**Introduction** - Summary

Technology has always been one of the most important aspects of gaining long term diplomatic power, especially in the military domain. In the past decade, this trend has grown exponentially with cyberspace introducing cutting-edge new technologies that create invisible power not only for states but also for civilians and commercial companies (Burton & Simona, 2019). According to Shaw, technological innovation including AI, software, and hardware applications are "gaining notoriety on a consistent basis. Moreover, new hardware and software weaknesses are regularly uncovered. The consequences of both are widespread, while they are about to influence geopolitics of countries deeply and profoundly" (Shaw, 2017).

In the present era, cyberspace is becoming a central and irreversible part of our world, dramatically affecting countries and their relations, especially for third world countries and weak countries that have been spun into cyberspace via cellular communication.

As artificial intelligence technologies develop, a new system emerges whereby ‘Big Brother’ has acquired powerful new tools for global management, control and surveillance. Consequently, technological supremacy is shifting from weapons to power of AI in information processing and analysis.

According to Walters, "Empires have risen and fallen with the evolution of land power, sea power, and air power" (Walters, 2014) For example, The US is shifting away from a war fighting regime based on human augmentation – "soldiers extending themselves as tool-beings – to an imperium of robotic autonomy " (Müller & Richmond, 2023).

A small number of technological powers in the information world: China, the United States, and Russia; along with capabilities and supremacy in defense in this space (monitoring, containment, and prevention), manage a "Hidden War" in which the borders and the meaning of states and diplomatic relations take on a whole new form.

In addition, many AI systems are built to achieve a strategic capability of cyber security, military super-power, as well as social surveillance tools (Liebetrau & Christensen, 2021). While AI started at the U.S, other states invested their efforts into research and development. The world’s greatest powers, U.S , Russia, and China, are found in a race

of AI development and implementation. For example, mastering AI and integrating it into military applications can gain it's holder a great power and global advantage.

As technology advances, so does the quantity of data getting larger and out of human integration capacity. Therefore, analysis of massive data requires technological solutions that can proportionally yield massive products and benefits. With an efficient implementation and use of AI a state can achieve great superiority in various domains such as the global economy and a powerful military. Now, more than ever, mastering AI has become a global race. AI is a strategic game-changer; the world's developed countries are using AI as a means to enhance national strength and security. However, as opposed to earlier strategic weapons such as nuclear weapons, AI systems could be developed and used not only in super-power states, but also in other countries, even third-world countries.

**Research questions**

While measuring the state of various powers of countries is not a trivial task (Beckley, The Power of Nations: Measuring What Matters , 2018), the measurement of the state of AI in a country is even a much more challenging task (Mishra et al., 2020). This thesis, demonstrates a methodology of how to build an AI and powers indexes using fuzzy logic (Schneider, 1987) and (Yosef et.al, 2022). Moreover, it develops a methodology to normalize these indexes to show the relations of AI index for countries to their power's indexes, making significant contributions in how to measure and show relations between various indexes.

An additional important contribution of this thesis is overcoming a common problem in many research studies using conventional regression analysis to show relations between dependent variable (AI index) to other variables (powers of countries) and measuring the importance of each index in relation to the dependent variable. Using conventional regression analysis would have failed to show the relations of AI index to the countries' powers indexes due to the high multicollinearity problem caused by high correlation among the power indexes (Ayinde et.al, 2015) This multicollinearity problem does not exist only in this thesis but also in many other studies. Therefore, the contribution of this thesis is in providing methodology which could be used by many

other studies to show relations among indexes which could not have been done up to today.

This is possibly the first time that the impact of AI and its implementation in numerous fields in international affairs and geopolitics will be analysed from the perspective of developing countries and developed countries, side by side with liberal democratic countries and communist/dictatorship countries. Thus far, most research emphasized the development, implementation, and strategic implications of AI for the US, Russia, and China (Saveliev & Zhurenkov, 2021). An AI index is offered, that includes various elements which allows to estimate a range in which the theoretical AI index might be. In addition, powers of countries are measured using from technological education to investment and resources (Appendix 2). That is, being aware to the difficulty of using one measure of an index, there was a need to develop a measure of a range for each one of the indexes for every country.

Thus, AI can be the tool that, for the first time in history, will put other states at the forefront of power and provide a significant advantage for other countries in gaining global influence, and not just through military power.

As a practical contribution of this thesis to assist other researchers to use the methodology developed in this study, "FuzzyAvi.org" website was especially established in which researchers could upload their data and receive normalized data set with all the measures of similarities.

Equipped with powerful methodology, the following hypotheses were explored:

Hypothesis 1: Countries with higher AI index have higher indexes of power.

Confirming this hypothesis is very important for policy makers. In simple words, increasing AI in a country could lead to increase in the power of a country. It seems that low barriers placed on the development of artificial intelligence could open the race for advantage and power through the investment and assimilation of AI.

Hypothesis 2: Countries with higher AI also have higher GDP, export, and publication of research.

This hypothesis directs the policy maker to the relations between AI to the most important powers of a country. While having large amount of resources and investment in Research & Development (R&D) as well as investing sizeable amount in military or investment in other powers is correlated with AI, it could turn out that actual publication of research is more important. It might not be enough to invest in technology or have plenty of resources if the financial condition of a country, as evaluated by export and GDP, is poor. Publication of research can have a substantial effect on the status of AI in a country. With the easy flow of information and cross countries research capabilities provided in developed internet platforms, it could help many countries with poor resources to get ahead by encouraging publishable research. The increase in AI status of a country could be a step toward having higher GDP and Export; that is, high life quality in a country.

Hypothesis 3: The positive relations between AI index and the power of country is higher for democratic countries than autocratic countries.

Hypothesis 4: There is a positive relation between the degree of government AI readiness and the power of the country.

In estimating the range of the AI index of all countries in the study, the readiness of a country for AI is used as one of the measures. Finding positive relationships between AI and the power of countries confirms that countries could increase their power by investing in AI infra-structure.

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## Literature review

Shoshana (2019) supports that “data is the new oil”, referring to data as a powerful resource. Concurrently, it also emphasizes how it is not seen as valuable until various technologies are developed and based on it. For instance, oil wasn’t relevant and valuable before the internal combustion engine was invented and developed at the beginning of the industrial revolution. Similarly, the information revolution with the rising of the internet, made access to big data an international competition.

Artificial Intelligence is primarily a "learning machine"; this means that it depends on the data it gets from the operator or government. When looking at the situation with a wide political view, managing this extensive change often comes with acquiring the people's legitimacy. In the era of advocating strict privacy policies, this step is hardly acceptable in western democratic countries, while autocratic countries, that have less patience for the public’s support will potentially gain a dramatic advantage in a short period of time.

The conflicting differences between democracies’ and autocracies’ AI approach is often thought as a conflict between two polar ethical systems, but it is also a conflict between two different data-processing systems (Harari, 2018). Democracy gives the power of information processing and decision making among many people and institutions in order to insure the most preventive decision whereas dictatorship concentrates information and power in one place. All the above differences can lead to a great change in the world political arena. One of the significant quotes on that subject was Russia’s President, Vladimir Putin, who has said: “whoever becomes the leader in this sphere will become the ruler of the world” (Vincent, 2017). Another voice was Elon Musk who is one of the most powerful businesspersons in the world. He tweeted saying that “competition for AI superiority at national level [is the] most likely cause of WW3” (Browne, 2017).

One of the factors in the field of data gathering and processing is the worldwide digitation, which is accelerating exponentially. Telecommunication networks, the integration of 5G networks and "Internet of Things"(IOT), enable enormous data traffic and deep machine learning. AI technologies can benefit from personal data that is collected through mobile devices, such as location, interests, financial and social status, educational attainments, and health situation. Therefore, commercial companies can

use this data to personalize advertising, better understand the market, improve the business productivity, and increase sales. All these benefits will result in market expansion and growth and increased output.

The newest AI developments and their strategical implications are reviewed in a wide range of fields. Some reviews point to specific paths of development. The report for US Congress categorizes certain directions of AI development that might have immense strategic impact in the military sphere. Among the spheres specified are: intelligence, surveillance and reconnaissance, logistics, cyberspace, command and control, and lethal autonomous weapon systems (LAWS) (Hoadley & Lucas, 2018). Importantly, the competition in the AI fields is reviewed in the context of rivalry with such countries as China and Russia, and in relation to international institutions.

However, some authors promote different points of view on AI impact in various spheres, including battlefield and broader military contexts. They view AI as a factor that might potentially shift power balances in general, even including such states as the USA for example (Horowitz, 2018).

In the beginning of the 2000s, when certain processes of digitization had been influenced for decades, new technological advances transformed the public sphere, including public politics on a completely new level. Manor (2019) defines digital society as an arena of conflicts even on Internet platforms such as Wikipedia during the early 2000s. However, he stresses that the new encyclopedia was a far cry from the old academic ones, and its relation to knowledge, expertise, and competence, was evidently different to the point of questioning the very concept of knowledge. Consequently, the very utility of the encyclopedia and its possible uses became rather problematic right from the start, not to mention internet battles within and around certain politically and ideologically controversial and ambiguous parts of Wikipedia (Manor, 2019).

However, an even more important development was that of the social media. In Manor's words: "The period between 2003 and 2007 saw the consecutive launching of social media sites including LinkedIn (2003), Facebook (2004), and Twitter (2006). YouTube and Flicker were both introduced in 2005…" (Manor, 2019).

Hocking and Melissen (2015) are rather optimistic regarding the social media's impact on diplomacy. They view conservative stances on diplomacy as clearly inaccurate and incorrect, bringing the examples of the former inability of major European diplomats

to cope with the novel technology like Palmerstone's negative reaction to the electric telegraph as something that would destroy diplomacy. And they suggest that one should learn from the historical progress with its foundation based on novel technologies.

Therefore, they believe that: "Social media has added an important real-time dimension to diplomacy, making communication ultra-fast and, by necessity, often less precise. For the first time, foreign ministries have no other option other than allowing diplomats with delegated authority to make mistakes in the social media – and to correct such mishaps immediately and preferably repeatedly". Importantly, these effects are strongly reminiscent of social media functioning in general. However, it seems that the abundance of serious mistakes in social media might indeed threaten the very essence of diplomatic affairs (Hocking & Melissen, 2015).

Another major historic event was the Covid-19 period, which is one of the most interesting in modern human history and which illustrates a fast change in worldwide proportions. It highlights the delicate balance between a deadly and highly contagious pandemic, and the interconnectedness of our digitally-driven global community. This circumstance compelled us to operate within a controlled environment, marked by enforced transparency, digitization, and intense scrutiny (Boone et al., 2022).

Each country was basically required to act in one way or another, demanding full transparency of their data (regardless of whether to receive financial assistance, professional assistance, disease data, vaccines, or anything else) and every action or decision received a response and result very quickly (weeks). Such conduct has no comparison in human history (Boone et al., 2022). The Covid-19 crisis has created three unnatural and new connections that have characterized the last decade at a very high intensity: First, there was an intertwining of transparency, visibility, global awareness, and media coverage, where everything is made public Second, the right to privacy became increasingly complex in an era dominate by social media era. Third, the need to decide and act quickly, while dealing quickly with the results. In recent years, the world has experienced accelerated change, with technology rapidly infiltrating everyone's lives and introducing various changed.

If in the past the world experienced revolutions every hundred years, today it occurs much faster and we can witness the consequences of new technologies almost immediately. The process of assimilating these technologies into our lives was initially

gradual but encountered strong resistance over the years from different countries, organizations, communities, and individuals.

In the past two years everything has accelerated due to the COVID world crisis. Humankind was forced to minimize human interactions so society became more digital. The last two years have intensified or dramatically differentiated between the "before" and the "after" since this process began simultaneously throughout the world but from then on, each country set out on its own on the terms it chose. Some countries have chosen to close, while some have chosen to ignore, and so on and so forth. It is important to recognize that every country has decided, acted, and experienced live feedback on the results of its actions but mostly given more opportunities to change as the crisis progressed.

This is an amazing race in which worldviews, types of government, different abilities, superpowers or third world countries all entered this race with about the same starting point, the same threat, almost the same tools, and probably the same knowledge which was shared by all. Each country has chosen its own way and course of action, an act that has dramatically affected the conduct of its citizens' lives, its economy, and its ability and that of its people to move in our global village.

**Methodology**

The research hypothesis is that the new reality aside AI will segregate countries by AI-policy. This thesis explores the hypothesis that AI is strongly associated with power of countries; thereby, investment in AI could increase other power of countries and provide competitive advantage.

In addition, this thesis tests the hypothesis that countries with higher AI also have higher GDP, exports, and publication of research; that is countries that invest in AI might experience high economic prosperity. This could be interpreted as a result of higher education as measured by publication of research.

Also, the research will check the validity of the claim that the democratic position (such as in the USA and Europe) will slow down the AI implementation because of privacy rights, while the autocratic countries will use AI to its fullest (such as China, Russia, African countries etc.) and win a dramatic strategic advantage in a short time and minimum cost. This change can shift the world power balance and design a new geopolitical map. But, finding that the status of a country as autocratic or democratic does not associate with the AI index will reject this hypothesis. To prove this hypothesis, the research will focus on several countries that resemble democratic, autocratic, developed and developing countries: USA, Israel, China, Russia, and Kenya. In addition, using fuzzy logic and soft regression will help to accept or reject this hypothesis.

Another research question will "drill down" how using AI systems can assist countries in Africa in becoming important actors in the diplomatic field, and specifically how to handle super-powers such as the U.S., Russia, and China. The change occurring in the AI-revolution will be fast and the effects will be absorbed in a short period, unlike older revolutions such as the industrial revolution. A great example for humanity to adapt technological changes was during the COVID-19 crisis when the whole world almost immediately changed their outdoor lifestyle to online: working from home, homeschooling, communicating via VC, video call to your doctor, buying online etc.

The research will be conducted in the quantitative approach, which is suited to the research, since it refers to wide ranged data from different subjects, aiming to find the quantitative connections between them, correlated to AI implementation.

The research data will gather from official open-data bases (for example “The World Bank”, which will be processed, normalized and finally analyzed using "soft regression" algorithms.

To investigate the research questions, the research will be conducted using a quantitative method.

I will answer the research hypothesis using a soft regression to show the relations between several powers and the implementation of AI. One of the biggest challenges in assessing the scope of artificial intelligence and its implementation is that it is not a quantitative, numerical measure but an abstract one and its effects are wide-ranging. For this purpose, it is necessary to look for other acceptable evaluation methods of such parameters in similar fields. For example, quality of life indicators which are "Soft" or "Fuzzy" and even subjective parameters.

This chapter will expand and explain the algorithm that comes to make the AI parameter measurable. Each variable that can indicate the degree of assimilation and use of artificial intelligence is treated as a numerical vector (for example - amounts of money invested in AI technologies, number of published studies, technologies...) Therefore, there is a collection of columns of numbers that represent the extent of AI in a country in a certain year; this research focuses on data for the year 2019. This year was chosen to eliminate the effect of Covid on some of the variables used in this study. Next, the data was put in a matrix in which each numeric column represents a measurement of a variable, while each row represents a country.

Since each column in the matrix is measured using different measurement scales, the values were normalized and expressed on a scale between 0 and 1, where 0 is the lowest number, 1 is the highest number and the values between 0 and 1 express the distribution between the minimum and maximum value while keeping the right proportion and maintaining its relative position on the scale (in relation to the other values). By scaling all columns to the same scale of 0 to 1, the various measures become comparable.

Also, in building the scale, abnormal values and their consequences must be taken into consideration. These exceptions are expected to significantly widen the datum range and harm successful modeling. For example, numerical outliers when measuring the same variable in different ways for a specific country. See below on the methodology

to remove this type of outlier, which shrinks the interval of the measure of every variable.

Using fuzzy information process is a method which is widely used to implement a solution for this problem.

Assuming there are $c$ numerical vectors ($\{X_l\}_{l=1}^{c}$), each consisting of $n$ elements ($X_l = (x_{1,l}, x_{2,l}, \ldots, x_{n,l})$). The normalizing of the data is performed based on the equation:

$$\mu_l(x_{k,l}) = \begin{cases} 0 & , x_{k,l} < min_l \\ \frac{x_{k,l} - min_l}{max_l - min_l} & , min_l \leq x_{k,l} \leq max_l \\ 1 & , x_{k,l} > max_l \end{cases} \quad \text{for all } k = 1,2,\ldots,n$$

where $\mu_l$ is a membership function for all $l = 1,2,\ldots,c$, $max_l$ is a cut-off value defining a full membership in the fuzzy set, and $min_l$ is a cut-off value defining no membership at all in the fuzzy set .

First, unrepresentative outliers were cut by two types of cuts- the high one named "HIGH CUT" and the low one named "LOW CUT" which defined as the upper and lower limits of the scale (between 1 and 0). Any value that exceeds the "High cut" limit is set to the "High cut" value and any value below the "Low cut" will be to the Low cut value to reduce the problem of outliers within the vectors (the column). Second, a range reduction process was used to moderate a large extent the measurement of a value for a specific country.

The following process of preparing the AI index and the powers indexes are very similar. In simple words, several sources relevant were used to measure the AI index and the powers of a country. Based on the Fuzzy methodology, outliers were removed and create a range in which the index for a country might be in (Schneider, M. 1987) and (Yosef, A., Shnaider, E., Schneider, M., & Rothstein, A. 2022). After preparing the data and normalizing it, it was possible to find the similarity of every power index to the AI index. Finally, the contribution and the Relative Importance of every power index were calculated in explaining the AI index.

In recent years, the world witnessed an increase in AI technologies breaking into the market - autonomous cars, smart banking services, security uses and more. There are voices worldwide who claim that the future lies in the widespread utilization of AI. On

the other hand, there are also voices of concern following the vast access to personal and national databases that until today were classified.

It is also possible to see significant differences between countries in their approach to implementing AI technologies, whether for cultural reasons or for reasons of political and governmental policy.

As discussed earlier, the level of AI assimilation, which is still in its beginning and depends on many factors, is difficult to measure, and therefore, also difficult to compare. This research addresses this challenge by collecting together several measures of AI index and processing the data so that the measure of the AI for a country will be in minimal range. In a similar way, the explanatory variable is measured. This allowed to compare different countries and investigate the correlations between level of development, policy and form of government of a certain country and the proportion of its AI implementation.

The parameters defined as the components of the index are:

- the number of resources in the country dedicated for AI develop in relation to all of its resources (between 0 and 1)
- the amount of research published in the country in relation to all its publications (between 0 and 1)
- the number of AI technologies exist in relation to population size

  (Between 0 and 1
- the extent of Open Data in relation to the population size (between 0 and 1)
- the number of laws enacted regarding AI in relation to all its new laws legislated in a certain year (between 0 and 1)

After normalizing each variable by itself, when preparing data for the modeling that will make up the new artificial intelligence index, each component defined above is treated as a numerical vector (column) so that a matrix of 5 columns and number of rows as the number of countries studied in the sample.

At the second step, a modeling will be conducted using the new values received and place them in the algorithm to calculate a proportional index composed by the five

parameters for each country and presenting the values received as an artificial intelligence index.

The country with the highest value represents the best performance of AI implementation (relative to the other countries in the sample), and the country with the lowest value represents the worst AI implementation (relative to the other countries in the sample).

To build the Powers Indexes, the process described in the previous section was used for the AI index. Also, performed additional modeling for the parameters representing the country's power according to the political science definition of "Power" as discussed earlier in this study.

Although these might be measurable parameters that are not "Soft" or "Fuzzy" (for example, the country's budget, GDP, etc.), but since the data is varied and in different magnitude, it is impossible to use the same unit of measurement without losing the Data's essence. Therefore, the same methodology is used to turn the data into a relative and comparable index.

The parameters that will be normalized for "Power Index" estimation are:

- **Physical resources** - the relative share of natural resources in the country from the total resources
- **Military resources** - military expenses from the GDP, and defense budget from the total state's budget
- **Economic resources** - GDP, the state's budget, exports of goods and services, international financial statistics
- **Knowledge and expertise** - total development and research expenses, total scientific and technological articles published in the country, number of R&D researchers (per million citizens)
- **Area and population** - number of people per square kilometer, world political stability index by country, illiteracy rate
- **National unity** - world democracies index, index of developed and developing countries

Before presenting the calculation based on the discussion in this section, the following section will describe the data sources examined and pulled the needed data.

**results**

The results show that the relation between the variables that measure a country's power and the AI index point that almost all the similarities are statistically significant. All the variables in all the combinations above show a value greater than 0.7 threshold, and almost all of them have statistically significant similarity above 0.8.

Finding a strong similarity in all these runs increases our confidants in measuring the relations between AI to the other measures of power. This result confirms our Hypothesis 1 which states:

Hypothesis 1: Countries with higher AI index have higher indexes of power.

Moreover, it is clear that the rows marked in yellow have the highest average similarities. That is, the variables: exports, GDP and research publication. This is a clear indication that economic strength as measured by GDP and exports and education as measured by research publication are correlated with AI. This confirms the second hypothesis which states:

Hypothesis 2: Countries with higher AI are also have higher GDP, exports, and publication of research.

The same conclusion could be seen in calculating relative importance for every power. The combined similarity (SComb) index was developed to measure the relative importance of every power to others. This index is a combination of all other measures of power. It was constructed as follows: every country was given the value of the power which is the closest to the AI Index. This construction of an index ensures that it will be closer to the AI index than any other power index. The "Similarity Combo" is composed of most or might be all the power indexes. By finding the contribution of each power index to this Similarity Combo index it is possible to find the importance of each power relative to the other power indexes in explaining the AI index.

After making the comparison and calculate "similarity rate" for each parameter, it has been found that the most significant contributors to the assimilation of artificial

intelligence are (marked in yellow): exports, GDP and academic publications. Therefore, it can be concluded that they are strongly important to AI implementation.

The relative importance of each power index to the Combined Similarity index could be seen in table 2, which shows the relative contribution of each power index in constructing the Combined Similarity index. The Export, GDP and Education as measured by Research publication are contributing the most to the index.

Moreover, these are very interesting results because the GDP and natural resources are not as significant as assumed before the data analysis, which emphasizes the importance of the country's education level and high technology to gain a strategic political power by implanting AI.

As mentioned in the "Methodology" section 9, using a "Fuzzy" research method and not regression made it possible to perform data analysis due to the fact that there is a strong correlation among the powers which created a "multi-co-linearity" problem, which does not allow us to use linear regression. On the other hand, using soft regression allows us to find these relations since multi-co-linearity does not affect the results as it does in linear regression.

To confirm the fact that there is a multi-nonlinearity problem in the data, calculate the correlation matrix between all explanatory variables, the power indexes. The results presented in tables 3A and 3B. All correlations above 0.25 were marked in the tables. This finding confirms that the multi variables regression cannot be used and thereby the soft regression was used.

At the beginning of the research, it was expected that there would be an inverse correlation between the degree of liberality of the country and the degree of implementation of AI. The logic behind that assumption was that in western countries, liberalism is often expressed in excessive protection of individual privacy. Nevertheless, using classified or even public data on social networks to analyzing them and derive insights about the citizens is considered a serious crime and may cause a real crisis of trust between the citizens and the government (as mentioned earlier in this study).

To test our 3rd hypothesis that the positive relations between AI index and power of a country is higher for democratic countries than autocratic countries, another index was

added: Democracy Index published by (The Economist 2019). The same process described above to build this index from raw data to the range. Then, calculated the similarity table, the contribution table and relative importance table. The three tables are presented as tables 4A, 4B and 4C respectively.

Table 4A shows that the similarity of the Democracy index is below the minimum required level of 0.7 to be statistically significant. Therefore, based on this data, It cannot be accepted that the positive relations between AI index and power of a country is higher for democratic countries than autocratic countries or vice versa (3rd hypothesis). Tables 4B shows that the contribution of the democracy index is the lowest of the other power indexes and table 4C shows that the democracy index has 0 relative importance. This reconfirmed our conclusions that there is no support for the hypothesis that AI will be more adopted in autocratic countries than in democratic ones**.**

Finally, examined the 4th hypothesis that there is a positive relation between the degree of government state/readiness in AI and the power of a country. This hypothesis can be confirmed based on the analysis of hypothesis 1. In estimating the range of the AI index of all countries in the study, the readiness of a country to AI as one of the measures was used. The finding above of positive relation of AI to power of countries confirms that countries could increase their power by investing in AI infra-structure.

## Conclusions

As described in this study and supported by many studies quoted, the challenge of measuring AI and power of countries is not trivial. Moreover, adopting the relevant methodology and implementing it to understand the relations between AI and power of countries is a big step in this field. Using Fuzzy logic, developing normalization of variables, measuring the similarity and contribution of various powers index to AI index allows us to arrive to important conclusions supported by data.

Artificial Intelligence is not only a buzz word, it is a field that could shape the economic status of countries, their geopolitical place in the global world, and the welfare of their citizens. The finding that AI is related to all the powers of countries examined in this study is a straightforward guide to policy maker to invest in AI. In simple words, countries with more investment in AI are countries with higher power.

My finding that AI is related to all types of power and closely related to economic power, as measured by exports and GDP, and education, as measured by published research is an eye opening. The age of internet which allows flow of knowledge, data, and research among scholars around the globe opens the door to every country to catch up in research and development in the lowest cost ever. Educational development, economic prosperity, and AI readiness continue to exhibit mutually reinforcing relations with supported evidence in the data presented in this study.

The benefit of AI development in a country does not relate to the regime of a country as democratic or autocratic. That is, every country could benefit from the development of AI which leads to higher power including economic prosperity. Policy makers, have to invest in opening their country to education and implementation of AI in their countries; thereby insuring higher welfare, prosperity and high global status.

In order to get the public's acceptance for AI and gain the people's support (which is highly necessary for national reasons), western countries must act in maximum transparency regarding the use of data and to present the many possibilities of using AI. For example, to achieve research and development purposes, to gain a political strategic superiority, to represent AI as a force multiplier, as a resource of knowledge and expertise that enables local and international means of power and also to optimize internal management of the country which serves the interest of all citizens.

Artificial intelligence joins the professions of data science, enabling massive processing of extensive data. In the age of the information revolution this evolution of data exploration is inevitable and the changes it brings about are exponential. The more "open" information there is, the better AI equips itself to recognize patterns, find their intricacies and draw conclusions that despite being "automatic", assimilates intelligence in their complexity.

The fact that AI does not depend on anything but itself causes concerns among certain people to naturally oppose its implementation. But in scientific and educated communities, the entry of AI is a significant and welcome force multiplier that enables research breakthroughs. There is a contrast in attitudes between an educated community and an uneducated community, that sometimes all of their familiarity with AI capabilities and the risks associated with it stem from social media, Fake-News and Science Fiction. This study has proved the correlation between the degree of education, which measured as published research, in a certain country, with an emphasis on scientific subjects and the acceptance of AI. Therefore, for developing countries to be able to gain a significant relative advantage over other Western countries in the race to AI, it should take advantage of the current state of lagging in regulation and at the same time, to put emphasis on promoting technological education and diverting budgets to education, research, and development.

Since artificial intelligence is an exponentially growing and changing field, It is recommend to continue monitoring the degree of AI implementation in the various countries according to the segments investigated in this study. Also, considering the power potential of implementing and using AI for the first time, resources must be directed to constant learning of the subject and drawing conclusions in short periods of time. nevertheless, it is of utmost importance at a strategic political level to understand the arena of data analysis and particularly the use of AI. Deep study of the subject and monitoring the changes can help predict geopolitical changes on a global scale.

In addition to the finding in this study, the implementation of fuzzy logic is an important contribution to this field. As explained in section 9 and as calculated in section 11, there is a challenging task using various indexes with strong correlation; a statistical problem known as multi co-linearity. A regression analysis in which multi co-linearity in the explanatory variables exist yield unbiased estimators, yet these estimators are

usually statistically non-significant and therefore could not be used to accept the hypothesis or reject it. As explained in section 9 and implemented in section 11, using similarity and soft regression, overcome this problem which allow to arrive to the finding presented in this study.

Moreover, it is hard to measure many of the indexes. For example, Gross Domestic Product (GDP) seems an easy index to measure. Yet, the World Bank provides eight indexes of GDP. By using range estimation of an index, all these indexes were used to find a minimum and a maximum range estimation of the GDP index for every country. By doing so, the range of the GDP index (and it is the case for all other powers and AI indexes) is more robust which include all available information which is richer than using just one out of the eight available measures of GDP.

In combining several estimators to find a range of an index, raises a new challenge on how to combine these estimators. For that, a process of two normalization steps and a process of two method to remove outlines were used. These two processes required innovative ways on how to normalize the estimators so that they could be combined together. For example, all the eight measures of GDP are measured in different scales and some countries are reported numbers which seems unreliable. These normalization process and removal of outliers fix these issues.

Finally, the similarity was carried out, contribution and relative contribution using four possible ways. using the minimum and the maximum values of the range of every index. Finding that the results of all these possibilities are similar, strongly support the finding.

For all the reasons mentioned above, the following are recommended as further research:

1. Do the same analysis over time. This research focused on 2019, a year prior to the Covid-19. By choosing 2019, this thesis isolated the effect of Covid-19 on many of the variables. It will be productive to extend the research for years after the Covid-19 to substantiate the results of this study.

2. The AI and other variables in this study could not have negative values and their distribution is not symmetric. After recognizing the short fall of the conventional method of using multi variable regression, the soft regression was used. Also, due to

the difficulty to pick one index for AI and one index for every power, a range estimation approach for every index was used. This required the use of several estimator forever index. In addition, to bringing all the estimators (variables) to the same scale, all the variables were normalized. As seen in chapter 9, this process depends on the min cut and max cut parameters of every variable. To determine these parameters, it was needed to use an innovative approach for determining the min cut and max cut. For future study, as more resources of data are being relisted, it is recommended to add more estimators to every index and continue research to substantiate the algorithm to measure the max cut and min cut.

3. According to the results mentioned above that show the correlation between power and AI, and the fact that there is a strong relation between education and AI, it is strongly recommended to continue the research to find a qualitative (Which could be measured by per capita measures or other innovative ways) and quantitative (which could be measured by total measures of power or other innovative ways) in relation to AI and education measure. New findings could direct policy makers to the type of education needed to enhance and expatiate the development of AI in a country. 4. In the last year it has been witnessed that AI is gaining more and more exposure in the public discourse and is evoking supporting voices and opposing voices, even fear of the deployment of the use of these means (Chat GTP, graphic apps etc.). It is recommended monitoring the public's position and how it correlates with the countries' policies.

5. In the last few years dramatic geopolitical changes have been witnessed following the war between Russia and Ukraine. The war caused severe economic effects all over the world, so it is interesting to see if there are changes in the trends presented between AI and economical state.

Also, different approaches that support or oppose the conflict diverse Europe and even Western and Eastern countries outside of Europe. It is interesting to see how geopolitical allies are being reshaped and whether there are more common factors for the countries of each block in other issues such as the implementation of AI etc.

In conclusion, it is widely believed that the future lies in AI, soon learning, and understanding it and its potential, the more it’s easier to get out of it. Countries which will implement the recommendations presented in this study will gain a great comparative advantage at the international political level and also at the national level

will allow optimization of internal processes, resource increase, and an increase of life standards.

The political arena is highly dynamic in this era of the "Information Revolution" and we are at the threshold of a new reality of data control. Therefore, the country that will hold the most professional AI skill and thorough manner, can change the global balance of power in its favor and become the new world power.