

Enhancing Alumni relations through database: The time-series model for graduates in Kazakhstani university

Yekaterina Smolyakova^a, Assem Syrlybay^b

^a *e.smolyakova@kbtu.kz*

^{a,b} *Kazakh-British Technical University, Tole bi 59, Almaty, 050000, Kazakhstan.*

Abstract

The study examines the potential for growth in the alumni association membership through the increasing number of university graduates. This study focuses on utilizing time series analysis and ARIMA modeling to forecast the number of alumni members in a university association. The growth of student enrollment presents significant potential for the expansion of the alumni association. However, the research reveals that the ratio of alumni association members to the total number of alumni is relatively small for the university under investigation. A literature review corroborates that the comprehensiveness of the university's graduates' database directly influences the willingness of alumni to participate in events and subsequently join the association. The results highlight the paramount importance of improving the database to enhance the conversion rate of alumni into association members. The forecast from two models demonstrates that an enhanced database would lead to an approximately twofold increase in the number of association members. However, a limitation of this study is that the quantitative analysis based on forecast models does not provide specific guidance on how to improve the database or predict the positive or negative effects of potential changes. Further research is required to identify specific strategies for improving the database, such as updating contact information and updating employment records, to foster greater alumni participation and increase the number of active association members.

Keywords: Alumni association, alumni database, time-series analysis, alumni management, graduates participation, alumni participation rate.

1. Introduction:

In the era of digitalization, universities have become reservoirs of invaluable data that can shape the prospects of future generations. Graduates are the cornerstone of any academic institution, representing the epitome of achievement and the embodiment of its core ideals. As technology advances, harnessing the power of a comprehensive database dedicated to tracking and documenting the journeys of these graduates has become a priority. This article delves into the significance, benefits, and challenges of establishing a university database of graduates. It explores its potential to revolutionize how higher education institutions connect and support their alum network.

Historically, universities have held a wealth of information about their graduates, but the organization and accessibility of this data have often been haphazard. Alumni associations and development offices have relied on manual record-keeping methods, resulting in limited insights and a disconnect between the institution and its graduates. However, with the advent of sophisticated information systems and data management tools, universities can unlock the latent potential within their graduate database and enrich the lives of current and previous students.

A university database of graduates primarily aims to provide a centralized repository for comprehensive student records, facilitating efficient management and accessibility of alumni information. By

implementing such a system, universities can streamline communication channels, enhance alumni engagement, and foster robust networks that benefit graduates professionally and personally. Additionally, this database opens up opportunities for targeted fundraising efforts, career advancement services, and alumni mentoring programs, truly harnessing the power of a tight-knit community rooted in academic excellence.

2. The environmental context

To enroll in a bachelor's degree program in Kazakhstan, the enrollee must graduate from high school, which is 12 years of education. Students enter university at the age of 17-18 and can receive a free education if they have good results in school and pass national testing. The government offers grants for university studies, but high school graduates must score the highest on the school's united national testing. Also, for admission to the university, additional academic requirements for some programs and knowledge of the English language are required, for example, when studies at the university are conducted in English.

When considering the local context in the country, it is important to understand that students in Kazakhstan and society traditionally view education as all services provided by the state and society. About 70% of all schoolchildren enter universities to continue their studies to receive higher education. In Kazakhstan, statistical results from 2021 represent that 66% of admitted students received government grants, and 34% chose to study on a paid basis. About 160,000 students enroll in the country's universities every year, then 5000 applicants to the university under the research study represented by 3,1% of the number of all applicants in the country (Bureau of National Statistics of Kazakhstan, 2023).

3. University profile

The university under the given study is one of the leading technical universities in Kazakhstan, located in Almaty. Founded in 2001, it is a world-class university engaged in modern research, education, and training of the scientific elite and highly qualified personnel for various sectors of the world economy. The university employs more than 650 people, including 41 percent professors, about 7166 graduates for 2023, and 5270 registered students for 2023, including 120 international students. The partners of the studied university, together with the global academic community and corporate and government sectors, consider the fundamental values of quality, academic integrity, and openness.

4. Literature review

Creating a successful university-to-alumni link can be challenging if the university does not know where students are and how to contact them. For instance, in many universities in Kazakhstan, information about graduates is not publicly available, and some official records and other informal data are stored in correspondence and files of faculty and staff who previously communicated with graduates in any given university.

In recent years, an emerging solution for universities that integrates alum relations is databases. These digital platforms have evolved from simple contact repositories into comprehensive systems that offer universities a wealth of possibilities. From tracking alumni activities to facilitating targeted communications, alumni databases revolutionize how universities engage with their former students (Bista et al, 2021).

For instance, some Western universities have the advantage of having a university database where all students and graduates are registered. In comparison, in a paper (Ebert K, 2015), a Swedish university has a database connected to the national population registration system and contains the home addresses of graduates in Sweden. Unfortunately, universities in Kazakhstan do not have a national database of valid email addresses. However, organizing it based on the state platform (electronic government) or within the

framework of any other database would be a great and effective idea. Such an idea, of course, would have high implementation costs but would solve many current issues regarding communication between the university graduate and the employer. One can also consider, as an example, American Ivy League universities, where specially created applications and groups on AZ social networks such as Facebook or LinkedIn are used to register such data (Dela Cruz A. et al, 2020).

Another equally important problem worth mentioning when discussing student registration in university databases is that students themselves often change their phone numbers, residential addresses, and even countries of work. This problem is more relevant specifically for university under research since its diploma has a highly positive status among international companies in Kazakhstan. According to the survey results, more than 60% of university graduates work in such corporations. Also, effective career advancement is important for a graduate, as graduates often try to change their place of work in the first 5-7 years after graduation in order to gain diversified experience in different companies. This strategy for the behavior of graduates in the labor market has a positive effect on their geo-mobility and, accordingly, on the frequent changes in their contact information.

Initially, university graduates are contacted by email, but they can also provide information about their place of work and personal phone numbers for registration in the University alumni database.

Having a comprehensive database is essential for any alumni relations program because it allows you to collect and organize alumni data, tracking their participation over time. This historical experience is critical to focused efforts to increase engagement, recognize alumni's contributions, and provide them with volunteer and philanthropic opportunities that align with their interests and prior involvement. Moreover, it is important to note that after graduating from the university, for the first few years, students are very closely connected with the university's career center, as they are in search of work and possible vacancies for their future careers. During this period, the graduate has a strong interest in ensuring that his contacts in the database are up to date. There is also a tendency among fresh graduates that the weaker the graduate's interest in possible vacancies, the weaker the desire to maintain contact with the university and update information about themselves in the university database (Cowell-Lucero, J. et al, 2021).

5. Methods

In the study, researchers used the ARIMA model, which stands for Autoregressive Integrated Moving Average, a widely used forecasting method in the field of statistics. It is particularly applicable to time series data, such as student enrollment trends in universities (Onyeka-Ubaka, J. N. et al 2017; Qin, L. et al., 2019).

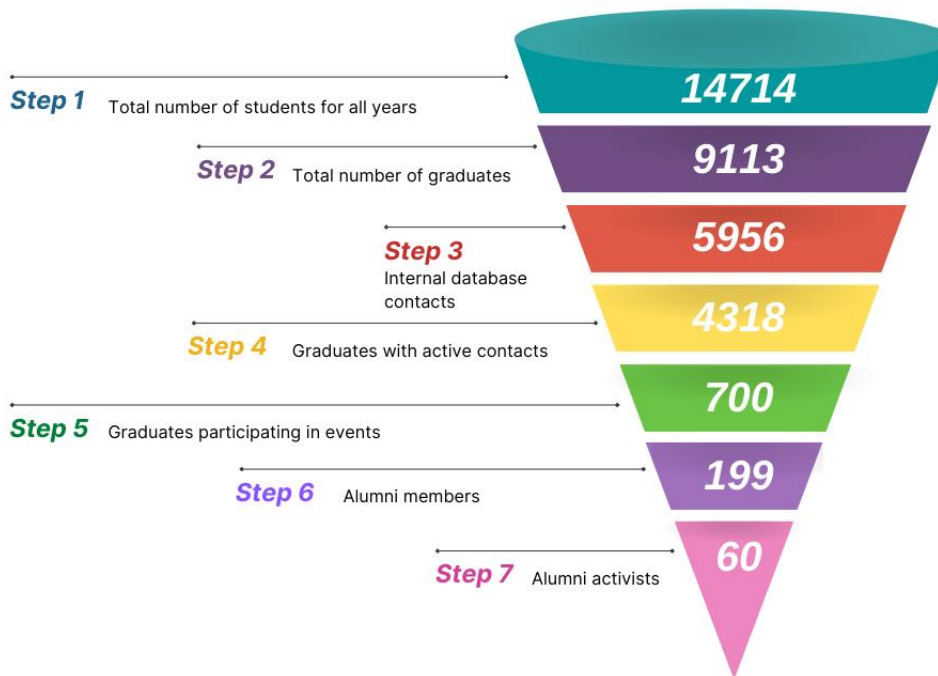
The ARIMA model consists of three main components: autoregressive (AR), differencing (I), and moving average (MA). The autoregressive component captures the relationship between the current observation and a certain number of past observations, predicting future values based on these past patterns. The differencing component deals with the non-stationary nature of the data by taking the difference between consecutive observations, thus creating a stationary time series. Finally, the moving average component considers the relationship between the current observation and a specific number of past forecast errors.

Applying the ARIMA model to student enrollment forecasting involves identifying appropriate values for the three components. This is done through analyzing the autocorrelation and partial autocorrelation functions of the enrollment data, as well as conducting unit root tests to determine the level of differencing required (Onyeka-Ubaka, J. N. et al 2017).

Once the ARIMA model is fit to the training data, it can be used to make predictions on future student enrollment numbers. These predictions can serve as valuable tools for university administrators,

allowing them to anticipate and plan for changes in student enrolment, allocate resources more efficiently, and make informed decisions regarding the admission process. For the purpose of the study, we obtained data on the total enrollment of students at university from 2002 to 2023, sourced from the registrar's office of the university.

Fig 1. Relationship funnel from university graduation to alumni membership



For the analysis, we focused solely on the data pertaining to the complete enrollment of students at given university, which includes undergraduate, master's, and doctoral programs. A total of 14,614 students were enrolled, encompassing both new and graduating students. At the time of conducting the research, the total number of graduates from the university amounted to 9113 individuals. Out of this quantity, the university possesses contact information from 5956 individuals in its internal database, which is 65% of the total number of graduates. Partially, contacts are inactive, as graduates may have changed their email or cell phone numbers. Additionally, graduates often change their workplaces and do not provide updated information to the university. There are actively engaged contacts from 4318 individuals, at least on communication method hold updated (email, cellphone, or workplace). If the university is willing to utilize its database to notify graduates about events and conferences, the graduates who receive the messages usually attend and participate. On average, there are 700 such graduates per year., which is 16% of the total active contact from the internal university database. On the other hand, there are 199 individuals who are members of the alumni association, with only 60 of them actively participating in the association's management processes (30% of the total number of alumni members).

The university has been steadily developing its internal databases since 2020. The number of registered graduates in the email database increased from 500 to 5,000 between 2018 and 2023, with a further

5956 current students registered in a separate inner database. The university also uses Telegram messenger (which is *cloud-based instant messaging application*) chats to stay in touch with alumni: about 600 people have involved for alumni community and about 4350 people in the university based career-community. Additionally, there are dedicated alumni groups on Facebook, although these are not currently organized or monitored by the university, but are used by alumni relations coordinators to promote alumni events and career days. The research found high activity among graduates on LinkedIn's professional social network. About 4,600 registered university graduates out of 9113 are present on this social network, and approximately 30% can be called active.

The research included 21 data points over time, specifically considering student enrollment in the undergraduate program. This sample size provides sufficient data for constructing a reliable ARIMA forecasting model (IBM SPSS). In addition to data on undergraduate enrollment, we also acquired information on the number of students who successfully graduated from the university until 2023.

Furthermore, researchers gathered data from the university's internal database, which was divided into two components: the Career Center for graduates and the internal student registration database. Finally, as part of the information-gathering process for the model, the alumni association's records were reviewed, and data on the overall number of association participants categorized by graduation year was collected. The percentage of graduates who received information through the database was determined.

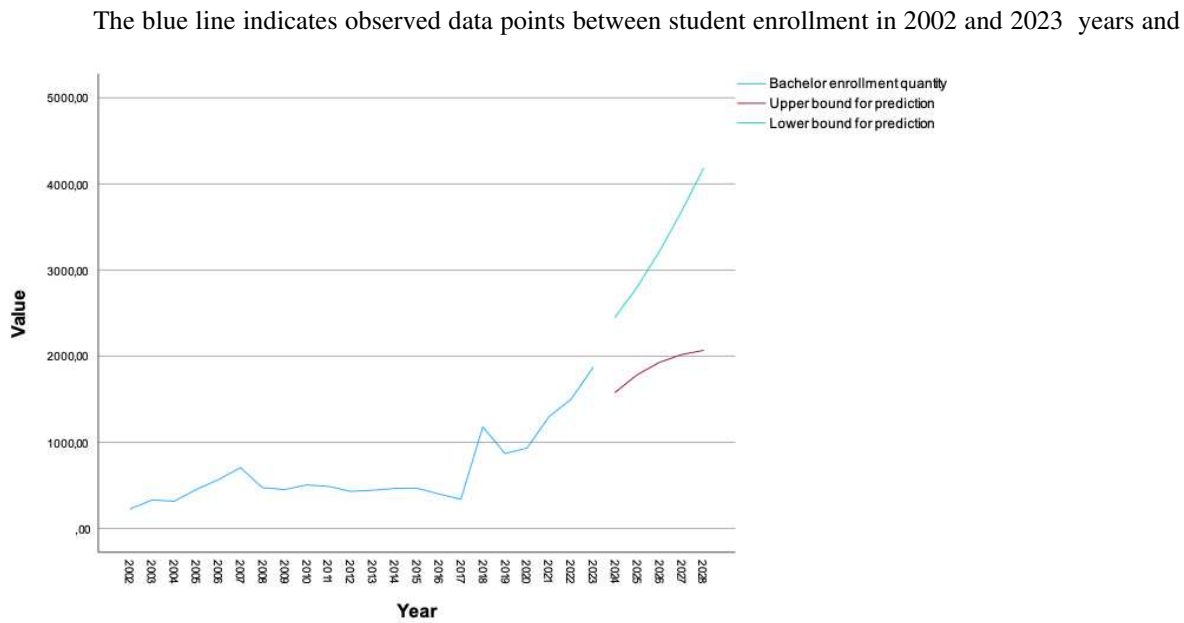
Table 1. Model Statistics

Model	Number of Predictors	Model Fit statistics		Ljung-Box Q(18)	
		Stationary R-squared	Normalized BIC	Statistics	DF
Graduates Model 1	0	-0,042	9,838	24,444	17
Contact-phone Model 2	0	0,524	9,711	.	0
Contact-mail Model 3	0	0,303	9,860	.	0

Exponential Smoothing Model Parameters				
Model	Estimate	SE	t	Sig.
Graduates Model 1	0,829	0,216	3,844	<,001
Contact-phone Model 2	0,359	0,099	3,643	,002
Contact-mail Model 3	0,529	0,110	4,793	<,001

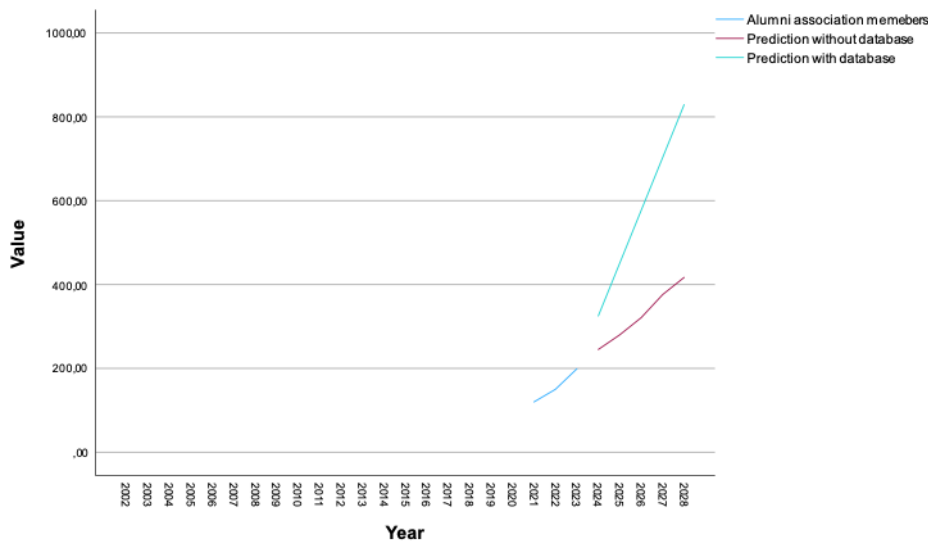
ARIMA (3, 2, 0) model was identified and chosen as the best model as compared to other ARIMA models because it has the lowest Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC). Parameters for ARIMA (3, 2, 0) were statistically significant since the p-value was less than 0.02 for all parameters.

Fig 2. The ARIMA forecasting model 1 for student enrolment.



forecasted data bounds after the 2023 academic year; green and red lines demonstrate prediction intervals. The uncertainty of the forecast is high; the forecast interval in 2028 will range between 2000 and 4000 people at a 95% confidence level. The trend is upward-sloping, meaning that, on average, the predicted values will increase. It is shown that enrolment of students is above the average level, indicating high enrolment levels for four predicted years.

Fig 3. The ARIMA forecasting model 2 for Alumni Association membership



The blue line indicates registered alumni members in 2022-2023. The green and red lines depict the forecast number of members, assuming and without improvements in university database management. The red line represents the likely scenario for the growth of the number of association members if the university maintains the current state of its database. The blue line signifies the potential growth for alumni involvement in the association.

6. Conclusions

Researcher used IBM SPSS modeling process to conduct forecasts for the number of alumni members in the university of Kazakhstan from 2024 to 2028. Based on the ARIMA forecasting models applied to the historical data of the number of enrolled students and alumni members in the university, it can be concluded that the models effectively capture the underlying trends and patterns in the data. The models show a significant level of accuracy in predicting the future number of alumni members.

The forecasting model 1 constructed for student enrollment quantity to university for four years from 2024 to 2028. It showed that the enrolment rate is above the average level, and both boundaries are upward sloping, indicating a rise in enrolment levels for four predicted years. Forecasting model 2 was run under two different assumptions: will the university improve inner database processes (personal emails and cell phone numbers), or will it remain the same. Additionally, the models provide insights into the factors influencing the growth or decline in the number of alumni members.

The growth in the number of incoming students represents significant potential for the alumni association's expansion. However, the study reveals that the ratio of association members to the total number of alumni is very small for this university. The literature review for this research confirms that an effective university database directly impacts the alumni's willingness to participate in events and subsequently join the association. The primary findings of this study emphasize the need for the university to improve its database in order to increase the conversion rate of alumni to association members, and achieve higher rates for cell phone numbers and active emails of graduates. The forecast of Model 2 indicates that an enhanced database will lead to nearly a twofold increase in the number of association members.

The ARIMA forecasting model demonstrates its efficacy in predicting the number of alumni members in the university accurately. It offers valuable insights for strategic planning and resource allocation in alumni engagement and management initiatives. One possible limitation of this study is that the quantitative time-series analysis based on forecasting models ARIMA does not provide specific guidance on how to improve the database and what changes will have a positive or negative effect.

Further research is required to identify specific strategies for improving the database, such as updating contact information and updating employment records, to foster greater alumni participation and increase the number of active association members.

References

- Bista, B., Shakya, A., Joshi, B., Pokhrel, A., Dangol, L., Kedia, M., & Sagar Baral, D. 2021. An Alumni Portal and Tracking System. *Journal of the Institute of Engineering*, 16(1).
- Bureau of National statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan. Postgraduate education in the Republic of Kazakhstan (At the beginning of the 2023-2024 academic year) URL: <https://stat.gov.kz/ru/industries/social-statistics/stat-edu-science-inno/publications/3921/>
- Chen, Y. A., Li, R., & Hagedorn, L. S., 2019. Undergraduate international student enrollment forecasting model: An application of time series analysis. *Journal of International Students*, 9(1), 242–261. <https://doi.org/10.32674/jis.v9i1.266>
- Cowell-Lucero, J., Westfall-Rudd, D., Rudd, R., & Whittington, P., 2021. Good practices of alumni relations professionals leading engagement programs and volunteers in colleges of agriculture at land-grant institutions.

- Ebert, K., Axelsson, L., Harbor, J., 2015. Opportunities and challenges for building alumni networks in Sweden: a case study of Stockholm University. *Journal of Higher Education Policy and Management*, 37(2), 252–262. <https://doi.org/10.1080/1360080X.2015.1019117>
- Onyeka-Ubaka, J. N., Agwuegbo, S. O. N., Abass, O., 2017. Application of the ARIMA Models for Predicting Students 'Admissions in the University of Lagos. *Journal of Scientific Research and Development*
- Dela Cruz, A., Basallo, M., Bere III, B., Aguilar, J., Calvo, C.K., Arroyo, J.C., Delima, A.J., 2020. Higher Education Institution (HEI) Enrollment Forecasting Using Data Mining Technique. *International Journal of Advanced Trends in Computer Science and Engineering*, 9. 2060-2064. 10.30534/ijatcse/2020/179922020.
- Qin, L., Shanks, K., Phillips, G. A., & Bernard, D., 2019. The Impact of Lengths of Time Series on the Accuracy of the ARIMA Forecasting. *International Research in Higher Education*, 4(3), 58. <https://doi.org/10.5430/irhe.v4n3p58>
- Rubens, N., Russell, M., Perez, R., Huhtamaki, J., Still, K., Kaplan, D., Okamoto, T., 2011. Alumni network analysis. 2011 IEEE Global Engineering Education Conference, EDUCON 2011, 606–611. <https://doi.org/10.1109/EDUCON.2011.5773200>