures. These requirements turned out to impose high complexity to the system's design and implementation.

3. Related work

The main goal of described RSD system is to find a suitable match between supply of offered apartments and respective demand from applicants. RSD system consists of three main modules: (1) data gathering module, (2) apartments distribution module, and (3) random selection module. The generic problem of matching supply and demand is commonly found in several areas. As a result of our search on the Internet, two similar systems that are regularly used mainly in the USA were found. They are Green card lottery system [e.g. 6] and Student Housing lottery system [e.g. 7].

Each of the compared systems is unique, although we can find some similarities between the corresponding modules. While the Green card lottery system is exact and gives all the applicants the same opportunities, the Student Housing lottery system slightly varies from university to university and gives priorities to certain group of people, which is quite similar to RSD system.

Accuracy of data entry of the applicants in data gathering module is basic for all three programs. Accuracy of data entry in RSD system is ensured by two rule-based expert systems for data and application validation and a doubled data entry in two parallel databases, while applicants for green cards and student rooms write directly on electronic application forms.

This is possible in the latter cases, because there is no special documentation needed to be enclosed, which is quite different to RSD system. As a matter of fact, the Fund has already implemented the relevant web application forms and offered such possibility to applicants. However, due to the inherent complexity of the underlying business process and the quantity of required documents that still couldn't be acquired in electronic form from relevant sources, such approach, instead of simplifying the procedures, turned out to impose additional intricacies. Also, parallel data entry of each of the applicant forms ensures almost 100% accuracy of all data written by applicants.

Considering the diversity of programs, the second module – which is apartment (room) and green card distribution – is more interesting. In case of distributing green cards the situation is not very complicated. Program apportions visa insurance among certain states in six geographic regions, where none receives more than 7% of all visas available. A person can apply just to fulfill certain criteria and no ranking is done. When distributing apartments and student rooms, ranking lists are formed to set priorities and on their basis applicants are divided into priority classes. In both cases higher priority class puts applicant into better position to win. While in RSD system apartment with the best priority is the first to be distributed, in Student Housing lottery system applicant with the best priority is the first to be choosing a room.

Random selection as the third module works very similar in all three programs. The main difference we can notice is that in RSD system and in some cases in Student Housing lottery program, applicants set their 'own lottery numbers', while in green card lottery system that is not the case. This number setting is tricky because it gives inadequate feeling that applicants have some control over the whole process. However, every number written by applicants is later changed into lottery number, which is then used in random selection.

Furthermore, only when distributing green cards, true random selection (lottery in the real sense) is used. Because there are no priority classes set, computer program assigns lottery numbers among all the applicants and the first 50.000 chosen can get their green card. In case of student room and apartment distribution, random selection is used only when there are more applicants categorized in the same priority class.

Beyond the evident differences between the modules of all three programs, there is another one, not directly connected to the program itself. It is the fact that in both comparable programs, applicants can choose other people who can benefit from their winnings; green cards can also be given to applicant's family and student can choose their own room-mates. In the case of apartments distribution this is not possible, because there is only a limited quantity of apartments available and each apartment is assigned to only one applicant.

4. Technical description

In this section we present a technical view of the information system that supports the described business process. First, we recap its six phases and give a more detailed explanation of each one. In particular we concentrate on issues that are important for the overall success of the implemented system. Among others, those issues include presentation of the available apartments on the Internet, handling of uncertainty about the size of the demand, interoperability with other e-Government resources and services, and some technicalities related to the computer supported procedure for the distribution of apartments and the use of random choice in the case of equal priority classes.

In the first phase of selling commercial apartments, the Fund's officers prepare a proposal for housing sale according to operation strategy and valid legislation. After adjustment of tenders' terms and confirmation of wording, the Fund publishes the tender in the media and on the Internet. Furthermore, on the Fund's web pages the entire tender documentation is published and available to general public. In the second phase potential applicants, who are interested in purchase, have to fulfill the prescribed form available at the Fund's web page and submit it accordingly. At the same time, each applicant must pay certain amount of money to guarantee the seriousness of the application. In the third phase, received applications are collected and marked with serial number and date of reception by the Fund. Also, since the majority of applications are submitted via regular mail, the data for each application are entered into two different databases. Such operation was introduced, besides more common ruled-based validation approach, in order to reduce the possibility of making errors within data input. Moreover, every input procedure, processing and verification of the data is by a responsible person is documented accordingly and retained in a special revision trace. This phase includes also the process of data validation, including the relevant data from various e-Government sources.

After the third phase is completed, all applications are ranked according to their priority, so that later on in the fourth phase the apartments are distributed among the applicants with the highest priority. However, when two or more applicants share the same priority rank, a potential buyer is selected by random choice, which represents the fifth phase. This process is particularly important because one of the requirements from the Fund's management was that each random choice has to be proven fair. How the fairness is proven is further described in the technical description section. The last sixth phase is relatively simple: all the applicants are notified about the outcome of the previous phases.

The first requirement originating from the underlying business process is that the offered apartments are suitably presented to applicants. Here, the Fund's management decided to put the presentation of the available apartments on the Internet. In such way, applicants could interactively display ground plans for apartments. Moreover, they could compare two or more ground plans and display apartments in 3D. It is our impression that the high quality of the presentation of the offered apartments substantially increased the number of attracted applicants.

It is commonly accepted fact that uncertainty about the size of the demand typically increases the complexity of the solution. Also in our situation, it was often difficult to estimate the size of the underlying problem. As always when it comes to technology, IT developers prefer fixed requirements and are not particularly keen on introducing new functionality in the middle of the project. Such a phenomenon can introduce severe obstacles in the process of software construction. However, because flexibility and robustness were also two desired virtues of the designed system, we had to spend some extra time and effort to account for large spectrum of possibilities.

By definition, interoperability is the ability of two or more systems, or components to exchange information and to use the information that has been exchanged. With respect to software, the term interoperability is used to describe the capability of different programs to exchange data via a common set of business procedures, and to read and write the same file formats and use the same protocols [8, 9]. In IT we can distinguish between several types of interoperability that can be ranked hierarchically from application interoperability, through semantic and enterprise interoperability to environment interoperability. Most of the up-to-date e-Government interoperable solutions seem to function solely on the application level;

moreover, even on this level they function in a rather fragmented manner. However, we believe that one of the most important challenges in the next decade will be shifting the interoperability paradigm to the level of semantic and enterprise interoperability, which will, among other things, in the long run rely heavily on already developed semantic web, metadata and knowledge management technologies [10].

For communicating with the outside world, the system incorporated also procedures to obtain data from various e-Government sources and services. The most important external source was the Central Register of Population (CRP), whose data were used to control pieces of information that were supplied by the applicants. The integration took part on the data exchange level, where we first prepared the file with applicants' identification numbers, sent it to the CRP via secure channel and, eventually, received their response where the data for each applicant were augmented with additional fields that were used for controlling.

Taking the integration between RSD programme and CRP one step higher using web services offers several additional benefits. First, it ensures high consistency with data given by the applicants. More importantly, it significantly shortens the duration of the data-entry process, allowing the fund's officers to perform additional controls within the same allocated time slot. Also, it offers the possibility to react swiftly and in a coordinated fashion when spotting any differences between the data sources. The only negative drawback is that the execution of RSD programme depends on the availability of external services outside Fund's control; consequently, the robustness of the programme decreases slightly.

5. Lessons learned from completed tenders

In the process of designing and constructing the decision support system for distributing Fund's apartments according to the provisions of the tender, there were several stakeholders that actively participated in all phases of the system construction. Due to the fact that the project had an extremely tight schedule, the inclusion of all the stakeholders was a necessary prerequisite for successful implementation. The stakeholders included system developers, business process owners, and system users. Although the project was more difficult to manage because of such inclusion policy, it turned out that we were able to produce the desired outcome faster and in a more reliable manner than otherwise.

To stress the importance of RSD programme working effectively, we show the increase of the number of applicants for Fund's apartments in the last four tenders. The trend shown in Figure 1 is quite alarming. Here, a proper response of the Fund's management would be evidently to increase the number of available apartments in tenders. However, the success of such task depends not only on the Fund's officials but also on other influential factors outside Fund's control. Note that the tender SF was relatively small and can be disregarded when estimating the general tendencies.

»What are my chances?« is the most often asked question by applicants in every tender. For that reason, the Fund on its web site announced a distribution of interest for each apartment according to main and additional requests including the highest preferential category. In spite of correct handling and detail explanation of allocation system and random selection of preferential categories, some individuals misunderstood the explanation and were consequently unpleasantly surprised by the results. In addition, the revealed interest after certain apartments caused an avalanche of applicants' wishes to displace main and additional requests, which was no longer possible in this phase. So, deciding how, when and which

information to expose to general public turned out to be one of the most crucial decisions during the whole business process.

Because of greater demand than supply of offered apartments, the main goal of the Fund's underlying business process is to assure the correctness of information and consequently, allocation of apartments to applicants with the highest priority. Every applicant can submit only one application, in which one major request for apartment and arbitrary list of additional requests are identified. When the data entry and data validation phases are completed, every applicant is notified about disentanglement of respective application. The applicants are therefore, invited to verify their data and, in case of any imperfections, to supply the relevant corrections. Verification of data is of utmost importance, especially because of its influence to applicant's priority class. Besides, the list of apartments that are marked on each application plays a substantial role in the process of apartment distribution. Any errors in this list can have dramatic effects in the corresponding process.

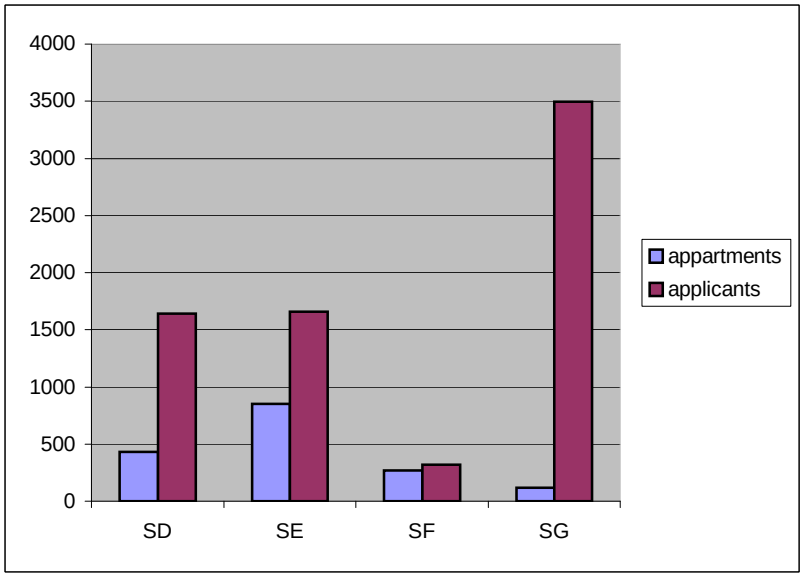

Figure 1: Supply of offered apartments and demand of applicants in the last four Fund's tenders. The tenders are labeled SD, SE, SF and SG, respectively.

The process of distribution of apartments is carried out at the Fund's headquarters in the presence of notary, five-member randomly chosen commission among applicants and the Fund's commission, which is selected by the Fund's director. The Fund's commission is formed of employees, which are not included in any of preceding process of input or data processing and do not have access to the data-bases and applications. The purpose of such arrangement is to alleviate any possible doubt in correctness and consistency of the carried distribution process. Also, used random number generator is published in a prominent literature [11]. After the selection of buyers for apartments is completed, every applicant is notified about the outcome of the distribution process. Whereas for the selected buyers the amount of money paid when sending the application form is transferred to their purchase account, not selected applicants receive their money back to their bank accounts. The Fund then prepares and closes the contracts for apartment purchase with the selected buyers. The data about selected buyers are then automatically transmitted into a separate computer application, which is used also for payment tracking with respect to the contract time limits and amounts.

6. Conclusion

Distribution of apartments under favorable prices by the Housing Fund of the Republic of Slovenia, public fund is very well media supported, which is one reason more why RSD system presented in this paper is so important. The system was designed in a flexible and robust manner. Also, one of the design objectives was an intuitive user interface that simplifies the use of the system and improves the users' learning curve.

RSD system consists of several modules that contribute to successful use in practice. First, it includes two rule-based expert systems for data and application validation. This technology is regularly used in the Fund's applications and can, therefore, be considered as and example of good practice. Also, the system enables data exchange with other e-Government services, like exchange with the Central Register of Population. Here, interoperability is spotted as one of the key success factors in implementing effective IT solutions for e-Government.

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