Investigaciones Regionales – Journal of Regional Research
https://doi.org/10.38191/iirr-jorr.25.004

Accepted Article

Country's governance quality impact on cloud computing adoption in the EU enterprises

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Received: 29 May 2024
Accepted: 24 March 2025

Abstract:

Cloud computing is widely recognised as a key technology that enables digitalisation, fuelling the digital economy growth. Using World Bank Governance Indicators, in this paper we examine how country's quality of governance (or good governance) impacts the use of cloud computing in the enterprises in the EU, hence affects digitalisation of the EU. In an empirical examination of 27 EU countries over a period from 2014 to 2021, it was found that good governance positively affects cloud computing adoption in the EU enterprises. In support of the institutional theory, we show that the improving country's governance quality is an important step in accelerating cloud computing adoption by the EU enterprises, the finding providing an important input to the EU government in their execution of the Industrial Strategy 2030, in which digitalisation and cloud computing adoption play an important role. Businesses operating in the EU countries with higher quality of governance are more likely to implement cloud computing in their operations, a cost and performance benefiting technology, a valuable insight to the EU enterprises, which gain direct benefits from increased cloud computing adoption in their businesses.

Keywords: Institutions; cloud computing adoption; digitalisation; good governance; country's governance quality; EU (Europe); World Bank governance indicators; quality of government index.
JEL Classification: O32; O43; O52.

El impacto de la calidad de la gobernanza de un país en la adopción de la computación en la nube en las empresas de la UE

Resumen:

La computación en la nube es ampliamente reconocida como una tecnología clave que facilita la digitalización e impulsa el crecimiento de la economía digital. Utilizando los Indicadores de Gobernanza del Banco Mundial, en este documento examinamos cómo la calidad de la gobernanza (o buena gobernanza) de un país impacta en el uso de la computación en la nube en las empresas de la UE y, por consiguiente, en su digitalización. En un análisis empírico de 27 países de la UE entre 2014 y 2021, se concluyó que la buena gobernanza influye positivamente en la adopción de la computación en la nube en las empresas de la UE. En apoyo de la teoría institucional, demostramos que la mejora de la calidad de la gobernanza de un país es un paso importante para acelerar la adopción de la computación en la nube por parte de las empresas de la UE. Este hallazgo proporciona una importante información al gobierno de la UE en la ejecución de la Estrategia Industrial 2030, en la que la digitalización y la adopción de la computación en la nube desempeñan un papel fundamental. Las empresas que operan en países de la UE con una gobernanza de mayor calidad tienen mayor probabilidad de implementar la computación en la nube en sus operaciones, una tecnología que beneficia tanto a los costes como al rendimiento, lo que constituye una valiosa perspectiva para las empresas de la UE, que se benefician directamente de una mayor

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adopción de la computación en la nube en sus negocios.

Palabras clave: Instituciones; adopción de la computación en la nube; digitalización; buena gobernanza; calidad de la gobernanza del país; UE (Europa); indicadores de gobernanza del Banco Mundial; índice de calidad de gobierno.

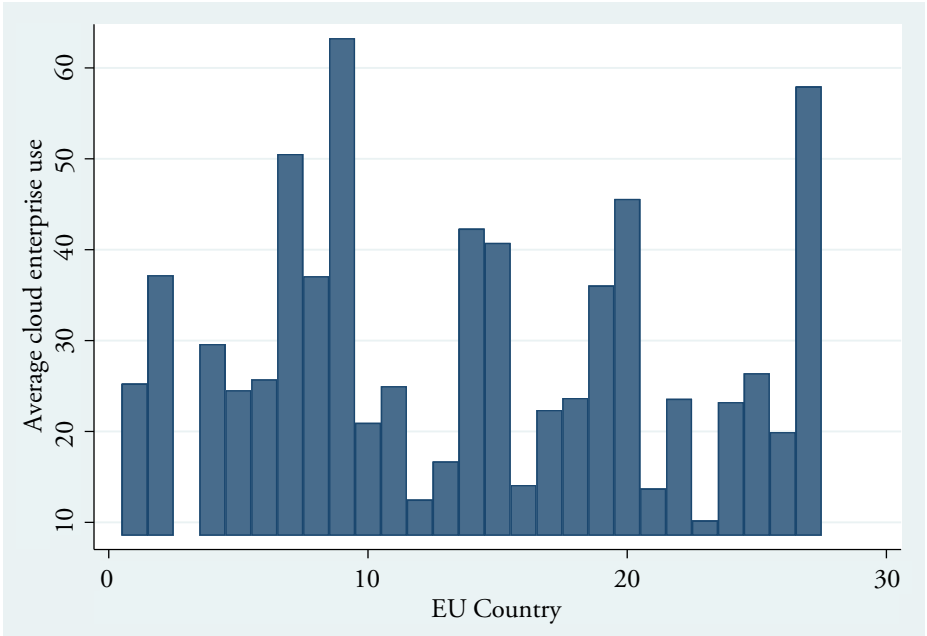
Clasificación JEL: O32; O43; O52.

1. Introduction

Digitalisation is extremely important to growth and development of countries; hence EU has been promoting the development of digital economy. In 2015, the EU Commission launched the Single Digital Market Strategy to assess the maturity of processes related to digitalisation, and in 2021, the Digital Europe Program was launched, with the aim to financially support the digitalisation of the EU countries. Cloud computing[1] is widely recognised as a key technology that enables digitalisation in our economies and societies. The business logic of using cloud computing resides on the premise that organisations can outsource their IT tasks and services at lower cost and higher efficiency. 'Cloud computing has some advantages for individual users; however, it has greater benefits for businesses/enterprises' (Karamujic, 2025). Adoption of cloud computing by enterprises is one of the main objectives of the EU Commission Industrial Strategy 2030 with the aim of accelerating the digitalisation and transforming the EU into 'the continent with a high share of digitalised business.' The specific goal that the Commission set is for 75% of the EU enterprises to have taken cloud computing services[2] by 2030.

Eurostat records the data on the use of cloud computing service in enterprises in the EU, with the Figure 1 below depicting the average use of cloud computing services in enterprises in each of the EU countries in the period 2014 to 2021.

Figure 1.
Average use of cloud computing services in enterprises in the EU

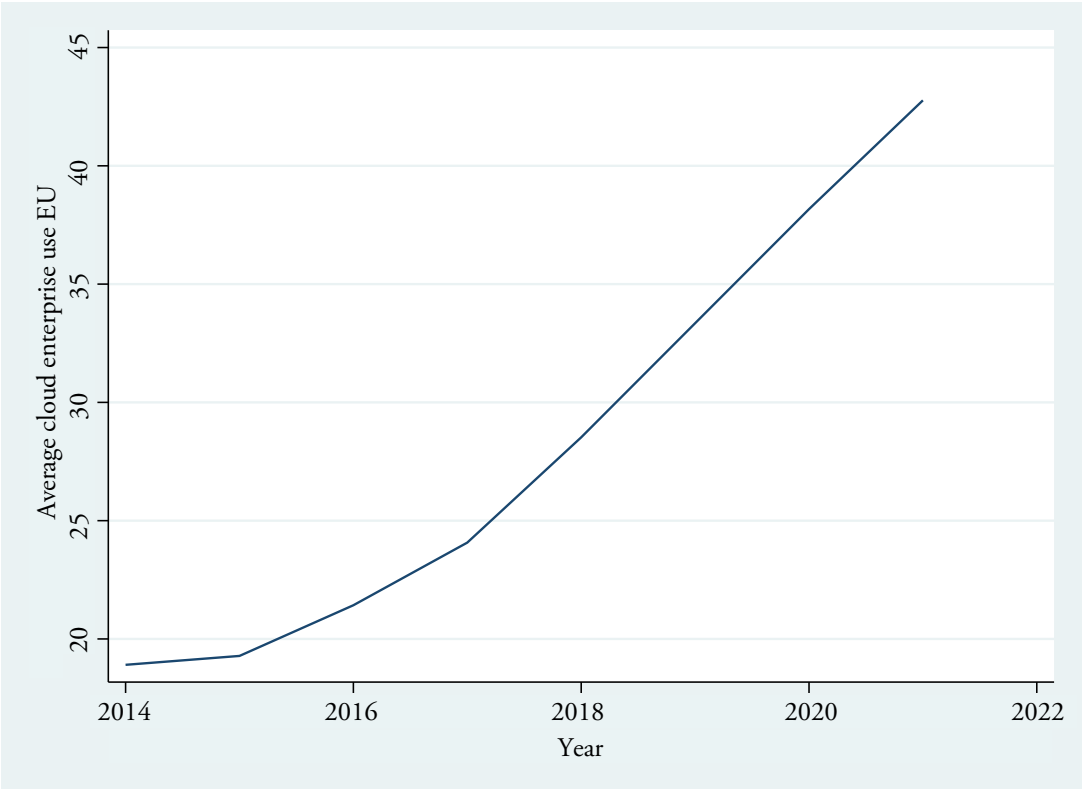


[1] 'Cloud computing is captured by the characteristics of on-demand computing and storage, with shared resources between multiple customers' (Vithayathil, 2017, p.1). 'Cloud computing enables the capable and deliverable IT as services to external customers using internet technologies' (Plummer, D.C. et al., 2008).

[2] Cloud computing is one of the key technologies enabling digital transformation. The other digital technologies mentioned in the Commission Industrial Strategy 2030 are Big Data and AI (Artificial Intelligence).

As it can be observed in the Figure 1 above, all the EU countries are still well below the goal of 75% use of cloud computing by enterprises to be reached by 2030, with 2021[3] average across the union being just above 40% (see Graph 1 below (Source: Karamujic, 2025, 'Does Gaia-X foster cloud computing adoption by European (EU) businesses?').

GRAPH 1.
Average % of EU enterprises using cloud computing services



Additionally, in Figure 1 above, one observes large deviations in the levels of adoption of cloud computing across the EU countries. For example, countries such as Finland (63%), Sweden (58%) and Denmark (51%) have highest levels of adoption of cloud computing services in their enterprises, while countries such as Bulgaria (9%), Romania (11%) and Greece (13%) have some of the lowest levels of the adoption in the EU.

Cloud computing has many benefits to businesses/firms/enterprises (Karamujic, 2025; Chen, Chaung & Nakatani, 2016; Xue & Xin, 2016), in terms of cost and performance benefits, and as such is referred to as business-oriented technology. Considering cloud computing benefits to businesses in general, regardless of national boundaries, one would not expect to see such a large deviation across the EU countries when it comes to the use of cloud computing services.

The EU, which is currently comprised of 27 independent countries, is governed under the set of common rules and regulations under the EU governance, with many laws and policies in the EU countries being common. However, due to the structure of EU, political and fiscal decentralization, the principles of subsidiarity, different legal enforcement and the executive institutions in each member state, the degree to which the EU laws and policies are implemented differs across the EU countries. Farole et al. (2011) note that the individual EU countries often face policy implementation issues related to their own institutional capabilities and governance.

[3] Data for 2022 and 2023 not published by Eurostat at the time of this research.

World Bank records governance indicators for over 200 countries in the world for the period from 1996 to 2022 (as per the current data). The indicators used by the World Bank are Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption. Those indicators, in particular the four indictors being Control of Corruption, Rule of Law, Government Effectiveness and Voice and Accountability, are often used as a proxy for good governance, measuring country's governance quality. The countries such as Finland, Sweden and Denmark mentioned previously have highest cloud computing use in enterprises in the EU, are also some of the top ranked counties globally when it comes to good governance as per the World Bank data and Quality of Government Index (Charron, Lapuente & Dykstra, 2014; Independent, UK paper, issue 2016). Similarly, the countries with lowest cloud computing use in enterprises in the EU, are some of the bottom ranked counties globally when it comes to good governance. Hence, leading to the proposition that good governance impacts cloud computing adoption in the EU enterprises.

In this paper, it is argued that cloud computing adoption in enterprises in individual EU countries is impacted by the specific country's institutional capabilities, those reflecting country's quality of governance. It is posed that the countries with higher quality of governance will have lower corruption level, higher applicability of rule of law and higher voice and accountability, hence in general are more effectively governed. Therefore, businesses operating in those countries will also be able to operate more effectively, with stronger business confidence and lower risk perceptions, focusing on business objectives such as cloud computing adoption rather than being influenced by the presence of corruption and/or lack of the applicability of laws. As such, those countries will have higher cloud computing adoption in enterprises as opposed to those with weaker quality of governance. No relevant research has been found that establishes an empirical link between a country's governance quality and its effects on cloud computing adoption by enterprises, a gap this paper is attempting to address.

The analysis is performed using the regression techniques on the panel data (per EU country/per year) of the percentage use of cloud computing service in enterprises and the average of the World Bank governance indicators, as a measure of good governance in EU countries.

This study aims to provide insights to whether and how institutions reflected in country's governance quality indicators matter when it comes to the cloud computing adoption in the EU enterprises. The findings of the study are important to both the EU government for the purpose of achieving its digitalization targets set in the Industrial Strategy 2030, as well as to the EU firms which gain direct benefits from increased cloud computing adoption in their business.

There are many different perspectives that can be taken in order to study technology adoption such as cloud computing in the EU enterprises, such as socio-economic, demographic, institutional or others, as was done in previous research. This paper, inspired by neo institutionalism as one of the main theories in the organisation research, focuses on the impact of the selected formal institutions reflected in the country's quality of governance on the adoption of cloud computing.

In this article the following structure is applied: Section 2 introduces relevant theory and reflects on the relevant research, followed by the formation of the hypotheses. The section after details the empirical analysis including the description of the data used, method applied and the results obtained. The paper concludes with the discussion, contributions, limitations and implications for research and practice.

2. Literature review and hypotheses development

There has been a number of studies that investigated the digitalization across countries, especially in the EU, such as studies by Tutak and Brodny (2022). In one of their studies, Tutak and Brodny analyse the level of business digital maturity in Europe by investigating the implementation of the digital technologies by companies. The digital technologies their study focused on are artificial intelligence, big data, cloud computing, 3D printing, robotization, the integration of internal process, integration with customers/suppliers, and cybersecurity. They found that Scandinavian countries (Finland and Denmark) and Malta have the highest levels of the implementation of those technologies, while Greece, Romania, Bulgaria, Hungary, and Latvia have the lowest levels. In a different study, Tutak and Brodny (2022)

investigate digital maturity of the SMEs in the EU countries and find that there is a large discrepancy between the initial EU member states (the initial 14) and the new member states (additional 13). They also find that there is a positive relationship between the digital maturity and some economic parameters such as GDP per capita. Both studies by Tutak and Brodny note there is a difference in the technology adoption by the businesses in different EU countries; however, they do not explain the reason for those differences. A study by Kovac, Zmija, Roy, Kusa and Duda (2024) provides a literature review on the topic of digitalisation in the EU and Western Balkan countries and notes that socio-economic context has a potential impact on digitalization, and notes that it has not been sufficiently reflected in the research to date.

Institutions are humanly devised constraints and as such can be either formal or informal (North, 1991). Informal institutions refer to the conventions and norms acceptable (or not acceptable) in the society and are typically reflected in country's national culture. Formal institutions are 'formal rules (constitutions, laws, rights, policies)' (North, 1991, p. 97) and as such are reflections of laws and policies in a country. North (1991) notes that the main purpose of formal institutions is to reduce uncertainty of operating in a certain country. 'Institutions set the boundary conditions under which business occurs (North, 1990), and are the dynamic, sense-making frames that guide actors/organizations to behave in appropriate ways' (Vu, Hartley & Kankanhhalli, 2020).

New institutional theory, or neo institutionalism, study impacts of institutions, both formal and informal, on organisations. According to the new institutional theory (Currie, 2011), 'developing and using technology by organisations is a subject to various institutional constraints or simply institutions.' Karamujic (2025), notes 'the institutions either push or inhibit individuals and groups to adopt the technology and may cause them to behave in not necessarily economic-rationalistic way'. Wan (2005) provides an institution-based theory of firm's strategy and performance, and states that due to the difference in quality of the formal institutions in different countries, resources and capabilities that companies can develop and have access to differ so does their performance.

Governance of a country denotes how the formal institutions are managed on a country level. Country's governance is typically measured by the World Bank governance indicators; hence, for most of countries it is possible to measure the quality of its governance using the World Bank governance indicators. In support of the institutional theory, in this paper we specifically investigate if and how formal institutions measuring the quality of governance (often referred to as good governance) using the World Bank governance indicators impact the adoption of cloud computing by businesses in the EU countries.

There has been increasing focus on good governance and its impact on growth and development of economies and societies. Wu, C-H. (2021) as well as other researchers (Bota-Avram, 2014; Ngobo & Fouda, 2012; Bruno & Claessen, 2010; and others) note that 'country governance is important'. Ngobo and Fouda (2012) based on their study of a relationship between good governance and the performance (profitability) of the firms in 21 African countries, find a positive association between good governance and firms' performance. They note that 'companies located in countries with better governance tend to perform better.' Additionally, they find that 'when the country's income level is lower, an improvement in public governance is more likely to impact a firm's performance than when the income level is relatively higher'.

Bota-Avram (2014) note 'the relevance of governance quality for the ease of doing business, highlighting the necessity to pay enough attention to ensuring good governance in order to provide effective development outcomes.'

Keser and Gokmen (2018) establish a positive relation between governance in the EU and Human Development Index measured a composite of education, literacy and income in that country. They find that at least three governance indicators measured by the World Bank, being Government Effectiveness, Regulatory Quality and Rule of Law have significant positive impact on the development of human capital in the country, hence note that 'better governance in a country, better its human development index.'

Kaufmann and Lafarre (2021) find that country's governance quality is positively associated with sustainability performance, referred to as corporate social performance[4] of the firms in the countries.

Charron, Lapuente and Dykstra (2014) in their research note that 'even in a highly developed area such as Europe, significant quality of governance variation exists between and within countries and that quality of governance has a significant impact on almost all dimensions within societies and economies, such as welfare, education, health, economic performance and others.'

Karamujic (2025), finds that national institutions affect cloud computing adoption; informal institutions such as national culture and few formal institutions such as trade union strength and government effectiveness. The focus was on few formal institutions that were found relevant based on the previous research, with the analysis conducted using the data on 38[5] countries globally.

The study by Baccianti, Labhard and Lehtimaki (2022) investigates the impacts of the quality of institutions on the technology diffusion measured by the number of individual internet users and the number of individual fixed broadband subscriptions in different countries, finding that 'a higher quality of institutions is associated with greater diffusion of digital technologies.'

Using a variety of sources on both national and sub-national level such as World Bank data complemented with variety of survey data, Charron, Lapuente and Rothstein (2011) of the University of Gothenburg developed a novel EQI (European Quality of Government Index), which is now commonly used in the research of country's governance quality impacts. Such one study using EQI is the study by Rodrigues-Pose and Di Cataldo (2014). In their study, Rodrigues-Pose and Di Cataldo assess the impact that the government institutions have on the innovative capacity in the EU, stating that institutions 'define degree of economic uncertainly in the society and the way the collective decisions are made.' Rodrigues-Pose and Di Cataldo note that the individual EU countries' governments vary considerably and argue that the countries with weak government governance will result in lower innovative performance when compared to the countries with stronger government governance settings. Using the European Quality of Government Index (Charron, Lapuente & Rothstein, 2011), and including the World Bank Governance Indicators of Control of Corruption, Rule of Law, Government Effectiveness and Voice and Accountability, they find that 'the quality of government governance plays a strong and significant role in the innovative potential of European regions.' Rodrigues-Pose and Di Cataldo (2014) additionally find that 'ineffective and corrupt governments represent a fundamental barrier to the innovation in the EU'. Governments that have effective policies and keep corruption under control foster innovation more when compared to their counterparts that are more corrupt and ineffective. Rodrigues-Pose and Di Cataldo (2014) in general acknowledge the importance of institutions on technology adoption and application, noting limited to date academic research of this phenomenon. There are studies that investigate the impacts digitalisation has on good governance by countries and corporates such as its impacts on corruption reduction and the rule of law implementation. However, few studies are found that investigate it the other way around, referring to the impacts the good (country) governance has on digitalisation and technology adoption. Example of such a study is a paper by Baccianti, Labhard and Lehtimaki (2022), centred around the impacts of good (country) governance on the adoption of digital technologies such as internet use and fixed broadband subscription. The research by Baccianti, Labhard and Lehtimaki (2022); however, analyses the impacts on the technology adoption by individuals, not the impact on the technology adoption by organisations and businesses, which is the focus of this study.

Therefore, considering the importance of cloud computing technology adoption to digitalisation, and the lack of research in the countries' quality of governance impacts on cloud computing adoption by the enterprises, this research arose with the specific focus on the EU countries.

The World Bank governance indicators are frequently used as a measure of country's governance quality and are generally accepted to be accurate and reliable (Dollar & Kraay, 2003; Charron, Lapuente

[4] 'Corporate Social Responsibility is the combination of environmental sustainability and social sustainability. Environmental sustainability ensures the long-term stability and resilience of the ecosystems that support human life, whereas social sustainability facilitates the respect and promotion of human rights and other basic social rights'

[5] Some of the EU countries used, such as Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Poland, Portugal, Spain, Sweden

& Dykstra, 2014; Rodrigues-Pose & Di Cataldo, 2014; Rodriguez-Andres, Amavilah & Asongu, 2016; and others). Charron, Lapuente and Rothstein (2011) when working on the European Quality of Government Index identified that four out of six World Bank Governance indicators are particularly relevant when measuring Quality of Government (QoG), being Control of Corruption, Rule of Law, Government Effectiveness and Voice and Accountability. Those four indicators are also used in this study.

Control of Corruption as per the World Bank definition refers to 'the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.' In corrupt governments, the decisions are not necessarily made for the best of societies and businesses, but rather for individual or privileged groups gains. A number or previous studies identified significant and negative link between corruption and economic growth and development, including technological progress (Rodrigues-Pose & Di Cataldo, 2014). In corrupt organisations and environments, business-oriented and benefiting technology such as cloud computing may not necessarily be supported unless there is a gain for corrupt individuals and groups, which in turn may inhibit the adoption of cloud computing.

Rule of Law as per the World Bank definition refers to 'the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.' Applicability, effectiveness and impartiality of courts are essential for investment and innovation (Rodrigues-Pose & Di Cataldo, 2014; Rose-Acerman, 2001). Vu, Hartley and Kankanhhalli (2020) in their study on country-level predictors of cloud computing adoption find that 'legal systems quality of a country, reflected in a rule of law' positively impact cloud computing.

Government effectiveness index definition refers to 'the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies'. As noted by Rodrigues-Pose and Di Cataldo (2014), effective governments are more capable of developing effective strategies and policies targeting the right areas of investments. Rodriguez-Andres, Amavilah and Asongu (2016) also find that government effectiveness has significant effect on the ICT adoption in their research in Sub Saharan Africa. In my previous research (Karamujic, 2025), in an empirical examination of the cloud computing revenues, as a proxy for cloud computing adoption, over a sample consisting of 38 countries globally (15 EU countries and 23 non-EU) over a five-year period, it was found government effectiveness, as one of six selected national institutions, significantly impacts cloud computing adoption in a country.

Voice and accountability as per the World Bank definition refers to 'the extent to which a country's citizens are able to participate in selecting their government, as well as a freedom of expression, a freedom of association, and a free media.' Rodriguez-Andres, Amavilah and Asongu (2016) relate voice and accountability to political governance in the country, 'the process by which those in authority are selected and replaced'.

As noted earlier, Charron, Lapuente and Rothstein (2011) use Word Bank's governance indicators of Control of Corruption, Rule of Law, Government Effectiveness and Voice and Accountability as the main pillars and apply combined averages of those four pillars per country to obtain quality of government index. Since those World Bank indicators are only available on a national level, Charron, Lapuente and Rothstein (2011) complement those with survey data on the levels of quality, impartiality and corruption of sub-national governments, resulting in adjusted index on both national and sub-national levels (e.g., Austria as a nation versus sub-national regions of Vienna, Lower Austria, Upper Austria and others). Hence, Charron, Lapuente and Rothstein (2011) obtained adjusted scores which they refer to as European Quality of Government Index (EQI).

As noted before, Rodrigues-Pose and Di Cataldo (2014) in their study on the impact of the government institutions on the innovative capacity in the EU, use the European Quality of Government Index (EQI) as well as separate the World Band good governance indicators of Control of Corruption, Rule of Law, Government Effectiveness and Voice and Accountability. The methodology applied in Rodrigues-Pose and Di Cataldo (2014) research, even though related to the innovation capacity, can be transposed to other domains, such as digitalization and cloud computing.

Similar to Rodrigues-Pose and Di Cataldo, this study poses that the country's governance quality impacts the use of cloud computing service (instead of the innovative capacity) in the EU. The quality of governance, referring to the quality of the institutions in a country, can affect the speed and the process of adoption of digital technologies. According to Baccianti, Labhard and Lehtimaki (2022), 'the process of digitalisation can benefit from the adjusting of institutions and governance to better suit the introduction of new technologies'. Controlling corruption will result in a fairer assessment of the adoption of technology such as cloud computing on its own merits, rather than being affecting by corrupt behaviours of those involved in the decision process. Hence, higher control of corruption in a country should result in an increased adoption of cloud computing technology. 'An institutional environment with a strong rule of law is likely to increase business confidence and lower risk perceptions of adopting new technology such as cloud computing, as it is known that business interests will be protected in such an environment' (Vu, Hartley & Kankanhhalli, 2020). Hence, higher rule of law applied in a country should result in an increased adoption of cloud computing technology. As noted in my previous paper (Karamujic, 2025), 'in countries with more effective governments, labour markets are more regulated, hence less resistant to implementing labour reducing technologies such as cloud computing. Governments in those countries take an active role in redeploying the workforce to other jobs and reskilling the workforce.' It was also noted that government effectiveness can imply greater application of rules and regulations which could be limiting to cloud computing adoption. Example being GDPR (General Data Protection Regulation) which is in force since 2018 across the EU states. Countries that do not have such regulation may experience greater level of flexibility when it comes to the adoption of cloud computing technology. However, in the context of the EU countries, the regulations such as GDPR are rather strictly imposed and evenly applied across the union, hence not making a significant difference across the member states. Hence, one would expect that higher government effectiveness in an EU country should result in an increased adoption of cloud computing technology. Higher voice and accountability implies higher confidence in political governance in a country, which in general is positive for a business environment, hence one would expect that it will have a positive effect on cloud computing technology adoption too.

Hence overall, one can say that the quality of governance in a country impacts confidence and risk perceptions of adopting a technology such as cloud computing by businesses/enterprises in that country. Thus:

> Hypothesis: The higher the quality of country's governance in a country, the higher cloud computing adoption in the enterprises in that country (focus in this study being the EU).

Where, the quality of country's governance in a country is reflected in the World Band good governance indicators of Control of Corruption, Rule of Law, Government Effectiveness and Voice and Accountability.

To test the above hypothesis, the dynamic panel regression methods are applied. The methodology and the analysis are further described in Data and Method section.

3. Data and method

3.1. Data

3.1.1. Use of cloud computing services in enterprises in Europe

Eurostat records the data on use of cloud computing service in enterprises in Europe in the period from 2014 until 2021 (with 2019 data missing). The data is based on the results of surveying 148,000 of EU enterprises with at least 10 employees in the EU NACE[6] classification (out of 1.5 million enterprises in this classification in the EU in 2021) including Small-Enterprises (10-49 employees comprising 83%

[6] NACE sectors covers are manufacturing, electricity, gas and steam, water supply, construction, wholesale and retail trades, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities, information and communication, real estate, professional, scientific and technical activities, administrative and support activities, and the repair of computers and communication equipment.

of the data sample), Medium Enterprises (50-249 employees comprising 14% of the data sample) and Large Enterprises (250 or more employees comprising 3% of the sample). The data is expressed as a percentage of enterprises in the NACE sectors (defined earlier in the footnote 4) using cloud computing services. It covers all cloud services being Infrastructure as a Service, Platform as a Service and Software as a Service for all enterprises with 10 employees or more (Source: Eurostat). The data is available for all 27 EU countries in a panel format, per country, per year.

Note: In order to onbtain fully balanced panel, the missing data points were estimated by averaging of the two neighbouring values. For example, if 2015 data for a specific country was missing, it was estimated to be an average of 2014 and 2016 data points. This was only applied in few cases, hence should not have a significant impact on the data. Additionally, the values for 2019 are missing and have been estimated as an average of 2018 and 2020 values.

This data was also used in another research paper that by Karamujic (2025), 'Does Gaia-X foster cloud computing adoption by European (EU) businesses?'

3.1.2. World Bank Governance Indicators (WGI)

Six worldwide governance indicators are Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption.

Each indicator is normalized to a range from -2.5 to 2.5, with zero mean and standard deviation of 1. Higher the value, indicates better perception of a given indicator. The data is captured via various data sources reflecting the perception of governments and is available since 1996 for over 200 countries.

As noted earlier, those indicators are often used as a proxy for the country's governance quality and often referred to as good governance, in particular Control of Corruption, Rule of Law, Government Effectiveness and Voice and Accountability. The values of those four indicators are used to come to an average per country (per year) as an estimation (proxy) of country's governance quality (good governance) for each of the 27 EU countries. The data range that each indicator takes is somewhat narrower than in the total global data sample, ranging from around -0.5 to 2.5, hence the average of the four indicators ranges from around -0,1 to just below 2.0. Since this research uses logs, 1.0 is added to the average of the World Bank indicators in order to ensure all the values are positive.

3.1.3. European Quality of Government Index (EQI)

The World Bank indicators are measured on a national level and assume that inter-country institutional variations are insignificant. This assumption has been challenged, resulting in a creation of a homogenous European Quality of Government Index (EQI) developed by the University of Gothenburg (Charron, Lapuent & Rothstein, 2011) measured on a sub-national level i.e., per region or province in a country. The index is developed first using an average of four of the World Bank indicators of Control of Corruption, Rule of Law, Government Effectiveness and Voice and Accountability. Subsequently, those World Bank indices' averages are combined with the survey data on the levels of quality, impartiality and corruption of sub-national governments, resulting in adjusted index on both national and sub-national levels. The values range from around -2.0 to +2.0 with the EU average being 0. Positive values imply regions are above the EU average, while negative values imply regions are below the EU average. Higher the value the better country's governance perception.

The EQI data was first collected in 2010 and then repeated for the periods 2013, 2017 and 2021.

3.1.4. General notes on the data used

All data values are rounded to the third decimal place.

Descriptive statistics and correlations for the data used can found the Appendix, Table A.

3.2. Method

3.2.1. Dynamic regression (GMM)

In this research, the dependent variable is the use of cloud computing services in enterprises in Europe in the period from 2014 until 2021. The independent variable is the country's governance quality (good governance) which is proxied by the average of the four World Bank governance indicators.

It is important to note that the European Quality of Government Index was also considered as a potential proxy for the country's governance; however, it was decided not to be used. The main reason being that the measurement of the European Quality of Government Index is only available for 2 years (2017 and 2021) out of the relevant period from 2014 to 2021 for which cloud computing service in enterprises in Europe data is available. Additionally, the cloud computing service in enterprises in Europe data is only available on national level, with no subnational details, for which the European Quality of Governance Index would be relevant. Moreover, the average of the four World Bank indicators and the European Quality of government Index are highly correlated (0.966, reference Appendix A), hence it is sufficient to use one of them in the analysis, in this case the average of the four World Bank indicators for which yearly data is available for the full period 2014 to 2021.

High correlations present between dependent and independent variable (0.32, reference Appendix, Table A) point to choosing a regression analysis as the main method in this analysis.

Since both dependent and independent variables are available in a panel structure with the observations recorded over the years, panel regression analysis is further selected. Additionally, it is expected that past values of dependent variable, being the use of cloud computing services in enterprises in Europe, affect the future values of the same variable, hence a dynamic regression is used. Vu, Hartley and Kankanhhalli (2020) choose GMM dynamic regression in their study on the analysis of the factors affecting cloud computing. They note that GMM method accounts for the presence of country-fixed effects and is more robust to heteroscedasticity and serial correlation potentially present in the error term compared to other regression techniques. GMM was also used in the study 'The impact of national institutions on cloud computing adoption. Comparison of cloud computing to mobile broadband adoption' (Karamujic, 2025). In that study, the focus was on the impact of informal and some formal institutions on cloud computing adoption in 38 countries globally, using cloud computing revenues as a proxy for the adoption. In this study, the focus is on the impact of the quality of governance in 27 EU countries on the use of cloud computing services in the EU businesses. Additionally, the previous study also compared cloud computing adoption to mobile broadband adoption proxied by the mobile broadband revenues in 48 countries globally. Even though the data and focus of the two studies are different, the methodologies applied are similar.

Log-log regression is also used since useful in interpreting results (one percent change in one of the independent variables (everything else held constant), explains x percent of the variation in the dependent variables). Since the independent variable, the average of the World Bank governance indicators, can take negative values, the data is slightly manipulated in order to apply logs, meaning a fixed value is added to each independent variable to make it positive. See further under Data.

The following statistical model is used to examine the relationship between the use of cloud computing in the EU business and the country's governance quality in the EU countries:

$$\text{lncloud\_use\_enterprise}_{it} = \alpha + \beta\, \text{lncloud\_use\_enterprise}_{it-1} + \gamma X'_{it} + \varepsilon_{it} \qquad \text{Eq (1)}$$

where $\text{lncloud\_use\_enterprise}_{it}$ is the log value of the use of cloud computing services in enterprises in Europe by country i in year t; $\text{lncloud\_use\_enterprise}_{it-1}$ is the lagged level of the log value of the use of cloud computing in the EU enterprises by country i in year t; X'_{it} is a vector containing the log of independent variable, the average of the four World Bank governance indices and a set of control variables as described in Version A, B, C and D below, and ε_{it} is the random error term.

Model versions with varying control variables are:

- *Version A* with net income per capita as a control variable. Net income per capital captures the level of development per country (Source: Worldbank) with the data available for all 27 countries and for each year from 2014 to 2021 time period. As noted in the previous study by Karamujic (2025), 'GMM assumes that the first differences of endogenous variables are uncorrelated with country fixed effects', which could be violated in this data set. Furthermore, the previous research by Ngobo and Fouda (2012), indicated that 'a role of good governance depends upon the country's income level'. To control for this potential violation and bias, net income per capita is added to the analysis.
- *Version B* adds ICT Sector as an additional control variable besides net income per capita. ICT Sector variable captures the percentage of the ICT sector in gross value added, meaning the contribution of the ICT sector to the growth economy (Source: Eurostat), with the data available for all but three EU countries (Cyprus, Ireland and Luxembourg) and the data points available for most of the years for the remaining twenty-four countries. In case the data was missing, the value from a previous year(s) is used (max of three years in the past).
- ICT Sector variable controls for the potential bias that the use of cloud computing is impacted by the extent of ICT sector development in a country.
- *Version C* adds and additional control variable being Broadband internet speed of over 100 Megabits availability in a country (Source: Eurostat) with the data available for all 27 countries and for each year from 2014 to 2021 time period.
- For businesses to effectively use cloud computing services they require internet speed of over 100 Megabits and more (Source: https://www.business.com/internet/bandwidth/), hence this additional variable controls for a potential bias related to the internet speed availability in different countries.
- *Version D* instead of net income per capita, uses GDP per capita in order to capture the level of development per country (Source: Worldbank) which in some studies (Tutak and Brodny, 2022) was found to be significantly related to the digitalization maturity. The rest of the control variables are consistent with the model version C, being ICT Sector and Broadband internet speed.

All model versions use time dummies to control for time-related shocks.

4. RESULTS

Tables 1 and 2 below detail the estimation results for the models specified in Eq (1) resulting from dynamic regression using one step GMM.

TABLE1.
The impact of the average of the four World Bank governance indicators on the use of cloud computing services in enterprises in Europe as per the dynamic regression (GMM one step) from STATA

The impact of the average of the four World Bank governance indicators on the use of cloud computing services in EU enterprises				
	Model A	Model B	Model C	Model D
Use of cloud computing in enterprises _lag value P value [95% Conf. Interval] (Std. Error)	0.829*** 0.000 [0.698 0.959] (0.067)	0.873*** 0.000 [0.706 1.040] (0.085)	0.886*** 0.000 [0.709 1.063] (0.090)	0.892*** 0.000 [0.712 1.072] (0.092)
Average of the four World Bank governance indicators P value [95% Conf. Interval] (Std. Error)	0.274*** 0.000 [0.125 0.424] (0.076)	0.205*** 0.001 [0.079 0.330] (0.064)	0.167** 0.043 [0.006 0.328] (0.082)	0.178** 0.024 [0.023 0.333] (0.079)
Net Income Per Capita	-0.000000678	-0.000000511	-0.00000053	
P value [95% Conf. Interval] (Std. Error)	0.164 [-0.00000163 0.000000278] (0.000000488)	0.575 [-0.0000023 0.00000128] (0.000000913)	0.563 [-0.00000233 0.00000127] (0.000000916)	
GDP Per Capita P value [95% Conf. Interval] (Std. Error)				-0.000000634 0.425 [-0.00000219 0.000000923] (0.000000795)
ICT Sector P value [95% Conf. Interval] (Std. Error)		0.004 0.368 [-0.005 0.013] (0.005)	0.002 0.786 [-0.010 0.013] (0.006)	0.001 0.882 [-0.010 0.013] (0.006)
Broadband P value [95% Conf. Interval] (Std. Error)			0.0003 0.213 [-0.0002 0.0009] (0.0003)	0.0003 0.209 [-0.0002 0.0009] (0.0003)
Constant P value [95% Conf. Interval] (Std. Error)	0.254*** 0.001 [0.105 0.402] (0.076)	-36.717*** 0.006 [-62.804 -10.631] (13.310)	-32.147** 0.038 [-62.536 -1.756] (15.505)	-31.95** 0.035 [-61.652 -2.251] (15.153)
N	189	166	166	166
Number of groups	27	24	24	24
Observations per group	7	5	5	5

Numbers rounded to 3 decimal places; *p < 0.1, **p < 0.05; *** p < 0.01.

TABLE 2.
GMM Hypotheses tests

The impact of European Quality of government Index on the use of cloud computing services in EU enterprises				
	Model A	**Model B**	**Model C**	**Model D**
Arellano-Bond test for AR(2)	z = 0.9 Pr > z = 0.367	z = 1.04 Pr > z = 0.297	z = 1.02 Pr > z = 0.308	z = 1.02 Pr > z = 0.307
Hansen test of overid. restriction	chi2(26) = 17.72 Prob > chi2= 0.886	chi2(26) = 16.46 Prob > chi2= 0.924	chi2(26) = 13.41 Prob > chi2= 0.980	chi2(26) = 11.68 Prob > chi2= 0.993

Firstly, important to note that Arellano-Bond tests and Hansen tests in Table 2 above, confirm the validity of GMM used, hence we can proceed with the analysis of the results in Table 1.

In Table 1, as expected, the lag values of the dependent variable are significant in all four models A, B, C and D with p values of 0.000, hence the past values of the use of cloud computing in the EU enterprises do significantly affect the future values.

This research's main hypothesis poses that the higher the governance quality in an EU country (proxied by the average of the four World Bank governance indicators), the higher cloud computing adoption in the enterprises in that EU country. As can be seen in all four models, this hypothesis is supported (Model A with p value of 0.000, Model B with p value of 0.001, Model C with p value of 0.043 and Model D with p value of 0.024). The relationship between the governance quality in EU countries and the use of cloud computing by EU enterprises is positive and significant indicating that 1% increase in the governance quality in the EU countries as measured by the average of the four World Bank governance indicators results in about 0.2% increase in cloud computing adoption in the enterprises in that EU country (measured as a percentage of EU enterprises that adopt cloud computing in that country). More accurately, 1% increase in the governance quality in the EU countries results in 0.274% increase in the percentage of EU enterprises that adopt cloud computing in that country as per Model A, 0.205% increase as per Model B, 0.167% as per Model C and 0.178% as per model D. Hence, the results obtained seems to be consistent across different models used with different control variables applied.

Model A has the most data points, while models B, C and D have less data since ICT Sector information is missing for 3 countries in the data sample.

5. DISCUSSION, CONCLUSION, CONTRIBUTION, AND LIMITATIONS

In this research, it was illustrated that the country's governance quality (good governance) positively affects the use of cloud computing in the EU enterprises. The empirical analysis was conducted using the average of the four World Bank governance indicators (Control of Corruption, Rule of Law, Government Effectiveness and Voice and Accountability) as a proxy for the governance quality. To accommodate for potential biases, four different models were used to control for factors such as net income, GDP, ICT sector development as well as broadband internet availability in different countries. All four models tested show the consistent results in support of the research hypothesis: The higher the governance quality in an EU country, the higher cloud computing adoption in the enterprises in that EU country.

5.1. CONTRIBUTIONS

This research makes several important contributions. Firstly, it supports the exiting theories, in particular neo institutional theory. According to the neo institutional theory, developing and using technology by organisations is a subject to various formal institutions. In this study we show that formal institutions represented by the World Bank governance indicators, being Control of Corruption, Rule of

Law, Government Effectiveness and Voice and Accountability are influencing the use of cloud computing services in the EU enterprises. As such, this study contributes to the body of research that supports the neo institutional theory, as one of the main theories in the organisation research. As noted in my previous research, 'In support of the neo-institutional theory, national institutions may cause individuals in a certain national setting not to behave in a necessarily economic-rationalistic way; hence, the success of the technology implementation, such as cloud computing, will depend on the organizations understanding of that national setting and taking right measures to manage it in the best possible way' (Karamujic, 2025).

Secondly, it empirically shows how the country's governance quality impacts the use of cloud computing services in the EU enterprises, stating that higher the governance quality in an EU country, the higher cloud computing adoption in the enterprises in that EU country. Similar research has not been conducted year to date and provides an important finding for both researchers and practitioners. Researchers can further investigate this topic and possibly extend it to different geographies and additional institutions, while practitioners, both governments and businesses, can take it as an input it its planning and management, as described further under practical implications.

Thirdly, this research contributes to the growing literature on the importance of good governance and its impact on growth and development of economies and societies.

5.2. Practical implications

Adoption of cloud computing by enterprises is one of the main objectives of the EU Commission Industrial Strategy 2030 with the aim of accelerating the digitalisation and transforming the EU into 'the continent with a high share of digitalised business.' The goal of 75% of the EU enterprises to have taken cloud computing services[7] by 2030 is quite a challenge, considering the 2021 EU average was just over 40%, with very large variations across the countries. This research aims to provide additional input to the EU government(s) and decision makers and support them with additional insights in terms of drawing their attention to the importance of the country's governance quality, and the improvement of it, for continued growth in the use of cloud computing in the EU enterprises, hence increase in digitalisation and achievement of their strategic objectives. Improving control of corruption, hence reducing corruption in a country; implementing greater application of the rule of law, hence ensuring legal system works well; ensuring government and its institutions work effectively and independently are all very important from various aspects, and in this research, it is shown that they are also very important for a country's adoption of technology such as could computing. EU and individual country governments and policy makers have significant influence on all of those as they are formal institutions and reflect policies and laws in a country. 'When aiming to increase technology adoption on a country level, the government should look at its laws and policies more critically and if necessary, adjust in order to enable higher adoption success' (Karamujic, 2025).

This research also aims to provide additional input to the EU businesses, for which the adoption of cloud computing and acceleration of digitalisation is essential given its many cost and performance business benefits. Enterprises operating in countries with higher governance quality are more likely to implement cloud computing in their operations. Hence, when establishing or planning to grow in certain EU countries, this research provides important insights to EU businesses.

This research also confirms previous research (Wan, 2005; Ngobo & Fouda, 2012) that companies located in countries with better governance tend to perform better, in this case measured by their adoption of cost and performance benefiting technology such as cloud computing.

5.3. Limitations

This research is focused on the use of cloud computing services in the EU enterprises and should be used in the context of the EU. In would be interesting to conduction similar research on a wider geography; however, Eurostat only records the use of cloud computing services in the EU enterprises, and no similar

[7] Cloud computing is one of the key technologies enabling digital transformation. The other digital technologies mentioned in the Commission Industrial Strategy 2030 are Big Data and AI (Artificial Intelligence)

data is available on a wider data sample. Additionally, there are also other aspects and parameters that may be considered relevant for cloud computing adoption; however, they are omitted and are not focus of this study. Focus is on the institutions echoed in country's governance quality indicators as previously explained.

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Appendices

Table A.
Descriptive statistics and bivariate correlations

Variable Name	N	Mean	Standard Deviation	Min	Max	1.	2.	3.
1.Use of cloud computing services in enterprises in Europe	216	28.758	16.645	4.9	75.5	1	0.32***	0.35***
2.Average of the four World Bank governance indicators	216	1.026	0.555	-0.1	1.963	0.32***	1	0.966***
3.European Quality of government Index (EQI)	216	0.38	0.948	-1.812	1.753	0.35***	0.966***	1

Numbers rounded to 3 decimal places; *p < 0.1, **p < 0.05; *** p < 0.01.