Factors Influencing Forecasting of Approval Time for Building Plans in Israel: Unveiling Insights for Urban Development

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Abstract

The approval process for building plans exerts a profound impact on our society. Understanding the factors that contribute to accurately forecasting the approval time for building plans in Israel is pivotal for enabling informed decision-making and gaining foresight into the future urban landscape. This work delves into the exploration of key elements that aid in predicting the time it takes to approve building plans in Israel, shedding light on the underlying dynamics that influence the process. By leveraging machine learning models and analyzing relevant factors, we uncover valuable insights into the determinants that shape approval timelines. Our study pioneers this investigation, focusing on uncovering the factors that play a crucial role in forecasting the approval time for building plans in Israel. The findings from this research offer essential knowledge to stakeholders, policymakers, and urban development professionals, facilitating informed decision-making and enabling a better understanding of the approval process for building plans in Israel.

1 Introduction

The process of obtaining approval for building plans in Israel holds significant implications for various stakeholders, including civilians, professionals, and policymakers. Accurate forecasting of the approval time for building plans is crucial for enabling informed decision-making and gaining insights into future urban development. This work presents a comprehensive analysis conducted as part of the "Meirim" NGO's initiative to provide processed and accessible data regarding building plans in Israel.

"Meirim" is an NGO dedicated to enhancing transparency and accessibility in urban development processes. By leveraging their extensive database, which includes plans' metadata, plans' actual content extracted from mined PDFs obtained from from Mavat (Planning Administration), and socio-economic statistical data sourced from the Central Bureau of Statistics (Lamas), this work seeks to contribute to a deeper understanding of the factors influencing the forecasting of approval time for building plans. Furthermore, we have developed a forecasting model that surpasses random guesswork, enabling us to make predictions regarding the time it takes for building plans to obtain approval.

This research not only demonstrates the efficacy of our forecasting model but also seeks to provide the features that leads to its success. Through the identification and analysis of various determinants, including geographic data, socio-economic data, and proposed area changes in the plan, our aim is to uncover the underlying influences that shape the timelines for approval.

2 Building Plans in Israel

Obtaining approval for building plans in Israel is a complex process, as an approved plan is legally mandated. Modifying an approved plan is typically permitted only under specific circumstances and is subject to strict limitations.

All building plans in Israel are uploaded to the Mavat system [1], which serves as a central repository for these plans. The life-cycle of a building plan involves submitting the plan to the local or regional committee, followed by deliberations that can lead to significant modifications. Subsequently, there is a phase for public objections, followed by further deliberations, ultimately resulting in either the denial or approval of the plan.

Building plans in Israel are accompanied by a wealth of associated data. This includes details such as the plan's name, geographic location, city, a short description, proposed changes in square meters (e.g., additional residential or commercial space), various documents such as trees annex, building annexes, traffic annexes, and more, as well as the building plan instructions. The building plan instructions are organized and consist of multiple tables. In this work, we will analyze a subset of these tables, focusing on those that are most relevant to our research.

Table 1.8 presents information on individuals or companies with vested interests in the building

plan. It includes the plan's submitter, initiator, and the professionals involved in its development. Another important table, Table 4, describes the permitted uses of different areas within the plan. For instance, it may specify that commercial establishments are prohibited in residential zones or that an area designated for public institutions must include a school.

3 Related Works

This study is pioneering in its examination of the approval timelines for building plans on a large scale, utilizing web-scraped data. Previous research in the field of urban planning has delved into specific aspects of building plans in Israel, focusing on particular plan categories. Mualam et al. [3] present insights into the approval process in Israel, highlighting that plans falling under the Supertanker track, designed to address the housing crisis, receive approval three times faster (12 months compared to 35 months) than others. Similarly, Alterman [2] investigates the impact of the significant immigration wave to Israel in the 1990s. The study reveals that due to the slow pace of planning authorities and the risk of leaving citizens homeless, Housing Minister Sharon intervened, initiating the formulation of special regulations to expedite the approval process.

4 Methods

4.1 Determining the Approval Date

Building plans in Israel exhibit various statuses, which can be categorized into six distinct groups: Public objections and comments, On the committee's table, Cancelled plan, Agreement in principle, Approved plan, and Plan preparation. Prior to this project, the task of mapping the original statuses to these grouped statuses was undertaken by Meirim.

To determine the approval date for each plan, we consider its first and last status updates. To ensure the validity of the data, we carefully check for inconsistent statuses or plans that remain unfinished. Specifically, we verify that the first status is either "On the committee's table" or "Plan preparation," and that the last status is "Approved plan." Plans that satisfy these criteria are retained for further analysis.

4.2 Features Extraction

We extracted features from multiple groups.

Committee Features. The committee, whether local or regional, was represented as one-hot encoded features in our analysis.

Area Changes as Features. For our analysis, we employed the proposed area changes within the building plan as features. Each entry corresponding to an area change includes information about its current approved usage (e.g., residential, commercial, etc.), the proposed modification by the plan, and the state of the land after the plan's execution. Since the list of possible area changes is finite and predetermined, we created a vector where each cell represents a specific change in state for a different possible area change. We deliberately excluded two infrequent possible area changes from our vector, considering their limited occurrence in the dataset.

Plan Geographic Features. For the plan geographic features, we employed the centroid of the plan's polygon (or multi-polygon) as a location indicator. Additionally, we considered the plan's area, measured in squared meters, to gain insights into its spatial extent. Furthermore, the plan's city information was incorporated using one-hot encoding. The 20 most common cities were assigned individual columns, while all other cities were represented in an "other" column. This approach allowed us to effectively represent the cities in the dataset while managing the dimensionality of the feature space.

Plan Submitter Features. Table 1.8.1 comprises essential information regarding the plan submitter. From this table, we extracted two columns: name and type. For the name column, we selected the nine most frequently occurring non-empty names, which are found in Appendix A. Subsequently, we constructed a vector for each plan, employing a Bag of Names approach, where each name has its dedicated column. A value of 1 indicates the presence of that specific name in the plan, while 0 signifies its absence. Additionally, we introduced an "other" column, marked as 1 if a submitter name outside the nine most common names was present, and 0 otherwise. Similarly, for the type field, we identified the eight most common non-empty types. The eight most common types are found in A. We employed the same Bag of Names approach as used for the name field.

Allowed Usages Features. Table 4 presents the allowed usages for each land use, represented as a list of usages separated by commas. To quantify this aspect of Table 4, we computed the comma count for each usage within the plan, considering two hypotheses. The first hypothesis postulates that a plan with a greater number of possible usages is more complex and, consequently,

may take longer to receive approval. The second hypothesis likens this list of usages to a grocery list, suggesting that the number of usages might not significantly influence the plan approval process.

Statistical Area Features. The Central Bureau of Statistics has partitioned Israel into small polygons, each referred to as a statistical area. These statistical areas serve as the basis for conducting surveys that yield valuable data, such as population numbers and age distributions, the count of males and females, the socio-economic cluster of the area, the city or settlements it encompasses, as well as its socio-economic index and ranking. A single building plan may apply to multiple statistical areas, prompting us to aggregate certain features. Specifically, we sum features related to population counts across all the statistical areas associated with a particular plan. For features related to socio-economic rankings, we take the mean across all relevant statistical areas.

5 Results

5.1 Exploration

Figure 1 shows that some building plans are approved very fast (less than 6 months), while some are approved in a very slow manner, even in more than 60 months (5 years). We can see that most of the plans get approved between 10 and 20 months.

Figure 2 shows that local committees approve plans faster than regional committees. Plans are usually smaller and some plans are promoted by the city that the local committee is from, which naturally causes the approval to be faster.

Figure 3 shows that the size of the plan affects the time that it takes for a plan to be approved. Plans with bigger areas take more time to get approved.

Figure 4 shows that building plans in some cities like Haifa, Petach Tikva and Jerusalem takes a lot of time to get approved while on the other hand building plans in Modiin Makabim Reut and Kfar Kasem are getting approved very fast on the average case, in less than a year. In all the other most common cities, it takes around 500 days to approve a building plan on average.

5.2 Most Important Features

We will rank the important features by training a Random Forest classifier and utilize its feature importance scores to assess the significance of each feature. In order to mitigate data noise and outlier impact during training, we employed the com-

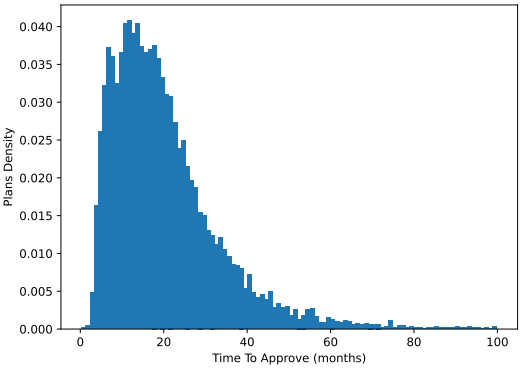

Figure 1: The distribution of time to approve building plans in Israel

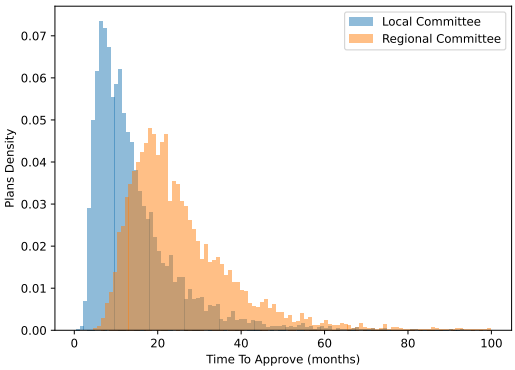

Figure 2: The distribution of time to approve building plans in Israel for local committees and regional committees

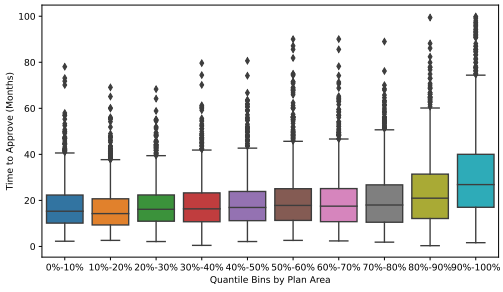

Figure 3: Time to approve plans split by the plans' area, each bin contains 10% of the plans and they are split by the plans' area.

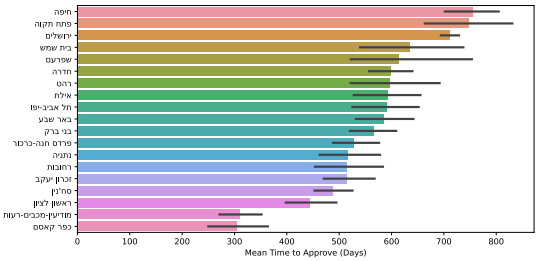

Figure 4: Mean and standard deviation of time to approve plans in the 20 cities or settlements that had the most building plans in their land.

puted features for forecasting the plan's approval timeframe within monthly bins, as opposed to directly regressing the precise days or months to approval. These categories were established by dividing the approval timeframe into five equal-count bins based on the data. The classification model, encompassing all the features, achieves an accuracy of 37.65% compared to a base-rate of 19.61%.

Analyzing the confusion matrix in Figure 5, we observe that our classification algorithm performs exceptionally well in identifying plans with significantly shorter (less than 10 months) or longer (more than 33 months) approval times. However, it encounters some challenges in accurately classifying plans within the middle range.

This algorithm holds great value, as extended approval durations entail higher expenses and, in certain cases, longer waiting periods for the public to experience improved quality of life, particularly in urban renewal scenarios. By predicting plans that will experience swift or protracted approval timelines, decision-makers can better plan and enhance the city's future development.

The 15 most important features can be seen in Table 1. We can see that latitude and longitude are the most important features by a big margin. After that we can see features related to area changes in residence areas, committee type and then socio-economic features. Allowed usages features and plan submitter features are not present in the 15 most important features.

6 Conclusions

This study successfully demonstrates the feasibility of forecasting the time required to approve building plans in Israel to a certain extent. The research highlights that the plan's location significantly influences this forecasting, alongside other features, including requested changes to the residence area, the specific committee handling the plan, and various socio-economic aspects.

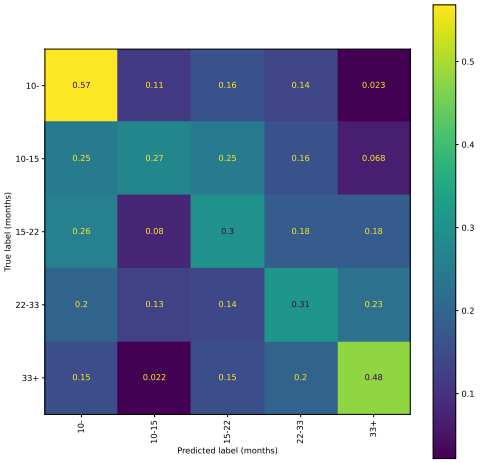

Figure 5: Confusion matrix for classification based on all the extracted features.

Feature	Importance Score
latitude	0.0363
longitude	0.0343
residence(sqm)_total_in_detailed_plan	0.0299
residence(sqm)_change_to_approved_state	0.0292
is_regional_committee	0.0261
residence(sqm)_approved_state	0.0257
is_local_committee	0.0250
population_aged_85_up	0.0230
rank_2019	0.0225
index_value_2019	0.0220
residence(units)_total_in_detailed_plan	0.0213
population_aged_15_19	0.0209
population_aged_65_69	0.0207
population_aged_30_34	0.0206
population_aged_10_14	0.0205

Table 1: Importance Scores of the Top 15 Features

By leveraging data-driven approaches and analyzing crucial factors, such as geographic and socio-economic variables, this work provides valuable insights into the approval timelines of building plans. These findings contribute to a better understanding of the approval process and can aid stakeholders, professionals, and policymakers in making informed decisions in the domain of urban development. The ability to forecast approval times can have profound implications for efficient resource allocation and improved urban planning strategies.

7 Acknowledgments

I want to thank Meirim's team for enabling this research. Their hard work over multiple years, especially in creating Meirim's crawler and collecting essential data, laid the foundation for this study. Special thanks go to Dror Givton, Meirim's product manager, for recognizing the significance of exploring building plans approval time in Israel and identifying the need for this research to benefit both Meirim and the public.

I would also like to acknowledge the contribution of ChatGPT, which was utilized to enhance the writing quality in this paper and played a role in generating part of the code used for the analysis.

References

[1] Mavat - israel's planning and building authority.

[2] Alterman, R. Can planning help in time of crisis?: Planners' responses to israel's recent wave of mass immigration. *Journal of the American Planning Association 61*, 2 (1995), 156–177.

[3] Mualam, N. Playing with supertankers: Centralization in land use planning in israel—a national experiment underway. *Land Use Policy 75* (2018), 269–283.

A Appendix - Plan Submitter Features

The plan submitter most common names are: Local Authority, local council, Government company/corporation, Israel Lands Authority, Ministry of Construction and Housing, Nature and Parks Authority, Ministry of Agriculture, local committee - local committee, local authority - local authority.

The plan submitter most common types are: Private, Local Authority, Other, local council, Government company/corporation, Israel Lands Authority, represents in force, Ministry of Construction and Housing.