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(ICSNS XXXVIII-2024)

Lisbon, 30 December 2024

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Load Forecasting Using of Smart Metering Infrastructure

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Abstract

Power systems are being upgraded worldwide as part of a transition toward climate-neutral systems. One of the main drivers of this transition is the need for a full digitalization of the electricity supply chain. These technologies open new business and technical possibilities in the operation of power systems. A "smart grid" is an electrical network that can integrate the actions of all of its users to achieve a sustainable, secure, safe, and economically efficient power system.
Electricity systems worldwide are deploying advanced metering technologies in residential sectors. Smart meters can monitor and process the electricity use of households at very high sampling rates.
Accurate load forecasting is essential for the reliable and efficient operation of a power system. Integration of renewable energy sources like wind and PV, as well as the increasing number of electrical vehicles will make the load profiles of the system too volatile and unpredictable. Short-term load forecasting can help to estimate load flows and to make decisions that can prevent overloading. Timely implementations of such decisions lead to the improvement of network reliability and to the reduced occurrences of equipment failures and blackouts. Load forecasting is also important for contract evaluations of various sophisticated financial products on energy pricing offered by the market.
Using data generated by smart meters a load forecast method is evaluated to ensure short term load forecasting. This method requires minimal data, using only energy measurements, similar-day approach and temperature. The performance of this approach is validated through nanogrids. This work highlights the potential of data-driven in distribution networks for load forecasting, using modern smart-grid technologies for improved grid management.

Keywords: Smart meters, Load forecasting, Distribution networks, Smart Grid, Residential sectors

1. Introduction

Load forecasting has always been important for planning and operational decision conducted by utility companies. Load forecasts can be divided into three categories[1, 2]: short-term load forecasting (STLF) for up to 1 day, medium-term load forecasting (MTLF) for 1 day to 1 year, and long-term load forecasting (LTLF) for 1±10 years. The accuracy of load forecasts has a significant effect on power system operations, both positive and negative forecasting errors resulted in increased operating costs. The forecasts for different time horizons are important for different operations within a utility company. Short-term load forecasting can help to estimate load flows and to make decisions that can prevent overloading. Timely implementations of

such decisions lead to the improvement of network reliability and to the reduced occurrences of equipment failures and blackouts [3].

2. Electricity consumption in the residential sector

Electricity is a very important strategic factor for the development of society. Among other things, it is widely consumed for the needs of buildings, as well as for ensuring the comfort of life. The development of the economy and technology, the continuous increase in the standard of living, the increase in the population and the number of buildings, and the continuous urbanization will continue to exert increasing pressure on the demand for electricity. According to the EIA [4], the global demand for energy in 2020 is in the order of 600+ quadrillion BTU, while by 2050 it is expected to increase by 50% in non-OECD countries (Fig.1). The forecast of electricity consumption on a global scale by sector until 2050 is given in (Fig.2).

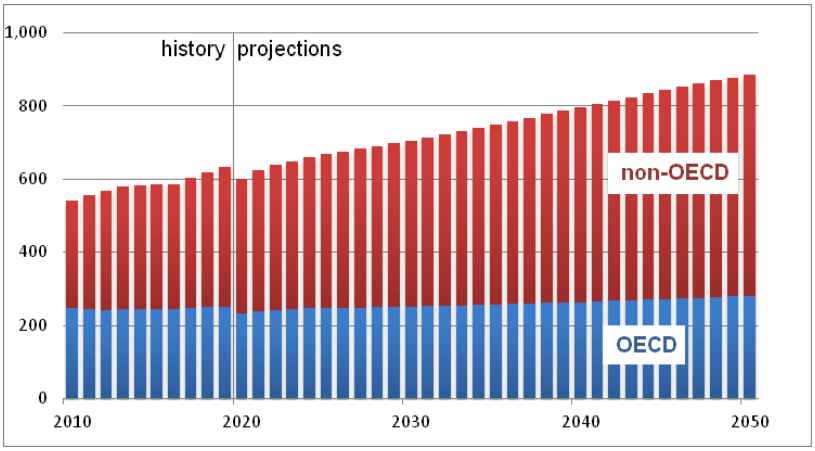

Fig.1 Forecast of energy consumption (quadrillion BTU) on a global scale by 2050

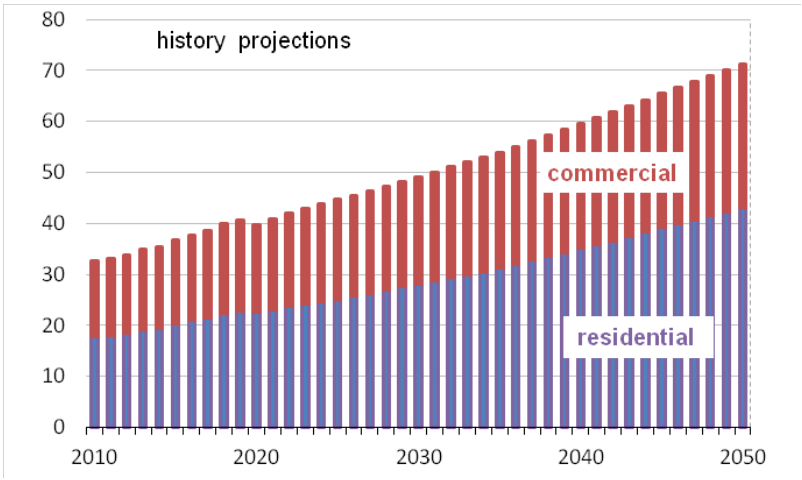

Fig.2 Forecast of electricity consumption (quadrillion BTU) worldwide by sector until 2050

Fig. 3 graphically presents household consumption data against total electricity consumption for the period 2010–2023 [5]. For 2023, household electricity consumption in relation to total consumption billed to tariff customers constitutes about 39.5%.

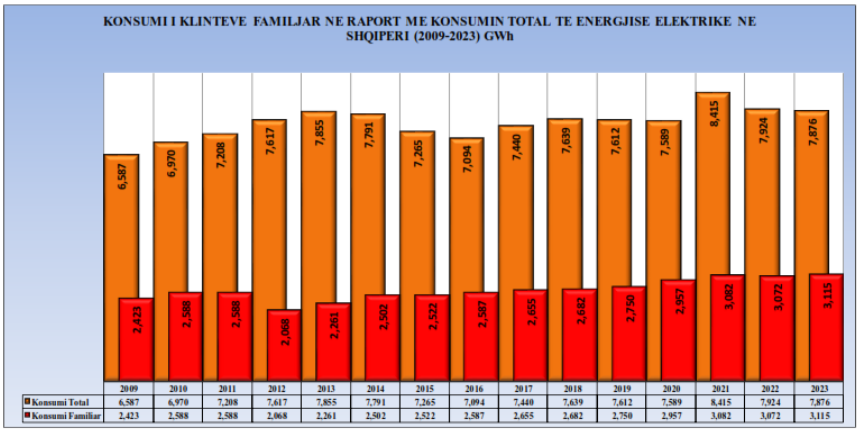

Fig.3 Household consumption versus total electricity consumption for the period 2010–2023

It is found that the users of commercial, public and residential buildings are the consumers with the fastest growth in energy use. In particular, electricity consumption in the residential sector occupies the main share of the energy balance in Albania.
Fig.4 presents the average daily consumption data for each month of 2023 compared to the average data for the period 2010-2022 [5], while Fig.6 shows the change in the average 10-year electricity consumption in Albania calculated in years 2017 and 2023. It is noted that consumption has maximum values in the winter season, values that can be explained by the demand for energy from heating and cooling systems in buildings.

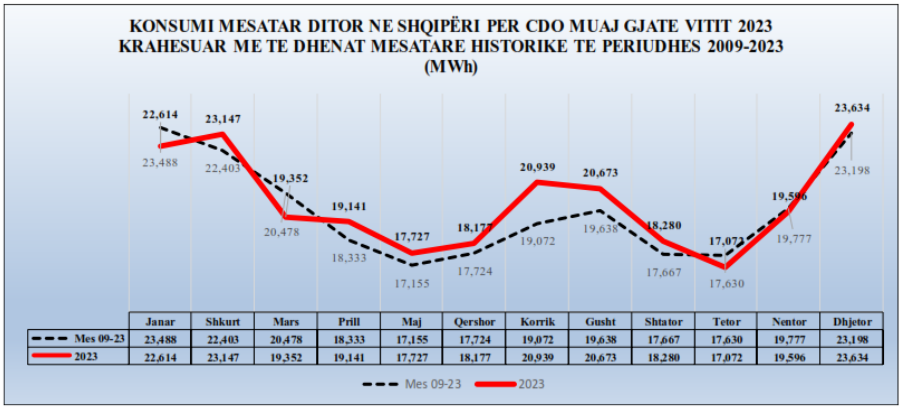

Fig.4 Average daily energy consumption in Albania for each month of 2023

According to ERE data [5], the average electricity consumption in Albania has an average increase of 4.9% for the years 2017-2023 with the highest values in the summer months of up to 10%.

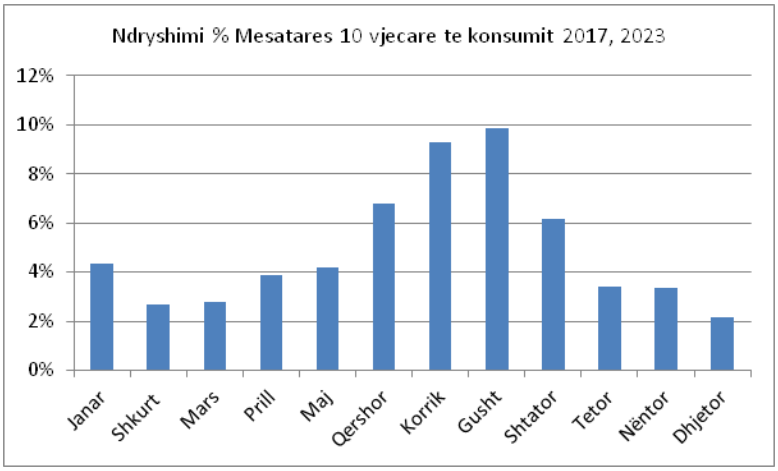

Fig.5 Change in the 10-year average electricity consumption in Albania calculated for the years 2017 and 2023

Since energy consumption in residential, public and commercial buildings accounts for a significant share of national energy consumption and is gradually increasing [5], energy management in buildings is an important issue that must be addressed to support the economy towards growth and is related to the cost of energy during use [6], the management of supply failure situations, the effective use of equipment and the network, and respect for the environment. Of course, the "smart" grid is one of the main technologies [7-10] for energy saving and undoubtedly a complete solution to the problem, but not feasible for a low-budget economy.

Current living standards result in homes containing electrical appliances such as stoves, washing machines, microwaves, refrigerators, televisions, computers, are considered as essential and in many cases can be found in multiple units in a single household. Often, energy use in buildings is inefficient [11] as a result of poor insulation levels, poor control of heating, ventilation, air conditioning and lighting, and ineffective operation of equipment.

3. Load forecasting using advanced metering infrastructure

The implementation of the Advanced Metering Infrastructure (AMI) is in alignment with EU directives which requires from the utilities to provide actual information on customers, so that customers can regulate electricity consumption, i.e. bi-monthly or monthly bills are not sufficient. On the other hand AMI have the potential to improve the Management of Distribution System through reduction of technical and non-technical losses, load management control, demand side management, etc.[8, 12-14] Accurate real-time load forecasting is essential for the reliable and efficient operation

of a power system. One of the main game changers is the deployment of advanced metering infrastructures. In 2023, around 146 million smart meters are estimated to be currently installed in the United States (more than 80% penetration rate) and 186 million in Europe (a 60% penetration rate), which plans to increase this number.[15]
We propose to utilize the accurate reporting of AMI to track the incoming load requests and their statistics using neural networks. In this paper, the mean absolute error (MAE), the mean absolute percentage error (MAPE) and the relative degree are used to evaluate the forecasting methods.
Cross-validation includes resampling and sample splitting methods that use different portions of the data to test and train a model on different iterations. With 5-fold cross-validation, the data are split into 5 parts. The model is trained and evaluated 5 times, each time using a different fold as the test set [16 - 18].
The models, trained with data of 5 buildings and predict energy consumption for the next hour. The models are trained and tested in three different scenarios: the first one uses 9 months as training data and the remaining three months are used for testing, the second one uses 10 months for training and the rest for testing, and the third scenario uses 11 months for training and 1 month for testing. In more detail Training/ testing period are:
1.Training: January-September, Testing: October-December
2.Training: January-October, Testing: November-December
3.Training: January-November, Testing: December
Detailed descriptions of the building data and the results obtained are provided in Table 1.
Table 1

Nr.	External Temperature statistics			Consumption statistics		
	$T(min)$	$T(max)$	σ_T	$P(min)$	$P(max)$	σ_P
1	$0.83^{\circ}C$	$37.22^{\circ}C$	$4.82^{\circ}C$	$30.85(kW)$	$414.3(kW)$	$63.28(kW)$
2	$4.44^{\circ}C$	$38.75^{\circ}C$	$3.70^{\circ}C$	$67.50(kW)$	$497.15(kW)$	$79.52(kW)$
3	$-8.61^{\circ}C$	$38.89^{\circ}C$	$10.70^{\circ}C$	$32.50(kW)$	$514.10(kW)$	$78.56(kW)$
4	$-16.67^{\circ}C$	$33.06^{\circ}C$	$11.68^{\circ}C$	$36(kW)$	$508.10(kW)$	$77.91(kW)$
5	$0.697^{\circ}C$	$34.44^{\circ}C$	$6.21^{\circ}C$	$108.47(kW)$	$510.95(kW)$	$93.53(kW)$

4. The method of neural networks

Neural networks are essentially non-linear circuits that have the demonstrated capability to do non-linear curve fitting. The outputs of an artificial neural network are some linear or nonlinear mathematical function of its inputs. The inputs may be the outputs of other network elements as well as actual network inputs (Fig.6).

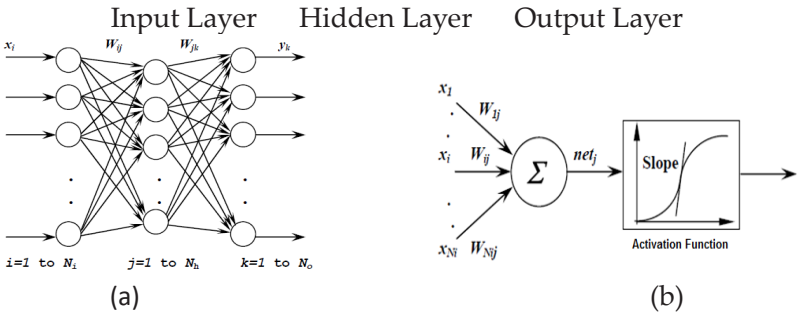

Fig.6. A feed-forward neural network (FNN) with a hidden layer (a) and the model of ***jth*** neuron in hidden layer b)

The methods used is based on multi-layered feed forward. The selection methods to be used is based on experiences gained from literature exploration [19-22].
A multi-layered feed forward ANN can be used for short-term load forecasting. A weighting factor, ***Wij***, connects input layer x_i with hidden layer ***jth*** performs a nonlinear transformation of input. The hidden layer output is as Fig.6,b is a nonlinear function weighting input signals:

$$A_j = f_h\left(net_j\right) \qquad (1)$$

Where $\mathbf{f_h}$ is nonlinear function of hidden layer (bounded monotonic function). If b_j is the activation function, $\mathbf{net_j}$ can be calculated as follow:

$$net_j = \sum_{i=1}^{N_i} W_{ij} x_i + b_j \qquad (2)$$

The structure of the output layer is the same as hidden one. The weighting factor, W_{jk} connect hidden layer ***jth*** with output layer y_k. The output of the neuron "***k***" can be formulated as follow:

$$y_k = f_n\left(net_k\right) \qquad (3)$$

Where f_0 is a nonlinear funksion of otput layer and net_k is calculated as follow:

$$net_k = \sum_{j=1}^{N_h} W_{jk} A_j + b_k \qquad (4)$$

The network outputs are linear functions of the weights that connect inputs and hidden units to output units. Therefore, linear equations can be solved for these output weights and activation function.
In this study, we will use five-fold-cross-validation (FFCV) to evaluate the learning performance for all classifiers. MATLAB Software, Neural Network Toolbox ™ will

be used for simulation. In our case, the network structure is a network with one hidden layer. Its selection is based on the experiences gained from the literature exploration, where this results as the most efficient network in solving the same problems. The training data are randomly partitioned into five parts, p_1, p_2, p_3, p_4, p_5. A single part is retained for validating the model and the remaining four parts are used as training data to train the model. The model is trained and evaluated 5 times.

Table 2: Partition of data for 5-fold cross validation:

Step	Training data	Data for validating	Result
1	p_1, p_2, p_3, p_4	p_5	x_1
2	p_1, p_2, p_3, p_5	p_4	x_2
3	p_1, p_2, p_4, p_5	p_3	x_3
4	p_1, p_3, p_4, p_5	p_2	x_4
5	p_2, p_3, p_4, p_5	p_1	x_5

The variables used, the minimum and maximum values of their deviation are given in Table 3. The similarity between cases will be evaluated as:

$$VS_i(x_i, y_i) = \beta VS_i^I(x_i, y_i) + (1-\beta) VS_i^J(x_i, y_i) \quad (5)$$

where β is the weight of the impact of each similarity on the outcome estimated during the training period with the value 0.6.

The weights of each variable are calculated by fitting a linear regression model to the values resulting from the similarities. In Table 3 there are the variable to be used.

Table 3

	Variable	d_{min}	d_{max}
V_1	Weekday Index	1	3
V_2	Temperature 3 hours ahead	2	6
V_3	Temperature 2 hours ahead	2	6
V_4	Temperature 1 hour ahead	2	6
V_5	Temperature at the hour of the forecast	2	6
V_6	Energy consumption 24 hours ahead	10	40
V_7	Energy consumption 1 week ahead	10	40
V_8	Average energy consumption 24 hours ahead	10	40
V_9	Energy consumption 3 hours ahead	10	40
V_{10}	Energy consumption 2 hours ahead	10	40
V_{11}	Energy consumption 1 hour ahead	10	40

Another important element is the determination of the number of neurons in the

hidden layer. After defining the learning algorithm, which is BFGS Quasi-Newton (trainbfg), we select the number of hidden neurons using 5 fold cross validation on the input data divided into 5 parts. The experimentation is carried out by changing the number of neurons from 1 to 10, and it turns out that the highest performance for the 5 buildings is the structure with 10 hidden neurons.
The models are compared with each other for the three scenarios mentioned above using as well as a baseline forecast model that predicts the average energy consumption for the training period. The models, which are trained with the same modeled data for each of the buildings, predict the energy consumption for the next hour. The results obtained by the 6 models are given in the next section.

5. Results and discussion

Static prediction is performed using traditional machine learning algorithms. The model learns according to the supervised technique, where the training data is presented to it simultaneously and the model is adapted on it according to the pair (input, output). Static prediction is performed by applying the methods of neural networks five-fold-cross-validation (FFCV). To evaluate the performances are used common metrics such mean absolute error (MAE), and mean absolute percentage error (MAPE).

$$MAE = \frac{1}{n}\sum_{i=1}^{n}(true_i - pred_i)$$

$$(6) MAPE = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{true_i - pred_i}{true_i}\right| x100\%$$

where n is the number of forecasting data.
represents the true value of the i-th data.
denotes the forecasting value of the i-th data.

The CVRMSE (Coefficient of the Variation of the Root Mean Square Error) is used to calibrate models in measured building performance. This is a metric that indicates instability in the observed relationship between variables in the baseline period. It is the coefficient of the variation of the predicted input series relative to the observed input series.

CVRMSE=([RMSE)/(mean(target)]x100%) (7)
where RMSE is root mean square error

(8)

$$RMSE = \sqrt{\sum_{i=1}^{n}\frac{(true_i - pred_i)^2}{n}}$$ The following Tables there are the forecast

result for the each building for three scenarios

Table 4: The forecast result for the first building for three scenarios.

Training	Method	MAE (kW)	MAPE (%)	CVRMSE (%)
January-September	Base	53.8710	23.3273	23.2763
	FFCV	11.3662	4.9127	6.7285
January-October	Base	51.8409	23.7835	22.7315
	FFCV	10.6910	4.8673	6.8724
January-November	Base	51.0902	23.7244	22.5692
	FFCV	11.7009	5.3404	7.1116

Table 5: The forecast result for the second building for three scenarios.

Training	Method	MAE (kW)	MAPE (%)	CVRMSE (%)
January-September	Base	63.6917	29.6577	26.5306
	FFCV	13.6186	5.9058	7.4721
January-October	Base	60.0290	27.9801	25.4045
	FFCV	14.1939	6.3771	8.1451
January-November	Base	56.7514	27.2829	24.6711
	FFCV	13.8927	6.1982	8.0955

Table 6: The forecast result for the third building for three scenarios.

Training	Method	MAE (kW)	MAPE (%)	CVRMSE (%)
January-September	Base	43.4609	21.9641	21.2198
	FFCV	12.1566	5.2858	6.5694
January-October	Base	40.3865	20.9064	20.5848
	FFCV	13.2517	5.8228	7.2477
January-November	Base	34.1477	16.9155	17.9709
	FFCV	12.2150	5.4207	6.3922

Table 7: The forecast result for the fourth building for three scenarios.

Training	Method	MAE (kW)	MAPE (%)	CVRMSE (%)
January-September	Base	54.1087	29.7308	25.1317
	FFCV	13.7841	6.5871	8.8668
January-October	Base	54.4976	30.7627	25.7734
	FFCV	14.4014	7.0326	9.3381
January-November	Base	49.6963	27.5676	24.1783
	FFCV	14.3206	7.1435	9.3210

Table 8: The forecast result for the fifth building for three scenarios.

Training	Method	MAE (kW)	MAPE (%)	CVRMSE (%)
January-September	Base	70.4309	31.5118	26.8713
	FFCV	17.5916	6.3740	7.6603
January-October	Base	78.6203	36.1097	28.3413
	FFCV	17.2968	6.5624	8.2346
January-November	Base	80.0767	39.7075	29.6764
	FFCV	17.4454	6.9446	8.4571

6. Conclusion

In this work, Short Term Load Forecasting in Distribution Network, using Advanced Metering Infrastructure (AMI) data and five-fold-cross-validation (FFCV) of neural network for three different scenarios demonstrates an alternate model for building relationships between weather and load data with better results compare classical forecasting methods. Using data generated by smart meters a load forecast method is evaluated to ensure for residential short-term load forecasting.
In case application of FFCV Neural Network with MATLAB® Software there are many factors that must be considered.
The results shown in the Tables from 4 to 8 express the dominance of artificial intelligence methods over the basic predictor, also the results obtained are within very satisfactory limits referring to the ASHRAE guidelines [23] for hourly calibrated data the CVRMSE should be within 30%.

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Seizure and confiscation as effective tools in the fight against criminality in preventive proceedings

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Abstract

The fight against crime in general and organized crime in particular is accompanied by a number of measures, be they preventive measures, in order to prevent, but also post factum measures, after the occurrence of the criminal offense.
Law systems have continuously tried to find effective tools in the fight against crime and especially measures of an economic nature, among which we mention without question the seizure and confiscation of property as a preventive measure, sanctioned under the Law on Prevention and Strike of Organized Crime (otherwise called the Anti-Mafia Law and OFL), as well as pecuniary security measures sanctioned in the CPC (Criminal Procedure Code). The purpose of these measures, in both cases, is to prevent criminal activity by seizing and confiscating their property assets. These are effective means of combating crime in general and organized crime in particular, as they also prevent further criminal offenses, such as the laundering of the products of criminal offenses and the negative effects they give on the economy, fair competition and the strengthening of the rule of law.
Albania has undertaken a series of legal reforms, improving its legislation to respond to this phenomenon and approximating the legislation with international acts.
In this paper we will make a treatment of the theoretical and practical aspect of the implementation of these measures in the Albanian system.

Keywords: Crime, confiscation, seizure, anti-mafia law, OFL, etc.

1. Introduction

Preventive proceedings, by nature, are proceedings of a civil nature intended to attack assets or commercial activity, due to suspicions that these assets are the product of criminal activity. Countries had realized that the fight against crime and in particular that of organized crime is complex and very dimensional, in order for it to be effective even the measures that had to be taken had to be very dimensional. The traditional means were ineffective, and new legal measures were needed to make this war effective. States had recognized that effective means are measures of an economic nature, as they target criminal activity, where it hurts the most. They take away the products of criminal activity and further prevent their perpetration, as they lack of funds to support this criminal activity. In the context of these measures, the legislator approved the law no. Regulation (EC) No 9284/2004 on the prevention and crackdown on organized crime *(hereinafter referred to as the Anti-Mafia Law)*. These measures are otherwise known as measures of a civil nature, as the procedure and rules followed for their application differ from the criminal one. Criminal law provides a standard of "*reasonable suspicion based on evidence*", for the occurrence of a criminal fact and the involvement of the person as a possible perpetrator of the criminal fact, the Anti-Mafia law is based on *indications* of the person's involvement in criminal activities. Such a

standard is made in order to facilitate the authorities in the fight against crime. This law reverses the burden of proof by leaving the subject whose property is seized to prove the legality of his assets. In order to improve the fight against organized crime and serious criminal activities, after the 2004 law, the law was adopted in 2009, which repealed the previous law, but remained with the same focus on aiming against criminal assets. The latter continued to be changed in response to the needs presented, the changes were noted that in its title from "*On Prevention and Strike of Organized Crime and Trafficking through Preventive Measures against Property*" the law was "*On Prevention and Strike of Organized Crime, Trafficking and Corruption through Preventive Measures against Property*". This made the law more comprehensive in relation to its scope of implementation by extending the implementation to criminal offenses of corruption and trafficking.[1]

Further in 2017, in the framework of the reforms undertaken, the scope of implementation of criminal preventive procedures continues to be expanded, changing the title of the law *to "On Prevention and Strike of Organized Crime, Trafficking, Corruption and Other Crimes through Preventive Measures against Property".* On the other hand, the most important change in this law is related to the standard used, which in some form protects the assets of the subjects of this law. If prior to the changes the existence of indications for involvement in criminal activities was foreseen, the law of 2017 strengthens the standard by requiring the presence of data that creates a reasonable suspicion of involvement in criminal activity and on the legality of assets.[2]

Despite the changes related to the scope of application and procedural aspects of implementation, the legislation has preserved the pecuniary character of the measures applied, sequestration and confiscation.

The seizure consists of a temporary measure granted by the court as a preventive measure, which in terms has a similarity with the PPC, on the deadlines of the preliminary investigation.[3]

Meanwhile, confiscation is a final measure of pecuniary character, which leads to the permanent loss of ownership of the subjects and the transfer of this property definitively in favor of the state.

In 2020, the executive's efforts towards criminality were accompanied by the adoption of the normative act with the force of law which created the special unit known as Operation Force of Law/OFL. An act accompanied by dilemmas and ongoing debates regarding its constitutionality. But the law successfully passed its constitutionality, although with many debates among the connoisseurs of the law, especially with its temporary character, the existence of an actual regulatory legal basis in force, such as the Anti-Mafia law, the overlapping of measures of pecuniary character and its legal regulations.

The principles between this law and the normative act are the same, the burden of

[1] Law No. 24/2014 "On some amendments and additions to Law No. 10 192, dated 3.12.2009, "On the prevention and suppression of organized crime and trafficking through preventive measures against property", accessed at the link: https://qbz.gov.al/eli/ligj/2014/03/20/24/f5a482d4-85ff-4c91-921c-7fe40bd22a1e .

[2] Article 4 of Law No. 70/2017 "On some additions and amendments to Law No. 10 192, dated 3.12.2009, "On the prevention and suppression of organized crime, trafficking and corruption through preventive measures against property", as amended, accessed at the link https://qbz.gov.al/eli/ligj/2020/07/02/85/9e834250-1649-4bda-b42c-ea015911abdc.

[3] See Article 323 of the CPC in relation to Article 12 of Law 10 192/2009, as amended.

proof in both cases belongs to the person who is subject to measures of a pecuniary nature. The only difference is the short time within which the justification of the property had to be realized, within 48 hours. This in itself can be considered a violation of a due process of law, since the person does not have a reasonable time to realize his defense in response to the actions of the proceeding authorities, which in turn have taken all the time necessary to identify and classify a person as the subject of the normative act.
The timeliness of this act and its results, whether they were effective or not, we will see in the following. However, the temporary nature of this act did not lead to a lack of fight against criminal activity, as measures of pecuniary character continue to be in force under the Anti-Mafia Law.

2. **The structures involved and their effectiveness in the fight against criminality in preventive proceedings**

In this normative act, there were a number of structures involved, which help to achieve the goal set by this act. Existing institutions had and have a key role in the fight against organized crime, whose competences are distributed between existing and newly created institutions.

2.1 Financial Intelligence Agency

The role of the Financial Intelligence Agency is irreplaceable, as a structure created by law no. 9917/2008 *"On the prevention of money laundering and terrorist financing"*, depending on the Ministry of Finance, which within this law has access to state data and can request information from the entities provided by this law on suspicious activities that testify to the laundering of the products of criminal offenses. The exchange of this information takes place at the request of the AIF and of the subjects from whom this information is requested.
The following is presented the reports made to the prosecutor's office and the police by the AIF, pursuant to this law.[4] Among the cases reported to the prosecution, it results that 57% are reported to the SPAK and the rest to the district prosecutor, where 23% are in the Tirana prosecution. The latter also testifies to the fact that most of the focus of the activity of laundering the products of criminal offenses occurs in Tirana where the most frequent transactions are related to activities that take place in this area.

Year	2019	2020	2021	2022	2023
Prosecuter	25	41	50	23	45
Polici	241	227	208	201	175
Total	**266**	**268**	**258**	**224**	**220**

In the framework of the fight against money laundering and terrorist financing, Albania is responsible for reporting to the EU structures and is monitored by MON-

[4] Page 7, 2023 report, accessed at the link: https://fiu.gov.al/raporte/ .

EYVAL[5]. In the 2022 report issued by this structure it results that despite the improvements that Albania has undertaken in this field it continues to remain on the "*grey list*" of the FATF (Financial Action Task Force).[6] This organization continues to pay attention to the Albanian state regarding the initiative of the tax program, which apparently is not in line with the principles of the FATF[7].

2.2 Court Against Corruption and Organized Crime

Subject matter competence for reviewing cases under the scope of this OFL act was given to the Court against Corruption and Organized Crime.[8] With the adoption of the normative act, the workload for this court was increased along with other issues addressed by this structure. As a result, SPAK/Special Prosecutor's Office had the power to proceed in these cases. The court had a controlling/validating role in terms of the activity of the police and the prosecution in imposing personal preventive measures sanctioned in Article 10 of the normative act as well as pecuniary measures applied by the police in cases of emergency.

2.3 National Coordination Committee for the Prevention and Fight against Organized Crime

This structure was established by normative act no. 1/2020, in order to coordinate the activity for the design, monitoring, supervision and implementation of the preventive measures provided for in this normative act. On the other hand, it served as a communication bridge for the exchange of information and the strengthening of cooperation with foreign law enforcement authorities, during the time and for the effect of the implementation of this normative act.

The Committee is chaired by the Minister of Interior and as member the Minister of Justice, the Minister of Finance and Economy, the General Prosecutor, the Head of the Special Prosecution Office against Corruption and Organized Crime, the Director of the State Intelligence Service, the General Director of the State Police, the Director of the Coordination Center against Violent Extremism, the General Director of the Directorate for the Prevention of Money Laundering. The Board meets once every three months and reports to the Board of Directors.

Its functions consist of:

- Follows and implements policies and drafts a plan of measures for coordinating actions to prevent and combat organized crime, terrorism;
- Evaluates the progress of the implementation of personal and pecuniary preventive measures given or applied in implementation of this normative act;

[5] It is a permanent monitoring body of the Council of Europe, entrusted with the task of assessing compliance with key international standards to combat money laundering and terrorist financing and the effectiveness of their implementation, as well as the task of making recommendations to national authorities regarding necessary improvements to their systems.

[6] International organization that monitors and sets standards in the fight against money laundering and terrorist financing, accessed at the link: http://www.fatf-gafi.org/en/search-page.html.

[7] Page 8, accessed at the link: https://rm.coe.int/moneyval-annual-report-2022-weeb-a4/1680abe10a.

[8] Article 9, Regulatory act no. 1, dated 31.01.2020 "*On preventive measures in the framework of strengthening the fight against terrorism, organized crime, serious crime and consolidation of public order and security*", which provides that: "*The request for taking preventive measures and opposing the measures taken under the definitions of this normative act are reviewed in the first instance by the Special Court against Corruption and Organized Crime according to the definitions of the legislation into force.".*

- Coordinates the provision of opinions, as well as guidelines regarding the follow-up of best practices regarding the procedures for the implementation of preventive measures;
- Coordinates inter-institutional cooperation, in the framework of the commitment to the prevention and crackdown on organized crime and terrorism.[9]

3. The effectiveness of these measures

During 2020 and 2021, the CCOC has reviewed a large number of requests for seizure and confiscation of property, according to the provisions of the Normative Act No.1, dated 31.01.2020 "*On preventive measures in the framework of strengthening the fight against terrorism, organized crime, serious crimes and consolidation of public order and security*", which aims at establishing personal and property preventive measures, according to its content. Requests with the object of confiscation of property under this Normative Act, due to the complexity in their review, have increased the burden of judges in their work and have lasted in time as a matter, this is because the court during the judicial review, in view of the burden of proof, in the framework of a fair and objective trial, have been summoned real estate appraisal experts and accounting experts authorized to assess the assets subject to confiscation, have been summoned witnesses, the evidence requested by the parties have been obtained. These trials have resulted not only in an increase in the caseload for judges, but also in the duration of trials. The following are the statistical data on the applicability of the Normative Act in relation to the Law of 2009.

3.1 Data on seizures and confiscation for the period 2019 – July 2023 by SPAK[10]

	Normative Act No. 1, dated 31.01.2020 (OFL)				Law No. 10192, dated 3.12.2009 (Anti-Mafia)				Penal Code §15.	
Year	Seizure requests	Seizure decisions	Request for confiscation	Decision to confiscate.	Seizure requests	Seizure decisions	Request for confiscation	Decision to confiscate.	Seizure requests	Seizure decisions
2019-2020	120	115	62	27	6	6	8	2	0	0
2021	25	28	72	54	14	14	4	5	6	6
2022	0	0	3	35	5	5	10	2	7	7
1-Jan-12-July 2023	0	0	0	8	6	6	1	3	2	2
Total	145	143	137	124	31	31	23	12	15	15

Table 1: Data from SPAK

In 2019-2020, we note a broader applicability of the normative act in relation to the

[9] Article 8, Regulatory act no. 1, dated 31.1.2020.

10 Data obtained from the annual reports of SPAK for the period 2020-2023 accessed at the link: https://spak.gov.al/raporti-vjetor/

Anti-Mafia Law in the period of adoption of normative act no. 1/2020

Referring to the report held by SPAK in 2020, it results that "*From the Special Prosecution Office for the period 19.12.2019 – 31.12.2020, a total of 313 material/property verifications were investigated, out of which 298 material assets were registered in the period 19.12.2019 – 31.12.2019, received for competence in the Special Prosecution Office against Corruption and Organized Crime by the Prosecution Office at the Court of First Instance for Serious Crimes in Tirana and 15 material assets for the period 01.01.2020 – 31.12.2020, registered in the Special Prosecution Office against Corruption and Organized Crime.*"[11] While pursuant to the normative act it results that for a period of almost 1 year 07.02.2020 to 31.12.2020, from the General Directorate of State Police, Operation Force of Law (known as OFL) were presented a total of 251 materials.

In our opinion, the applicability of the Anti-Mafia law remained shadowy in the period of implementation of the normative act, OFL, due to the overlap of the legal regulation, but also to the fact that the normative act created more facilities for the prosecution of these cases, but on the other hand, it was given increased attention by the authorities to make it mass applicable to the very dilemmas that accompanied this act from its adoption until its extinction as an act.

3.2 Statistics of the Ministry of Interior [12]

OFL FROM FEBRUARY 1 TO DECEMBER 31, 2020

OFL has processed and completed the pecuniary verification for 515 files:

243 files have been referred to SPAK for 1,877 assets.

	Folder	Subjects	Assets	Type of Assets
Files Referenced in SPAK	160	183	1013	Immovable assets
			474	Movable assets
			262	Trading activities allowances/assets
			19	Bank Account
			1	Monetary Value Loaned to Third Parties
			1	NGO
	160	183	1770	
Files referred by the State Police in SPAK in cases of emergency, for the validation of the measure.	83		10	Immovable assets
			94	Movable assets
			3	Trading activities allowances/assets
	83	0	107	
Total	243	183	1877	

[11] Data obtained from SPAK annual reports, accessed at the link: https://spak.gov.al/wpcontent/uploads/2023/01/Raporti-2020-perfundimtarr.pdf , pg.17.

[12] Link: Aktiviteti i OFL në 2020 - Ministria e Brendshme (mb.gov.al).

			314	Immovable assets
			224	Movable assets
The Court's Decisions			98	Trading activities
	105		5	Bank Account
	105	0	641	

Table 2: Data from the Ministry of Interior

In a prima facia look at the data, we find that the assets affected are mainly of an immovable character, as well as a positive effect it has given to commercial activity, as these activities are widely used for cleaning products. At first glance, these activities seem legal, but these serve to launder of these products. Organized crime uses different ways to launder finances coming from the world of crime, these financial transactions are such that they try to lose track of the origin of money to introduce it into the financial system as a legitimate source, through fictitious acts, various shell and complex transactions.

The authorities should have a higher focus on investigating the financial system and how transactions are conducted in financial institutions from one account to another, investigate "*Cash Flow*", where this money is invested. Generally, in order to have a money laundering, organized crime mainly tends to invest in businesses in order to generate legitimate income and launder the proceeds of the underworld.

The normative act aimed to create a new asset analysis mechanism, enabling investigative bodies to identify and seize assets that are not justified by lawful sources, in the framework of the fight against crime and corruption.

In the fight against organized crime, in particular, coordination between the institutions involved in this mission is indispensable. At a time when OFL was conceived as an ad hoc structure, the time available was not enough to achieve close cooperation between these structures. This has resulted in a lack of a common strategy of these structures to fight organized crime through the crackdown on their assets.

One of the main problems of OFL, as we stated above, is that it focuses on the assets of individuals, not having a clear mechanism to investigate the sources of this wealth. This has led many individuals to escape legal prosecution, resulting in a limited efficacy of the act.

The anti-mafia law, on the other hand, provides a broader framework for the investigation and confiscation of assets related to organized crime. So, although OFL is an attempt to improve the situation, it seems that it is not enough to cope with the complexity that criminal offenses that affect the financing of organized crime present.

Conclusions

This article deals mostly with the legal regulation brought by the normative act OFL, in a regulatory legal system, in preventive proceedings in Albania, with a focus on the fight against organized crime, money laundering and other illegal activities. Much of the analysis focuses on laws and normative acts adopted over the years, as well as on the effectiveness of the structures that have been put in place to implement them.

The legislation on preventive proceedings has undergone several changes since the adoption of the first law in 2004, the adoption in 2009 of the new law, the changes it underwent as well as the provisional adoption of the normative act OFL. This legal improvement had a tougher approach to organized crime and corruption, improving the standards required for the seizure and confiscation of assets. The new laws were aimed at improving the measures in the fight against crime. One of the common and important predictions is the change of the burden of proof, which means that the subjects who are under investigation now have to prove the legality of their assets, unlike the traditional concept of criminal law thus facilitating the role of the authorities in the fight against organized crime. Over the years, various strategies for the fight against criminality have been considered, accompanied by the creation of new structures such as Operation Force of Law (OFL) with normative act no. 1/2020 This was followed by a series of major debates at the state level.

Its implementation in practice brought efficiency, seizing and confiscating assets part of the criminal activity, because this law had its object more extensive than the Anti-Mafia law. The problems could have been related to the burden of proof, in an informal economy as our country used to be, which may have led to the seizure and confiscation of assets that did not flow directly from these criminal activities. The criminal offenses that were the subject of this law, such as murder, did not produce products, but the subjects occurred in an informal economy, could not prove the legal origin of the property and these assets were confiscated.

Despite the positive consequences in the fight against the products of the criminal offense, the effectiveness of the measures has been limited, linked to the temporality of these measures and the law itself.

OFL temporarily replaced the anti-mafia law even though the latter was in force and continues to be. The structures responsible for the implementation of this law should increase its effectiveness in practice. Despite the efforts made, there are still challenges to face, for a more integrative approach to bring more effective results in practice, preparing long-term strategies in the fight for the cleansing of criminal offense products, increasing institutional cooperation in this fight.

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Normative act no. 1, dated 31.1.2020 "On preventive measures in the framework of strengthening the fight against terrorism, organized crime, serious crimes and the consolidation of public order and security";

Link: https://fiu.gov.al/raporte/;
Link: https://www.fatf-gafi.org/en/search-page.html ;
Link: https://rm.coe.int/moneyval-annual-report-2022-web-a4/1680abe10a ;
Link: Aktiviteti i OFL në 2020 - Ministria e Brendshme (mb.gov.al);
Link: https://spak.gov.al/raporti-vjetor/ ;
Link:https://spak.gov.al/wp-content/uploads/2023/01/Raporti-2020-perfundimtarr.pdf.

The physical effects of pain on patients after surgery

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Abstract

Background
The adequate management of postoperative pain continues to be a challenging process for healthcare professionals. The International Association for the Study of Pain (IASP) defines pain as an unpleasant emotional sensation associated with actual or potential tissue damage. The prevalence of acute moderate to severe pain varies in high-standard Western countries with rates ranging up to 55% and in developing countries it can reach up to 88%. Postoperative pain, if not effectively treated, can be associated with severe negative effects, compromising the physical and psychological status of patients.
Objectives
To assess the physical effects of postoperative pain in patients in general surgery, at the Mother Teresa University Hospital Center, Tirana, Albania.
Methodology
The study is a cross-sectional study conducted in the General Surgery Service at the "Mother Teresa" University Hospital, during the period January – November 2024. For data collection, a validated questionnaire of the American Pain Society (APS), "American Pain Society Patient Outcome Questionnaire (APS-POQ-R) 1995/2010 for "Postoperative Pain Assessment and Management" adapted to the 2010 version, was applied.
Results
108 (45.6%) female patients and 129 (54.4%) male patients participated in this study. The mean age of the study population was 49.5 (±18.9) years, with a range from 18 to 83. The prevalence of POP in the study was 79.3% 95%CI (74.2.-83.7). The prevalence of moderate and severe pain ≥7 in the study shows a decreasing trend from the first day to the third day. Regarding side effects, immobilization prevails with 71 (29.8%) of the reported cases, followed by tachycardia 68 (28.6%) and peripheral vascular resistance with 53 (22.3%). Next, another physiological side effect that affects patients with untreated pain is insomnia with 42 (17.8%) cases. Among others, atelectasis is also present with 18 (7.6%), pneumonia with 8 (3.4%), cough deprivation with 20 (8.5%), deep vein thrombosis with 15 (6.3%) and finally, muscle atrophy with 10 (4.2%).
Conclusion
This study concludes the impact that the level of postoperative pain has on the occurrence of negative effects after surgery. Further studies should focus on the importance of adequate acute pain management to reduce physical complications in patients who have undergone surgery.

Keywords: Postoperative pain, side effects, adequate management.

Introduction

Pain is a complex multifactorial phenomenon that is considered an inevitable part of the human experience, but not a normal sensation in the absence of pathology. Despite advances in the understanding of pain and technological improvements in pain management, studies have concluded that many patients still experience acute moderate to severe pain. This indicates that pain management remains a challenging

process in the surgical setting (Andrés et al., 2017).
Literature data indicate that more than 300 million operations are performed globally each year, due to the various physical conditions treated with surgical intervention. (Correll et al., 2014).
Postoperative pain poses a challenge for healthcare professionals. Inadequate treatment of acute postoperative pain can lead to physical and psychological side effects, which affect the outcome of surgery, economic status, postoperative morbidity, quality of life, patient rehabilitation and discharge from hospital, as well as the chronicity of pain. (Hughes, 2008).
It is also worth noting that there have been improvements in postoperative pain management due to new guidelines and improvements in acute pain management techniques. Despite this, there is still a high incidence of moderate to severe pain after surgery in both developed (41-61%) and developing (60-80%) countries (Timerga et al., 2024). Adequate treatment of (POP) is a complex, difficult and ongoing global process. According to statistics from the literature, the prevalence of postoperative pain has not been reduced, a fact that clearly demonstrates the significance of this problem. Postoperative pain management should be a focus for healthcare institutions, as one of the main components of patient satisfaction, thus reflecting the quality of care and the results of POP treatment.
Prolonged periods of inadequately treated postoperative pain can also affect the wound healing process. Studies that have evaluated postoperative pain have concluded that this symptom interferes with various physical activities from 42% to 100% and with sleep quality from 21.4% to 75% (Yarnitsky et al., 2008).
Untreated postoperative pain can negatively impact perioperative outcomes and favor chronic pain (Cregg et al., 2013). Untreated postoperative pain can result in negative short- and long-term consequences. These adverse effects can cause adverse outcomes for patients in terms of morbidity and mortality.
Postoperative pain can also cause decreased mobility. Immobilization can cause complications such as thrombosis, respiratory problems including pneumonia, skin damage, and constipation. All of the negative effects mentioned above directly influence the morbidity, mortality, and quality of life of surgical patients, creating social problems in terms of significantly increasing healthcare costs.
Such studies determine the effectiveness of postoperative pain management and identify physical factors associated with ineffective postoperative pain management, aiming to guide further research, with the aim of improving postoperative healthcare to enable patients to have a better quality of life.

Methodology

Objectives
Assessment of POP prevalence according to study variables
Assessment of the physical and psychological effects of pain after surgery

Material and methods
The study is a cross-sectional study conducted in the General Surgery Service at the

"Mother Teresa" University Hospital in Tirana, during the period January - November 2024. A validated questionnaire of the American Pain Society (APS) was applied for data collection, the "American Pain Society Patient Outcome Questionnaire (APS-POQ-R) 1995/2010 for "Postoperative Pain Assessment and Management" and adapted to the 2010 version.

Inclusion criteria in the study : The study included adult, conscious patients, aged >18 years, who underwent surgical interventions and procedures in the mentioned institutions and were treated in the ward.
Exclusion criteria from the study : The study did not include patients with:
- communication difficulties
- not conscious

Sample size
This study included 108 (45.6%) female patients and 129 (54.4%) male patients , in order to obtain a 30% reduction in pain 24 hours after surgical intervention with study power $1 - \beta = 0.8$ and confidence interval for $\alpha = 0.05$ (95%CI) and with probability proportional to the number of interventions in each hospital included in the study. The mean age of the study population was 49.5 (±18.9) years, with a range from 18 to 83

Instrument and method of data collection
Data collection was enabled through a questionnaire of the "American Pain Society Patient Outcome Questionnaire (APS-POQ-R) 1995/2010 for "Postoperative Pain Assessment and Management" which was adapted according to the 2010 version . This questionnaire has been validated and standardized by the authors and is recommended as the basic instrument for assessing the quality of pain management , translated and applied in many countries around the world [9]

Staff training
The study also interviewed 47 medical staff members at the three hospitals included in the study regarding their training on pain and its management.
Data processing
Patient interviews were conducted by FSHMT students trained in the application of the study questionnaires, which were coded in order to maintain anonymity and confidentiality.

Statistical tests used
Kolmogorov-Smirnov: for testing the distribution of continuous variables: age, pain score Chi-square (χ^2): for comparing percentages of categorical variables
McNemar: for comparing the prevalence of pain by day: on the first, second, and third day after surgery. ANOVA repeated measures and paired t-test: for comparing the average pain value by day and by activity - rest/movement
Pearson's correlation: for assessing the relationship between patient information and pain level - Information coding was done: information 'Yes" = 1 and information

"No" = 0; Pain coding was done: Severe pain ≥7=1 and Mild pain=0. The p value ≤ 0.05 was considered statistically significant.

Results

Socio-demographic characteristics of the patients in the study.

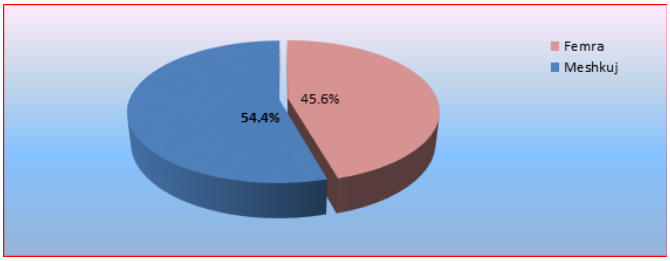

Figure 1. Distribution of cases by gender

In Figure 1, we present the distribution of patients with POP by gender, where males predominate with (54.4%) of cases and the rest (45.6%) are female patients, with no statistical difference between them p>0.05.

Table 1. Summary age statistics

Sample size	237
Youngest age	18.0
The oldest age	83.0
Average age	49.5
95%CI for the mean	45.8 - 54.0
Median	50.0
Standard Deviation (SD)	18.9

Table 2 shows the mean age of the study population, which is 49.5 (±18.9) years, with a range from 18 to 83 years, i.e. the youngest age of the patients is 18 years and the oldest is 83 years.

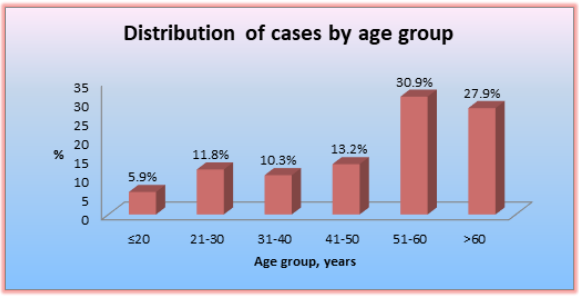

Figure 2. Distribution of cases by age group

Figure 2 shows the distribution of patients by age group, where it can be seen that the largest number of patients belonged to the age group 51-60 years (30.9%), while in the age group 31-40 years and ≤20 years a significant decrease in the number of patients is observed with, respectively 10.3% and 5.9% of the total patients. Based on these results, it is clear that there is a difference in the distribution of patients by age group, which is indicated by the significance value (χ^2=85.1 p<0.01) which demonstrates a statistically significant relationship.

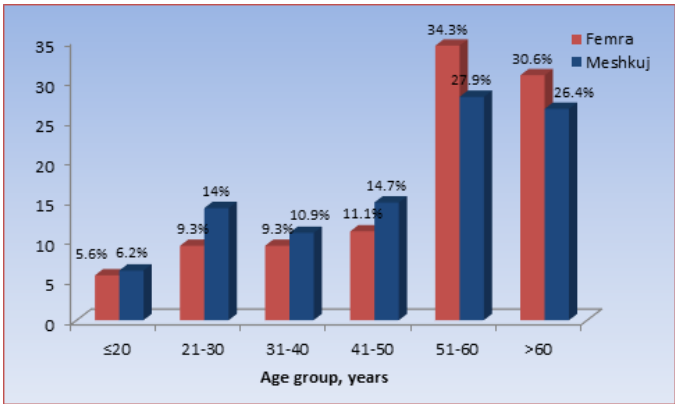

Figure 3. Distribution of cases by age group and gender

Figure 3, presents the distribution of patients by age group and gender. Based on these results, it is clear that there is no difference in the distribution of patients by age group and gender, which is indicated by the significance value (χ^2=3.0 p=0.6) which proves a statistically significant relationship.

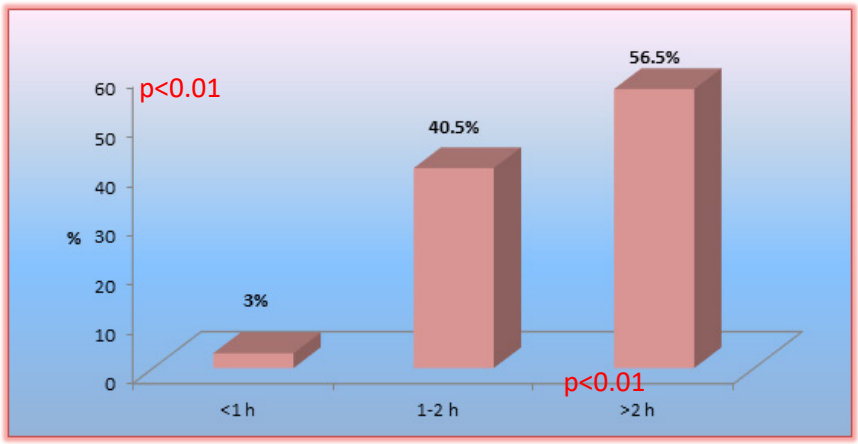

Figure 4. Duration of surgical intervention in patients

Figure 4, it is seen that the duration of surgery >2h had the largest number of patients 134 (56.5%), followed by duration 1-2h with 96 (40.5%) patients and duration <1h with 7 (3%) patients. Based on these results it is clear that there is a difference between the duration of surgery in patients with a predominance of duration >2h which is shown by the significance value (χ^2=107.5 p<0.01) which proves a statistically significant

relationship.

Table 3. Distribution of cases according to POP assessment frequency

POP assessment frequency		%	P
According to intensity		66.2	<0.01
In the interval 4-6(h)		23.5	

Figure 5. Distribution of total cases by POP assessment frequency

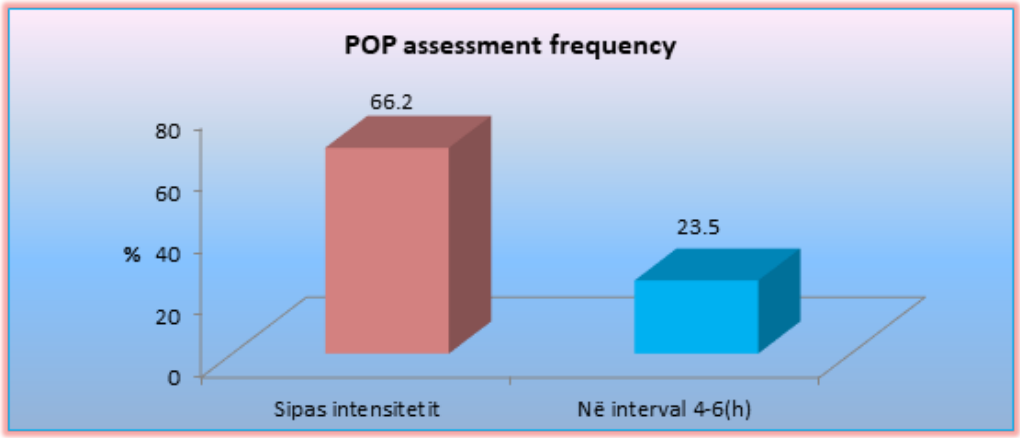

Figure 5, present the frequency of patient pain assessment. As can be seen, pain assessment according to intensity was performed in 157 (66.2%) patients, and every 4h in 56 (23.5%) cases. Based on these results, it is clear that there is a difference in the frequency of pain assessment, where the frequency of POP assessment according to intensity prevails, which is indicated by the significance value (χ^2=202 p<0.01)

Table 4. Prevalence of POP based on the total number of subjects included in the study

POP prevalence	N (%	Cumulative %	P
POP: YES	237 (79.3)	79.3	<0.01
POP: NO	62 (20.7)	100.0	
Total	299 (100.0)		

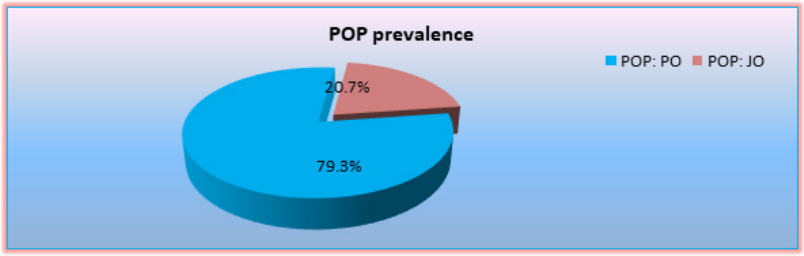

Figure 6. POP prevalence based on total number of subjects
From figure 6, it can be seen that the prevalence of POP in the study resulted in 79.3% 95%CI (74.2.-83.7).

Physiological and psychological effects of pain

Table 5. Physiological effects of pain

Physiological effects	N (%)
Cough suppression	20 (8.5)
Atelectasis	18 (7.6)
Pneumonia	8 (3.4)
Increased arterial pulse	44 (18.7)
Tachycardia	68 (28.6)
Sweating	46 (19.2)
Immobilization	71 (29.8)
Deep vein thrombosis	15 (6.3)
Muscular atrophy	10 (4.2)
Insomnia	42 (17.8)

Table 5. present the side effects of untreated pain, including the physiological effects of pain. As can be seen, of these side effects, immobilization predominates with 71 (29.8%) of the reported cases, followed by tachycardia with 68 (28.6%) and peripheral vascular resistance with 53 (22.3%). Next, another physiological side effect affecting patients with untreated pain is sweating with 46 (19.2%) cases, followed by increased arterial pulse with 44 (18.7%), insomnia with 42 (17.8%) cases. Among others, atelectasis is also present with 18 (7.6%), pneumonia with 8 (3.4%), cough deprivation with 20 (8.5%), deep vein thrombosis with 15 (6.3%) and finally, muscular atrophy with 10 (4.2%). Based on these results, it is clear that there is a difference between the types of side effects of untreated pain, which is indicated by the significance value (χ^2=264 p<0.01).

Discussion

This study aimed to evaluate the impact of post-surgical pain on the occurrence of physical effects in patients after surgery. Acute postoperative pain that is not properly managed has numerous short-term and long-term consequences. Short-term effects include physical limitation, emotional status, and mood disturbance, while long-term effects include morbidity, development of chronic postoperative pain, impaired recovery from surgery, prolonged opioid use, and increased medical costs (Gan, 2017).

The prevalence of moderate to severe postoperative pain varies worldwide. According to the literature, the prevalence of moderate to severe postoperative pain in the United States and Europe is 86% and 70%, respectively (Zaslansky et al., 2015). However, since our results also show that moderate to severe pain is strongly associated with multiple outcomes, including patients' postoperative physical activity, sleep, emotions, adverse effects of pain treatment, and patient satisfaction, we believe that improving acute pain management is necessary.

Identifying patients at high risk for acute postoperative pain is crucial in the management of acute postoperative pain. Surgical factors are one of the most important factors influencing acute postoperative pain, and the degree of postoperative pain varies greatly among patients from different surgical specialties and undergoing different operations. The degree of patient participation in the pain management process is associated with patient satisfaction and pain relief. (Kaptain et al., 2017). We will need to pay more attention to patient communication and pain assessment, so that patients are more involved in decision-making about pain treatment.

Management continues to be a global problem that is still controversial for health institutions, a fact that shows the importance of considering this issue. Despite technological progress, acute pain remains a common occurrence after surgical interventions. The prevalence of postoperative pain has been intensively evaluated in many countries and its high values indicate that the management of (POP) is still unsatisfactory, especially in abdominal and thoracic surgeries. Ineffective pain management is associated with potential negative physiological and psychological effects for patients, in addition to the high financial cost of their care. Effective postoperative pain control is important to prevent adverse effects such as tachycardia, hypertension, myocardial ischemia, decreased alveolar ventilation, immobility, deep vein thrombosis as well as delayed wound recovery, strong impact on morbidity and mortality and high cost of health care (Vadivelu et al., 2017).

From the results of our study, regarding the physical side effects of acute pain, immobilization prevails with (29.8%) of the reported cases, followed by tachycardia (28.6%) and peripheral vascular resistance with (22.3%). Next , another physiological side effect that affects patients with untreated pain is sweating with (19.2%) cases, followed by increased arterial pulse with (18.7%), insomnia with (17.8%) cases. Among others, atelectasis is also present with (7.6%), pneumonia with (3.4%), cough deprivation with (8.5%), urinary retention with (7.5%), deep vein thrombosis with (6.3%) and finally, muscular atrophy with (4.2%).

Conclusions

This study aims to determine the importance of effective postoperative pain management based on the complexity of physical effects and complications in patients after surgery and the ongoing challenges of health care professionals to prevent these situations after surgical interventions. The issues that were discussed in this material can serve as an opportunity for future research, to directly influence the physical and psychological rehabilitation of patients after surgery. There are ongoing challenges in the adequate control of postoperative pain. Effective assessment and management of postoperative pain can improve communication with patients and prevent the negative effects of postoperative pain.

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A new Approach for Short-Term Electricity Load Forecasting

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Abstract

Forecasting electricity demand is a fundamental process for planning periodic operations and facility expansions in the electricity sector. The liberalization of energy markets has led to a major increase in the complexity of demand patterns, making it difficult to select the right forecasting model for a given power network. Despite the development of numerous forecasting methods, none can be universally applied to all demand patterns. In this context, this study examined hourly electricity demand forecasting model using trendline methods which include linear trendline, moving average, exponential smoothing, polynomial, and logarithmic trends. Consequently, this paper introduces a practical methodology designed to serve as a guide for constructing Electric Power Load Forecasting models that integrates advanced pattern segmentation techniques with traditional trendline models. Unlike conventional approaches, which often apply a single forecasting model to the entire dataset, our method decomposes the time series into homogeneous segments, allowing each segment to be modeled with a unique polynomial trend. Applying Change Point (CP) approach demonstrated improvements in forecast accuracy, as evaluated by performance metrics such as Mean Absolute Percentage Error (MAPE), Root Mean Square Error (RMSE), and also Cubic Root Mean Error (CRME). Real hourly load data from the Durres electric network is utilized as a case study. The polynomial trendline emerged as the most effective forecasting method among those evaluated. The evaluation of these methods, using the specified metrics, demonstrated that the decomposition process surpassed the performance of individual trendline methods. Notably, the decomposition approach achieved the lowest values for MAPE, RMSE, and CRME, recording 0.891%, 0.147 MW, and 0.054 MW, respectively. The results provide insights to assist in forecasting the future needs of this network.

Keywords*:* Electric Power Load Forecasting, Time Series, Pattern segmentation, Trendline Methods, Change point.

1. Introduction

Electric power, as a product, contains specific characteristics that set it apart from material products. Notably, electricity must be generated in real-time to meet demand, because it cannot be stored. Among the many strategic objectives of electric power companies is to deliver stable and safe electricity to end-users. Consequently, Electric Power Load Forecasting (EPLF) is an essential process for the electric sector's planning and operation as well as for electric power systems. Accurate forecasting is crucial as it leads to substantial savings in operating and maintenance costs, enhances the reliability of power supply and delivery systems, and assists in making correct decisions for future development.

EPLF is categorized according to the planning horizon's duration. Short-term forecasting encompasses a period of up to one day or one week ahead, medium-

term forecasting spans from one day or week to one year ahead, and long-term forecasting covers periods extending beyond one year [1,2]. Scheduling the generation and transmission of electric power relies on short-term forecasts. While long-term forecasts are important for the strategic development of the power supply and delivery infrastructure, such as generation units, transmission systems, and distribution networks, medium-term forecasts are utilized in planning fuel purchases [1].

A numerous factor, including temporal, social, economic, and meteorological variables impact the electricity demand pattern, leading to complex variations in the pattern [1,3]. Randomness (noise) in the load pattern is mainly caused by environmental and social factors, such as consumers behavior.

The diversity and complexity of demand patterns have driven the development of sophisticated EPLF methods. The literature is rich with various EPLF methodologies, reflecting numerous attempts to achieve the most accurate load forecasting estimations. Major methods include time series techniques such as regression, Box–Jenkins ARIMA, ARMA, exponential smoothing, and transfer function (dynamic regression); neural networks; fuzzy logic; and support vector machines [4, 5, 6, 7, 3, 8, 9]. Additionally, several review papers on EPLF methods provide comprehensive overviews, including works [1, 10, 11, 12, 13].

As investigated at [14], the fundamental forecasting techniques are classified into qualitative and quantitative methods. The availability of data is the key factor in the selection of an appropriate method. These methods are categorized according to the extent of mathematical analysis incorporated in the forecasting model. Qualitative techniques, such as the Delphi method, curve-fitting, and technology comparisons, which depend on expert judgments, are often utilized when historical data is insufficient or nonexistent.

On the other hand, quantitative methods, including regression analysis, decomposition methods, Box-Jenkins methods and exponential smoothing, are based on mathematical and statistical computations. The mathematical models underpinning these techniques are discussed in detail in [15]. For instance, short-term time series analysis using regression was studied at [16]. Reference [17] applied a curve-fitting approach to forecast energy supply and demand planning using energy consumption data, evaluating performance using Mean Absolute Percentage Error (MAPE) and Root Mean Square Error (RMSE).

In their review of electrical load forecasting models, authors at [18], observed that despite their simplicity, regression methods continue to be widely prevalent for both long-term and short-term forecasting. In contrast, other statistical methods, such as time series analysis, are also extensively employed. Furthermore, [19] presented a curve-fitting prediction approach for short-term load forecasting, in which a genetic algorithm was used to minimize the error between actual and forecasted load, in order to determine the optimal parameters of a Gaussian model. Additionally, [20] explored the use of linear regression and polynomial curve fitting for forecasting wind and solar power production.

Singular spectrum analysis was investigated in [21] as a way to enhance the implementation of forecasting methods, based on decomposition pattern, for electric

load. Authors at [22] utilized artificial neural networks (ANN) and fuzzy logic to develop a load forecasting model. Using historical data, [23] forecasted the following day's electrical load demand using exponential smoothing grey models.
Authors at [24] presented two techniques for data adjustment to enhance the quality of information by addressing abnormal data points caused by daylight saving time and holidays. Their findings showed that models based on autoregression and ANN experienced improvements. AI has greatly improved many aspects of load forecasting. Techniques such as ANNs, fuzzy systems, as well as support vector machines have attracted academic interest, but their adoption in industry remains limited [25].
While advanced machine learning methods such as neural networks or deep learning have shown promise in load forecasting, but have no presence in load forecasting tools used by power companies, so this study primarily aimed to identify a practical forecasting technique for hourly peak load demand, focusing on developing a user-friendly tool by planners in distribution regions. The methods are considered to be highly interpretable by practitioners in the field. They can be changed easily in multiple regions like Durres where large historical data is available but limited computational resources for machine learning models might be present. The polynomial trendline approach effectively identifies many non-linear patterns within each segment, while segmentation skillfully adjusts the model to multiple periods, dealing with seasonal as well as social variations in demand. The researchers selected multiple load forecasting models based on multiple special demand pattern factors, including holidays, temporal variations, meteorological conditions, as well as seasonal influences. Consequently, an analysis of these parameters was deemed essential prior to the development of any forecasting model. Time-series and curve fitting techniques, including exponential smoothing, moving average, polynomial trends, and hybrid methods (such as pattern segmentation), were employed to augment existing methodologies. These techniques are distinguished by their clarity and cost-effectiveness, while still providing precise results. The performance of these methods was evaluated using several statistical metrics, with the most commonly utilized being mean absolute percentage error (MAPE), cubic-root mean error (CRME), and root mean square error (RMSE).
The objective of this paper is to present a practical methodology for EPLF designed to analyze electric load patterns and predict short-term future load demand. Unlike existing methods, which apply a single trendline to the entire time series, our decomposition method identifies structural breaks in the dataset and applies unique polynomial fits to each segment. This segmentation addresses the variability inherent in short-term electricity load, improving forecast accuracy as demonstrated through the application of the Change Point (CP) technique. Notably, this methodology builds upon existing models but introduces a customizable segmentation approach that adapts dynamically to changes in demand patterns, significantly enhancing predictive accuracy. This methodology emphasizes its capability to integrate and utilize diverse forecasting models for enhanced accuracy and applicability in load forecasting scenarios.
This paper is organized into five sections. The second section provides a detailed explanation of the methodologies utilized in the case study. The third section presents

the case study itself. The fourth section delves into a discussion of the results and conducts a comprehensive evaluation of the performance of these methods using a range of statistical metrics. Lastly, the fifth section presents the conclusions derived from the analysis.

2. Load Forecasting Methods and Accuracy Measure

The pattern exhibited by the time series aids in understanding the historical behavior of the data, revealing repeated and trend patterns. Appropriate forecasting models that align with these patterns include regression or trendline models such as straight-line or linear, moving average, exponential smoothing, polynomial trend, logarithmic trend, and a methodology, which is mainly based on decomposition and segmentation of the load time series. Each model was applied to the same hourly data set, and the results were subsequently compared.

2.1 Linear trend method

This method is employed to model the relationship between load consumption and various factors, such as day type and weather conditions [26]. It operates on the assumption that historical data will generally be consistent with future trends. The general form of the linear trend method and its calculation process are outlined in (1).

$$Y_t = a_0 + b_1 \tag{1}$$

Y_t - the linear trend value in period t,
a_0 - the intercept of the linear trend line,
b_1 - the slope of the linear trend line,
t - the time period.

The value of a_0 and b_1 are determined using simple averaging as (2).

$$b_1 = \frac{\sum_{t=1}^{n}(t-\bar{t})(Y_t-\bar{Y})}{\sum_{t=1}^{n}(t-\bar{t})^2} \quad \text{and} \quad a_0 = \bar{Y} - b_1\,\bar{t} \tag{2}$$

t - the average value of period
Y - the average value of the time series.

2.2 Moving average method

The moving average is a smoothing technique used to generate estimates of future values by analyzing the underlying pattern of a dataset [26]. The forecast for the period under consideration is made using the average of the most recent N data values in the time series. Mathematically, a moving average forecast of order k can be expressed as (3).

$$F_{t+1} = \frac{\sum(\text{most recent k data values})}{N} = \frac{Y_t+Y_{t-1}+\cdots Y_{t-K+1}}{N} \tag{3}$$

F_{t+1} - the forecast of the time series for period t+1,
Y_t - the actual value of the series in period t,
Y_{t-1} - the previous value of the series.

For forecasting the future time period, a two-hour moving average (N=2) was utilized.

2.3 Exponential smoothing

This method is a special case of the weighted moving average method in which the most recent observation receives the highest weight [26]. The weights for the other data values decrease exponentially as the observations move further into the past. The equation for the exponential smoothing model is given by (4).

$$F_{t+1} = aY_t + (1-\alpha)F_t \qquad (4)$$

F_{t+1} - the forecast value of the time series for the period t+1,
Y_t - the actual value of the time series in period t,
F_t - the forecast of the time series for period t,
- the smoothing constant with value of ().

2.4 Logarithmic trend model

The logarithmic model is another non-linear approach applied for forecasting peak load. It can be represented by the following equation (5), [26].

$$Y = \text{antilog}\,(C+dt) \qquad (5)$$

Y - the dependent variable (load in MW),
t - the hours.

2.5 Polynomial trend model

The polynomial trend model is another approach used for forecasting peak load, particularly effective in capturing non-linear patterns in the data. A polynomial trend of degree 'n' is given by the following equation (6).

$$Y = a_0 + a_1 t + a_2 t^2 + \ldots + a_n t^n \qquad (6)$$

Y - the value of the load (dependent variable),
t - hours,
a_0, a_1, and a_n - the constants to be determined.
The polynomial trend model allows for flexibility in fitting the curve to the data by adjusting the degree of the polynomial, thereby accommodating more complex patterns in the load data.

2.6 Polynomial trend model with Pattern Segmentation

The polynomial trend model with pattern segmentation or change point (CP) is a new approach used in this analysis. In our approach, firstly is identified the number

and the position of CP. Then, a polynomial trend of degree 'n' is given an equation, the same as (6), for each segmented region.

2.7 Forecast and accuracy measure

The selection of the optimal forecasting method is determined by evaluating the performance metrics. These metrics assess the accuracy and reliability of each method in producing forecasts [27]. The method that exhibits the lowest value for the selected metrics is deemed the most effective, while the method with the highest value is considered the least effective. In this study, mean absolute percentage error (MAPE), root mean square error (RMSE), and cubic-root mean error (CRME) were employed to assess the accuracy of the forecasting methodologies. The results obtained by applying each method to the same dataset are systematically presented in Section IV.

$$\begin{cases} \text{MAPE} = \frac{1}{N}\sum_{t=1}^{N}\left|\frac{A_t - F_t}{A_t}\right| \cdot 100 \\ \text{RMSE} = \frac{1}{N}\sqrt{\sum_{t=1}^{N}(A_t - F_t)^2} \\ \text{CRME} = \frac{1}{N}\sqrt[3]{\sum_{t=1}^{N}(A_t - F_t)^3} \end{cases} \quad (7)$$

A_t - the actual value at time t,
F_t - the forecasted value at time t and
N - the number of data points used.

3. Case Study

Distribution system of Albania is organized into 11 distribution areas, with total consumption of 7.876 GWh [28]. The distribution of supply with electricity for 2022 is presented in Fig. 1.

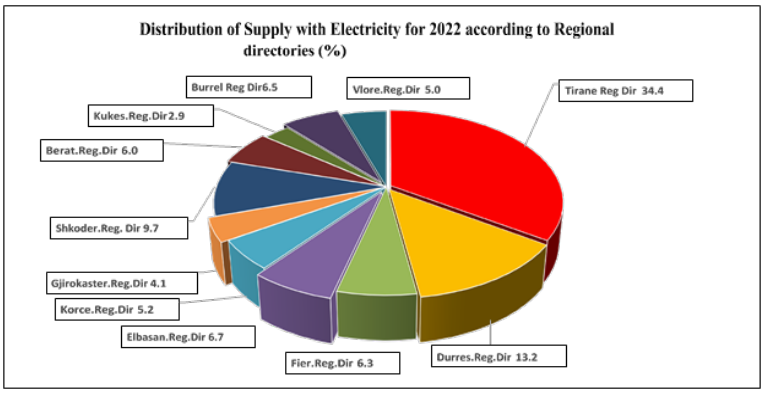

Fig. 1. The distribution of supply of electricity for 2022 [28]

The region of Durres ranks as the second largest region in terms of electricity consumption in the country, accounting for 13.2 % of the total consumption [28]. Each region is responsible for its own load forecasting. The case study uses hourly peak demand data from the Durres electric region, which has undergone significant demographic and infrastructural changes, particularly due to tourism-driven growth. For this analysis, the time series was segmented into two distinct periods, each representing a unique pattern in load consumption. These segments were identified based on statistical analysis of CPs, where shifts in demand pattern—such as increased tourist activity during the summer—were detected. Each segment was modeled using a polynomial trendline tailored to that period, with assumptions such as constant meteorological conditions and holiday effects applied to adjust for potential anomalies in the data. The rationale behind segmenting the data lies in the region's dynamic load profile, where different trends dominate across seasons and tourist influx period. However, the winter months of December, January, and February continue to exhibit the highest electricity consumption, primarily due to the extensive use of heating appliances.

In Fig. 2 is illustrated the hourly load profile for the day with the highest recorded load throughout the entire year. This profile provides a comprehensive analysis of the variations in electricity demand over a 24-hour period, thereby highlighting the peak consumption intervals and offering valuable insights into the daily demand patterns.

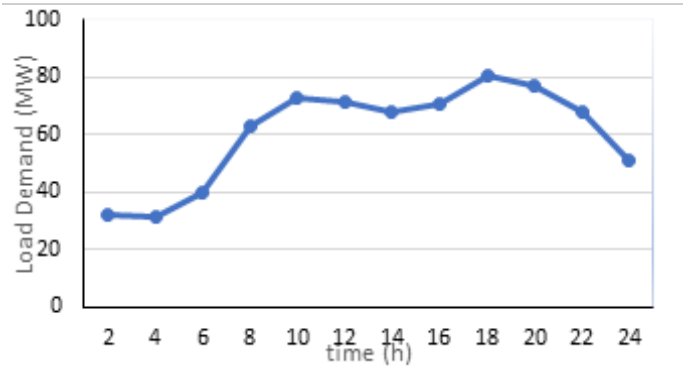

Fig. 2. The hourly peak load profile

Each of the forecasting models discussed above has been applied to the recorded load data for analysis. The analysis was conducted using Microsoft Excel.

4. Results and Analysis

The performance evaluation of each forecasting model for electricity demand, using the same dataset, was assessed using MAPE, RMSE, and CRME, as calculated according to equation (7) and summarized in Table 1. These metrics serve to gauge the accuracy and reliability of the forecasting methods, where higher values indicate inferior performance, while lower values indicate superior performance.

The results illustrate that the exponential smoothing method (row three) produced MAPE, RMSE, and CRME values of 20.73, 2.778 MW, and 1.202 MW, respectively. Following closely, the linear trend (row one) exhibited values of 20.047, 2.465 MW, and 1.160 MW. The logarithmic trend (row four) demonstrated values of 16.975, 2.065 MW, and 1.073 MW, whereas the moving average approach (row two) yielded values of 17.092, 2.454 MW, and 1.803 MW. Notably, the 6th order polynomial trend (row five) displayed the most favorable performance with MAPE, RMSE, and CRME values of 6.148, 0.725 MW, and 0.194 MW, respectively. Based on these findings, the polynomial trendline emerges as the optimal forecasting method among those evaluated, due to its consistently lower values across all assessed accuracy measures. This underscores its effectiveness in predicting electricity demand over the forecasted period.
The results of Table 1 reveal that, following the segmentation of the time series, the values of the accuracy measures exhibit a decrease. This reduction signifies an enhancement in the performance of the applied polynomial trendline. Specifically, the polynomial trendline method, as shown in the sixth row of the table, achieves values of 0.891 for MAPE, 0.147 MW for RMSE, and 0.054 MW for CRME.

Table 1. Performance results of the models

Methods	MAPE (%)	RMSE (MW)	CRME (MW)
Linear	20.047	2.465	1.160
Moving Average	17.092	2.454	1.803
Exponential	20.730	2.778	1.202
Logarithmic	16.975	2.065	1.073
Polynomial	6.148	0.725	0.194
Pattern Segmentation (CP)	0.891	0.147	0.054

According to the accuracy metrics detailed in Table 1, the polynomial trendline emerged as the most efficacious forecasting method among those assessed. Therefore, this approach has been adopted for curve-fitting to the decomposed actual data. Fig. 3 (a, b) show the 6th order polynomial trend for the first and second segment of load time series. The first segment has a specific similarity and the second segment has another similarity. In other words, for each group, each polynomial parameter demonstrates a trend.

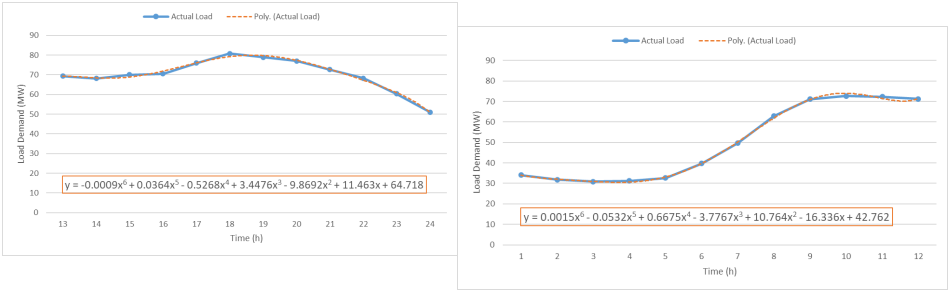

Fig. 3. Polynomial trend of the first segment of load time series (a) Polynomial trend of the second segment of load time series (b)

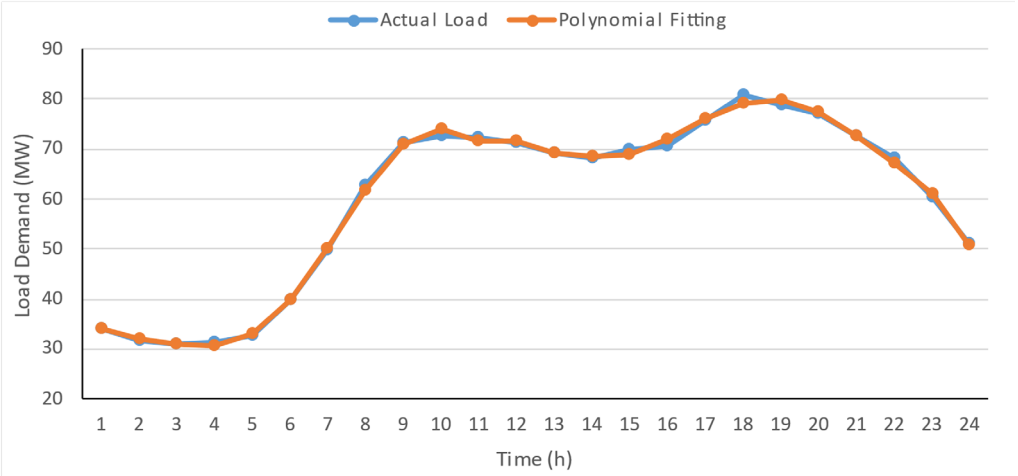

Fig. 4. The merged plot of the values derived from the trendline equations applied to each segmented region

The curve shown in Fig. 4 is plotted by combining the values derived from the trendline equations applied to each segmented region of the time series. This approach leverages the segmented trendline models to better capture the underlying patterns and variations in the data, resulting in a more accurate representation of the forecasted electricity demand across different regions of the dataset. While each of the forecasting methods yielded satisfactory results, the polynomial trendline combined with pattern segmentation demonstrated superior performance, as evidenced by the evaluation metrics presented in Table 1. This approach's enhanced accuracy underscores its effectiveness in capturing the intricate patterns and trends within the data, thereby providing the most reliable forecasts.

5. Conclusion

Electricity demand forecasting is a pivotal task in the strategic planning and operational management of electricity production. It is integral in determining the resources necessary for power plant operations, including daily fuel consumption. Moreover, it is fundamental to the strategic planning for the development and maintenance of electric plants and networks. The reliability of the forecasting model is paramount, as it must maintain a high level of accuracy with respect to the input variables.

This study focused on hourly electricity demand forecasting methods using a trendline approach, including linear trendline, moving average, exponential smoothing, polynomial trendline, and logarithmic trendline. The time series data were segmented into homogeneous regions, within which polynomial trends were identified. The analysis was conducted using Microsoft Excel. Each method's results were evaluated using well-known performance metrics such as Mean Absolute Percentage Error (MAPE) and Root Mean Square Error (RMSE). Additionally, a novel performance evaluation metric, Cubic Root Mean Error (CRME), was introduced.

The performance of these methods was assessed based on these metrics, revealing that the decomposition process outperformed the individual trendline methods. The decomposition method yielded the lowest MAPE, RMSE, and CRME values, at 0.891%, 0.147 MW, and 0.054 MW, respectively.

This study underscores that while various forecasting methods can produce accurate results, the efficacy of these methods can be significantly enhanced by incorporating time series segmentation and polynomial trends. It also suggests that increasing the exponent values of the forecast error, such as using $(Error)^3$ and $(Error)^4$, can serve as effective performance evaluation metrics, with higher exponent values resulting in lower mean error values.

The findings underscore the necessity for tailored forecasting methodologies for individual electric networks and plants, recognizing that the factors influencing electricity demand differ across countries. In developing nations, for example, electricity demand exhibits dynamic and rapid growth, necessitating bespoke forecasting methods to address these unique conditions. This paper thus advocates for the customization of forecasting models to align with the specific characteristics and requirements of each electricity network, ensuring enhanced accuracy and reliability in demand prediction. Future research efforts could concentrate on enhancing forecasting models by integrating external factors like economic indicators, weather forecasts, and socio-demographic data. These variables exert substantial influence on electricity demand patterns, potentially enhancing forecast accuracy, particularly for medium to long-term projections.

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Application of the decline curve analysis in calculation of the decline rate and determination of the abandonment time for the Amonica oil field in Albania

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Abstract

The porous media of the geological formation in which the oil and gas is accumulated, can be considered as a closed system, within which different fluid filtration laws are developed, and this system is defined as a single hydraulically connected system. Decline analysis method, which is based on three types of decline like exponential decline, harmonic decline and hyperbolic decline, helps in various studies about production analysis and forecasting. Based on data and information provided such as annual oil extraction, average daily oil per well, cumulative oil, the number of wells in use for the period of ten years for the Amonica oil field located in Albania, the practical implementation of the decline analysis was made, making possible the building of the corresponding cartesian and semi-logarithmic curves, the determination of the decline rate, including the nominal decline calculated by the method of least squares, as well as the effective decline rate for every year. From the determination of these values, it was continued with the calculation of the predicted theoretical rate with two methods for the ten-year period, then the comparison of the values with the real rate and the graphic compatibility. Also, based on the calculated rate of decline as well as the determined theoretical rate and the economic limit taken into consideration, the time of abandonment has also been determined.

Keywords: Exponential Decline, Oil Field, Producing Life, Decline Rate, Economic Limit. Abandonment Time.

1. Introduction

The shape of the underground oil and gas reservoir affects the filtration of the fluids it contains.

A description of the irregular shape of the reservoir boundaries is possible using numerical simulators. The geometry of fluid flow can be classified into three forms; radial flow, linear flow and spherical flow, which are taken into consideration in the various calculations used during well testing [1,2]. The very fine voids and channels which together make up the space where the liquid moves in the oil-bearing rock form a tangled network spread in a different way and with cross-sections that vary according to the geometric shape [3,4,5]. Therefore, starting from the practical meaning of the word, by agreement, we will call the movement of fluids in porous media and fractures filtration [5,6]. In reservoir engineering, the flow and type of fluids that progress in porous media, the hydrodynamic parameters and the filtration stages impacting the production led to pressure drop [7]. These parameters are the key to the practical solutions of numerous subjects that are faced during the exploitation of oil fields [8]. With the utilization of the pay zone and the extraction of the fluid to the surface, the pressure will start to decline, and this pressure drop affects not

only the physical-chemical changes of the fluid but also the behavior of the reservoir [9,10] . Depending on the stage and regime of exploitation by applying the analysis of production decline curves and determining its type for the reservoir taken into consideration, specifically the Amonica oil field, the decline rate is determined and then the forecast of future production and the time of abandonment of the reservoir, based on the established economic limit, below which the continuation of operations in the Amonica oil field is not commercial. The rate of the economic limit is the rate of production that will guarantee the repayment of expenses from the direct operation of a well [9,10] . At the end of this economic limit, it is often advisable to closely analyze the costs charged against a well and determine than how much they would actually save if the well were abandoned. This savings provides the best measure of the economic margin of production, because spending can continue if other wells are kept in operation.

2. Methodology

Starting from the "curvature" in the production-rate-versus-time, Arps (1945) proposed that curve can be expressed mathematically by a member of the hyperbolic family of equations. Arps recognized the following three types of rate-decline behavior [2,3]:

- Exponential Decline
- Harmonic Decline
- Hyperbolic Decline

Based on technical data for Amonica Oil Field such as annual oil extraction, average daily oil per well, cumulative oil, the number of wells in use for the period of ten years (showed in table 1), the practical implementation of the decline analysis was made, making possible the construction of the corresponding cartesian and semi-logarithmic curves, the determination of the decline rate, including the nominal decline calculated by the method of least squares, as well as the effective decline rate for every year.

			YEARS								
Nr	**Technical Data**	**Unit**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1	**Number of wells in use**	**N/r**	**25-27**	**25-29**	**24-27**	**25-26**	**23-26**	**22-23**	**17-23**	**17-19**	**19**
2	**Annual oil Extraction**	**Ton**	**7598.5**	**7588.2**	**6888.5**	**6290.2**	**6016.7**	**5767.9**	**5115.1**	**5103.1**	**4150**
3	**Average Daily Oil Per Well**	**Ton/ Day* well**	**1.72**	**1.37**	**1.25**	**1.24**	**1.07**	**1.13**	**1.13**	**1.24**	**1.20**
4	**Cumulative Oil**	**Ton**	**657847**	**665435**	**672323**	**678614**	**684630**	**690398**	**695513**	**700616**	**704766**

Table 1-Technical Data for Amonica Oil Field in Albania

Since the decline determined based on the production data for the Amonica oil field presented in table 1 is an exponential decline, below the three basic formulas for calculating the decline rate are written in the case of exponential decline, including here the effective decline rate and nominal decline rate with their respective values, as well as graphs of rate-time dependence in cartesian coordinates and semi-logarithmic coordinates, on which the type of decline (figure 1 and figure 2).

1. $D = \frac{\sum_{i=1}^{n} t * \ln\frac{q_i}{q_t}}{\sum_{i=1}^{n}(t^2)} = 0.066$
2. $D^* = \frac{q_i - q}{q_i} = 0.047$
3. $D = \ln\frac{q_2}{q_1} * \frac{1}{(t_1 - t_2)} = 0.051$

From the above values for the three decline rates, the average value of the decline rate was taken into consideration, on the basis of which it was continued for the calculation of the theoretical debits and the time of abandonment.

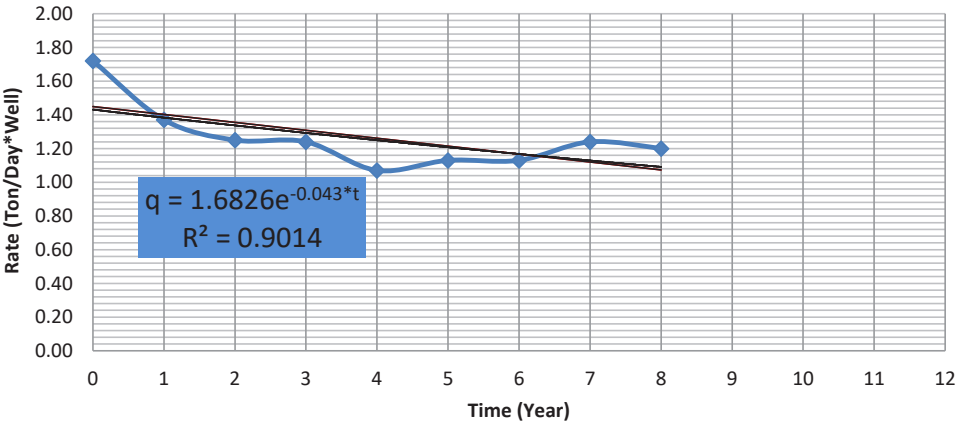


Figure 1- Rate-Time Dependence in Cartesian Coordinates

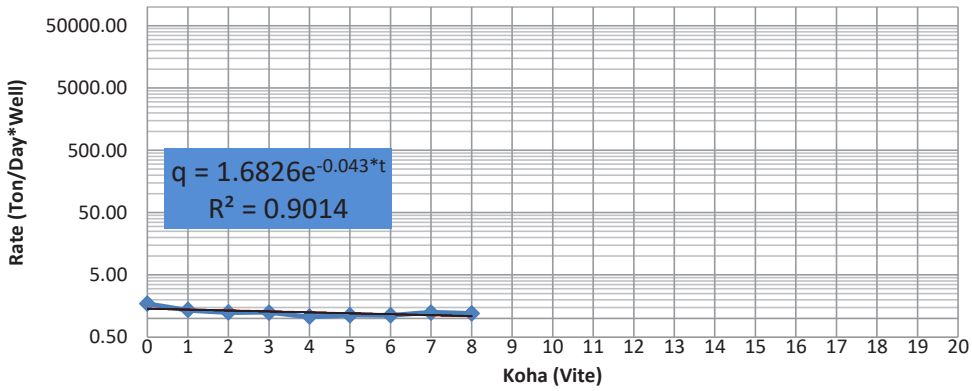
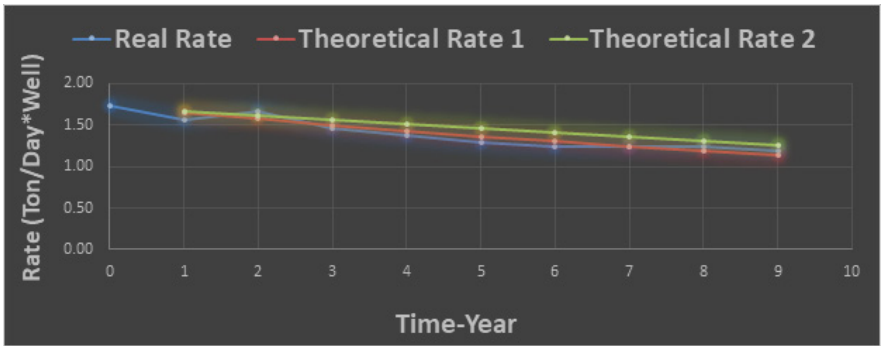


Figure 2- Rate-Time Dependence in Semi log Coordinates

3. Results and Discussion

Currently, the decline determined for the Amonica oil field is an exponential decline. In determining of this decline rate, the above three formulas were taken into consideration, which included both the effective decline and the nominal decline. Starting from the first two formulas where the decline rates are 0.066 for the nominal decline calculated by the least squares method and 0.047 for the effective decline or in other words the decline calculated at each point for each year, it was made possible to calculate the two theoretical rates and building the graphic compatibility as following.



$Time - t$ (Year)	Average Daily Oil Per Well	$q_t = q_i * \exp(-D*t)$ Theoretical Rate Method 1	$q_t = q_i * (1-D)^t$ Theoretical Rate Method 2
Column1	Column2	Column3	Column4
Year	Real Rate	Theoretical Rate 1	Theoretical Rate 2
0	1.73		
1	1.56	1.650627028	1.670995806
2	1.67	1.574895714	1.614004036
3	1.47	1.502638978	1.558956055
4	1.37	1.433697405	1.505785566
5	1.30	1.367918894	1.454428534
6	1.24	1.305158323	1.40482311
7	1.24	1.245277228	1.356909552
8	1.24	1.188143497	1.310630156
9	1.19	1.133631081	1.265929187

Figure 3- Matching the theoretical rate with the real rate

Tabele 2- Calculated values for the theoretical rate with two methods

Starting from Fig.3, based on the relationship that exists between the calculated theoretical rate and the real real, we come to the conclusion that the compatibility between them is high, which in itself expresses a satisfactory calculated value for the average decline rate. Based on this, if no other method to increase production will be carried out at the oil field, i.e. the reservoir will be exploited based only on its natural energy, it becomes possible to calculate the production forecast for the coming years based on the value of this decline rate. All the above data on the

basis of which the relevant calculations presented in the table and the illustration of the respective graphs were made, are technical data obtained on the site (field application) during the exploitation operations carried out over the years in the Amonica oil field. Another important parameter that has been calculated based on the average decline rate (defined above) is the abandonment time, i.e. the maximum time in which this oil field is expected to be exploited in a commercial way. This maximum (abandonment) time is determined depending on the economic limit set, below which it is considered that any operation to be developed is not commercial. The economic limit of the reservoir as a whole is determined based on the value of the average daily oil per well, which is taken as 0.90 (ton/day*well) with number of wells in use until 25. The economic limit of the well was put by a study based on for this year. The economic limit for this underground oil reservoir was established by a study based on these production time periods and taking into account the case that there would be no additional works in the reservoir such as fluid injection to increase the energy of the formation or infill drilling. Based on the value taken into consideration and considering that initial Average Daily Oil per Well was 1.72 (ton/ day*well) and Decline Rate =0.04/year the abandonment time will be as following:

$$q_t = q_i * e^{-Dt}$$

$$0.90 = 1.72 * e^{-0.04*t} = \frac{0.90}{1.72} = e^{-0.04*t} \rightarrow \frac{1.72}{0.90} = e^{0.04*t}$$

$$0.04 * t = \ln 1.91 \rightarrow 0.04 * t = 0.64 \rightarrow t = 16\ year$$

This then implies that the total life of the reservoir in order to be commercial from 2005 to the time of abandonment is 16 years. Based on this achievement, we conclude that the reservoir will be commercial, being exploited without any intervention in it, such as injections, supplementary drilling, fractures, etc, until 2026.

4. Conclusion

In general, for any hydrocarbon operation that is considered during the development of an oil and gas field (Development Plan), production decline curve analysis can be applied to both technical assistance for the prediction and future development of underground oil reservoirs. and gas, but also in a forecast and economic analysis in the various investments that will be carried in the fields including equipment and facilities such as pipelines, plants and treatment facilities. The production decline rate is a very important parameter based on which it becomes possible not only to predict the production in the future, but it also helps in determining the time of abandonment by indirectly expressing the natural energy potential of the underground reservoir.

5. Nomenclature

$\mathbf{q_i} \rightarrow initial\ oil\ \ flow\ rate$
$\mathbf{q_t} \rightarrow oil\ flow\ rate\ at\ time\ \ t$

$\boldsymbol{t} \rightarrow time, year$
$\mathbf{D} \rightarrow nominal\ decline\ rate$
$\mathbf{D}^{*} \rightarrow effective\ decline\ rate$

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Developing Intercultural Competence in Business English through Artificial Intelligence (AI)

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Abstract

In today's globalized world, developing intercultural competence is a must. Intercultural competence encompasses the knowledge, skills, and attitudes required to communicate effectively across cultures. This paper explores the potential of artificial intelligence (AI) in facilitating the development of intercultural competence. Artificial Intelligence (AI) continues to shape education, offering innovative ways to enhance this vital skill. AI technologies such as chatbots and language learning applications, provide real-time feedback, and promote learner autonomy. However, challenges remain, including the risk of over-reliance on AI. The study concludes that while AI is a powerful tool for developing intercultural competence, it should complement, rather than replace, real-world experiences. Policy recommendations from organizations like UNESCO underscore the importance of integrating AI responsibly into educational practices.

Keywords: intercultural competence, artificial intelligence, teaching business English.

Introduction

In our interconnected world, engaging in business with international companies and participating in global meetings have become essential. This reality requires individuals to be prepared in the field of economic and cultural awareness.

Intercultural competence (IC) plays a pivotal role in equipping individuals with knowledge, skills, attitudes, and awareness important to communicate in a globalized world. IC means the ability to communicate effectively with individuals from various cultures. Developing this competence involves experiential learning, studying abroad, and engaging in cross-cultural interaction. However, intercultural competence is not merely about acquiring factual knowledge about English-speaking countries; it also encompasses understanding and appreciating cultural differences.

Developing intercultural competence is quite challenging because it requires adopting new teaching approaches that integrate linguistic competence and intercultural competence. Artificial Intelligence (AI) however, provides additional tools to make this learning process more accessible. The main aim of this article is to examine the role of AI in developing intercultural competence skills. According to UNESCO (2023), "generative AI (GENAI) is an artificial intelligence technology that automatically generates content in response to prompts written in natural-language conversational interfaces". GenAI has rapidly evolved, gaining public attention through tools like ChatGPT. These tools can be accessible to wide range of users offering personalized and interactive experiences, allowing learners to explore cultural diversity in innovative ways.

Moreover, AI offers numerous opportunities to develop the four language skills:

speaking, listening, reading and writing. AI provides real-time feedback, significantly enhancing learners' potential to develop their communication skills. It can simulate cross-cultural scenarios, allowing learners to practice intercultural communication effectively. AI-based language applications can teach not only grammar and vocabulary but also idiomatic expressions and cultural nuances, fostering a deeper understanding of different cultures.

Additionally, AI enhances learner autonomy by proving immediate feedback and addressing common challenges faced by English learners, such as limited access to native speakers and lack of immediate feedback. This article underscores the potential of AI in developing intercultural competence, and making language learning more effective.

The role of AI in promoting intercultural competence

Intercultural competence is a dynamic and continuous process that requires a well-thought-out approach to integrating intercultural competence through AI. As Cheng (2024) noted, incorporating Information and Communication Technology (ICT) can prepare students with good knowledge of cultural awareness and IT skills. Tools like GPT 3.5 and GPT 4 can produce human like text and Chan (2023) suggested that the widespread availability of AI tools creates the need to develop AI education policies that equip students with these skills. UNESCO (2023) emphasizes the dominance of AI in the economic field, encouraging universities to prepare students to benefit from AI technology and become more competent and responsible users.

AI-powered chatbots can simulate conversations with individuals from various cultural backgrounds, enabling learners to practice appropriate responses based on the context. AI can play an important role in facilitating this process by analyzing a learner's progress, tailoring content to their specific needs, addressing cultural misunderstandings in real-time. For instance, if a learner struggles with understanding cultural norms in a business setting, AI system can create simulations to facilitate their learning process.

Teachers can use AI tutors to create adaptive exercises and cultural scenarios that help students understand complex intercultural concepts. This approach can also prepare students by familiarizing them with local business etiquette and norms. Zmire (2024) highlighted that while culture can be studied through books, they can't replace direct interaction with people. For instance, students can use ChatGPT to ask specific questions regarding cultural issues or translate business text into different languages, which can be particularly helpful. However, it is crucial to address concerns associated with to the use of AI such as over-reliance. Kasneci, et al. (2023) warn that over-reliance on AI might hinder critical thinking and problem-solving skills, since AI simplifies the answer. This situation could lead to what Chan (2023) called "AI-giarism."

To mitigate this risk, students should be encouraged to analyze, interpret, and evaluate information provided by AI. Learners need to be aware of their limitations and to use AI to enhance their learning process. However, AI should complement, not replace, real-world experiences. Atlas (2023) mentioned that AI tools, like ChatGPT,

lack understanding of human emotions, intentions and moral reasoning, and the ability to understand the emotional and psychological needs, which are essential for intercultural competence. Similarly, Kasneci et al. (2023) noted that AI cannot replace human creativity and critical thinking.

UNESCO (2023) recommends developing policies to integrate GenAI into curricula, teaching, learning, and research. They suggest enhancing human capacity to work with AI responsibly, and promoting GENAI as a tool for empowerment rather than replacement. While AI is a valuable resource for enhancing learning and teaching, it can never fully replace educators or real-world cultural interactions.

Studies have shown that AI has a significant impact on developing intercultural competence. AI-based interactive platforms offer immediate feedback, promoting learner autonomy. These platforms can simulate cross-cultural scenarios, allowing learners to practice intercultural skills. AI-based language applications not only teach grammar and vocabulary but also idiomatic expressions. However, ChatGPT and similar tools sometimes generate texts with mistakes and need to be used carefully. Despite these challenges, these tools are continually improving in data processing.

Educators must carefully consider what is essential for their students' future careers. To achieve this, they need ongoing training to stay updated to the current technological advancements. Additionally, students must be monitored continuously to ensure the effective and responsible use of AI tools.

Method

This study involves 50 first-year students from the Agricultural University of Tirana, using a questionnaire adapted by Chan (2023). It was designed to understand the experience and attitudes of students towards AI. The survey utilized a five-point Likert scale (strongly disagree-strongly agree) and was conducted online. The aim was to gather insights to improve the University's teaching and research mission, particularly in integrating AI into the learning process. The study aims to guide educators on effectively combining intercultural competence with AI and to enhance the students' learning experiences by making Business English courses more engaging and relevant to real-world demands.

Hypotheses

H1. AI tools enhance learners' ability to understand cultural nuances and improve their Business English skills

H2 Over-reliance on AI can limit direct human interaction and cultural immersion, which are critical to developing intercultural competence.

Results and Discussions

Findings from the quantitative data

The results indicate a general acceptance and positive outlook towards the integration of AI tools in education. AI tools are appreciated for their role in enhancing specific

skills and understanding cultural differences, but participants believe they cannot entirely replace real-world intercultural competence.

Table 1 Descriptive analysis for quantitative results

Item	N	Mean	Median	SD
I have used generative AI technologies like ChatGPT	50	3.74	4.0	1.0062
AI has a positive impact on my education by enhancing learning experiences	50	3.38	3.00	0.878
AI tools should be integrated into future teaching methods to improve education outcomes	50	3.04	3.00	1.087
Students need to learn how to use AI effectively for educational purposes	50	3.64	4.00	1.208
ChatGPT can provide helpful guidance for completing homework and assignments	50	4.-02	4.00	0.742
Using ChatGPT reduces my opportunities with others in learning settings	49	3.12	3.00	.949
I am concerned that I may become overly dependent on AI tools like ChatGPT	50	3.04	3.00	1.106
AI technology may replace traditional teaching roles in the Future	49	3.37	4.00	1.286
I am concerned about the privacy of my personal data when using AI tools	50	3.44	4.00	1.163
AI tools enhance my Business English	50	3.50	4.00	0.974
To what extend do you agree that AI tools can help you understand cultural differences?	50	3.58	4.00	0.883
AI tools help me understand cultural differences more effectively	50	3.02	3.00	0.979
AI technologies enhance my awareness of cultural norms and values in professional settings	50	3.02	3.00	0.845
AI tools help me learn about local business etiquette and cultural practices effectively	50	3.24	3.00	0.870
AI fosters an appreciation for cultu0ral diversity by exposing me to a variety of perspectives	50	2.90	3.00	0.974
AI –based tools can complement, but not replace, real- world intercultural competence	50	4.18	4.00	1.004

Usage and impact of AI technologies: the majority of students (mean: 3.74, median: 4.0, sd: 1.006) declared that have use generative AI technologies. Participants generally agree (mean; 3.38, median: 3.00, sd: 0.878) that AI positively enhances their learning experiences. There's moderate agreement (mean:3.04, median: 3.00 sd:1.087) on the need to integrate AI tools in teaching. Students believe (mean:3.64, median:4.00, sd: 1.208) they need to learn how to use AI effectively.

Specific AI tool usage: students strongly agree that ChatGPT provides helpful guidance for homework and assignments (mean: 4.02, median: 4.00, sd:0.742). Some are concerned that ChatGPT may reduce opportunities for interaction (mean: 3.12, median: 3.00, sd: 0.949).

Concerns and Replacement of Roles**:** according to the data there is a moderate agreement that AI might replace traditional teaching roles (mean: 3.37, median:4.00,

sd: 0.974). Participants are somewhat concerned about the privacy of their data (mean 3.04, median 3.00, sd: 1.1106) and moderate concern about data privacy.
Enhancement of language and cultural understanding**:** students agree (mean:3.58, median 4.00, sd: 0.883) that AI tools help them understand cultural differences. AI helps in learning local business etiquette and cultural parities (mean: 3.24, media: 3.00, sd:0.870). Students moderately agree that AI may enhance awareness of cultural norms (mean; 3.03, median: 3.00, sd; 0.974) However, there is a strong agreement that AI can complement, but not replace, real-world intercultural competence (mean 4.18, media; 4.00, sd;1.004).
The data suggest a moderate to strong agreement that AI tools are effective in enhancing Business English and helping users understand cultural nuances. The data supports hypothesis 1 (H1), indicating that AI positively impacts on improving language skills and cultural nuances. The second hypothesis (H2) indicates moderate concern that AI can reduce human interaction and create dependency. However, they agree that direct interaction is very important.
Most participants see value in AI tools for enhancing education, especially in specific skills like Business English and cultural understanding. AI presents numerous opportunities to enhance intercultural competence and learning experiences. By addressing the challenges and maximizing the benefits of AI, educators can better prepare students for a globalized world. However, there is a need for training programs to help student effectively use AI tools while being aware of potential dependencies and privacy concerns.
The use of AI technology is quite inevitable, prompting universities to make strategic decision about its integration. Continuous monitoring of AI implementation is crucial to ensure its effectiveness. Additionally, educators need training in order to understand how AI can be implemented into the curricula to enhance students' outcome.

Limitations

A mixed-method approach could have provided a more insightful view of the students' perception. Future research should incorporate qualitative methods alongside quantitative surveys to gain deeper insight into the role of AI in developing intercultural competence.

Conclusion

The integration of artificial intelligence in education presents numerous opportunities to enhance the learning process of the students. AI has the potential to change the way intercultural competence skills are developed. By incorporating AI into education, students can be better prepared for the challenges of an interconnected world. AI provides personalized and real-life learning experiences that make it easier for students to understand and adapt to different cultures.
One of the major advantages of AI is its ability to create interactive scenarios. AI tools like ChatGPT allow students to practice communication and learn about different

cultural values. Overall, AI can be highly beneficial for both students and teachers. However, there are still challenges that need to be addressed regarding the inclusion of AI in education. For instance, not all students have equal access to AI-based educational resources.

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Approaches of parents' involvement in their children's academic achievements in secondary education: Challenges and perspectives

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Abstract

Purpose: The main aim of this paper is to investigate the attitudes of parents and teachers regarding parental involvement in the students' academic achievements in secondary education in the Devoll District, Albania. It highlights the multifaceted factors influencing parental involvement in school life, such as societal importance placed on education, parents' educational and cultural background, teacher training, societal democratization, and tradition.
Design/methodology/approach: This research uses a combination of qualitative and quantitative methods to examine parental involvement in secondary education. The study includes 50 third-year students and 50 parents from various schools in the Devoll region between June 2021 and March 2023. Two semi-structured questionnaires were constructed for parents and teachers, using a LIKERT scale for attitudes. The data was analyzed using the SPSS package.
Findings: The findings underscore the need for enhanced communication and collaboration between teachers and parents, with a focus on aligning priorities, addressing concerns, and fostering a supportive environment for students' academic achievements.
Research limitations/implications: Comparative studies across different regions or countries with varying socio-cultural contexts could help identify common trends or divergences in teacher-parent-student relationships. This could contribute to a broader understanding of the factors influencing parental involvement in education.
Practical implications: Educators and schools should adopt diverse communication strategies to engage parents, including phone communication and other virtual means. Regular, systematic notifications about students' academic achievements can help keep parents informed and involved.

Keywords: Parental involvement, academic achievements, teaching process, learning process, econdary education.

1. Introduction

In the conditions where the entire human society is facing fundamental changes in psycho-social, political, and cultural aspects, processes such as teaching, learning, and teacher-parent-student relationships are encountering new problems and challenges. "The level of parental involvement in school life and decision-making at various levels varies from one place to another. It is the result of simultaneous factors

such as the importance given to education for determining the child's future and his economic and social status in a specific society, the level of educational and cultural formation of the parents that determines their readiness to communicate with the school and teachers, as well as their expectations, the ways in which teachers have been formed and trained regarding collaboration with parents and respecting them as co-educators of the child and clients of the school, the level of general participation in political and social life that reflects the overall level of democratization of society, the influence of tradition, etc."

The attitudes of teachers and parents need to have an acceptable level of alignment in order to positively influence the learning process. The academic achievements of students seem to be influenced not only by processes such as teaching and the strategies used in class but also by parenting styles.

According to Ramsey and Bender, the students' success in their academic achievements, especially in pre-university education, depends on close collaboration between teachers, parents, and students. However, Ramsey points out that it's the teacher who can make this connection strong or weak by using various techniques related to communication, like making empty threats or trying too hard to be politically correct. (Ramsey, 2009; Bender, 2004; Guskey, 2023).

Parenting styles also have a considerable impact on students' attitudes toward school, the teaching process, and consequently, their academic achievements. Active and concrete involvement of parents seems necessary at all levels of education; however, secondary education presents challenges due to the value placed on academic achievements and the challenges of selecting students' future professions at the end of this educational level.

Every effort and support from parents towards the teaching process helps teachers successfully realize the teaching process: the acquisition of scientific knowledge (Nelson, Lott, & Stephen, 2013, p. 3). A positive classroom atmosphere and strategies in line with their age and individual characteristics, along with ongoing collaboration with parents, form the basis for achieving specific or general objectives that the school has. Attention and affection need to be ensured in family environments and then in classroom environments (Costa, 2016, p. 12–16). If this attention is lacking, every effort by the teacher for a quality learner would be difficult.

Moreover, other authors believe that involving parents in the education process is not easy due to the new characteristics of the current post-modern society, whose influences may be understood and observed in the years to come. Thus, parenting styles and the overall ways in which students behave in home environments—environments where encouragement should occur and punishment of students should be eliminated—are essential (Tushi, 2015, p. 8).

2. **Literature review**

Family and school, as two primary agents with significant influence on the socialization process of students, play an extraordinary role in their social and professional development. Parents have a crucial role in the education and modeling of their children's behavior, given that children spend more time at home with their

parents than in school, and also due to the fact that children have more interaction within the family than at school, (Epstein, 2001).
Thus, the level of academic achievements of students, as important indicators of the attainment of educational objectives, is closely related to the demonstrated professionalism of the school and its close and continuous collaboration with parents. The approach of parents and their involvement in the education of students becomes a fundamental factor in students' academic achievements, (Bailey, 2017; Bido, 2020; Nigussie, 2021).
Furthermore, parental involvement in the education of children leads to the further strengthening of the parental role. Epstein believes that the influence of parents on the academic progress of children is crucial because students tend to interact more in home and family environments than in school environments (Epstein, 2001). Similarly, Epstein is convinced that the professionalism of teachers, schools, or the entire education system is not valid if the school and the family do not collaborate closely. Indeed, Epstein proposed early on models and concrete ways, both in practical and theoretical aspects, on how teacher-student-parent collaboration can be achieved and how this collaboration can lead to the improvement of students' academic achievements (Epstein, 1992).
Other studies have shown that parental involvement in education can vary over time and space due to the influence of four factors: the frequency of parent-teacher contacts, the quality of parent-teacher interactions, participation in educational activities at home, and parent participation in school activities (Izzo, Weissberg, Kasprow, & Fendrich, 1999). In a similar vein, these factors will have an impact on students' attitudes toward the teaching process and their behavior in classroom or school settings. The attitudes of parents toward the education system in general and the teaching process in particular are also reflected in the manifested behaviors of students in school environments. This includes behaviors oriented in two directions:

1. The manifested behavior of students towards teachers
2. The oriented behavior of students towards the teaching process

According to Izzo, Weissberg, Kasprow, & Fendrich (1999), students' approaches to their academic achievements and their level of achievement are determined and reflected by the attitudes of parents towards the school, teachers, the teaching process, etc.
Furthermore, (J., L., Epstein and Associates, 2009), emphasizes that in the effective cooperation between the school and the family, four factors influence and can strengthen this cooperation: high commitment to learning, principal support, a welcoming climate, and two-way communication between partners.
However, there are studies that have shown that parental involvement in the education of students, even in the early years of school, through control and participation in task completion, significantly increased students' anxiety levels and negative self-esteem (Xanthacou, Babalis, & Stavrou, 2013). For this reason, many studies have focused on specific aspects of student-parent collaboration to avoid emotional burdens that harm performance, reduce self-esteem, and significantly increase anxiety levels (cited in the same source).

Moreover, other studies have demonstrated that this pressure from parents on students' increases among adolescents aged 10–19 due to characteristics related to the physical, psychological, and mental appearance of students (Noorlila Ahmad, 2023).

In the context of high parental expectations regarding academic achievements and social success, as well as dealing with physical and emotional changes, parental pressure around academic achievements can lead to an increase in the tendency for academic deception in school (manipulations for reasons of grades through copying, etc.), the manifestation of mental illnesses, eating disorders, sleep disturbances, etc.

Therefore, it is necessary to have a clear understanding of the current level of teacher-parent-student collaboration beforehand so that interventions and proposals can meet expectations for improving students' academic achievements through increased parental involvement in secondary education.

2.1 Reforms and the Local Legal Framework on Pre-University Education for the Enhancement of Students' Academic Achievements in Albania

Over the past two decades, the education system worldwide has undergone significant changes. Different countries have responded to these changes through reforms, targeting specific sectors of education. This is because the challenges facing education today, influenced by technological developments and achievements, are no longer the same as those of two or three decades ago. Faced with teachers, parents, school leaders, policymakers in the field of education, etc., there is a need for new competencies to be acquired (Townsley; Lang 2023).

In Albania, such an effort has been made through the cycle of reformative changes in 2014, at both the systemic and practical levels of teaching. This reform went through three main phases: the Phase of Correction of the Content of Education (until 1995), the phase of preparation for change, based on Law No. 7952, dated June 21, 1995, "On Pre-University Education System (1995–2010)," and the phase of further reform of the Pre-University Education System (SAPU), based on Law 69/2012, dated June 21, 2012, "On the pre-university education system in the Republic of Albania", (2012 and onwards), (Ministry of Education and Sports, 2014).

Despite proposals presented in the report of the Ministry of Education and Sports (Ministry of Education and Sports, 2014) and many other initiatives in this field, attention was mainly focused on teacher training and ensuring their competencies in the field of teaching. The positive outcomes of these reformative initiatives seemed increasingly distant when, in the 2018 International Assessment Report PISA, high school students in the country ranked 51st among 72 participating countries, leaving behind only 21 countries. Albania has participated in the Program for International Student Assessment (PISA) since 2000, where it was ranked at the bottom of the participating countries' list, leaving only two countries behind. In 2012, it was ranked 56th, surpassing 9 countries, and in 2015, it ranked 51st out of 72 participating countries, leaving behind 21 countries. Educational reforms were in the early years of their implementation, and assessments of their effectiveness sparked national debates and discussions among specialists and policymakers in the education system.

Similarly, the same International PISA Assessment Report in 2019 ranked Albanian high school students in 61st place out of 80 countries in total. Thus, the result had worsened by 10 places, even though the number of countries surveyed was higher. Once again, Asian countries like China and Singapore topped the rankings, followed by Estonia as one of the European countries with the best high school education system in the world.

2.2 "Schools as a Community Center" initiative and legal framework for pre-university education in the Country towards improving students' academic achievements

In Albania, the term "school as a community center" has been widely used in the last decade, engaging various projects initiated by governmental and non-governmental organizations, both nationally and internationally. The aim is to bring parents closer to the education process and enhance the academic achievements of high school students and beyond. Initiatives also included research at the national level, focusing on increasing the school's activities to encourage parental involvement in pre-university education. Several subsequent reports were prepared, detailing proposals on how issues related to teaching and improving student outcomes in secondary education and beyond could be enhanced.

However, there were few instances where the terms "parent community" or "parental collaboration" took precedence. Meanwhile, the Internal Regulations of schools, guided by the Ministry of Education (now the Ministry of Education and Sports), explicitly determine that parents and teachers hold three annual meetings within the school premises to familiarize themselves with the academic results of students in secondary education. Similarly, the same guidance recognizes the right of parents to meet with teachers whenever they report specific problems. Thus, according to the current law on pre-university education in the country, Article X on the "Rights and Duties of Students and Parents," Article 62 on the "Rights and Duties of Parents" states:

1. Parents are the main partners of the educational institution in the overall development of their child and the institution.
2. The parent has the right to: a) be informed by the relevant educational institution about the current educational legislation, the institution's regulations, and the curriculum it offers to his/her child; b) be informed about the safety, health, and environmental conditions of the institution and demand their fulfillment according to Albanian legislation; c) be informed about his/her child's activities in the institution and give consent for complementary and extracurricular activities organized by the school; ç) be informed about the main directions of the institution's activities and its achievements compared to similar institutions. (Amended by Law No.56/2015, dated 28.05.2015, published in the Official Gazette No.105, dated 23.06.2015).
3. The parent has the duty: a) to ensure that his or her child regularly attends the educational institution and learns regularly; b) to notify of changes in his or her child's health and behavior; c) to participate in meetings on issues related to his or her child; and d) to contribute to the overall functioning of the institution.

Referring to the above article, we observe that there is a legal basis allowing

collaboration between teachers and parents, as parents are considered important actors and contributors to the learning process of students.

3 Methodology

The methodology used in this research is a combination of qualitative and quantitative methods. Thus, for the realization of this research, a considerable number of previous studies, both in Albanian and foreign languages, regarding parental involvement in secondary education have been reviewed. The research also includes comparing the attitudes of parents with those of teachers to create a clearer picture of the limiting factors that hinder parental involvement in the education of secondary school students.

3.1 Participants in the study

The research population includes all students studying in secondary education in the Devoll region, while the population of parents consists of all parents with children studying in secondary education in the Devoll region. The sample selection was done randomly and consists of 50 third-year students from the following schools: "Fuat Babani" Secondary school in Bilisht, "Avdulla Progri" Secondary school in Progër, "Nesim Kaçani" Secondary school in Miras, "Jorgo Plaku" Secondary school in Hoçisht, and "Ali Feto" Secondary school in Fitore. The sample of parents is also 50, selected randomly.

3.2 Instruments of the study

Within the framework of this research, two questionnaires were constructed: a semi-structured questionnaire for parents and a semi-structured questionnaire for teachers. A LIKERT scale with 5 alternatives in descending order (5-1), always, often, sometimes, rarely, never, was used as the measurement scale for teachers' and parents' attitudes. For the analysis of the collected data, the SPSS package (Statistical Package for Social Sciences) was used.

3.3 Research period

With the aim of data collection, interviews with teachers and parents were conducted during the period June 2021–March 2023. During the interviews with teachers and parents, anonymity and research ethics were respected.

3.4 Research questions

Through the findings of this research, answers to research questions such as the following will be provided:

- What are the main forms of parental support for the academic achievements of students in secondary education?
- What are the limiting factors of the lack of parental involvement in the education of students in secondary education?
- What strategies can be used in cases of lack of involvement, what adaptation is needed, and to what extent can they be effective?

• What is the relationship between the level of parental involvement and the academic achievements of students?

4. **Analysis of the parents' questionnaire**

To examine the correlation between the variables included in the study and the questionnaire for parents, the correlation table has been constructed as follows:

Table 1. An overview of the parents' questionnaire variables

Correlations						
		Your education	Ways of setting up teacher-parent meetings	My main concern is the behavior of my child in school	My main concern is the academic achievements of my child	We are informed step by step by teachers about every achievement of the student (my child)
Your education	Pearson Correlation	1	.630**	-.342*	.337*	-.327*
	Sig. (2-tailed)		0.000	0.015	0.017	0.020
	N	50	50	50	50	50
Ways of setting up teacher-parent meetings	PearsonCorrelation	.630**	1	-.432**	.618**	-.301*
	Sig. (2-tailed)	0.000		0.002	0.000	0.034
	N	50	50	50	50	50
My main concern is the behavior of my child in school	PearsonCorrelation	-.342*	-.432**	1	-.447**	0.243
	Sig. (2-tailed)	0.015	0.002		0.001	0.090
	N	50	50	50	50	50
My main concern is the academic achievements of my child	Pearson Correlation	.337*	.618**	-.447**	1	-0.228
	Sig. (2-tailed)	0.017	0.000	0.001		0.111
	N	50	50	50	50	50
We are informed step by step by teachers about every achievement of the student (my child)	Pearson Correlation	-.327*	-.301*	0.243	-0.228	1
	Sig. (2-tailed)	0.020	0.034	0.090	0.111	
	N	50	50	50	50	50
**. Correlation is significant at the 0.01level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

If we analyze Table 1, it is noticeable that the educational level of parents is correlated with other variables. In the case of „*Ways of setting up teacher-parent meetings*," there is a significant positive correlation, as the correlation coefficient is 0.63 and the p-value is 0.000 < 0.01. Thus, parents with a higher educational level report a variety of possibilities for cooperation with teachers.

Regarding the variable „*My main concern is the behavior of my child in school*," there is

a negative correlation, meaning that parents with a higher educational level are less concerned about the behavior of their children. The reason may be that there is no reason to worry.

With the variable *„My main concern is the academic achievements of my child,"* there is a positive correlation, indicating that parents with a higher educational level seek more academic achievements from their children.

The variable *„We are informed step by step by teachers about every achievement of the student (my child)"* also shows a positive correlation.

Table 2. The connection of the variable "Parents' evaluation of their children's academic achievements

		Parents' evaluation of their children's academic achievements.	I regularly get notification about the parent-teacher meetings.	My main concern is my child' academic achievements.	In the planned teacher-parent meetings, communication is generally and not concretely about a specific problem of each student.	I regularly attend parent meetings.	I regularly take part in activities organized by the class and/or school.
Parents' evaluation of their children's academic achievements.	Pearson Correlation	1	-.395**	.362**	-.296*	0.114	-0.041
	Sig. (2-tailed)		0.005	0.010	0.037	0.434	0.776
	N	50	50	50	50	49	50
I regularly get notifications about the parent-teacher meetings.	Pearson Correlation	-.395**	1	-0.266	.550**	-.335*	0.099
	Sig. (2-tailed)	0.005		0.062	0.000	0.019	0.492
	N	50	50	50	50	49	50
My main concern is my child' academic achievements.	Pearson Correlation	.362**	-0.266	1	-0.258	-0.012	0.178
	Sig. (2-tailed)	0.010	0.062		0.071	0.935	0.215
	N	50	50	50	50	49	50
In the planned teacher-parent meetings, communication is generally and not concretely about a specific problem of each student.	Pearson Correlation	-.296*	.550**	-0.258	1	-0.167	0.216
	Sig. (2-tailed)	0.037	0.000	0.071		0.252	0.132
	N	50	50	50	50	49	50
I regularly attend parent meetings.	Pearson Correlation	0.114	-.335*	-0.012	-0.167	1	-.290*
	Sig. (2-tailed)	0.434	0.019	0.935	0.252		0.043
	N	49	49	49	49	49	49

I regularly take part in activities organized by the class and/or school.	PearsonCorrelation	-0.041	0.099	0.178	0.216	-.290*	1
	Sig. (2-tailed)	0.776	0.492	0.215	0.132	0.043	
	N	50	50	50	50	49	50
**. Correlation is significant at the 0.01level(2-tailed).							
*. Correlation is significant at the 0.05level(2-tailed).							

Considering Table 2, it is observed that parents' evaluation of their children's academic achievements is associated with the fact that they are regularly informed about teacher-parent meetings in school (negative correlation, and this also implies the fact that there is no significant correlation with the variable "I regularly attend parent meetings") and that they are concerned about the academic achievements of their children (positive correlation).

Table 3. The connection of the variable "The evaluation and the presence of parents in parent-teacher meetings"

Your assessment as parents of your child's academic achievements at school.						
Crosstabulation Regularly		I go to parents' meeting				Total
		Only in planned meetings	I go when I have the possibility/rare	I do not go at all		
Parents' evaluation of their children's academic achievements.	High	0	5	5	1	11
	Medium	3	13	5	8	29
	Low	1	4	0	4	9
Total		4	22	10	13	49

Based on the sampling, according to the results obtained in Table 3, it appears that the majority of parents have an average assessment of their children's academic achievements, and also, most of these parents only attend scheduled parent meetings at school. Meanwhile, the majority of the selected parents have an average assessment of their child's academic achievements and express that they are informed "sometimes" about teacher-parent meetings (Table 4).

Table 4. The connection of the variable "Parents' evaluation of the parent-teacher meeting's notifications"

I regularly get notification about the parent-teacher meetings. Crosstabulation							
		I regularly get notification about the parent-teacher meetings.					
Never		Rarely	Sometimes	Often	Always		Total
Parents' evaluation of their children's academic achievements	High	1	0	2	8	1	12
	Medium	3	4	11	6	5	29
	Low	4	1	3	1	0	9
Total		8	5	16	15	6	50

Table 5. The connection of the variable "Parents' education and their participation in parent-teacher meetings"

The education of parents. Crosstabulation							
		I regularly get notification about the parent-teacher meetings.					
Never		Rarely	Sometimes	Often	Always		Total
Your education	Elementary education	5	2	2	7	2	18
	Secondary education	3	3	11	8	4	29
	High Education	0	0	3	0	0	3
Total		8	5	16	15	6	50

Considering Table 5, it is observed that the majority of the selected parents have a secondary education, and they are occasionally or often informed about teacher-parent meetings.

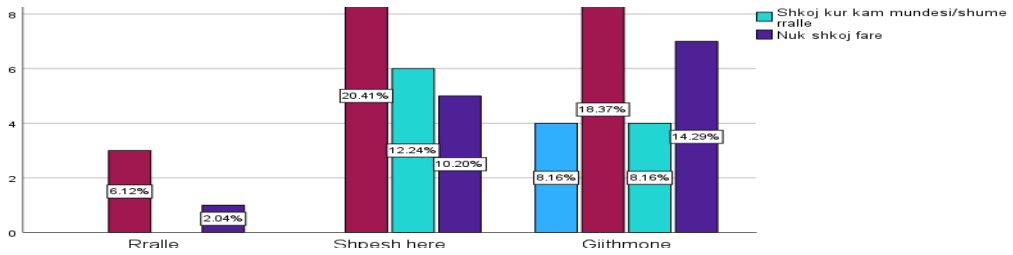

Figure 1. The connection of the variable "Parents' frequency of attending to parent-teacher meetings and the topics of discussion"

In Figure 1, it is evident that the majority of parents only attend scheduled meetings, and in these meetings, teachers present more issues encountered by students than their academic achievements.

Table 6. The connection of the variable "Parents' frequency of attending to parent-teacher meetings and their main concern"

In meetings with parents, teachers present only the problems encountered by students and not their achievements.* My main concern is my child's academic achievements. Crosstabulation

		My main concern is my child‘s academic achievements.					
Never		Rarely	Sometimes	Often	Always		Total
In meetings with parents, teachers present only the problems encountered by students and not their achievements.	Rarely	2	2	0	0	0	4
	Often	8	7	1	1	4	21
	Always	3	8	2	3	9	25
Total		13	17	3	4	13	50

According to the results obtained in Table 6, it is observed that parents often or always, during parent-teacher meetings, only present the problems of students and not their achievements. However, a majority of parents, either “rarely” or “never,” do not have a primary concern about the academic achievements of their children.
To assess the reliability of this parental questionnaire regarding their involvement in the academic growth of their children, the Cronbach’s Alpha coefficient is calculated.

Table 7. Cronbach’s Alpha coefficient

Reliability Statistics	
Cronbach‘s Alpha	N of Items
0.883	11

In Table 7, the coefficient is 0.883, and it is very close to the number 1. The closer the coefficient is to 1, the more reliable the study is.

5 Analysis of the teachers’ questionnaire

In the observation, 50 teachers in the Devoll Region were involved. To see the relationship between variables, correlation tables were constructed as follows:

Table 8. An overview of the teacher's questionnaire variables

Correlations						
		I know all the parents of the students I teach as they regularly show up at the scheduled school meetings (once a month).	I communicate with most parents by phone about their children's progress.	Most parents attended meetings with teachers only in case of children's problems (conflict between friends).	Parents are unable to control the academic progress of their children.	Relations with classmates, or other issues related to the socialization of students are the subject of meetings with parents.
I know all the parents of the students I teach as they regularly show up at the scheduled school meetings (once a month).	Pearson Correlation	1	-.345*	.307*	.404**	-.406**
	Sig. (2-tailed)		0.014	0.030	0.004	0.003
	N	50	50	50	50	50
I communicate with most parents by phone about their children's progress	PearsonCorrelation	-.345*	1	-.331*	-.341*	.579**
	Sig. (2-tailed)	0.014		0.019	0.015	0.000
	N	50	50	50	50	50
Most parents attended meetings with teachers only in case of children's problems (conflict between friends).	Pearson Correlation	.307*	-.331*	1	.724**	-0.220
	Sig. (2-tailed)	0.030	0.019		0.000	0.125
	N	50	50	50	50	50
Parents are unable to control the academic progress of their children.	Pearson Correlation	.404**	-.341*	.724**	1	-.298*
	Sig. (2-tailed)	0.004	0.015	0.000		0.035
	N	50	50	50	50	50

Relations with classmates, or other issues related to the socialization of students are the subject of meetings with parents.	Pearson Correlation	-.406**	.579**	-0.220	-.298*	1
	Sig. (2-tailed)	0.003	0.000	0.125	0.035	
	N	50	50	50	50	50
*. Correlation is significant at the 0.05level (2-tailed).						
**. Correlation is significant at the 0.01level (2-tailed).						

In Table 8, several variables were considered, and it is observed that the most significant correlation is between "The majority of parents present issues to teachers only in case of problems with their child's friends" and "Parents cannot control the academic performance of their children," with a correlation coefficient of 0.724. This connection may be because teachers have noticed that parents only attend meetings when their children have issues and do not seem very concerned about their academic achievements.

Table 9. The coefficients of variable correlations

Correlations					
		I communicate with most parents by phone about their children's progress.	Parents are unable to control the academic performance of their children.	Relations with classmates, or other issues related to the socialization of students are the subject of meetings with parents.	Parents show interest in the academic progress of their children.
I communicate with most parents by phone about their children's progress.	Pearson Correlation	1	-.341*	.579**	-.488**
	Sig. (2-tailed)		0.015	0.000	0.000
	N	50	50	50	50
Parents are unable to control the academic performance of their children.	Pearson Correlation	-.341*	1	-.298*	0.150
	Sig. (2-tailed)	0.015		0.035	0.297
	N	50	50	50	50

Relations with classmates, or other issues related to the socialization of students are the subject of meetings with parents.	Pearson Correlation	.579**	-.298*	1	-.620**
	Sig. (2-tailed)	0.000	0.035		0.000
	N	50	50	50	50
Parents show interest in the academic progress of their children.	Pearson Correlation	-.488**	0.150	-.620**	1
	Sig. (2-tailed)	0.000	0.297	0.000	
	N	50	50	50	50
*. Correlation is significant at thë 0.05level(2-tailed).					
**. Correlation is significant at thë 0.01level(2-tailed).					

In Table 9, various variables and their correlation coefficients are presented. It is evident that there is a strong negative correlation (correlation coefficient -0.620) between "Relationships with classmates, or other issues related to student socialization, are the subject of meetings with parents" and "Parents show interest in the academic performance of their children." This implies that parents who show higher interest in their children's academic achievements are less interested in discussing social relationships with classmates in teacher meetings.

Taking "Parents cannot control the academic performance of their children" as the dependent variable and "I know all the parents of students who attend classes because they regularly attend scheduled meetings at school (once a month)," "I communicate with the majority of parents by phone about the progress of their children." "Parents request meetings with teachers in addition to scheduled meetings for specific issues." "The majority of parents present issues to teachers only in cases of problems with their children's friends." "Relationships with classmates, or other issues related to student socialization, are the subject of meetings with parents," and "Meetings with parents are useful because many students have improved their learning outcomes when this collaboration is realized." as independent variables, a multiple regression model has been constructed as shown in Table 10:

Table 10. The model of multiple regression

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	42.875	7	6.125	10.744	<.001[b]
	Residual	23.945	42	0.570		
	Total	66.820	49			

As seen, the significance is smaller than 0.001, which means that the model is significant. Additionally, we can observe the coefficient of determination (R-squared) in Table 11, which is closer to 1 than to 0.

Table 11. The coefficient of determination

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.801[a]	0.642	0.582	0.755

Also, with the aim of ensuring as much complete information as possible for teachers and parents regarding the above issues, the questionnaire contained the following open-ended questions for teachers:

"If, in the above issues, none of the problems that concern you about teacher-parent meetings and beyond are included, you are invited to describe them below. Also, if you have any ideas or proposals regarding specific ways of teacher-parent cooperation or any concerns you may have, you are invited to write them down." The responses from teachers and their proposals are summarized in the following issues:

1. Collaboration with parents also involves communication by phone or other means, without the need for their physical presence in school environments.
2. If parents see it as necessary and beneficial, they can attend more frequently than scheduled meetings in school settings, as they also have a legal right to so-called „specific case" meetings.
3. Parents can propose a range of topics to be addressed in meetings with teachers, and the meeting themes are not static.
4. The lack of parental support and control is at high levels, directly influencing their results.
5. Teachers express their willingness to provide parents with thoughts, advice, ideas, and suggestions on how to improve their students and reinforce learning in the family.
6. Their collaboration with the school psychologist poses a real problem for students, as parents are often unaware of their children's concerns, while the main focus and interest remain the final results in lessons.
7. The involvement of parents in activities organized by the class or school is another way to conduct meetings with parents.
8. Parental advice can guide and address issues with teachers that they consider valid for discussion.

At the same time, the questionnaire for parents also included an open-ended question: *Propose ideas regarding new ways of communicating with parents, providing arguments for them*. Only 32% of parents responded to the open-ended question, and their responses, along with suggestions, are summarized as follows:

1. Teachers can communicate individually with each parent, not necessarily in the presence of other parents.
2. Parents should be notified every week, systematically, about their children's academic achievements.
3. inclusion of the school psychologist in the education of children, as most parents report that their children have never or very rarely met the psychologist due to teasing and bullying that occurs in class among students. Their proposal was for teachers to create a periodic schedule where all students, without exception, have at least one meeting per week with the school psychologist, aiming to avoid teasing

among classmates.
4. Elimination of the exclusion of students from the teaching process and removing them from the classroom in cases of inappropriate behavior as a form of punishment for students displaying unsuitable behavior This form can be replaced with immediate notification to parents and then following the appropriate procedures.
5. Periodic notification to parents about any activities planned by the school or class
6. Creating opportunities for parents to be present in the teaching process on specific days, through self-introduction, sharing their professions, etc., as a form of awareness and the message to students that parents are there at all times to support and assist them in the learning process and beyond
7. Organizing meetings with parents, with or without the presence of teachers, where experiences are shared, and, why not, taking successful cases as models from each other?

5. Conclusion

- The majority of parents are not satisfied with meetings with teachers, claiming that they are not regularly notified about their development, which, according to them, is the main reason for the small number of parents who regularly attend meetings with teachers.
- Most parents raise their children's behavior in school environments as a major concern, and the interest in these behaviors seems to prevail over the desire to be informed about their children's academic achievements.
- Only a small portion of surveyed parents presented the academic achievements of their children as a primary concern.Another concern they expressed was the topics covered in meetings with teachers. Their claim was that these topics were general issues discussed about many things, but not in the way they desired or were specific to each student.
- Another important issue expressed by parents is that meetings with teachers do not sufficiently address issues related to their children's learning but only deal with the problems of „problematic" students.
- Thus, students who exhibit inappropriate behavior in class become the subject of discussion and debate that can last for hours, not allowing physical time for discussions on equally important issues.
- Misinformation about the results of children was another concern for a significant portion of parents, except for quarterly results sent home through their children.
- There was also dissatisfaction with class teachers who, according to them, have the responsibility to inform parents about the progress of their children both in terms of behavior and academic achievements.
- Parents also express reservations about the teachers' goodwill to communicate more frequently and about the main issues that concern their children. Only a small percentage of parents have expressed that communication with teachers is friendly, at satisfactory levels, and that they are in favor of cooperation with parents.
- On the other hand, when asked if they participate in activities organized by the school or class, the majority of parents have reported that they have never attended

any school or class activities.More than half of the teachers—over 50% of them—do not know the parents of the students. According to them, this is because a considerable number of parents do not attend scheduled meetings or other class-organized events.

- At similar levels, there is the issue of biweekly parent-teacher meetings. Teachers express dissatisfaction with parental collaboration with them or support from the family towards the students.According to the teachers, most parents do not show the appropriate interest in the academic progress of the students. According to them, parents whose children have average or high results are more interested in their assessments. Meanwhile, for them, the concern is the low interest shown by parents whose children need to improve their results when they are very low.
- According to them, most parents do not take personal initiatives to meet with teachers, and in many cases, the main reasons for their meetings become conflicts between children.Teachers also express concern about the low level of parental support at home. They suggest that parents can seek and accept their advice and guidance since they are informed about the ways their child learns. Thus, teachers provide models and specific guidance for parents on how to help their children at home through control or guidance in solving tasks, exercises, or essay construction.
- The majority of teachers acknowledge the fact that not all parents have the means to help their children due to their commitments. However, teachers express that effective time and priority management can create effective opportunities in the learning process for students.
- Teachers see the possibilities for improvement as more conditioned by the willingness and systematic control of parents than by the economic and social problems of these families. The themes addressed in meetings, according to teachers, are often left to parents to raise and propose important issues. However, according to them, in conditions where the number of parents who regularly attend meetings is low, these expectations are significantly lowered.
- Their main concern is not conflicts between students, because it does not often happen that they conflict with each other or with different teachers. Their concern is the low level of their academic achievements, which, according to them, run parallel to inappropriate behaviors manifested in class but are still not conflictual.
- Regarding the discussion of the role of the class teacher, teachers express concern about the high expectations parents have for class teachers. According to them, there is a school regulation that clearly defines the duties and responsibilities of the class teacher.
- A concern for teachers was also the very low presence of parents in various activities organized by the class or school. According to them, on average, each class holds 3-5 scientific, artistic, and cultural activities that take place with the presence of teachers and school leaders under the guidance of class teachers but without the presence of parents.

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Albanian students in Greek Minority schools in Albania: attitudes, development of bilingualism and school performance

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Abstract

Bilingualism is a centuries-old diachronic phenomena in southern Albania. In this multilingual setting, the relative importance of each language is determined by commerce, social, and national variables. Greek is now fairly used, and students of Albanian descent are making a concerted effort to study the language as a second language. For Albanians who live in neighborhoods with a Greek minority, minority schools are an alluring option. This is because learning Greek is essential for their future career advancement and integration into Greek society.

The aim of this study is to determine and analyze the factors that influence students whose mother tongue is Albanian to choose Greek education. Additionally, the study will document the views of educators regarding the challenges they face during the didactic process in a diverse classroom, as well as the overall academic achievement of bilingual students and the challenges they encounter when learning Greek. Additionally, the study aims to collect recommendations from educators on how to best support bilingual students in overcoming their language acquisition obstacles. A questionnaire was selected as the main instrument for data collection because it makes it possible to collect data from a large number of teachers and makes data processing reasonably simple.

The study found that in order to support multilingual pupils in their classes, the majority of teachers modify and adapt their teaching strategies as much as feasible. They list the following as some of the strategies they utilize: intercultural projects, simpler language exercises, individualized education, especially in the elementary cycle, and parallel usage of Albanian to reinforce spoken Greek. When they think it's necessary, teachers also deploy easy-to-use teaching tools to help pupils learn.

Keywords: bilingualism, education, heterogeneity, school performance.

1. Introduction

As we enter the fourth decade, a sizable portion of Albanians reside and work in Greece with their families for a variety of social and economic reasons. For these citizens, Greek is therefore their second language. It is also the language of instruction for the second generation of immigrants.

Numerous immigrant families went back to Albania following the financial crisis. The majority of returned immigrant children were born, reared, and educated in Greece. They are difficult or impossible to integrate and adjust to in Albanian classrooms for obvious reasons. Additionally, there are villages close to the minority areas where the locals use Albanian as their first language. Their desire to continue their study at minority schools is fueled by their proficiency in Greek. These factors contribute to the considerable rise in Albanian-origin students attending Greek minority schools in primary, secondary, and postsecondary education during the past few years. In or-

der to meet the requirements and demands of all socioeconomic and cultural groups and encourage the creative engagement of all students, education systems must now design a school environment. Preparing pupils to be citizens of a multicultural society who will respect linguistic and cultural diversity while still maintaining their cultural identity is currently the primary goal of education. Since education is one of the most fundamental tools for influencing a person's beliefs, values, and behavior, it does play a significant part in the new multicultural reality. (Kaga, 2001. Paleologu & Evangelou, 2003).[1]

2. **Aim, objectives of the study**

The study aims to determine and analyze the factors that influence students who speak Albanian as their first language to choose Greek education, as well as to document the views of educators regarding the challenges they face during the didactic process in a diverse classroom, the overall academic progress of bilingual students, and the challenges they face when learning Greek.

2.1 Research Questions for the Teacher Questionnaire

1) What do the teachers think about the bilingual kids' overall academic development and the challenges they face when learning Greek?
2) What additional training and qualifications do teachers require for bilingualism and class heterogeneity?
3) What are teachers' advice for bilingual students to properly cope with their language issues?

3. **Methodology**

Because it can be administered to a large sample of students and its data can be processed, compared with each other and with the theoretical framework, and lead to important findings and conclusions [2] the questionnaire was selected as the primary method of data collection in the research framework. In sociology research, the questionnaire is the primary method of gathering data, and it is frequently used.

3.1 Kinds of questions

We believed that both open-ended and closed-ended questions should be included in the questionnaire, given the theoretical approach and overall direction of the study. Since the research is both quantitative and qualitative, closed questions make it easier to quantify data, while open questions provide extensive, in-depth, qualitative investigation of problems. Since teachers are in charge of the second foreign language learning process—in this case, Greek—and have a more comprehensive visual approach to any challenges that students may encounter, the questionnaire concentrated on the research approach from their perspective.

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2 Αθανασίου,Λ.(2007). «Μέθοδοι και τεχνικές έρευνας στις επιστήμες αγωγής. Ποσοτικές και ποιοτικές προσεγγίσεις» (σ.σ.144-145).

4. **Research participants**

Eight teachers from Bularat and Dervicjan, the two biggest Greek minority schools, took part in the study.

	Age	Degree	Specific studies	Class he\she is currently teaching	Nr.of students per class	Nr. of Albanian students per class	Years of teaching experience	Years of teaching experience with Albanian students
Teacher 1	20-30	Un.Gjirokastër DGJLQGR[3]	Master	I-rë	6	3	1 year	1 year
Teacher 2	50-60	Institute of higher learning	Master Seminars	II-të	3	1	35 years	35 years
Teacher 3	30-40	Un.Gjirokastër DGJLQGR	Master	III-të	13	3	10 years	10 years
Teacher 4	30-40	Un.Gjirokastër DGJLQGR	Master	IV-ët	9	1	18 years	18 years
Teacher 5	40-50	Un.Gjirokastër DGJLQGR	Qualifying seminars	V-të	8	4	26 years	26 years
Teacher 6	40-50	Un.Gjirokastër DGJLQGR	Master	VI,VII, VIII,IX	49	16	26 years	5 years
Teacher 7	20-30	Un.Gjirokastër DGJLQGR	Master	IV,V,VI,VII VIII,IX	70	22	1 year	1 year
Teacher 8	40-50	Un.Gjirokastër DGJLQGR	Master	VI,VII,VIII,IX, High school	85	30	23 years	23 years

5. Examination of the Teacher Questionnaire

A. The inclusion of albanian students in education

- **Does the Educational Directorate have any provisions or guidelines regarding the participation of children of Albanian descent in the educational system?**

Nearly all of the teachers who responded to this question stated that, from the perspective of the Educational Directorate as well as the Analytical Program, there is no formal provision for the inclusion of bilingual children in education. Each teacher said that the school directorate has a formal requirement that requires pupils to take a written test to confirm their level of Greek language proficiency after registering.

- **What were your initial responses as a teacher when these students first arrived at school?**

Many respondents initially stated that one of their first behaviors was to try to approach kids in order to greet them warmly and help them get to know one another. Additionally, they created a customized program that aided in their quicker transition to the school curriculum.

B. Training of teachers

[3] Departamenti i gjuhës, letërsisë dhe qytetërimit grek.

• ***To ensure a uniform approach to these pupils, is there a seminar or information available for all teachers (from the school itself, an official organization, etc.)?***

The majority of the teachers made it clear that no teacher seminar has been arranged by the official educational bodies to provide them with a shared platform for working with bilingual kids.

Contrary to the aforementioned statements, instructors also gave positive feedback, stating that they receive updates on intercultural education topics from the school administration on a regular basis.

• ***Do you believe that holding a training seminar to assist these kids would be beneficial?***

According to the majority of respondents, the most crucial factor in intercultural education is teacher training. They suggest both ongoing, recurring trainings from the Education Directorate and training activities conducted within the school to fill in the gaps and weaknesses in their training.

• ***Does each teacher have the authority to pursue further training in order to serve bilingual students?***

The majority of respondents gave affirmative answers to this question, emphasizing that everyone's right to early notice of similar school-related issues is a personal matter. Some teachers encourage their systematic training through seminars because they acknowledge their inadequacies in managing multicultural classrooms; this is known as the "conscious" teaching role. According to a different perspective, the teacher's life is all about upgrading continuously.

C. Curricula

• ***How are these students treated during teaching (alone or together with others)?***

It is important to note that respondents' opinions on co-education and the differentiated treatment of bilingual kids in the classroom are split. Teachers in elementary schools specifically report that they change the exercises' content to cover easier subjects, steer clear of examinations, and opt for oral exams instead. The majority of the sample, however, gave negative answers to the issue and agreed that bilingual pupils shouldn't be kept apart from other students. Depending on the thematic approach, all children collaborate in the primary cycle's first grades, and teachers must pay close attention to each student's needs.

• ***What challenges do you encounter while implementing the didactic approach in a heterogeneous classroom?***

Every teacher describes their position as significant. They acknowledge the issue of their inadequate training in intercultural education, even though they believe they understand its tenets and objectives.

They contend that teachers should implement innovative teaching strategies that consider the language and cultural diversity of Albanian-speaking students, which in turn will account for their educational diversity. For this reason, it is especially crucial to conduct activities that facilitate interaction between students in the two groups, ultimately aiming to assimilate them. This shift in the problem of bilingual education is attested to by the use of various didactic and modified teaching techniques. Since every student speaks Albanian, they list teachers' encouragement of students to use their mother tongue by encouraging them to bring books, myths, and

fairy tales to read aloud to their peers and to take part in artistic school activities to express their emotions as good practices. They believe that the school accepts their culture in this way.

- ***Do you believe that learning Greek is hampered, aided, or unaffected by the mother tongue C1 (Albanian)?***

Respondents' answers regarding the treatment of students' mother tongue in relation to Greek differ greatly. According to 50% of the sample, Albanian makes studying Greek more difficult, and they back this up with the following claims. When Albanian is the primary language spoken in the household and is used often, leaving little opportunity for Greek, children struggle to learn the Greek language.

- ***Have you observed pronounced shortcomings (inadequacies) in Greek comprehension and communication, leading to a failure to engage with the curriculum? Why?***

It is evident from the experience of the teachers who were surveyed that while their mother tongue has not hampered academic achievement, some students were unable to respond to the school program because of their linguistic deficiencies in the Greek language, and the majority only experienced difficulties for a brief period of time. The most significant shortcomings pertain to knowledge of the Greek language, both in written and spoken forms, the use of spelling conventions, sentence structure, etc.

- ***Do you think it would be beneficial for these students to attend intensive Greek lessons prior to starting the regular school curriculum?***

Many teachers feel that it is beneficial for Albanian-speaking kids to take Greek lessons for a while before starting school. They nearly all agreed in their responses that it is a good idea for the child, his family, and the teacher because it makes their jobs easier.

D. Interaction / socialization

- ***How do teachers handle these students' relationships with others, and how do other students treat these individuals? Did you face challenges? If so, how did you resolve them?***

"*... At the beginning it is difficult and unpleasant on both sides due to the lack of a communication code*" and "*... In the beginning, difficulties arise which are handled through communication, cooperation between children and participation in school activities*" are the conclusions reached by nearly all teachers about how the other students treat the students who speak Albanian. Youngsters of this age do not distinguish between languages and religions, they become close to their peers without exception, and no issues arise, particularly when they speak Greek to a reasonable level. They readily establish cordial relationships, frequently assist in classes during the primary cycle, and communicate through play and body language.

- ***Do these students have any issues with their behavior or socialization? If yes, describe them and provide an explanation.***

We live in a place where children and teachers are familiar with both the Albanian language and the cultural background that these children bring, thanks to interactions with the Albanian community and bilingual education at school: "*...I choose activities that emphasize the students' experiences, their daily life experiences in relation to the language community to which they belong, to achieve the strengthening of their motivation to learn Greek as a second language*."

- ***Do you believe that children who speak Albanian as their mother tongue benefit from living alongside children of other linguistic backgrounds?***

They cultivate the spoken language by involving students in working groups and allowing them to interact during organized activities and free play: "*...I think that joint activities within the school help a lot because there is interaction and thus they are given the opportunity to hear Greek from native speakers outside of class where the children are more relaxed*." This is the unanimous opinion of the teachers.

- ***Do you support these pupils' involvement in school events and parties? Have you seen any signs of interest from them?***

The teachers responded that they plan events for the national feasts of the two communities that are open to the local community, the school, or the classroom, and that all of the children participate: *"...of course we encourage them and see great willingness to participate*," and "*...are involved in all school celebrations and activities."*

E. Family

- ***Do you, as a school, collaborate with the families of children who are of Albanian origin?***

Teachers unanimously respond favorably to collaboration between the home and school because they see it as essential and frequently strive for it. Everyone agrees that one of the main responsibilities of all teachers is to tell parents about their children's school environment, the learning process, and how to modify instruction to fit the needs of a heterogeneous class.

- ***Do the families of the children appear to be assisting in any way to ensure the pupils' seamless and speedy integration? How can this be?***

Most of the time, families support their children's efforts to fit in at school. According to remarks made by teachers, "*...there was daily telephone communication and frequent meetings with parents to keep them updated on the progress and issues facing the children.*" According to a teacher, it is crucial to note that parents want the best for their child and would like their child's quick and smooth inclusion in the school program.

F. Difficulties in learning the greek language

- ***How would you rate your bilingual kids' overall academic performance?***

While acknowledging that there are always outliers and that certain children frequently perform exceptionally well, the majority of teachers in the survey describe bilingual kids' performance as generally satisfactory: *In my experience as a teacher of bilingual pupils, there is a readiness to put forth a lot of effort, as well as a hunger, perseverance, and dedication, as well as a love in learning Greek.*

- ***Where do you most often encounter language difficulties, in writing or speaking, and where do you attribute them?***

The majority of participants cited issues with written language, grammar, sentence structure, and vocabulary as the most common language difficulties faced by bilingual pupils. They indicate that while they have no trouble with spoken language, written language can be more challenging.

- ***What do you think are the best strategies for dealing with bilingual pupils' linguistic barriers when they are learning Greek in elementary school?***

Since the number of kids speaking Albanian is growing annually, the majority of teachers concur that the school needs to develop a policy to deal with this phenom-

enon. Particularly for bilingual pupils in the primary cycle, the school should figure out how to integrate them, including adding more Greek language instruction and offering the option of creating various student groups based on proficiency.
Reduced pace and demands on these students, personalized activities and instruction, interactive games, differentiated instruction, a cross-curricular language approach, teacher preparation, and collaboration with the school and family are additional strategies to address the phenomenon that were mentioned to a lesser degree.

6. **Conclusions**

The primary motivations for Albanian-speaking students' preference for Greek education, as well as their passion for Greek language and culture, are revealed through a careful examination of the teachers' responses. Serious considerations that have a direct impact on the outcome of learning a second language are the desire to study the language, the intention, and a favorable attitude toward the Greek language and its people.

It holds a significant position in the scope of teachers' recommendations for suitable didactic and educational practices for bilingual pupils as well as the drafting of a systematic bilingual education policy. When it comes to teaching bilingual students, they emphasize individualized activities and individualized instruction, interactive games, interdisciplinary approaches to language, the use of the cooperative group method, lowering the pace and demands for these students, and differentiated instruction to improve communication skills in the Greek language.

7. **Results and discussion**

So that students of Albanian descent can seamlessly integrate into the bilingual education system and make normal academic progress at the same rate as the Greek-speaking students, the educational authorities of the Greek minority are concerned about this new multicultural school reality, which requires the quick development of solutions and practices in the area of bilingual education. Additionally, the school aims to provide equitable education and care to all students, including Albanians and minorities.

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Migration, Integration, and Shared Challenges: The Albanian Diaspora in Italy

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Abstract

One of the largest and most important immigrant communities in the country is represented by the Albanian diaspora in Italy, with a long history of migration that dates back to the early 1990s. Italy has welcomed over 500,000 Albanians. The integration of this community presents many opportunities as well as important challenges for both nations. This discussion will actively examine the multiple complications of migration along with the integration process, placing emphasis on the many economic, social, as well as ethnic contributions of the Albanian diaspora in Italy. The session will explore key questions like: How can Albania, along with Italy, collaborate for better integration of many Albanian migrants into Italian society while keeping their ethnic identity? What social, economic, as well as political challenges does the Albanian community face in Italy and in what ways can both governments actively collaborate to overcome them? How can ties between the two countries be strengthened by the Albanian diaspora? Mutual understanding as well as ethnic exchange can be promoted. The session will actively explore how both nations shape migration policy. It will also focus on the broader European context especially considering the pressing challenges from irregular migration economic disparity and demographic changes. The discussion aims to provide recommendations that improve cooperation between Albania and Italy, support the successful integration of the Albanian diaspora and strengthen a more all-embracing bilateral relationship. This theme will provide a thorough analysis of many migration trends, multiple social integration strategies, as well as the collective responsibility of both countries to tackle the challenges and opportunities presented by the Albanian diaspora in Italy.

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Keywords: Albanian Diaspora, Migration, Integration, Bilateral Relations, Social Integration, Cultural Identity, Economic Contributions, Migration Policy, European Union.

I. **Introduction**

Many Albanians have migrated to Italy, representing one of the most important diasporic movements in Europe over the past few decades. The migration was prominently begun after the fall of communism in Albania in the early 1990s. During this time, economic opportunities and stability were enthusiastically sought by Albanians in neighbouring Italy. In Italy, one of the largest immigrant groups is formed by the Albanian community. Their adventure reflects the complicated processes of integration as well as identity preservation along with bilateral cooperation. The diaspora has importantly influenced many ethnic, social, as well as economic aspects of Italian society. Diaspora includes more than just moving to a new place. It presents the challenges, and opportunities that communities encounter as they navigate ethnic integration in host societies. Albanians in Italy face important challenges such as social prejudice, economic underemployment, as well as legal barriers. They play an important role in contributing to Italian society while also intensely maintaining strong

ethnic ties with Albania. This paper examines how Albanian migrants face integration challenges, contribute to Italian society and how both countries work together to improve integration and build stronger bilateral relati

II. **Historical Context of Albanian Migration to Italy**

In 1991, Albania experienced an important moment in its history when its communist regime collapsed. Thousands of Albanians sought Italy as a land of opportunity while facing political instability, economic crisis, as well as common poverty. In the early 1990s, overcrowded boats crossed the Adriatic Sea in chaotic attempts to reach Italian shores during the initial wave of migration. These impressive images drew global attention, presenting Albania's battle as well as its population's strong determination for a better future.

More organized forms were taken on by subsequent migration waves, including legal migration pathways and family reunification. Italy enforced stricter immigration controls in the late 1990s. Albanians still migrated through regularized channels to seek jobs as well as stability. Istat's data clearly draws attention to how Albanian migration peaked during the 1990s as well as how it gradually stabilized in the 2000s. The Albanian diaspora in Italy has truly grown importantly over the last three decades. Now it has created itself as one of the largest foreign communities in the country. The Italian National Institute of Statistics (Istat) reports that nearly 450,000 Albanians live in Italy as of 2021. This number constitutes almost 10% of the entire immigrant population. Both first-generation migrants who arrived during the 1990s and second-generation Albanians who were born or raised in Italy make up this population. The Albanian community mainly inhabits northern as well as central Italy, with many important populations existing in areas such as Lombardy, Emilia-Romagna, Veneto, in addition to Tuscany. Lombardy, an economic hub, attracts many Albanians seeking jobs in construction, manufacturing, as well as services. Large communities exist in Emilia-Romagna as well as Tuscany. These communities benefit greatly from many contributions by Albanians in agriculture and small business enterprises. A large portion of the Albanian population in Italy is relatively young, with many people being under the age of 35. This trend presents how young adults as well as families moved abroad in the 1990s and 2000s in search of better opportunities. The second-generation Albanian youth increasingly integrate into Italian society, pursuing higher education along with professional fields such as medicine, engineering, as well as law. This strong presence importantly improves both the economic and social fabric of Italy, while also encouraging an energetic ethnic exchange between the two nations. Challenges related to integration are faced by many, yet an energetic and influential diaspora of Albanians is maintained within Italian society.

III. **Integration Challenges for the Albanian Diaspora**

The Albanian diaspora in Italy navigates a complicated process of social integration, shaped by ethnic differences, linguistic challenges and public view. Many Albanians have successfully built lives in Italy, but their adventure to complete social inclusion

has varied greatly. For many first-generation migrants, acquiring the Italian language presents many important challenges. Many Albanians who arrived in the 1990s had very little to no knowledge of Italian, which made it quite difficult to navigate everyday life, secure stable employment, as well as engage with local institutions. Local governments and NGOs have importantly increased access to Italian language education through multiple language programs over time. Many regions do not receive enough of these programs. This situation leaves several communities underserved. Many second-generation Albanians are bilingual and speak both Italian and Albanian fluently. This linguistic adaptability has actively helped increase their social mobility as well as guarantee their integration into Italian society. Strong familial ties and patriarchal standards in Albanian traditions and customs are occasionally conflicted with by some Italian social standards, particularly in urban, liberal areas. Many ethnic events, including the Albanian Ethnic Days in cities like Milan as well as Bologna, have importantly bridged these gaps, providing many Italians with comprehension into Albanian heritage while promoting mutual understanding. Many early Albanian migrants experienced large prejudice, often being linked to crime due to media portrayals in the 1990s. The stigmatization actively blocked meaningful social acceptance. Success stories in sports, academia and entrepreneurship have driven changing narratives over the years. Many football players of Albanian origin such as Elseid Hysaj as well as many prominent academics have zeroed in on the positive contributions of the diaspora. They often present the important effect these contributions make. Many community centres and many religious institutions have played an important role in building strong social networks. Places of worship and ethnic associations have been created by both Muslim and Christian Albanian groups, creating spaces for community cohesion and engagement with broader Italian society. The "Arbëresh" legacy actively connects the older Albanian community in southern Italy with historical ties between Albanians and Italians.

Economic Integration

The experience of economic integration for the Albanian diaspora in Italy varies, showing both success, and challenge based on generation and region. First-generation migrants encountered major challenges, such as underemployment and wage discrimination, but the diaspora has steadily built a stronger economic presence. Low-skilled, labor-intensive jobs in sectors such as construction, agriculture, as well as domestic work were predominantly taken on by first-generation Albanians who arived in the 1990s. Many people were often underpaid or found themselves working in precarious conditions, often lacking formal employment contracts due to their legal status during the early waves of migration. Discrimination in the labor market limited upward mobility for this generation, causing many to feel trapped in low-wage jobs, in spite of possessing relevant skills or qualifications. Albanians play an important role in Italy's construction sector, especially in the northern and central regions. Construction businesses are now owned or managed by many, who are transitioning from being labourers to entrepreneurs. Seasonal agricultural work has been relied on by Albanian migrants. This is especially true in Emilia-Romagna as well as

Veneto. Tasks involve grape harvesting for vineyards as well as work in fruit farms, both of which are important to Italy's agricultural economy. In the domestic service sector, caregivers as well as housekeepers for Italian families have been prominently occupied by Albanian women, in particular. Recently, more Albanians have taken up business ownership. They have made this transition more often. It was reported by the Italian Chamber of Commerce that there are over 30,000 businesses owned by Albanians in Italy, which include multiple types such as restaurants, retail stores, logistics and construction companies. In Tuscany, for example, Albanian-owned eateries enjoy popularity for blending Italian as well as Balkan cuisines, which reflect the ethnic integration of the diaspora. Diverse professional fields are being entered by second-generation Albanians, who are benefiting from education as well as bilingual skills. Many work in medicine, engineering, IT, as well as finance. A sharp difference is marked by this to the first generation's concentration in manual labor. A 2020 study by the European Commission showed that more than 65% of second-generation Albanians found employment in skilled or semi-skilled professions, which is an important increase from 30% among their parents. Large remittances are sent by Albanians in Italy back to Albania, with the average amount exceeding €150 million annually. These funds actively support families as well as investments. They also strengthen development projects in Albania, which creates a strong economic link between the two countries. Albanian women actively contribute to Italy's labor market in domestic work as well as healthcare, while they reliably uphold customary gender roles within families. Younger women are increasingly pursuing education as well as professional careers over time, thus breaking customary standards.

The Albanian government has set up consulates along with embassies throughout Italy to help its citizens. Major cities like Rome, Milan and Bari host consulates. These consulates provide important services such as passport renewals, legal assistance, as well as diaspora registration. The Albanian Ministry for Europe, and Foreign Affairs runs the State Agency for the Diaspora. This agency organizes many outreach programs to connect many Albanians abroad with their homeland. Many initiatives, such as the "Diaspora Development Program," actively zero in on ethnic preservation in Albania by funding many language schools and multiple ethnic events for Albanians in Italy. These schools operate in regions like Lombardy as well as Tuscany. They help second-generation Albanians learn Albanian history, literature in addition to language. Organizers hold annual Diaspora Summits that encourage Albanians in Italy to maintain ties with their heritage and promote professional networking opportunities. The Albanian government has streamlined remittance services by partnering with Italian financial institutions, which has reduced transaction costs for migrants sending money home. The program "Be Invested in Albania" actively targets the diaspora. It offers great incentives like tax benefits for starting businesses in Albania. Many Albanian entrepreneurs in Italy actively use this program to invest broadly in real estate, agriculture as well as tourism back home. Albania allows dual citizenship, which actively enables Albanians in Italy to proudly maintain their Albanian identity as well as acquire Italian nationality. Cross-border mobility and access to legal rights in both countries are eased by this dual status. Bureaucratic hurdles for the diaspora have also been eased by the Albanian government, with online access to important

documents as well as services being allowed.

IV. The Role of Both Countries in Facilitating Integration

Italian laws such as Legge Martelli (1990) along with later immigration reforms have built an important foundation. This foundation helps legalize the status of Albanian migrants. In the late 1990s, regularization campaigns helped thousands of undocumented Albanians. They were able to obtain residence permits. Many Decree-Law No. The emphasis on integration measures, including access to education, healthcare, as well as housing for legal migrants, is placed by 286/1998, the Consolidated Act on Immigration. Programs like "Piano Nazionale per l'Integrazione" (National Integration Plan) have been implemented in Italy, which provides language courses, employment training, as well as social support for migrants. Regions like Emilia-Romagna and Lombardy are actively leading integration efforts through municipal projects, presenting these initiatives as often localized. Specific programs like the 'Work4Integration' project equip migrants with skills for the labor market. These programs include vocational training in construction, agriculture and technology. The Italian government actively funds multicultural festivals and initiatives that celebrate Albanian culture, such as the Albanian-Italian Ethnic Week, which is held annually in Milan. These events seek to promote understanding between cultures and lessen xenophobia. Italian and Albanian artists, musicians and filmmakers collaborate on projects that present the diaspora's contributions, bringing Albanian culture into mainstream Italian media. Public healthcare and education systems are accessible to migrants, including Albanians. Targeted services, such as translation assistance in hospitals as well as schools, are offered by many municipalities, guaranteeing accessibility for non-Italian speakers. In cities like Rome as well as Bologna, programs such as "Sportello Immigrati" (Immigrant Desks) offer information about legal rights, housing, in addition to employment for Albanian migrants.

Italy has made progress in incorporating second-generation Albanians into the educational system as well as promoting their integration. The "Scuola e Integrazione" (School and Integration) initiatives improve classroom inclusivity by encouraging intercultural dialogue as well as providing mentorship for students of migrant backgrounds. Many integrations of Albanian youth have been eased by sports programs, especially football clubs, with some important successes, such as "Elseid Hysaj," inspiring a younger generation while "Ermal Meta" has become a household name in Italy, helping to reduce stigma.

Italy, along with Albania, has actively signed many bilateral agreements to greatly increase economic cooperation. The Italy-Albania Joint Economic Committee drives investments, allowing Italian businesses to leverage a skilled Albanian workforce in sectors such as textiles as well as technology. The skills of the Albanian diaspora are targeted to be harnessed for large economic growth in both countries by programs such as "Migration and Development", which is co-funded by the European Union, as well as several other initiatives. The Italy-Albania Year of Culture draws attention to the shared ethnic heritage. This program presents the bonds between the two nations. Art exhibitions, film screenings, as well as historical seminars take place in

cities such as Tirana, and Rome. Albania, as well as Italy, has collaborated on educational exchange programs. Many scholarships for Albanian students to study in Italian universities improve connections between many young people from both nations. Albania has received important support from Italy in fighting irregular migration via multiple joint border control efforts and a range of anti-trafficking programs. The partnership between the two nations in Frontex actively zeroes in on securing the Adriatic migration routes as well as providing important humanitarian support. Collaborative efforts to address asylum requests have importantly streamlined processes, guaranteeing truly humane treatment for Albanians seeking refuge during times of crisis, as well as effectively supporting their needs. Many Albanians contribute importantly to Italian society. Their ethnic traditions, cuisine, music as well as festivals improve it. Many Albanian ethnic festivals in Milan and Rome actively promote multiculturalism and encourage better understanding between diverse communities.

Conclusion

The Albanian diaspora in Italy depicts the challenges and opportunities that come with migration, integration and bilateral collaboration. From the chaotic migration waves of the early 1990s to the establishment of an energetic, multidimensional community, Albanians in Italy have been made integral to the country's social as well as economic fabric. Political instability and economic hardship fueled the initial wave of Albanian migrants after the fall of communism. Over the decades, more structured pathways were evolved, including family reunifications as well as labor market integration. Many people face linguistic and ethnic barriers that obstruct social integration. Many stereotypes and systemic biases further obstruct this process. Many second-generation Albanians have made important strides. They have achieved higher levels of education as well as professional success. Many Albanians actively improve Italy's economy, especially through important roles in construction, agriculture and entrepreneurship. The diaspora shows its adaptability and resilience by transitioning from labour-intensive roles to skilled professions as well as business ownership. Both Albania and Italy have played important roles that have been important. Through ethnic and economic programs, Albania actively engages its diaspora, while Italy's integration policies and public services create mutual benefits.

Both countries must create scholarships for Albanians in Italian universities and professional training programs for the Italian labor market. Many ethnic initiatives, such as Diaspora Days and multicultural festivals, actively promote mutual understanding and importantly reduce lingering prejudices. We should increase funding for Albanian-language schools in Italy to preserve heritage among second-generation migrants. Italy should actively simplify pathways to citizenship as well as residency for long-term Albanian residents, particularly for those who are contributing greatly to the economy and society. This includes accelerating the recognition of Albanian qualifications in professions such as teaching, as well as engineering. We should expand many programs that actively encourage a greater number of Albanian entrepreneurs in Italy and attract large Italian investments in Albania. Joint ventures in tourism as well as technology can successfully leverage important strengths. These

ventures in agriculture can encourage large economic growth for both countries. Vulnerable groups within the Albanian diaspora must receive special attention. This includes women in precarious jobs as well as undocumented migrants. Many thorough support systems, including legal aid as well as social services, play an important role in achieving all-embracing integration. Media campaigns that present many achievements of Albanians in Italy can be used to counter multiple lingering stereotypes. We should increase success stories, including those of Albanian professionals, athletes and entrepreneurs, to reshape public view.

The potential of migration is depicted by the Albanian diaspora in Italy. This migration improves both the host country as well as the home country. By having the remaining challenges addressed and deeper bilateral cooperation encouraged, it can be guaranteed that the diaspora continues to thrive by both Albania and Italy, contributing to a shared future of prosperity and ethnic exchange.

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Enforceable title in Albanian legislation

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Abstract

The right to a fair trial includes having the case heard within a reasonable time and extends to the enforcement stage of the court decision. An enforceable title is not always a final court decision, and a final court decision is not always an enforceable title. The enforcement of a final court decision is always carried out in accordance with the law and involves several stages, one of which is the mandatory enforcement phase, which directly impacts the interests of the parties involved. A final court decision cannot be enforced against individuals who were not parties to the case.

Keywords: Court ruling, enforceable title, enforcement of court decisions, trial, case law.

1. Introduction

An enforceable title is any legal act that, according to civil procedural provisions, includes an obligation, such as a financial obligation, or any other act based on specific legal rules that are equivalent in legal power to final court judgments.[1]
Civil procedural law[2] clearly defines the cases in which enforceable titles apply.[3] An enforceable title must clearly identify a recognized and specific obligation that can be enforced, wich is not dependent on meeting certain deadlines, and is not conditioned by other circumstances or mutual obligations.
A final judgment, according to the Civil Procedure Code, is a court decision that cannot be appealed. This happens when no appeal is filed within the legal time limits, or when the appeal is withdrawn; when the appeal is rejected, or when the court decision is upheld, changed, or the case is dismissed in the second instance. However, not every final judgment is an enforceable title, and not every enforceable title is a final judgment.[4]
An enforcement order cannot be issued, nor can a bailiff carry out the enforcement of court decisions for 'proving a legal fact,' decisions on 'recognition claims,' or decisions that 'cancel or invalidate an administrative act' (except for the interim decision to suspend the enforcement of an administrative act, according to Article 329 of the Civil Procedure Code), as well as any decisions that are simply declaratory.
A final judgment is binding on the parties,[5] their heirs, individuals deriving rights from the parties, the court that issued the decision, and all other courts and

[1] See Unified Decision No. 980, dated 29/09/2000, of the Supreme Court's Joint Chambers.
[2] Refer to Article 510 of the Civil Procedure Code of Albania
[3] The list of executive titles is not exhaustive, as other acts may also be considered as such if specifically designated as titles by special laws. For example, sales tax invoices, which under Law No. 48/2014 "On Delayed Payments in Contractual and Commercial Obligations," are treated as executive titles, with the enforcement office responsible for their execution. Electricity bills, which under Law No. 8662, dated 18.09.2000 "On Treating Electricity Consumption Bills as Executive Titles," as amended, are also treated as titles, along with decisions from various institutions that impose a fine obligation.
[4] Refer to Supreme Court Decision 45/2001
[5] Refer to Article 510 of the Civil Procedure Code of Albania.

institutions. A final judgment only applies to what has been decided between the same parties, regarding the same subject and cause.[6] A matter that has been resolved by a final judgment cannot be tried again, unless the law provides otherwise. This provision leads to the conclusion that a final judgment is binding only on those who were parties to the case.[7]

2. Issuing an enforcement order

The execution order is a judicial decision issued by the Court addressed to the authorities responsible for enforcing the enforceable title. For the execution order to be issued, it is necessary for the enforceable title to provide definitive, complete, and unconditional proof of the obligation.

An executive order is not always issued for final judicial decisions.[8] The legislator has specified that an executive order will not be issued for decisions related to securing a lawsuit, court-imposed fines, orders for mandatory evidence collection, decisions regarding court costs, or civil court decisions for provisional enforcement, which are directly executed by the baliff following notification of the decision. The Civil Procedure Code[9] stipulates that a decision denying the issuance of an executive order can be appealed in accordance with the rules for specific appeals.

This rule states that an appeal can only be made if the court rejects the execution order. However, it doesn't specify the procedure if the execution order is approved. Therefore, no appeal can be filed against a decision that approves the execution order. The issuance of the execution order does not coincide with the start of execution of an enforceable title. The decision to issue the order is a factual check, serving as a discretionary judgment to confirm that the enforceable title meets the required conditions for validity. Enforcement begins when an execution request is submitted to the bailiff.

3. Challenging the validity of enforceable titles

Challenging the validity of enforceable titles or the obligations contained within them is outlined in the Civil Procedure Code.[10] It states that the debtor can request, through a lawsuit filed in the competent court where enforcement takes place, that the enforceable title be declared invalid, or that the obligation either does not exist, exists to a lesser extent, or has been extinguished. However, if the enforceable title is a court decision, the debtor can only challenge it based on facts that occurred after the decision was made.

[6] Refer to Supreme Court Decision No. 628/2000.

[7] Refer to the principle of 'Res Judicata,' which states that a matter cannot be judged twice. This is linked to the principle of legal certainty, where a final decision issued by a court is not subject to challenge. The Supreme Court, in Unifying Decision No. 928 dated 15.05.2000, stated: 'Once the decision in the first instance becomes final, the issues resolved by it are considered res judicata and cannot be subject to reexamination in the second instance of the case, at any level of the court where the case has passed. The validity of a final decision cannot be contested, except when the Civil Procedure Code explicitly provides special procedures and means for such a challenge.'

[8] Refer to Article 511 of the Civil Procedure Code of the Republic of Albania.

[9] Refer to Article 511 of the Civil Procedure Code of the Republic of Albania.

[10] Refer to article 463 of the Civil Procedure Code.

In these cases, the court will handle the matter urgently and may order the suspension of enforcement, with or without security, until the trial concludes. Challenging the validity of the enforceable title or the obligation within it must be done through a regular lawsuit before the court in the place of enforcement, not through an appeal against the actions of the bailiff. Facts that occurred before the decision cannot be used as grounds to challenge the decision but may be used to request a review.
Additionally, these decisions cannot be challenged during the enforcement phase of the invalidity or non-existence of their content. The validity or existence of the enforceable title can be challenged for all other enforceable titles that are not court decisions, and for any reasons that allow the title, as a document containing an obligation, to be contested during the declaration of rights phase or for reasons related to the extinguishment or reduction of the obligation.[11]

4. Decisions made with temporary enforcement and the consequences of their cancellation by the higher Court

A court decision may be issued with temporary enforcement[12] when an obligation for child support is established, for work-related compensation, or for the restoration of joint possession of a marital home.
Temporary enforcement may also be granted if the delay in execution could cause significant, irreparable damage to the claimant, or if enforcement would become impossible. In such cases, the court may require the claimant to provide a guarantee, which will be assessed by the court.
If the debtor is outside Albania, the judicial enforcement officer must comply with international instruments[13] ratified by our country and currently in force, in order to enforce the court decision. This may be done by delivering the relevant acts or notifications to the appropriate authorities of the requested state, or by requesting these authorities to carry out the enforcement themselves.
Child support obligations and the restoration of joint possession of the marital home are two key family law matters governed by the provisions of the Civil Procedure Code, which emphasize the importance of parental responsibility.[14] It is essential that the court's decision is clear, comprehensive, and includes all necessary details.
Furthermore, the case of *M.C. v. Bulgaria* serves as a typical example of the European Court of Human Rights (ECtHR) increasingly stressing the application of national legislation by courts, in accordance with Articles 6 and 8 of the European Convention

[11] Alqiviadh Lamani, Civil Procedure of the People's Republic of Albania, Tirana 1962, p. 297.
[12] Refer to Article 317 of the Civil Procedure Code.
[13] Among the multilateral international instruments, we highlight: the Hague Convention on 'Civil Procedure,' which Albania joined through Law No. 10 182, dated 29/10/2009; the European Agreement on the Transmission of Requests for Judicial Assistance, ratified by Law No. 8705, dated 01/12/2000; the Convention on the Service of Judicial and Extrajudicial Documents Abroad, which Albania joined through Law No. 9554, dated 08/06/2006; the Convention on the Recognition and Enforcement of Foreign Arbitral Awards, which Albania joined through Law No. 8688, dated 09/11/2000; and the Convention on the Recognition and Enforcement of Foreign Civil and Commercial Judgments, which Albania joined through Law No. 10 194, dated 10/12/2009.
[14] The case before the Strasbourg Court, Bajramaj v. Albania, failed to enforce the decision regarding the exercise of parental responsibility and the right to contact with the child.

on Human Rights.[15]
The Civil Procedure Code[16] outlines the situations in which a court decision is subject to provisional enforcement. Additionally, Article 319[17] of the Code addresses the consequences of overturning a decision that was made with provisional enforcement. The Joint Chambers of the Supreme Court of the Republic of Albania have noted that misunderstandings have arisen in practice regarding how to handle the consequences of enforcing a decision that was later annulled by a final judgment. Therefore, under Article 314 of the Civil Procedure Code, it is necessary for the Joint Chambers to clarify and interpret their decision no. 643, dated 11.05.2000. This clarification will provide a unified approach for similar cases in judicial practice through the decision that will be issued for this purpose.
"If, after the first decision is overturned, the case is dismissed and the decision becomes final, the original court must return to the other party everything that was obtained through the provisional enforcement of the first decision."
The way the consequences of enforcing a decision, which is later overturned by a final ruling, are dealt with should not differ from how the consequences are handled when the provisional enforcement of a decision, not yet final, is later overturned. In all cases where the new ruling, issued after the overturn, differs from the first decision—which was either fully or partially enforced—the party who benefitted must return all the benefits received from the enforcement of that decision.
As a rule, the return of benefits should be specified in the final ruling issued after the earlier decisions were overturned. However, even if the court does not explicitly address the consequences of the full or partial enforcement of an unjust decision that has later been overturned, the solution remains clear. The bailiff's office, which carried out the full or partial enforcement of the unjust decision, must require the beneficiary to return all the unjust benefits, at the request of the court, in accordance with the procedure set out in Article 511 of the Civil Procedure Code.[18]

5. Notarial act and the conditions it must meet to be considered an enforceable title, according to the practice of the High Court in Albania

The High Court of the Republic of Albania, in its Unifying Decision No. 980, dated 15.09.2000, interpreted the notarial act in the context of Article 510/d of the Civil Procedure Code, which was originally worded as follows: *"Enforceable titles include... d) Notarial acts authorizing the payment of a contractual obligation or any other prior debt, directly from bank deposits or the wages of the person granting the authorization, and from their credits to third parties."*
After amendments to the Civil Procedure Code, judicial practice in this area has also evolved. The Civil Panel of the High Court has interpreted Unifying Decision No. 980, dated 15.09.2000, issued by the Unified Panels of the High Court. Through Article 105 of Law No. 8812, dated 17.05.2001, "On Amendments and Additions to Law No.

[15] Refer to the case of Pini and others v. Italy, in which the court found a violation of Article 6 of the ECHR.
[16] Refer to Article 317 of the Civil Procedure Code.
[17] When a decision is annulled by the appellate court or the Supreme Court, provisional enforcement is suspended. If, after the annulment of the initial decision, the claim is dismissed and the decision becomes final, the party that initially won is required to return to the other party everything that was received through the provisional enforcement of the initial decision.
[18] Refer to Decision No. 1025, dated 09.10.2000 and 27.10.2000, of the United Chambers of the Supreme Court.

8116, dated 29.03.1996, the Civil Procedure Code of the Republic of Albania," the content of Article 510/d was revised as follows: *"Enforceable titles include... d) Notarial acts containing a monetary obligation, as well as acts for the granting of bank loans."*
Building on this reasoning, the Civil Panel of the High Court[19] concluded that it was the legislator's intent, through the amendment of Article 510/d of the Civil Procedure Code, to consider as enforceable titles all notarial acts containing monetary obligations, including loan contracts drawn up by a notary. The Court argued that any notarial act containing a monetary obligation qualifies as an enforceable title, specifically referencing loan contracts. As an enforceable title, the notarial act must represent a unilateral and abstract legal obligation for the payment of a specific amount of money. A notarial declaration for the payment of a set amount can only be contested for falsification or for the grounds outlined in Article 609/1 of the Civil Procedure Code. Case law[20] distinguishes between two main types of notarial acts: those involving agreements between individuals and those related to bank loans provided by legally recognized entities and institutions, which are considered the primary forms of loan contracts. When a notarial act[21] contains a monetary obligation, the parties must specify how the obligation will be fulfilled. Additionally, they must consider the format of the act in which they will accept the fulfillment of the obligation for the sake of evidentiary purposes.
For a notarial act[22] to qualify as an enforceable title, it must also clearly state the legal cause for the creation of the obligation.[23] The Joint Chambers[24] have clarified that the content of the agreement between the parties does not reveal the legal cause of the obligation, which may arise from a contractual agreement or be defined by specific legislation. To be considered an enforceable title under the amended Article 510(d) of the Civil Procedure Code, the notarial act must explicitly include the legal cause behind the obligation.

6. Conclusion

The enforcement of a judicial decision can only occur based on an enforceable title, which primarily includes court rulings and other acts explicitly outlined in the Civil Procedure Code. These acts, by their executive nature, carry the same force as final court decisions for all legal effects. However, not every final decision qualifies as an enforceable title, nor is every enforceable title a final decision.
An enforceable title must specify a clear, enforceable obligation that is not contingent on meeting specific deadlines and, above all, is not dependent on other conditions or reciprocal obligations. Therefore, a final court decision that merely affirms a legal fact, without imposing an obligation, cannot be considered an enforceable title, as it is not enforceable but purely declaratory. A final judgment is binding for the parties, their heirs, and anyone who derives rights from the parties, as well as for the court that issued the decision and all other courts and institutions. A final judgment

[19] Refer to Decision No. 427, dated 11/04/2006, of the Civil Panel of the Supreme Court.
[20] Refer to Decision No. 427, dated 11.04.2006, of the Civil Panel of the Supreme Court.
[21] Refer to Decision No. 77, dated 12.02.2015, of the Civil Panel of the Supreme Court.
[22] Refer to Decision No. 558, dated 30.10.2014, of the Civil Panel of the Supreme Court.
[23] Refer to Decision No. 427, dated 11.04.2006, of the Civil Panel of the Supreme Court.
[24] Refer to Decision No. 35, dated 30.05.2002, of the Civil Panel of the Supreme Court."

only has authority regarding what has been decided between the same parties, for the same matter, and for the same reason. A dispute that has been resolved with a final judgment cannot be reconsidered, unless the law provides otherwise. A final judgment is binding only on the individuals who were parties to the case.
The bailiff's office cannot extend its jurisdiction to enforce an enforceable title against persons who were not parties in the judicial process, even if these individuals have an interest in the obligation established by the judgment. The legislator has specified that if the parties do not agree on the enforceable title, they may request the competent court in the execution location to declare that the enforceable title is invalid, that the obligation does not exist, or that it exists in a smaller extent or has been extinguished. When the enforceable title is a judicial decision or an arbitral award, the debtor may challenge the execution of the title only for facts that arose after these decisions were made.
No provision in the Civil Procedure Code allows the challenge of the execution order. Since the issuance of the execution order is part of a non-contentious process, it is issued to verify the conditions for the validity of the enforceable title, which, in fact, can be easily challenged in court for invalidity. For a notarial act to be considered an enforceable title, it must involve a unilateral legal action that includes a clear obligation to pay a specific amount of money. The obligation can be abstract, where only the amount is specified without explaining its origin, or concrete, when it is clear that the obligation arises from, for example, a previous contract. The obligation must be precisely defined, enforceable, not tied to the fulfillment of specific deadlines, and not conditional on other circumstances or mutual obligations. All of these conditions must be met for the notarial act to qualify as an enforceable title.[25]

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-The Civil Procedure Code of Albania.
-Decision No. 980, dated 29/09/2000, of the Supreme Court's Joint Chambers.
-Decision No. 628/2000 of the Supreme Court.
-Decision No 45/2001 of the Supreme Court.
-Alqiviadh Lamani, Civil Procedure of the People's Republic of Albania, Tirana 1962, p. 297.
-The case before the Strasbourg Court, Bajramaj v. Albania, failed to enforce the decision regarding the exercise of parental responsibility and the right to contact with the child.
-Pini and others v. Italy, in which the court found a violation of Article 6 of the ECHR.
-Decision No. 1025, dated 09.10.2000 and 27.10.2000, of the United Chambers of the Supreme Court.
-Decision No. 427, dated 11/04/2006, of the Civil Panel of the Supreme Court.
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-Decision No. 35, dated 30.05.2002, of the Civil Panel of the Supreme Court.
-Decision No. 980, dated 29/09/2000, of the Joint Chambers of the Supreme Court.

[25] Refer to Unified Decision No. 980, dated 29/09/2000, of the Joint Chambers of the Supreme Court.

The impact of English Language on developing intelligent Algorithms in Software Engineering

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Abstract

English plays a crucial role in advancing the development of intelligent algorithms in software engineering. This paper explores how strong English language skills facilitate access to essential algorithmic documentation, enhance understanding of complex technical frameworks, and drive innovation in the design and implementation of intelligent systems. Using a survey-based methodology involving students, the study investigates the relationship between English language and the ability to design, implement, and deploy intelligent algorithms effectively. The findings show that English significantly improves the efficiency, accuracy, and creativity of algorithm development by enabling software engineers to better understand technical documentation, libraries, and methodologies. Respondents indicated that grasping complex algorithmic concepts and applying them to real-world problems becomes much easier when they have a high level of English language skills. Additionally, English makes it easier to adapt and integrate pre-existing algorithms, particularly in areas such as natural language processing, leading to faster and more accurate implementation in practical applications. This study emphasizes that English is not just a supplementary skill but a fundamental competency in software engineering that accelerates the creation and deployment of intelligent algorithms. The paper concludes that proficiency in the English language in software engineering education and professional settings can foster innovation, promote global collaboration, and ensure wider participation in the development of intelligent algorithms, ultimately driving progress and advancing the field.

Keywords: English proficiency, intelligent algorithms, English algorithm development, natural language processing (NLP), English innovation.

1. Introduction

In today's fast-evolving technological landscape, English has become the dominant global language, bridging the East and West, as well as the North and South. It has firmly established itself as the language of commerce, science, engineering, and technology (Parupalli Srinivas Rao, 2019). In the field of software engineering, English is crucial for developing intelligent algorithm systems that learn and adapt to perform complex tasks. These algorithms depend heavily on technical documentation, research papers, and collaboration platforms, all of which are predominantly in English. This reliance highlights the significant role of English in driving technological advancement and fostering innovation. One of the key advantages of computer-aided technology in English language learning is its ability to offer interactive and engaging content Nguyen, T. M. N. 2022). The transformative impact of technology on education is

evident, particularly in English language learning, where it enhances outcomes and supports innovative teaching methods. (Sharma, 2009; Singhal, 1997).

As English continues to evolve and shape global communication, it drives advancements in technology, making language learning more accessible, effective, and engaging for learners worldwide (Liu, J., & Yan, S. 2022).

The intersection of information technology and language learning has garnered increasing attention from researchers in recent years (Ahmadi, M. R. 2018).

English proficiency is now essential in an interconnected world, not only as a tool for effective communication but also as a key to accessing global knowledge and opportunities (Gomathi, R. D., Saravanan, R., & Kumar, R. 2024). Proficiency in English opens doors to international collaboration and empowers individuals to engage with cutting-edge research, thus promoting personal and professional growth. The rapid advancements in technology are creating numerous opportunities that significantly enhance the learning and mastery of the English language, fostering improved language skills and proficiency Fryer, L., & Carpenter, R. (2006).

Additionally, algorithms using machine translation technology exemplify how English shapes algorithmic design. Beyond translation, improving comprehension through cultural annotations and contextual explanations tailored to individual proficiency levels (Shu 2024). Machine learning is revolutionizing computer-aided English-spoken teaching by enabling personalized, adaptive, and interactive learning experiences (Zhang, Y., & Li, N. 2022). Computer-aided technology has revolutionized the landscape of English language learning, offering an array of innovative tools and resources that cater to the diverse needs and preferences of learners (Zhang, J. 2022). One of the key applications of machine learning in computer-aided English spoken teaching is in speech recognition and analysis (Yuan, X., & Zhu, R. 2022). Building upon recent advancements in natural language processing (Yin, L. 2024), the algorithm aims to provide accurate and nuanced translations of foreign texts into English, enabling learners to access a diverse array of literary works from around the world (Li, R., & Wang, S. 2023). Machine learning systems also analyze vast amounts of linguistic data, including speech patterns, pronunciation nuances, and language usage contexts (Gu, Y., Wu, W., White, M., Aziz, H., & Liew, K. 2022). Therefore using machine learning and natural language processing may successfully advance reforms in English teaching and learning (Wang, 2019). The algorithms aims to enable English language learners to go on a life-changing voyage of discovery and exploration within the world of foreign literature(Mardini, G. I. D., Quintero, M. C. G., Viloria, N. C. A., Percybrooks, B. W. S., Robles, N. H. S., & Villalba, R. K. 2024). Furthermore, intelligent algorithms are not limited to translation; they can create adaptive learning environments that cater to individual learning styles. (Chen 2024) emphasizes the potential of network structures and autonomous learning algorithms to personalize English language education. Automated assessment tools, speech recognition software, and language proficiency tests enable learners to receive instant feedback on their pronunciation, grammar usage, vocabulary comprehension, and overall language proficiency (Chen, R. 2022). The development of algorithms that can support learners in acquiring both programming skills and English proficiency, enhancing programming language learning (Adnan et al., 2018). The impact of English

in algorithms, as it demonstrates how algorithms can be designed to assess language skills effectively, thereby influencing educational and professional outcomes. The integration of technology and algorithms in language assessment exemplifies the broader implications of English proficiency in algorithmic applications (Li 2024).

A survey conducted among software engineering students reveals that English proficiency significantly improves technical skills, facilitates better collaboration, and enhances the development of intelligent systems. These algorithms are designed to meet diverse learner needs, indicating that further research is needed to optimize their designs and evaluate long-term outcomes in language competence (Zhang, 2024).

Furthermore, the integration of English in programming education highlights its significance in technical fields. reflecting the language's dominance in the tech industry (Idris & Ammar, 2018).

The application of machine learning in teaching spoken English also demonstrates the transformative potential of intelligent algorithm. Sophisticated algorithms analyze vast amounts of linguistic data to provide personalized feedback, significantly improving spoken language skills (Liu, 2022).

The importance of sentence representation and sentiment analysis in natural language understanding, further showcasing the impact of English on algorithmic development (Guminska 2023). Attention mechanisms can improve semantic analysis in English language processing, marking an important advancement in algorithmic capabilities (Chen, Z., & Du, W. 2022).

The integration of English into virtual assistants like Amazon Alexa and Apple Siri underscores its importance in intelligent systems. Despite the dominance of English in NLP, this creates challenges for linguistic diversity and inclusion, as speakers of underrepresented languages face barriers to accessing technology and information (Joshi et al., 2020; Bruyne, 2023). Natural Language Processing (NLP) where technologies enhance the accuracy of translations by understanding context and nuances in language, making the learning process more effective (Lexigo 2024). Language like English is the example of natural language. NLP involves inputting natural language into machines and then having the machines output information to humans, enabling people to interact with computers using natural language (Chen, D).

This research demonstrates that English is not merely a helpful skill but a necessity for software engineers. By examining the relationship between English, NLP, and software engineering, this study highlights the pivotal role of English in global collaboration, innovation, and the development of intelligent systems. As the world becomes increasingly interconnected, the importance of English in shaping the future of technology cannot be overstated.

2. Methodology

This study uses a survey-based approach to explore how English proficiency influences the development and application of intelligent algorithms in software engineering. The focus is on software engineering students, aiming to understand how language

skills impact key areas of algorithmic work, such as design, implementation, and problem-solving.

2.1. *Participant Selection*

The survey was distributed to 230 software engineering students from various universities in Tirana. Participants were selected to reflect a wide range of English proficiency levels, ensuring that the responses represented a diverse set of experiences.

2.1.2. Survey Instrument

The survey was conducted using a structured online questionnaire, divided into two main sections:

- *Section 1: Algorithm Development and English Proficiency:* This section gathered insights from participants about how their English proficiency affects their ability to access documentation, understand technical frameworks, implement algorithms, and solve problems effectively.
- *Section 2: Interaction with NLP Tools (e.g., Alexa and Siri):* In this section, participants were asked about their experiences with tools like Alexa and Siri, focusing on how their English skills influence their understanding and use of these NLP technologies. Issues such as pronunciation, clarity, and accessing advanced features were explored.

2.2. *Data Collection*

Data was collected through an online questionnaire, where participants provided responses to a series of questions about the impact of English proficiency on algorithm development and interactions with NLP tools. This approach allowed for a clear understanding of participants' perspectives on how their language skills affect technical tasks and the use of voice-activated technologies, ensuring consistency across responses.

2.3. *Data Analysis*

The collected data was analyzed to identify patterns and relationships between English proficiency and different aspects of algorithmic work. Descriptive statistics provided an overview of the data, while inferential analyses, such as correlations, were used to uncover significant trends.

3. Results

Section 1: General Impact of English on Algorithm Development

The statement "Proficiency in English helps access essential algorithmic documentation" received overwhelmingly positive responses (Figure 1). A significant majority, 76.5% strongly agreed and 20.9% agreed, resulting in 97.4% of participants acknowledging the importance of English in navigating critical resources. Only a small fraction (1.7%) were neutral, with minimal disagreement. These results underscore the dominant role of English in the field of technical documentation and its perceived necessity for success in this domain.

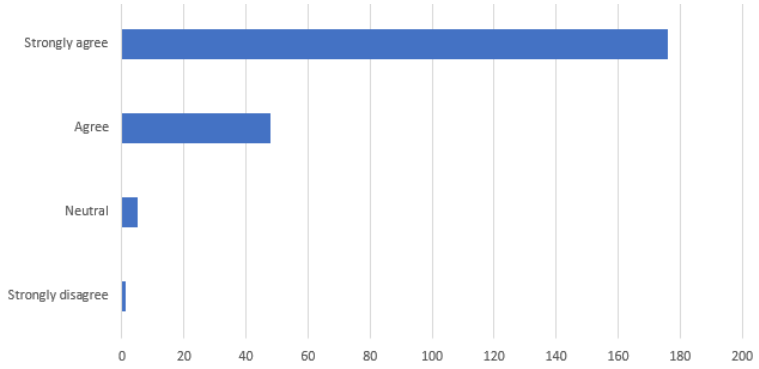

Fig.1. The Role of English Proficiency in Algorithmic Documentation

The statement "Strong English skills enhance understanding of technical frameworks" received broad support (Figure 2). A notable 71.3% of participants strongly agreed, with an additional 24.3% agreeing, totaling 95.6% who affirmed the importance of English proficiency for understanding technical concepts. Only a small minority remained neutral or disagreed, highlighting

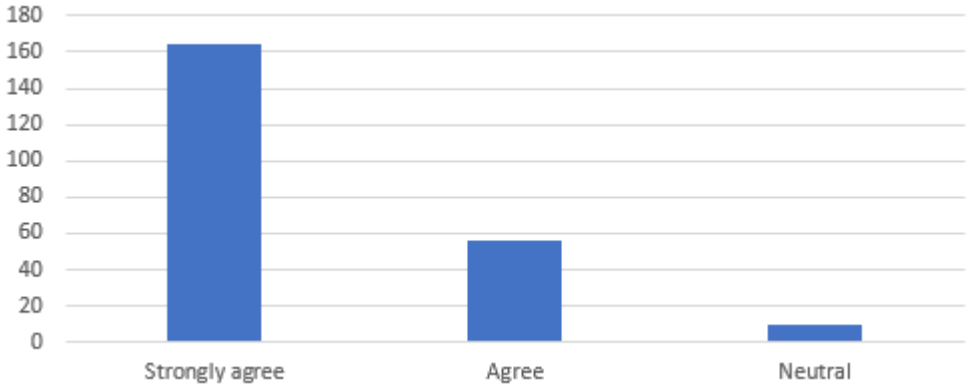

Fig.2. English Proficiency and Technical Frameworks

The statement "Proficiency in English improves your ability to implement complex algorithms" was met with strong agreement (Figure 3). A majority of respondents, 72.2%, strongly agreed, while 22.2% agreed, resulting in 94.4% recognizing the value of English fluency for handling complex algorithms. Only a small percentage remained neutral or disagreed, emphasizing the clear link between language skills and algorithm implementation.

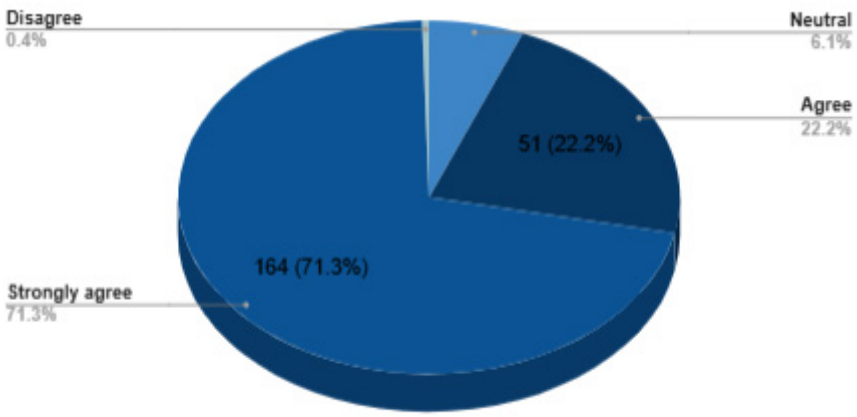

Fig.3. English Fluency and Algorithm Implementation.

Responses to "Proficiency in English enables you to understand and use algorithm libraries effectively" demonstrated strong support (Figure 4). A majority of 72.6% strongly agreed, and 22.2% agreed, totaling 94.8%. A small percentage remained neutral or disagreed, emphasizing the widespread view that English proficiency is essential for navigating algorithm libraries, with minimal dissent regarding its importance in technical documentation.

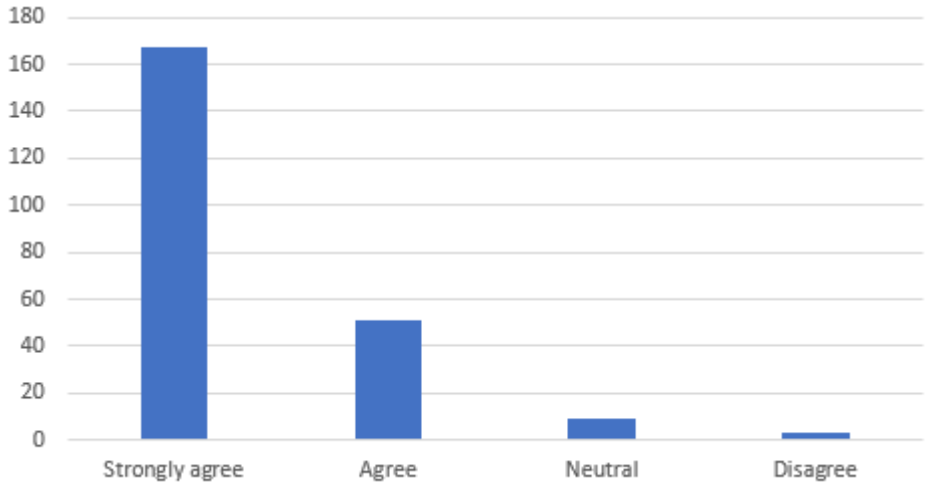

Fig.4. English and Algorithm Libraries

The statement "Proficiency in English improves your ability to solve real-world problems using algorithms" revealed strong support (Figure 5). A majority of 71.7% strongly agreed, and 20.4% agreed, totaling 92.1%. This highlights the vital role English plays in applying algorithmic knowledge to real-world problems, with very

few participants expressing neutrality or disagreement.

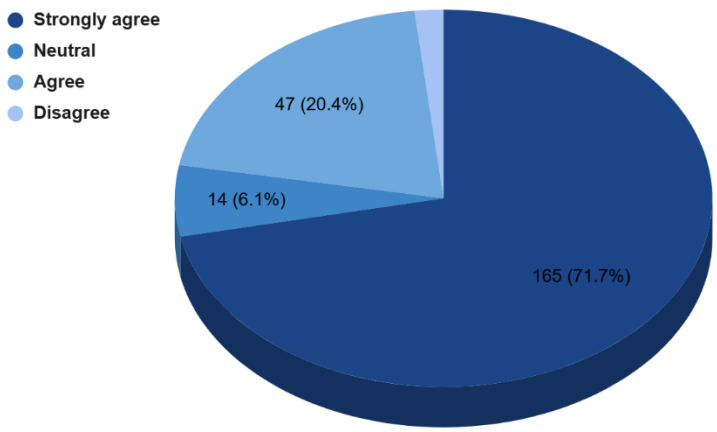

Fig.5. English Proficiency in Solving Real-World Problems with

Algorithms

Participants largely supported the statement "The availability of English-language resources affects the speed of your algorithm development." A total of 71.3% strongly agreed, and 21.7% agreed, resulting in a combined 93% agreement rate (Figure 6). Only a small percentage of neutral (7%) or dissenting (0.3%) responses further emphasize the critical role English-language resources play in accelerating algorithm development.

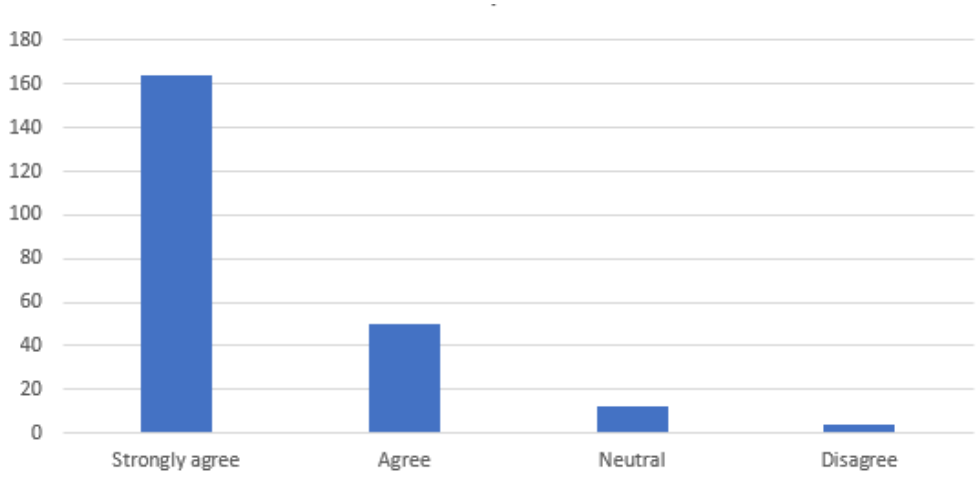

Fig.6. English-Language Resources and Development Speed

The statement "English significantly impacts the efficiency of algorithm development" received strong agreement (Figure 7). A majority of 70% strongly agreed, with 22.6% agreeing, resulting in 92.6% of participants recognizing the importance of English in improving algorithm development efficiency. Only a small percentage remained neutral or disagreed, highlighting the potential impact of language barriers on progress in algorithm-related tasks.

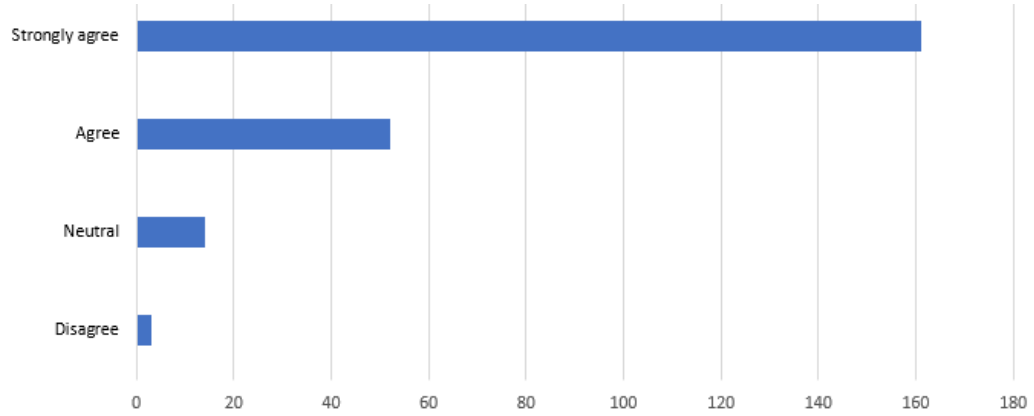

Fig.7. English and Algorithm Development Efficiency

The question "Does your understanding of NLP (Natural Language Processing) concepts improve with higher English proficiency?" The results indicate that 71.3% of respondents strongly agree, and 23.9% agree, making for a total of 95.2% who recognize the significant impact of English proficiency on understanding NLP concepts (Figure 8). This underscores the importance of English, as many NLP principles depend on English-based datasets, tools, and research.

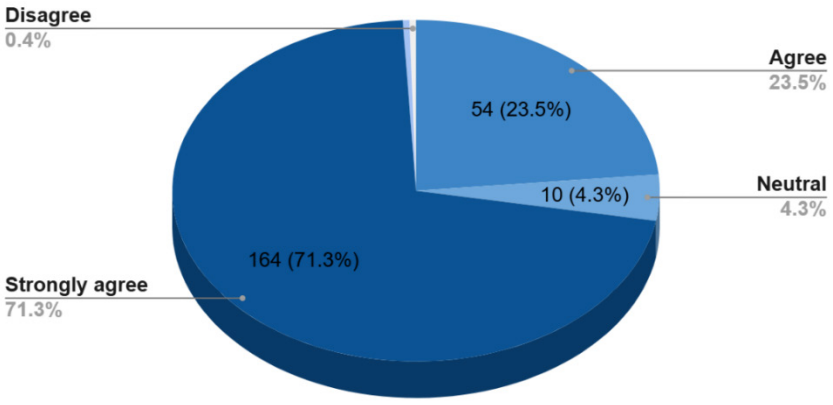

Fig.8. English Proficiency and NLP Concepts

Section 2: Daily Interactions with Siri and Alexa

When asked if they feel confident using English commands with Alexa or Siri, 66.1% of respondents strongly agreed, and 23.9% agreed, leading to a total of 90% who feel comfortable interacting with these devices in English (Figure 9). A small percentage remained neutral or disagreed, which may reflect differences in individual English proficiency levels.

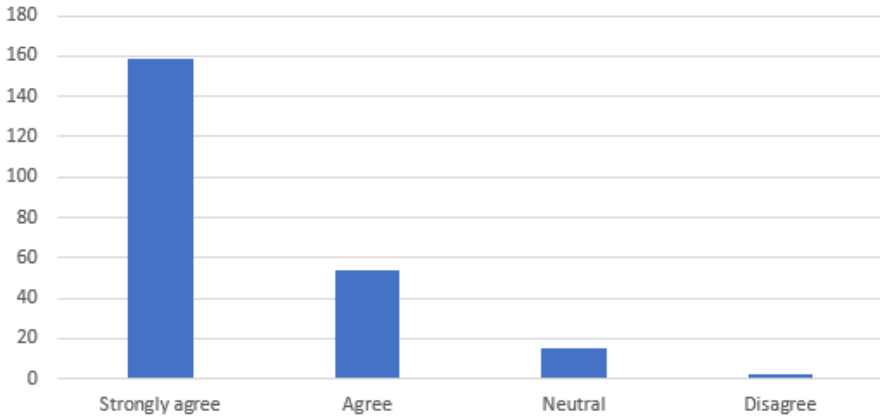

Fig.9. Confidence in Using Voice Assistants

The question "Have you experienced misunderstandings in English due to your accent or pronunciation?" elicited mixed responses (Figure 10). A combined 48.3% (27% strongly agreeing and 21.3% agreeing) reported experiencing misunderstandings because of their accent or pronunciation. However, 27.4% were neutral, and some disagreed, indicating that experiences with accent-related challenges vary widely among individuals.

Fig.10. Challenges with Accents and Pronunciation

The question "How often do you encounter errors in commands due to accents or mispronunciations in English?" revealed varying experiences (Figure 11). A total of 35.2% of participants reported often encountering errors, while 23.9% said they

sometimes face issues, and 17.6% rarely experience problems. A smaller group reported never having these issues, highlighting how accents and pronunciation can impact the accuracy of voice-command systems.

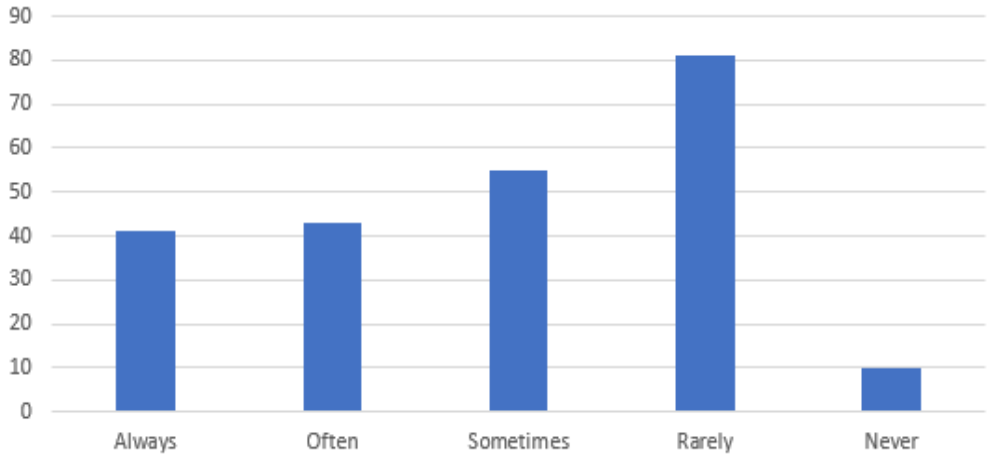

Fig.11. Accuracy in Voice Commands

Lastly, responses for "Does your English proficiency impact how effectively you use these assistants?" saw strong agreement from participants (Figure 12). A total of 57.8% strongly agreed, and 30.9% agreed, resulting in 88.7% acknowledging the impact of their English skills on using voice assistants effectively. This emphasizes how important clear English is for maximizing the functionality on the tools.

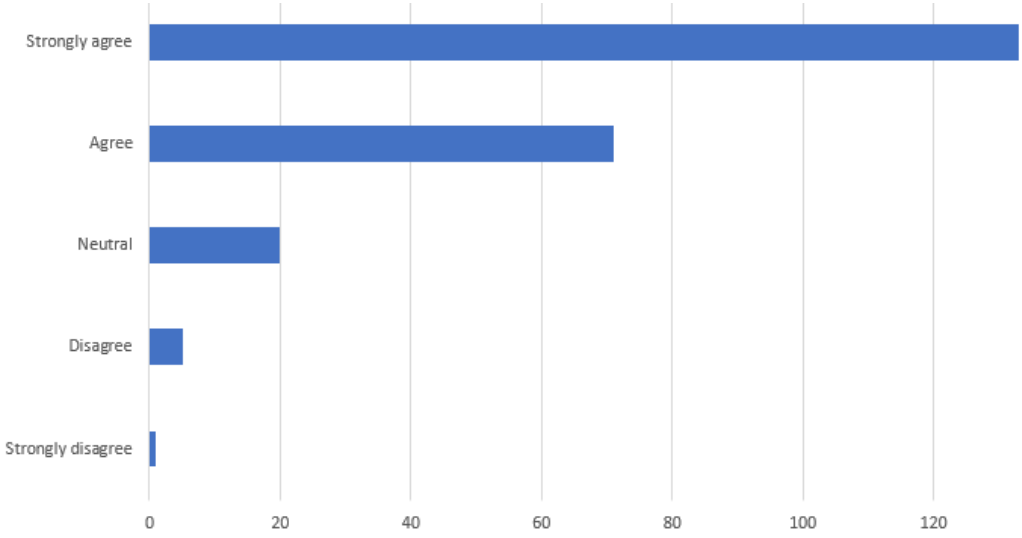

Fig.12. English Proficiency and Voice Assistant Effectiveness

4. Discussion

The English language plays a huge role in how intelligent algorithms are developed in software engineering. It opens up a lot of doors, but it's not without its challenges. Let's break it down and see what the benefits are, what the downsides look like, and how we can tackle them.

4.1. *Benefits of English Language on Developing Intelligent Algorithms*

One of the biggest upsides to knowing English as a software engineer is having access to an enormous treasure trove of resources. Most programming languages, frameworks, and libraries come with documentation written in English. This makes it so much easier for developers across the globe to learn from each other, swap ideas, and collaborate smoothly.

Another great thing about English is how it helps with understanding complex algorithms. A lot of cutting-edge fields, natural language processing (NLP), require diving deep into really technical concepts. If you're comfortable with English, you're better equipped to learn and use these frameworks, which can lead to more creative solutions and better results.

On top of that, being proficient in English makes it easier to tweak and build on existing algorithms. Open-source projects, for example, thrive because developers worldwide use English as a common ground. In areas like NLP, where language and algorithms go hand in hand, knowing English can speed up the process and improve accuracy.

And let's not forget how English acts as a bridge for global teamwork. It's the go-to language for developers working together across borders. This kind of collaboration sparks innovation, helping not just individuals and teams, but the entire field of software engineering move forward.

4.2. *Challenges and Disadvantages*

That said, putting so much emphasis on English isn't without its problems. For starters, focusing almost entirely on English-based resources can overshadow important contributions from other languages and cultures. We might miss out on unique ideas or methods that could really enrich the field.

Another issue is the mental strain that comes with working on complex technical concepts in English even for those fluent in it. Processing dense material in a second language can be exhausting and might slow down progress, even for experienced developers.

Then there's the risk of everything becoming too uniform. When English dominates, it's easy for the field to get stuck in one way of thinking. This kind of intellectual homogenization can limit creativity and make it harder to explore solutions that come from different cultural or linguistic perspectives.

4.3. *Addresing the challenges*

There are ways to tackle these challenges, though. One big step would be to create more resources that represent diverse languages and cultural perspectives. Imagine

platforms where developers can share knowledge in multiple languages the conversations and ideas that could come out of that would be incredible.
We also need to make room for methodologies and insights that aren't centered on English. Encouraging research and development from different backgrounds can bring in fresh, dynamic perspectives that keep the field exciting and inclusive.
Tools powered by artificial intelligence and machine translation can bridge language gaps, making it easier for people to access and contribute to technical knowledge, no matter what language they speak.

5. Conclusions

This study makes it really clear: English proficiency is not just a useful skill but a vital one for anyone working with intelligent algorithms in software engineering. The overwhelming consensus from our survey shows that engineers who are fluent in English have a distinct advantage when it comes to understanding technical documentation, navigating complex frameworks, and implementing cutting-edge algorithms. Respondents highlighted how English helped them work more efficiently, boosted their creativity, and made problem-solving significantly easier.
What's particularly striking is how English serves as a key to a much larger ecosystem of tools, libraries, and global expertise. This is especially true in fields like natural language processing, where English-based datasets and models dominate. Strong English skills allow engineers to leverage pre-existing solutions and integrate them into their work faster and more accurately, driving real-world results.
Ultimately, English is much more than just a language for technical communication it's a catalyst for innovation. As intelligent algorithms become more integrated into various industries, having a strong command of English allows engineers to stay connected to global advancements and collaborate across borders. It's clear from our findings that language proficiency opens doors not just to better resources, but to more meaningful contributions to the field.
In light of this, it's essential that software engineering education and professional development prioritize English language training. By equipping engineers with strong language skills, we can ensure that they're not just proficient in coding, but also in understanding and shaping the future of technology.
At its core, English proficiency isn't just about reading documentation it's about connecting with the broader world of innovation, learning, and collaboration. It empowers engineers to break down barriers, adapt to new challenges, and push the boundaries of what's possible. As such, English is an indispensable skill for anyone looking to make a real impact in the world of intelligent algorithms and beyond.

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Automatic calculation of critical clearing time in simulation tool

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Abstract

The critical clearing time (CCT) indicates the maximum duration in time allowed for a short circuit before the system becomes unstable. The calculation of the critical clearing time becomes very important in today meshed electrical systems with mixed generation sources like hydro and renewable photovoltaic and wind generators. It is within the scope of transmission operators to perform the calculation of CCT, for different system conditions, from close to real time operation to year ahead planning processes for new investments and their impact on the value of CCT. System operation Guideline in Europe stipulates in article 39.2 cit. *"Each TSO shall ensure that the fault clearing times for faults that may lead to wide area state transmission system instability are shorter than the critical fault clearing time calculated by the TSO in its dynamic stability assessment carried out in accordance with Article 38.*(*Commission Regulation (EU) 2017/1485 - of 2 August 2017 - Establishing a Guideline on Electricity Transmission System Operation*, n.d.)"
Important parameters for power system equilibrium are rotor angles, node voltages and frequency. Hence power system stability can be divided into: (i) rotor (power) angle stability, (ii) voltage stability and (iii) frequency stability.
In this work, it will described the background theory of critical clearing time and its importance for the stability of the power system. Simulation tools currently provide a good framework for the calculation of Critical Clearing Time. The tool PSS/E from Siemens will be used, with the case study of the Albanian Power system to perform such calculations. The Albanian Power system relies heavily on hydro energy sources, nevertheless in the recent years there is a steady increase of photovoltaic plants. Due to their technology photovoltaic plants do not have any inertia which on the other hand, is drawback in terms of rotor angle stability for the power system. In this study using PSS/E simulation tool CCT is calculated for faults in various locations of the system, hence considering the distance between generator and fault location, comparing the results of the faults near big hydro generators and photovoltaic plants. As a conclusion of the work done, it will be recommended optimal clearing time for faults in most important locations of the Albanian power system comparing the results also with the grid code requirements.

Keywords: Critical clearing time, power system, PSS/E, simulation.

Introduction

Albania's electricity transmission system consists of lines operating at voltage levels of 400 kV, 220 kV, 150 kV, and 110 kV, along with substations, transmission, and interconnection. The system is linked to six cross-border interconnection lines with

neighboring countries Kosovo, Montenegro, and Greece. The 400 kV network has been significantly developed in the past decades, thus enhancing interconnections with neighboring countries. The construction of the 400 kV interconnection line between Elbasan (Albania) and Bitola (North Macedonia), will increase further the cross-border transmission capacity.

The 220 kV network plays a significant role for the connection of generation sources to consumption centers and is further connected to the 110 kV network through 220/110 kV transformers. The 110 kV network supplies all 110 kV distribution substations, serving as load nodes, and directly connects other customers. Run-of-river hydropower plants, with a combined installed capacity of approximately 435 MW, are connected to the 110 kV network. Additionally, numerous hydropower plants currently under construction are expected to connect to both the 110 kV and 220 kV networks. The total installed capacity in Albania's transmission network amounts to 2,441 MW. Table 1, provides detailed data on generators connected to the transmission system.

Table 1 Generation sources connected to transmission system

Power Plant	Number	Power (MW)	Share in %
HPPs	46	2,230	91%
TPPs	1	97	4%
PVs	2	115	5%
Total	49	2,441	100 %

As of 2024, Albania's renewable energy capacity is hydro based, which accounts for a sizeable portion of the 2.44 GW installed(*OST Annual Report 2022*, n.d.). The country's mountainous terrain and numerous rivers make it an ideal location for hydropower plants. However, to diversify its energy mix, Albania is increasingly focusing on solar, wind, and biomass energy sources. In 2024 the Ministry of energy through auctions provided Power Purchase Agreement for 300MWp of new solar capacity. In Figure 1, are indicated the generation installed capacity according to the connection point in the transmission and distribution grid in Albania.

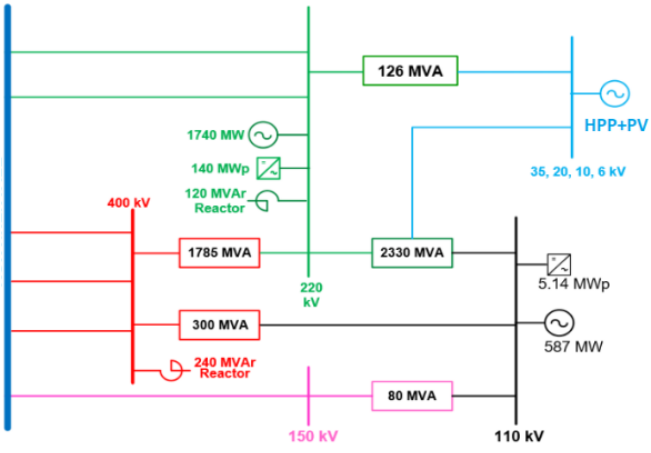

Figure 1 Simplified diagram of transmission network

In this context, interconnection lines are essential to enable the exchange of electricity within power systems, therefore the clear identification of significant elements is mandatory for transmission operators.
In the recent years, there have been many run of river hydropower plants connected to the Albanian power system, whereas most of them have been connected into 110kV and distribution system. All these exploitations of Albanian rivers and consequently increase of installed generation capacity has led to a less dependent situation from imports for country adequacy.

Description of phenomena

The rotor (power) angle stability of a power system can be enhanced, and its dynamic response improve, by correct system design and operation. For example, the following features help to improve stability:

- the use of protective equipment and circuit-breakers that ensure the fastest possible fault clearing;
- the use of single-pole circuit-breakers so that during single-phase faults only the faulted phase is
- cleared and the un-faulted phases remain intact;
- the use of a system configuration that is suitable for the particular operating conditions (e.g.
- avoiding long, heavily loaded transmission links);
- ensuring an appropriate reserve in transmission capability;
- avoiding operation of the system at low frequency and/or voltage;
- avoiding weakening the network by the simultaneous outage of a large number of lines and transformers.

In practice, financial considerations determine the extent to which any of these features can be implemented and there must always be a compromise between operating a system near to its stability limit and operating a system with an excessive reserve of generation and transmission. The risk of losing stability can be reduced by using additional elements inserted into the system to help smooth the system dynamic response. This is commonly referred to as stability enhancement and is the subject of this paper.
The equal area criterion is a graphical–analytical method for fast assessment of the first-swing transient stability. The power–angle transient characteristics corresponding to the three stages of the disturbance (pre-fault, during fault conditions and post fault) (Machowski et al., 2012) .
Figure 2, shows how the equal area criterion, described (Machowski et al., 2012), can be used to analyze the effect of a three-phase fault on the system stability. To simplify the discussion, damping will be neglected) and the changes in the rotor speed will be assumed to be too small to activate the turbine governor system. In this case the mechanical power input from the turbine can be assumed to be constant.
The generator is represented by the classical model with a constant transient emf

behind the transient reactance while the system is represented by a constant voltage V_s behind the equivalent reactance X_s. The reactances of the transformer and line L1 are X_T and X_L respectively. The pre-fault equivalent reactance of the whole transmission link is:

$$x_{dPRE}' = X_d' + X_T + X_L + X_s \quad (1)$$

The use of symmetrical components allows any type of fault to be represented in the positive-sequence network by a fault shunt reactance Δx_F connected between the point of the fault and the neutral, according to equation 1:

$$x'_{dF} = X'_d + X_T + X_L + X_s + \frac{(X'_d + X_T)(X_L + X_s)}{\Delta x_F} \quad (2)$$

For a three-phase fault $\Delta x_F = 0$ and, according to Equation 2 $x'_{dF} = \infty$.

Thus power transfer from the generator to the system is completely blocked by the fault with the fault current being purely inductive. During the fault the electrical power drops from its pre-fault value to zero as illustrated by line 1–2 in **Error! Reference source not found.** and remains at zero until the fault is cleared by opening the circuit-breaker. During this time the rotor acceleration ε can be obtained from the swing equation, Equation 3, by dividing both sides by M, substituting, $P_D = 0$ and writing in terms of δ to give

$$\begin{aligned} M\frac{d\Delta\varpi}{dt} &= P_m - P_e - P_D = P_{acc} \\ \frac{d\delta}{dt} &= \Delta\varpi \end{aligned} \quad (3)$$

$$\varepsilon = \frac{d^2\delta'}{dt^2} = \frac{P_m}{M} = const. \quad (4)$$

Integrating Equation 4 twice with the initial conditions $\delta'(t=0) = \delta_0^{'}$ and $\Delta\varpi(t=0) = 0$ gives the power angle trajectory as

$$\delta' = \delta'_0 + \frac{\varepsilon t^2}{2} \quad or \quad \Delta\delta' = \delta' - \delta'_0 = \frac{\varepsilon t^2}{2} \quad (5)$$

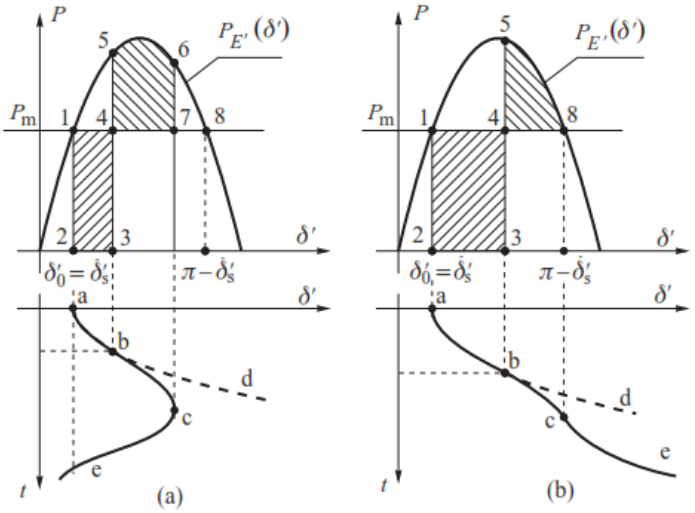

Figure 2 The acceleration and deceleration areas: (a) short clearing time; (b) long clearing time

Figure 6.2 The acceleration and deceleration areas: (a) short clearing time; (b) long clearing time.

This corresponds to the parabola a–b–d in Figure 2a. Before the fault is cleared the rotor moves from point 2 to point 3 on the power–angle diagram and acquires a kinetic energy proportional to the shaded area 1–2–3–4. When the fault is cleared at $t = t_1$ by opening the circuit-breaker, the rotor again follows the power–angle characteristic $P_{E'}(\delta')$ corresponding to the reactance given by Equation 1 so that the operating point jumps from point 3 to point 5. The rotor now experiences a deceleration torque, with magnitude proportional to the length of the line 4–5, and starts to decelerate. However, due to its momentum, the rotor continues to increase its angle until the work done during deceleration, area 4–5–6–7, equals the kinetic energy acquired during acceleration, area 1–2–3–4. The rotor again reaches synchronous speed at point 6 when:

$$\text{area 4-5-6-7} = \text{area 1-2-3-4} \tag{6}$$

In the absence of damping the cycle repeats and the rotor swings back and forth around point 1 performing synchronous swings. The generator does not lose synchronism and the system is stable. Figure 2b shows a similar situation but with a substantially longer fault clearing time $t = t_2$ when the kinetic energy acquired

during acceleration, proportional to the area 1–2–3–4, is much larger than in Figure 2a As a result the work performed during deceleration, proportional to the area 4–5–8, cannot absorb the kinetic energy acquired during acceleration and the speed deviation does not become equal to zero before the rotor reaches point 8. After passing point 8 the electrical power $P_{E'}(\delta')$ is less than the mechanical power P_M and the rotor experiences a net acceleration torque which further increases its angle. The rotor makes an asynchronous rotation and loses synchronism with the system. Two important points arise from this discussion. The first is that the generator loses stability if, during one of the swings, the operating point passes point 8 on the characteristic. This point corresponds to the transient rotor angle being equal to $(\pi - \hat{\delta}'_s)$, where d is the stable equilibrium value of the transient rotor angle. Area 4–5–8 is therefore the available deceleration area with which to stop the swinging generator rotor. The corresponding transient stability condition states that the available deceleration area must be larger than the acceleration area forced by the fault. For the case shown in Figure 2a this criterion is:

$$\text{area 1-2-3-4} < \text{area 4-5-8} \tag{7}$$

As the generator did not use the whole available decelerating area, the remaining area 6–7–8, divided by the available deceleration area, can be used to define the *transient stability margin.*

$$K_{area} = \frac{area \quad 6-7-8}{area \quad 4-5-8} \tag{8}$$

The second important observation is that fault clearing time is a major factor in determining the stability of the generator. This is borne out by Equation 5 where the accelerating area 1–2–3–4 is seen to be proportional to the clearing time squared. The longest clearing time for which the generator will remain in synchronism is referred to as the *critical clearing time*. The relative difference between the critical clearing time and the actual clearing time can be used to give another measure of the transient stability margin:

$$K_{time} = \frac{t_{cr} - t_f}{t_{cr}} \tag{9}$$

Where t_{cr} and t_f are the critical and actual clearing times.

Methods

The steps to calculate CCT in PSS/E(*Program Application Guide Volume 2 PSS®E 35.6.1 September 2023 Siemens*, n.d.) are described below:

1. Pre-define the contingency (fault) to be simulated, the contingency initiation time, total simulation time, and the initial contingency duration
2. Set the 'Relative Angle Threshold' value which will be used to check for stability conditions 3
3. Select the relative angle calculation method which will be used for checking if the system is stable or not
4. Start the CCT Calculation.

Once the CCT calculation is initiated, PSS/E runs the simulation with the contingency applied for the pre-defined fault duration checking whether the system is stable or not. In calculating CCT, PSS/E first applies the contingency for the specified initial fault duration, checking for stability at each time step when the contingency is applied. If the system remains stable for the fault duration, the next fault duration ("candidate fault duration") is set equal to double the current fault duration, and the next PSS®E simulation is repeated.
If the system becomes unstable, the next candidate fault duration is calculated by picking the middle time between the last stable and the first unstable candidate times and repeating the next CCT calculation attempt. If the time difference between two consecutive candidate times is less than or equal to PSS/E time step (Δt), then the last stable candidate time is declared as the calculated value of CCT. The progression of PSS/E simulation from one candidate fault duration to the next is shown in Figure 3.

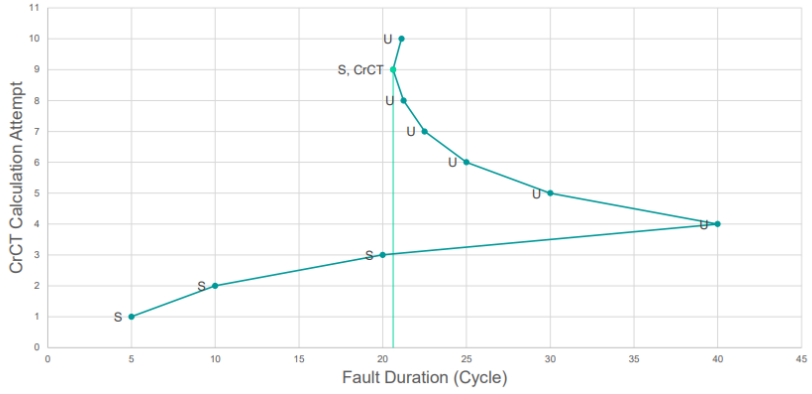

Figure 3 Progression of Critical Clearing Time Calculation in PSS/E

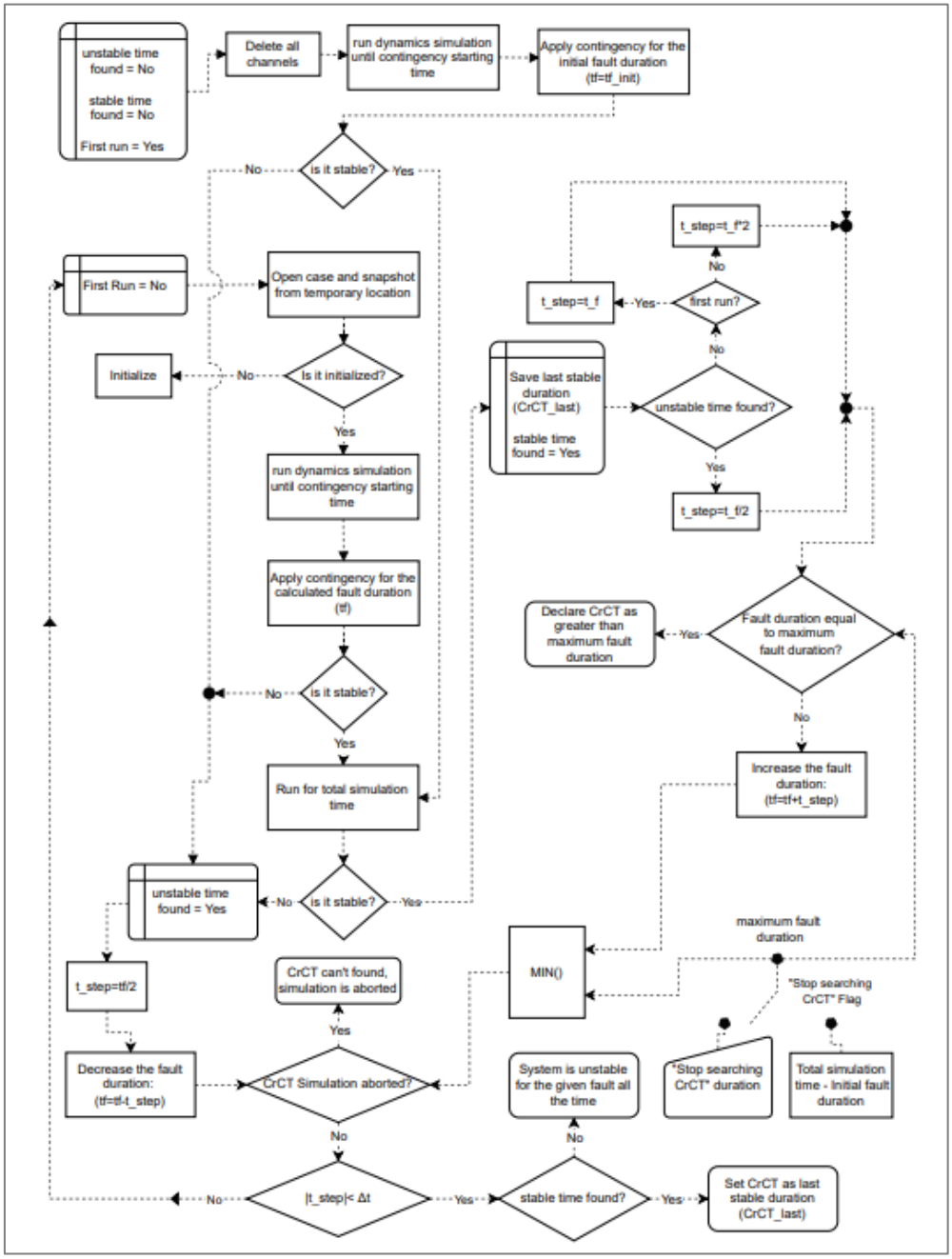

*Figure 4 Flowchart of Critical Clearing Time Calculation PSS/E(*Program Application Guide Volume 2 PSS®E 35.6.1 September 2023*, n.d.)*

Critical Clearing Time is the maximum time for which a disturbance can be applied without the power system losing stability. There are several ways to check if the system is stable or not, but the one used in PSS/E is based on checking if the rotor angle of synchronous machine exceeds a set value.

Analysis

Critical Clearing time will be calculated using the PSS/E module present in version 35.6. The Albanian power system is modeled, including 400kV, 220kV, and 110kV elements. The distribution system is modeled with equivalents in 110kV substations by active and reactive power. Generators are modeled in detail using the standard PSS/E library according to IEEE models for Automatic Voltage Regulators (AVR) and Speed Governors (SG). Most of the generators are modeled using the GENSAL model in PSS/E and GENROU.

Table 2 Summary of Albanian Power System PSS/E model

PSS/E Model Summary				
Buses	Generator	Branches	Transformers	Loads
284	131	209	123	97

The automatic calculation of Critical Clearing time will be done for the following scenarios:

- 3 Phase Fault connection point of large Hydro Generator.
- 3 Phase Fault near big load center (far from generators).
- 3 Phase Fault in 400kV, 220kV and 110kV transmission lines.

The analysis of the critical clearing time has been performed for 3 hydropower plants connected in the 220kV network. In Table 3 it can be observed that the critical clearing time for each hydropower plant for 3 phase faults in the respective 220kV connection point with the transmission network.

Table 3 Critical clearing time for Fierze, Koman and Vau Dejes Hydro power plants

Hydro Plant	Installed Power (MVA)	t (seconds)	Cycles
Fierze	500	0.34	17.03
Koman	600	0.25	12.53
Vau Dejes	250	0.40	19.84

The automatic critical clear time calculation has also been performed for the 400 kV and 220 kV busbars that have strong connections to the network with several lines, as shown in Table 4. It can be noted that in the main substations, the clearing time is bigger compared to substations that have weaker connections to the network, i.e., Fier Substation on the 220kV side has only 3, 220kV lines, compared to substation Tirana1, which has 7, 220kV overhead transmission lines.

Table 4 Critical Clearing time for load substations

Substation	Voltage Level (kV)	t(second)	Cycles
Tirana2	400	0.52	26.09
Elbasan2	400	0.53	26.25
Zemblak	400	0.55	27.34
Tirana1	220	0.50	25.16
Rrashbull	220	0.48	23.78
Fier	220	0.25	12.66

Furthermore, it has been analyzed also the critical clearing time for transmission lines for different voltage levels, including 400kV and 220kV. The results of such calculations are shown in Table 5.

Table 5 Critical clearing time for 400kV and 220kV overhead lines

Substation1	Substation2	Voltage Level (kV)	t(second)	Cycles
Tirana2	Rrashbull	400	0.48	23.78
Tirana2	Koman	400	0.55	27.34
Zemblak	Elbasan2	400	0.55	27.34
Vau Dejes	Tirana1	220	0.40	19.84
Koman	Tirana2	220	0.25	12.53
Elbasan1	Fier	220	0.39	19.41

Results and discussion

To further analyze the stability of the system in terms of rotor angle stability, manual calculation has been performed. It has been chosen a fault on a 220kV overhead line Vau Dejes-Tirana1. The automatic critical clearing time showed a critical clearing time of 0.4seconds. The analysis has been run, for 2 cases, one with fault duration time lower than CCT and the other with a fault duration time bigger than CCT. The chosen fault durations are 0.2 seconds and 0.5 seconds. The results are plotted in
Figure 5.

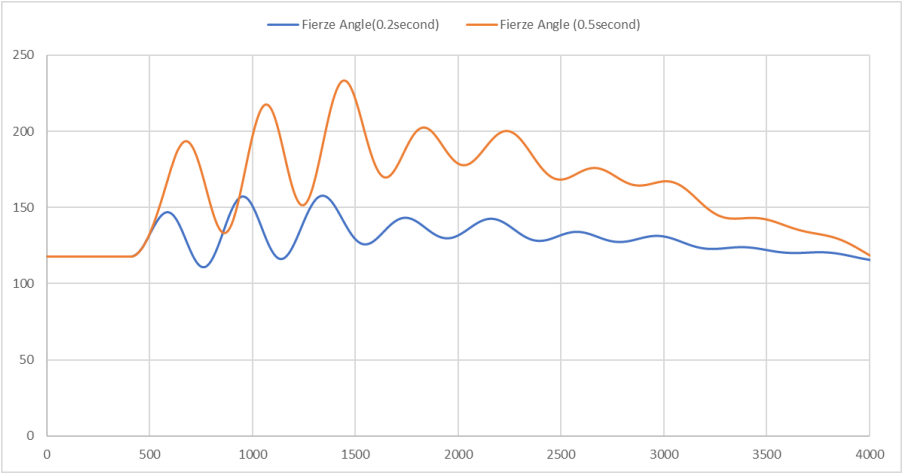

Figure 5 Angle in Fierze hydro generator for 2 fault duration cases

It is obvious that the swing in rotor angle for fault duration will cause the generator in Fierze to go out of step, hence tripping. Very similar results have been obtained for Koman hydro power plant generators. The angle change in Koman is even larger. These results underline the importance of critical clearing time for rotor angle stability in the system, by doing detailed dynamic stability studies.

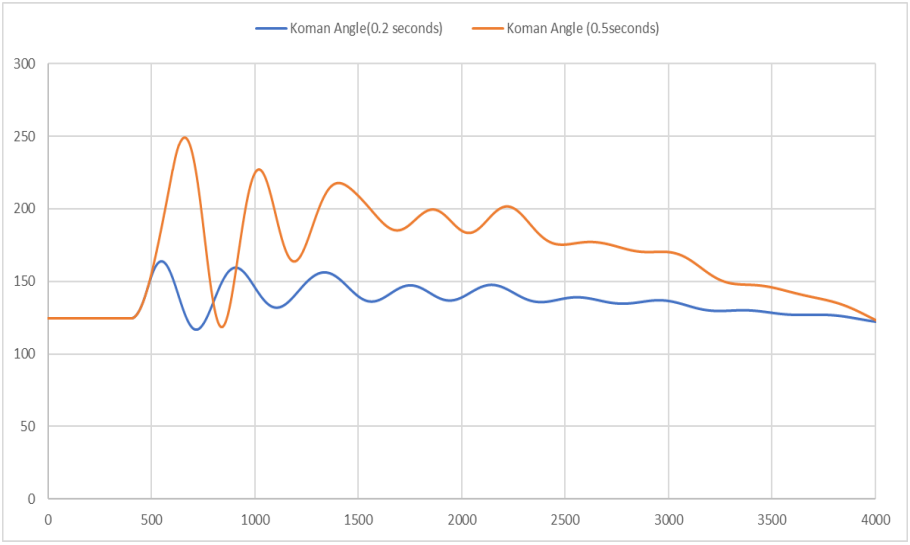

Figure 6 Angle in Koman Hydro generator for 2 fault durations cases

The Albanian Grid Code(*Kodi-i-Transmetimit-Vendimi-i-ERE-Nr.-63-Dt.11.04.2022*, n.d.) stipulates in article 84, that it is within the duty of transmission system operator to perform detailed grid studies to determine the fault clearing times. The studies shall cover static and dynamic aspects of grid stability. Article 85 of Grid Code stipulates the following minimum requirements for critical clearing time of relays in transmission system relay protection.

1. 400kV, 80miliseconds.
2. 220kV, 110miliseconds.
3. 110kV, 120miliseconds.

These times also include the circuit breaker time for opening the transmission line and the calculation time of the relay itself. In all cases of calculations in the study these thresholds were not exceeded, hence the work done in this study can be considered as a benchmark for the Albanian Power System.

Conclusion

In this work, a general overview of the Albanian power system. One of the most important aspects is the security of the system and its stability in static and dynamic terms. The Albanian Grid code underlines the importance of such studies also to determine the critical clearing time. The critical clearing time defines the maximum allowed duration of the fault in the power system for it to sustain its angle stability. The definition of critical clearing time is not the same value for each fault type or location in the system. There are many uncertainties or factors that affect the critical clearing time.

In this study the authors used a calculation tool, PSS/E, to perform the calculation of CCT in an automatic way to speed up also the calculation process, and it is also compared with manual calculation. The calculation has been done for faults near hydro generators, which are in major number in the Albanian power system. Furthermore, calculations have been carried out also for faults in key substations that supply the biggest load center with electricity.

Key findings indicate that the critical clear time calculated is longer than the grid code requirements; hence, the application of the grid code standards for relay requirements will suffice to maintain power system security. All new installations should be checked again to see whether the limits of critical clear time are respected for new relay settings.

Another aspect of Critical Clear time calculation investigated was also the comparison for node location in the system. The results showed that faults near generators due to higher short circuits have obviously shorter critical clear time; considering this, special care should be taken for relay setting near generators to have a fast action to reduce fault duration near generators. Dynamic studies in coordination with protections selectivity coordination studies play a key role for these cases.

The findings and recommendations from this study provide a foundation for improving fault-clearing mechanisms and ensuring the reliable operation of the

Albanian power system amidst its transition to a more diversified energy mix.

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