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Assessing the Unemployment Problem Using A Grey MCDM Model under COVID-19 Impacts: A Case Analysis from Vietnam

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Abstract

The COVID 19 pandemic has led to a new global recession and is still causing a lot of issues because of the delays in the employment of people. This scenario has severe consequences for many countries' labor markets in the world. This problem's complexity and importance requires an integrated method of subjective and objective evaluation rather than intuitive decisions. This research aims to investigate sustainable indexes for assessing the unemployment problem by using a Multi-Criteria Decision-Making Model (MCDM). Grey theory and Decision Making Trial and Evaluation Laboratory (GDEMATEL) are deployed to transform the experts' opinions into quantitative data. The analysis based on 20 crucial criteria is employed to determine the weights of sustainability of unemployment problems. The results revealed that the top ten of determinants are Economic growth, Industrialization, Foreign direct investment, Real GDP per capita, Education level, Trade Openness, Capacity Utilization Rate, Urbanization, Employability skills, Education system expansion, which have the most significant effects on the unemployment rate under COVID 19 impacts. Furthermore, GDEMATEL could effectively assess the sustainable indicators for unemployment problems in "deep and wide" aspects. The study proposes the Grey MCDM model, contributes to the literature, provides future research directions, and helps policymakers and researchers achieve the best solutions to the unemployment problems under "economic shocks."

Keywords: COVID-19, Unemployment, DEMATEL, MCDM, Grey Theory

JEL Classification Code: C02, C61, D53, Q14

1. Introduction

The whole world is facing an adverse epidemic named Covid-19 in recent times. It started in December 2019 in Wuhan city, China, and has spread its negative impacts worldwide. According to WHO, the number of confirmed

cases was recorded at over 350 thousand in March 2020 and then reached over 2 million patients at this research time. Additionally, 235 countries had entered the WHO's list of places where the virus has been verified. Social-distancing rules, quarantine restrictions are actions taken to prevent the spread of the virus; even though many countries have been attempting to tackle it, others remain passive. In a strongly internationalized world, almost all aspects of the global economy are affected by the pandemic; office workers work from home, prohibitions on gatherings, sporting events, celebrations, and bans on traveling. To be more specific, European nations such as Greece, Portugal, Spain, France, and Italy are more likely to take the hit since these countries rely on the tourism industry, disruptions in the supply chain would affect exporters and importers due to lack of materials and demand for imported goods. Moreover, a stock market crash in March 2020 had revealed that no business sector is left untouched under the impacts of the COVID 19 problems (Fernandes, 2020).

Unemployment has already been a questionable issue for a long time, and then it becomes particularly severe in this

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sensitive time. The number of unemployed labor in the world was 188 million people last year, and according to various economic reports based on the epidemic situation, this number could rise from 5,3 million (“low” script) to 24,7 million people (“high” script) (ILO, 2020). This increase could be explained by the severe impact of Covid-19 on the labor market, which plays a vital role in promoting worldwide GDP. In a developed country, the USA, the number of unemployed people exceeded 43 million, as reported by the United States Department of Labor. As of August 2020, the unemployed accounted for 8.4% of the U.S. workforce, down from the April 2020 peak of 14.7%. Official estimations may be far from reality since many people are being perceived as employed even though they are absent from work.

In Vietnam, the government quickly responded to the COVID 19 with swift adoptions to new working procedures, online protocols, social-distancing rules being imposed, and enforced border closures. Under the negative impacts of the pandemic, almost all business sectors in Vietnam are heavily influenced. However, entertainment, tourism, and hospitality services tend to suffer more than others. There will be more unemployed people, and these business sectors may find it challenging to recover from the collapse. The Vietnamese government still sticks to the plan to achieve economic growth of 6.8% for the year 2020; this is hard to accomplish concerning the ongoing financial problems. Vietnam is an exporter of commodity goods; not only does it focus on developing export markets, but Vietnam also pays attention to tourism industry development schemes. The second outbreak of the virus in the nation’s central region might put a dampener on the economic development plan, with the resettlement of quarantine zones nationwide, continuous bans on recreational activities, and prohibited access to affected countries. A report by the World Bank on August 4, 2020, clearly shows that the economic growth of Vietnam could slow down by nearly 7%, which is exponentially lower than that of the same period, the lowest over the past three decades. Even though Vietnam has maintained a resilient growth rate, it is a growth rate which has been observed in the Covid-19 affected nations.

Given the complexity of the COVID 19 pandemic, the number of business closures reached around 30,000 from January to June 2020, higher than the number for 2019. It is evidenced that the urban unemployment rate reached 33%, and nearly half the workforce in the country now suffers from unemployment. In addition to that, the government expects that the monthly average income could decrease by 5%. Reduction in available jobs contributes to the loss of a large source of income for workers. This factor leads to a significant decrease in the consumption of goods and services, which affects businesses and economies’ prospects. Labor poverty is also forecasted to upsurge, as declining income due to deteriorating economic activities will

adversely affect the near-poor or anyone living below the poverty line (Ngo & Nguyen, 2020; Ngoc, 2020).

Recently, sole proprietorships, small and medium-sized enterprises have resumed business activities. Nevertheless, it is notable that the two main driven forces of the economy are foreign demand and domestic consumption. There are many uncertainties in the international business context. It’s indeed challenging to anticipate changes in economic factors affecting the unemployment rate.

This research aims to evaluate factors causing Unemployment in Vietnam to assuage and offer solutions for the ongoing issue. There are already numerous research papers on unemployment in many parts of the world. Typically, in a study conducted by Ogbeide et al. (2016), the ECM technique was employed to examine resource dependence and financial development on the unemployment rate in Nigeria(Ogbeide, Kanwanye, & Kadiri, 2016). Clark and Lepinteurb (2019) hypothesized that adult unemployment experience could be transmitted from older generations to analyze explained variables, namely family background, childhood, life satisfaction, and social norms. Another research applying the regression analysis model by Hossain and Afrin (2018) indicated a strong relationship between graduate attributes, employability skills, and job mismatch (Hossain et al., 2018). Considering that there have been various research papers on the Unemployment proposing regression technique, several limitations are still related to the data collection method and data input. For the mentioned researches, there is a missing link between economic variables and societal factors. Therefore, the complexity and importance of the unemployment problems requires multi-criteria decision-making approaches rather than intuitive decisions due to the COVID 19. In recent years, many methods for decision-making have been applied in solving similar problems.

From the beginning of the 1970s up to now, a significant number of multiple criteria decision-making (MCDM) methods, as well as their extensions, have been introduced (Kahraman, Cebeci, & Ruan, 2004; Kariuki, van Arendonk, Kahi, & Komen, 2017; Popovic, Stanujkic, Brzakovic, & Karabasevic, 2019; Tichit, Puillet, Sabatier, & Teillard, 2011). All these MCDM methods can be used to solve a wide variety of problems from different areas. Compared to some other regions, MCDM methods in solving problems related to unemployment are not approached. The MCDM approaches are widely suitable and significant in evaluating complicated problems, such as Analytical Hierarchy Process (AHP), Decision Making Trial and Evaluation Laboratory (DEMATEL), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Analytic Hierarchy Process (ANP), Linear Programming, and Fuzzy Programming (Ashrafzadeh et al., 2012; Banaeian et al., 2015; Efe, 2019; Kahraman et al., 2004; Kariuki et al., 2017; Kosareva et al., 2016; Li et al., 2020; Montazar & Behbahani, 2007; Nguyen

et al., 2020; Popovic et al., 2019; Raj & Sah, 2019; Rajesh & Ravi, 2015; Tichit et al., 2011; Chen et al., 2016). The unemployment problem as a scientific topic is very suitable for applying MCDM methods because of its extensive grey programming methods in solving various issues. All these examples show that MCDM methods are very much applicable for solving multiple problems. This study aims to fill the research gap and investigate sustainable indexes to assess the unemployment problem using an MCDM Model.

It is necessary to incorporate two groups of variables in the analysis to capture the determinants of unemployment. Therefore, the complexity and importance of the unemployment problems require multi-criteria decision-making rather than intuitive decisions to identify and analyze the situation under COVID 19 impacts. This research investigates sustainable indexes for assessing the unemployment problem using a Multi-Criteria Decision-Making Model (MCDM). Grey theory and Decision Making Trial and Evaluation Laboratory (GDEMATEL) are deployed to transform the experts' opinions into quantitative data. This technique helps to investigate the causal relationship between the proposed criteria and determine the weight of each criterion of unemployment problems. The analysis based on 20 main sustainability criteria is used for the determination of sustainability indicators.

Hossain and Afrin (2018) studied the factors influencing the unemployment rate among fresh graduates in Klang Valley, Malaysia, using the regression technique (Hossain et al., 2018). By referring to previous research work, they discovered that fresh graduates who lack employability skills, struggle with English, and communication skills have a tendency to be picky when it comes to finding jobs with decent salaries (Zahid, 2015). Therefore, there is a strong relationship between employability skills, graduate attributes, and job mismatch. Meanwhile, Yuksel and Adah (2017) employed the MARS method to examine the correlation between economic factors such as interest rate, inflation rate, economic growth, current account deficit, exchange rate volatility, and unemployment rate. It was concluded that higher economic growth negatively affects the unemployment rate, whereas the interest rate positively influences the unemployment rate.

Regarding the results, Yuksel and Adah give recommendations to reduce interest rates and improve Turkey's economic performance. In addition to that, Turkey should control the inflation rate carefully since the execution of inflation rate reduction schemes could cause the unemployment rate to increase (Yuksel & Adah, 2017). Ogebeide et al. (2016) argued that FDI, economic growth, and exchange rates affect unemployment. Long-run and short-run regression analysis indicated that resource dependence and an increase in private credit tremendously worsen unemployment. Also, in Nigeria, the Real GDP per capita,

FDI, trade openness, and exchange rate depreciation could significantly reduce unemployment while increasing industrial capacity usages improves it. Government capital expenditure poses a threat to the unemployment rate and inflation rate even but not significantly, has a mixed impact in both short-term and long term projection (Ogebeide et al., 2016).

In a study conducted by Bayrak and Tatli, the youth unemployment rate (YUR) was used as a dependent variable and with producer price index (PPI), higher education schooling rate (HESR, economic growth rate (EGR) being independent variables to determine factors affecting youth unemployment. With data obtained from the database of the World Bank and the Turkish Statistical Institute, the use of the co-integration test and ARDL bond test produced results that PPI and HESR negatively influence YUR. In contrast, YUR is negatively associated with EGR but not significantly in the long-run. By using regression analysis, Clark and Lepinteur (2019) found that current unemployment conditions negatively correlate with life satisfaction. Moreover, past unemployment experience exerts a scarring effect on other adult outcomes; a good example is earnings (Arulampalam, 2001). Achievements in education and good behavior both minimize adult unemployment. For a supplement, emotional health at the age of 16 is perceived as a strong indicator of unemployment for women. Therefore, it is concluded that adult unemployment experience could be reproduced and transmitted from older generations. Other studies conducted about the unemployment rate with the use of societal variables in Turkey, France, the U.S., Indonesia, and Europe showed that with higher education levels, the proportion of senior high school workforce have significant, yet positive impacts on the unemployment rate. Bayrak and Tatli (2016), Clark (2019), Hall (2017), Puspajuita (2017) arrived at the results by using different methodologies. This includes ARDL, regression, DMP, Descriptive, and multiple linear regression models. On the other hand, factors such as the provincial minimum wage, labor absorption elasticity, and the level of Urbanization were found to have reverse effects on the unemployment rate. Also, high discount rates, tax wedge, and Population were positively related to unemployment.

Considering that there have been various researches on the unemployment proposing regression technique, several limitations are still related to the data collection method and data input. For the mentioned researches, there is a missing link between economic variables and societal factors. We propose a Grey MCDM method to investigate the determinants influencing the unemployment rate based on the existing research papers, and then we decided to employ selected criteria following the real case in Vietnam due to COVID 19. This research work is structured into five sections, with the introduction part, followed by sections for literature review, methodology, and the last two sections are a real case analysis and conclusions.

2. Proposed Criteria

Numerous researchers analyzed influencing factors for the unemployment problem. In our attempt to extract criteria from the literature review (Appendix 1), 15 experts, including five business owners, five policymakers, and five academicians, who have at least 10 to 15 years of experience, were interviewed to propose a group of 20 sustainably appropriate criteria for the analysis of GDEMATEL model. The definitions of criteria are shown as follow (Table 1):

Economic growth (M1): Economic growth is conventionally referred to as the percent rate of increase in the total production of goods and services in an economy.

Real GDP per capita (M2): This criterion is an inflation-adjusted measurement obtained by dividing the total economic output of a country by the Population to compare the standard living of countries.

Capacity Utilization Rate (M3): Capacity Utilization Rate represents performance in the manufacturing industry. This could be reflected as average percentages by industry and 100% for the whole economy.

Producer price index (M4): The producer price index indicates changes in domestic producers' product's average price.

Urbanization (M5): Urbanization is referred to as the movement of rural Population to townships, cities, indicating the development of human society.

Industrialization (M6): The process of incorporating mechanical science, electrical science, and chemical science to production activities.

Minimum wages (M7): Minimum wages are defined as the minimum wages paid by an employer for the work done.

Rural-urban migration (M8): Migration is the movement of people from a geographical location to one another alongside short-run and long-run settlement.

FDI (M9): Foreign direct investment is an investment considering a long-lasting relationship with a resident entity in one economy rather than of the foreign direct investor.

Labor absorption (M10): The number of workers being absorbed in the business sector.

Economic freedom (M11): Economic freedom is about individuals' autonomy to get involved in acquiring economic goods and resources.

Education level (M12): The implication behind the Education level is the highest level of schooling attained by a person in the educational system of a country where education is received.

Employability skills (M13): A set of skills required in almost any industry and could be transferable from one job to others; this includes general skills.

Social norms (M14): Social norms are informal rules that regulate people living in groups and societies.

Health (M15): According to the WHO, Health is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."

Population growth (M16): Population growth is described in the form of a percent rate, reflecting population increases over a period of time.

Unemployment insurance (M17): Unemployment is the status of being unemployed involuntarily, referring to those looking for employment opportunities but could not get a job.

Trade Openness (M18): Trade Openness is measured by a ratio of total trade to a country's GDP.

Education expansion (M19): Is defined as a rise in the number of enrollments in the education system of a country.

Family background (M20): The type of family a person comes from affects not only their education level, but also job prospects.

Table 1: Proposed Criteria

M1	Economic growth
M2	Real GDP per capita
M3	Capacity Utilization Rate
M4	Producer price index
M5	Urbanization
M6	Industrialization
M7	Minimum wage
M8	Rural-urban migration
M9	FDI
M10	Labor absorption
M11	Economic freedom
M12	Education level
M13	Employability skills
M14	Social norms
M15	Health
M16	Population growth
M17	Unemployment insurance
M18	Trade Openness
M19	Education system expansion
M20	Family background

3. Proposed Methodology

In this section, some basic definitions of Grey theory and the proposed GDEMATEL method are briefly presented in the following sections:

3.1. Introduction to Grey Theory

This research presents a background of grey numbers, grey set in the grey theory (Deng J, 1989). The concept of a grey system is found in **Fig. 1**. In the following, this research

briefly reviews some essential definitions of grey theory. The grey theory can be utilized with any imprecise decision-making process. The grey values can be easily converted into crisp numbers by converting fuzzy values into crisp scores (CFCS).

Definition 1:

A grey system is described as a system of grey numbers and grey variables with uncertain information shown in Fig. 1. X denotes a closed and bounded set of a real number, and a grey number X_g is defined as an interval with known upper bounds (x_{gu}) and lower bounds (x_{gl}) and unknown distribution information for X :

$$x_g = [x_{gl}, x_{gu}] = \{x' \in X | x_{gl} < x' < x_{gu}\} \quad (1)$$

Definition 2:

Grey number operation is defined as sets of intervals rather than real numbers. This study cited the basic operation laws of grey numbers. The following equation (2)- (5) are basic mathematical operations applied in grey number theory:

$$x_{g1} + x_{g2} = [x_{gl1} + x_{gl2}, x_{gu1} + x_{gu2}] \quad (2)$$

$$x_{g1} - x_{g2} = [x_{gl1} - x_{gl2}, x_{gu1} - x_{gu2}] \quad (3)$$

$$x_{g1} \times x_{g2} = [\min(x_{gl1} \times x_{gl2}, x_{gl1} \times x_{gu2}, x_{gu1} \times x_{gl2}, x_{gu1} \times x_{gu2}), \max(x_{gl1} \times x_{gl2}, x_{gl1} \times x_{gu2}, x_{gu1} \times x_{gl2}, x_{gu1} \times x_{gu2})] \quad (4)$$

$$x_{g1} \div x_{g2} = [x_{gl1}, x_{gu2}] \times \left[\frac{1}{x_{gl2}}, \frac{1}{x_{gu2}} \right] \quad (5)$$

Definition 3:

For the two grey numbers $x_{g1} = [x_{gl1}, x_{gu1}]$ and $x_{g2} = [x_{gl2}, x_{gu2}]$, the possible degree of $X_{g1} \leq X_{g2}$ can be shown as follow:

$$P\{x_{g1} \leq x_{g2}\} = [\max(0, L^* - \max(0, x_{gu1} - x_{gl2}))] / L^* \quad (6)$$

Where $L^* = L(x_{g1}) + L(x_{g2})$, the positive relationship between (x_{g1}) and (x_{g2}) is identified as follow:

1. If $x_{gl1} = x_{gl2}$ and $x_{gu1} = x_{gu2}$, that $x_{g1} = x_{g2}$ then $P\{x_{g1} \leq x_{g2}\} = 0.5$
2. If $x_{gl2} > x_{gl1}$ that $x_{g2} > x_{g1}$, then $P\{x_{g1} \leq x_{g2}\} = 1$
3. If $x_{gu2} = x_{gl1}$ and $x_{gu1} > x_{gu2}$, that $x_{g2} < x_{g1}$ then $P\{x_{g1} \leq x_{g2}\} = 0$
4. If there is an intercrossing part in them, when $P\{x_{g1} \leq x_{g2}\} > 0.5$; that is $x_{g2} > x_{g1}$.

where $P\{x_{g1} \leq x_{g2}\} < 0.5$, that is that $x_{g2} < x_{g1}$

This study developed a new solution of GDEMATEL to optimize personnel evaluation and selection. The procedure for the GDEMATEL method is presented as follows:

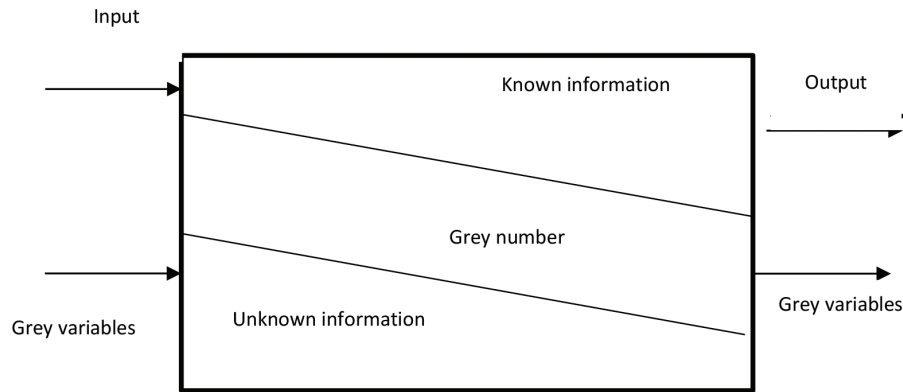


Figure 1: The concept of the grey system

Table 2: Linguistic Grey Assessment

Values	Linguistic assessment	Proposed grey values $[X_{gl}, X_{gu}]$	
		X_{gl}	X_{gu}
0	No influence	0.0	0.1
1	Very low influence	0.1	0.3
2	Low influence	0.2	0.5
3	Medium influence	0.4	0.7
4	High influence	0.6	0.9
5	Very high influence	0.9	1.0

Step 1: Considering fifteen influencing factors of recruitment and personnel selection from experts' opinions and identifying their relationships. A direct-relation matrix can be constructed.

Step 2: Based on the grey set theory to construct the influencing factors of personnel selection. We are establishing an overall grey direction-relation. K experts evaluate criteria Ci with i = 1, 2,3, n in terms of pair-wise relations using a linguistic scale. For this point, five-level of the assessments are defined in **Table 2**.

Normalizing the lower bound and upper bound with the grey values by the following Eq. (7), where k is the number of experts.

$$A = \begin{bmatrix} a11 & \wedge & a1j & \wedge & a1n \\ M & & M & & M \\ a1i & \wedge & aij & \wedge & ain \\ M & & M & & M \\ a1i & \wedge & anj & \wedge & ann \end{bmatrix}$$

$$\begin{aligned} \underline{x}_{g1k}^{ij} &= (\underline{x}_{g1k}^{ij} - \min \underline{x}_{g1k}^{ij}) / \Delta_{min}^{max} \\ \underline{x}_{guk}^{ij} &= (\underline{x}_{guk}^{ij} - \min \underline{x}_{guk}^{ij}) / \Delta_{min}^{max} \end{aligned} \quad (7)$$

where $\Delta_{min}^{max} = \max \underline{x}_{guk}^{ij} - \min \underline{x}_{g1k}^{ij}$

Computing the total normalised crisp value using Eq. (8):

$$Y_k^{ij} = [\underline{x}_{g1k}^{ij} (1 - \underline{x}_{g1k}^{ij}) + (\underline{x}_{guk}^{ij} \underline{x}_{guk}^{ij})] / (1 - \underline{x}_{g1k}^{ij} + \underline{x}_{guk}^{ij}) \quad (8)$$

Calculating the final crisp values by Eq. (9):

$$Z_k^{ij} = \min \underline{x}_{g1k}^{ij} + Y_k^{ij} \Delta_{min}^{max} \quad (9)$$

Hence, k direct-relation grey matrices (Z^1, Z^2, \dots, Z^k) of each expert are obtained. Then the average grey direct-relation matrix is taken by Eq. (10)

$$Z = \sum_{i=1}^k Z^k / k \quad (10)$$

Step 3: The normalized matrix A is obtained by Eq. (11) and (12)

$$K = 1 / \max \sum_{j=1}^n a^{ij} \quad (11)$$

$$X = K \times A \quad (12)$$

Step 4: Computing the sum of rows (D_i) and the sum of columns (R_j), respectively:

$$D = \left[\sum_{j=1}^n m_{i,j} \right]_{n \times 1} \quad (13)$$

$$R = \left[\sum_{i=1}^n m_{i,j} \right]_{1 \times n} \quad (14)$$

Step 5: Creating the value of $(R_i + D_i), (R_i - D_i)$. The influencing factors can then be shown in the causal relationship diagram.

Step 6: In the GDEMATEL method, structural relationships occur between the analyzed elements, and it is a premise for the use of GDEMATEL in the weighting of criteria.

We determine criteria weights using the results of GDEMATEL with Eq. (15), (16) in this study.

$$W_i = [(R_i + D_i)^2 + (R_i - D_i)^2]^{1/2} \quad (15)$$

$$W_i^{nor} = W_i / \sum_{i=1}^n W_i \quad (16)$$

Where W_i^{nor} is normalized weights of criteria.

4. Empirical Results and Discussion

This research approached 20 proposed criteria, and they are as follow: (M1) Economic growth, (M2) Real GDP per capita, (M3) Capacity Utilization Rate, (M4) Producer price index, (M5) Urbanization, (M6) Industrialization, (M7) Provincial minimum wages, (M8) Rural-urban migration, (M9) FDI, (M10) Labor absorption, (M11) Economic freedom, (M12) Education level, (M13) Employability skills, (M14) Social norms, (M15) Health, (M16) Population growth, (M17) Unemployment insurance, (M18) Trade openness, (M19) Education system expansion, (M20) and Family background.

The GDEMATEL method first started with the presentation of 20 criteria used for data analysis. In the following step, 15 experts were inquired to evaluate the influence of each of the 20 criterias on the scale of 0 to 4, with 0 being “no significance,” scores from 1 to 4 as “very low significance,” “low significance,” “high significance,” “very high significance” respectively. After measuring the importance of contributing criteria, a pair-wise comparison was implemented based on the aforementioned score scale, whereby scores of 0, 1, 2 indicate “no significance,” “very low significance,” and “low influence.” In contrast, scores of 3 and 4 refer to “high significance” and “very high significance.”

Rankings of weights of selected criteria are shown in Table 3. It's obvious that (M1) Economic growth is the most influential factor to the unemployment rate, followed by (M6) Industrialization, (M9) Foreign direct investment (FDI), (M2) Real GDP per capita, (M12) Education level. Meanwhile, the rest in the top 10 is made up of factors such as Trade (M18) Openness, (M3) Capacity Utilization Rate, (M5) Urbanization, (M13) Employability skills, (M19) Education system expansion. (M1>M6>M9>M2>M12>M18>M3>M5>M13>M19).

Table 3: DEMATEL Results and Criteria Weights

Criteria	Crisp Di+Ri	Crisp Di-Ri	Wi	W nor	Rankings
M1	3.5148	0.2881	3.5266	0.075	1
M2	2.8971	-0.3509	2.9183	0.062	4
M3	2.5691	-0.6079	2.6401	0.056	7
M4	2.0577	-0.3803	2.0925	0.045	14
M5	2.5521	0.2145	2.5610	0.055	8
M6	3.1811	0.2363	3.1899	0.068	2
M7	2.2380	-0.0699	2.2391	0.048	12
M8	1.9241	-0.1451	1.9296	0.041	15
M9	2.9650	0.3394	2.9844	0.064	3
M10	1.7734	-0.3396	1.8056	0.039	16
M11	2.1923	0.6276	2.2804	0.049	11
M12	2.8684	-0.0213	2.8685	0.061	5
M13	2.3323	-0.4371	2.3729	0.051	9
M14	1.3938	-0.2279	1.4123	0.030	20
M15	1.4979	-0.1005	1.5013	0.032	19
M16	2.0660	0.6558	2.1676	0.046	13
M17	1.5420	-0.3440	1.5799	0.034	18
M18	2.5009	0.8629	2.6456	0.057	6
M19	2.3464	-0.0282	2.3466	0.050	10
M20	1.6917	-0.1720	1.7004	0.036	17

The proposed decision methodology has been successfully applied to this complex problem. The results obtained from the GDEMATEL technique illustrated that (M1) Economic growth, (M6) Urbanization, (M9) Foreign direct investment, (M2) Real GDP per capita, (M12) Education level is the most important criteria affecting the unemployment rate. Research results of previous literature on unemployment are partly in line with GDEMATEL findings.

Regarding the influence of Education level on unemployment performance in Malaysia, Hossain and Afrin (2018) hypothesized that Education level could not assure fresh graduates stable jobs in Klang Valley, Malaysia since questionnaire results indicated the disagreement of the majority of 167 respondents with the question group for Education level (Hossain et al., 2018). Nevertheless, it might be an intuitive conclusion due to the fact that the research results were recorded based on the opinions of fresh graduates in Malaysia. By contrast, this study's findings revealed that (M12) Education level was recognized as one of the top 5 most significant criteria. This study's results are also identical to Ogbeide et al. (2016), who investigated that increase in FDI, and Real GDP per capita affect unemployment levels (Ogbeide et al., 2016). (M9) FDI and

(M2) Real GDP per capita was ranked in the third and fourth place among 20 selected criteria.

Besides, Economic growth and Urbanization were found to be insignificant in research work by (Puspajuita, 2017; Yüksel & Adalı, 2017). Because there was a lack of multi-criteria-based case using both subjective and objective evaluation methods, making the research findings less convincing. This is the first research that proposed the Sustainable Indexes for Unemployment problem using A Multi-Criteria Decision-Making Model of GDEMATEL. Therefore, the proposed method should be adopted to evaluate the ongoing issues better and might as well help to avoid the misunderstanding of the real implications behind the unemployment rate.

5. Conclusions

Like many other developing countries, unemployment has become an essential issue in Vietnam, which directly and indirectly creates economic problems under COVID 19 pandemic impacts. This study aims to explore the determinants of Unemployment in Vietnam using Grey theory integrating the GDEMATEL method. The findings

from the case study indicated the need for a multi-criteria framework in unemployment analysis. It is essential to highlight the GDEMATEL technique's effectiveness, which helped structure the problem hierarchically with the relevant criteria and reached the sustainable indexes to deal with unemployment.

From the managerial perspective, the proposed approach helped provide researchers and policymakers with more relevant criteria. Based on the results, stakeholders might acknowledge the importance of influencing factors of unemployment. The youth and the low-skilled laborers are more vulnerable to unemployment in comparison with the medium and high-skilled workers. It is because youth and low-skilled laborers are experiencing a shortage of high-level skills. That being said, it is necessary for the Vietnamese government to create a labor market that could assuage the unemployment problem for the youth. Another solution should be for the government to invest more capital in education so that the youth and low-profile laborers are able to become self-reliant rather than being job-seekers. Moreover, evidence has been found that sustaining stable economic growth while maintaining a welfare system throughout a specific period could positively impact the distribution of jobs on the labor market. Besides, this research study targets paving a pathway for further research work into the unemployment rate. In a futuristic pandemic or a natural disaster, researchers can use the selected set of criteria to anticipate negative impacts yet offer suitable measurements for the government in case of a crisis. This research study is the first one being conducted using the GDEMATEL technique to analyze the unemployment rate so that there are a few limitations. For example, the study did not consider sensitivity analysis; it is crucial to compare the research findings with other techniques such as DEA, ELECTRE, VIKOR. Incorporating the mentioned techniques must be implemented to give a good overview of factors affecting the unemployment rate.

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Appendix 1: Featured Studies related to unemployment

No.	Authors	Scope	Method	Results
1	Hossain and Afrin (2018)	Klang Valley, Malaysia	Regression	There is a strong relationship between graduate attributes, employability skills and job mismatch
2	Yuksel and Adah (2017)	Turkey	MARS method	Higher inflation rate negatively effect unemployment rate. Interest rate has a positive influence on the unemployment rate
3	Ogbeide et. al (2016)	Nigeria	Regression	FDI, economic growth and exchange rate affect unemployment
4	Bayrak and Tatli (2016)	Turkey	ARDL	Higher education level and producer price index decrease unemployment rate. Economic growth rate effect YUR negatively but insignificantly in the long term
5	Andrew E. Clark, Anthony Lepinteurb (2019)	France	Regression	Growing up in a favorable context (high family income, educated and engaged parents) significantly reduces the unemployment experience.
6	Robert E. Hall (2017)	The USA	DMP model	High discount rates imply high Unemployment
7	Erna A. R. Puspajuita 1 (2017)	Indonesia	Descriptive and multiple linear regression	Urbanization, labor absorption elasticity and the provincial minimum wage have negative effect on unemployment rate. Industrialization rate has a positive effect on unemployment.
8	JB Morgan, A Mourougane (2001)	Europe	Cobb-Douglas method	The replacement ratio positively associates with structural unemployment. Measures of mismatch and trade union density were positively associated with structural unemployment.
9	LX Chen, YB Chew, RLH Lim, WY Tan, KY Twe (2017)	China	ARDL approach	GDP growth, Population are significant to unemployment rate.