The Impact of Open Data Implementation on Entrepreneurial Attitude with Regard to Moving towards UN Sustainability Goals

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Abstract

This study aimed to investigate the impact of open data implementation as part of data governance initiatives on entrepreneurial attitudes in Europe and Central Asia. Such has never been determined or investigated in a measurable form. Using regression (OLS) analysis of secondary data on the open data implementation index from the Open Data Barometer (ODB) and the Entrepreneurial Attitude index from GEI, this study investigates the impact of open data implementation (as a national data governance strategy) on entrepreneurial attitudes in Europe and Central Asia. This study introduces a novel approach that advances our understanding of sustainable development goals. The study establishes a causation of the 32% impact of open data implementation on entrepreneurship attitudes toward recognizing opportunities in Europe and Central Asia.

This study advocates for the establishment of a comprehensive national open data initiative as a catalyst for fostering entrepreneurial attitudes within Europe and Central Asia. Moreover, it emphasizes the importance for entrepreneurs to cultivate the necessary attitudes for achieving their business objectives successfully. The study recommends further investigation using a recent dataset. The study's findings improve the understanding of how to induce entrepreneurial attitudes in Europe and Central Asia in pursuit of post-pandemic economic development.

Keywords: data governance; open data implementation; open data; entrepreneurship attitude; entrepreneurship

Introduction

This study aims to investigate and gauge the impact (in numerical measurements) of open data implementation as part of a data governance strategy on entrepreneurial attitudes in Europe and Central Asia. The findings will create an opportunity to leverage open data implementation as an inducing factor for entrepreneurs' attitudes toward economic progress in a particular region. Entrepreneurial attitude is defined as the general sense of a country's population toward recognizing entrepreneurial opportunities (Acs, Szerb, 2010). This is also significant in the wake of the asserted failure attributed to the EU's Lisbon strategy. The Lisbon strategy represented a planned course of action in March 2000 to achieve ambitious targets and more concerted action across different EU member states and institutions by 2010. Economic renewal as one of Lisbon's strategic objectives were not fulfilled, as expected, due to lack of implementation, a long implementation period, and lack of coordination (Nam et al., 2021).

Potential findings will be significant to economic policymakers, practitioners, and potential entrepreneurs in Europe and Central Asia, especially in pursuit of UN-SDG8 objectives 8.1 and 8.2. Economic policymakers will be able to develop and deploy an open data implementation framework, policy, and principles that stimulate economic renewal by inducing the required entrepreneurial attitude in pursuit of current and future objectives in the region. Practicing entrepreneurs will identify potential sources of motivation for creative and innovative attitudes in pursuit of entrepreneurial success. Existing entrepreneurs will identify the basis on which attitudes are formed in pursuit of entrepreneurial success, risk reduction, and avoiding business failure (Ekundayo et al., 2023). As key stakeholders of the UN-SDG8, developing the right entrepreneurial attitude in the region will help prime entrepreneurship and behavioral intent contained within the respective polities.

The Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) of the United Nations (UN) address some of the most important problems the world is currently experiencing. These challenges include poverty, gender inequality, environmental degradation, climate change, peace, and justice. Goal 8 of the UN-SDGs is about unprecedented work and economic growth. As declared by the UN, achieving this objective is not only a fundamental human right, but also a requirement for a world that is peaceful, prosperous, and sustainable (Kota et al., 2021). In pursuance of the UN-SDG8 objectives, the UN set relative targets. One of such targets is to maintain per capita economic growth in accordance with local conditions, with the least developed countries' GDP growth rate needing to be at least 7% annually (8.1). Another target is to increase economic productivity through innovation, technical advancement, and sector-specific attention to high value-added and labor-intensive industries (8.2). Thus, it is pertinent to investigate the variables that contribute to these targets relative to the UN-SDG8 (Fonseca et al., 2020). As a commitment to these global objectives, nations are identi-

fying comparative advantages, variables, and sub-economic elements that can be leveraged to boost their pursuit and achievement of these objectives (Fonseca et al., 2020). Biomass (Blair et al., 2021), renewable electricity (Swain, Karimu, 2020), circular economy framework (Schroeder et al., 2019), and thr construction industry (Fei et al., 2021) are some of variables and sub-economic elements that havr been leveraged in pursuit of SDG objectives and targets. This study argues that open data implementation is a valuable variable in Europe and Central Asia.

A key objective for this study is to validate the theory of planned behavior (TPB) (Ajzen, 1991) using an experimental strategy. Ajzen's (1991) Theory of Planned Behavior posits that behavioral intention is a function of a person's motivation and influences. It argues that motivations and influences over time are impacted by the attitudes, abilities, and subjective norms of individuals (Ajzen, 1991). According to this theory, attitude, ability, and subjective norms are often induced by background variables across various human endeavors.

Empirical review and analysis show that, while attitude is a construct that is generally complicated to measure, it represents a person's behavior toward compliance with a concept (Carmi, Bouhnik, 2020). Attitude, as a reflection of who we are, is an outcome of the integration of both internal and external variables within the context of a person's existence (Carmi, Bouhnik, 2020). Some of these factors are family, peer groups, and religion (Rosado-Cubero et al., 2022). Attitudes are expressed in terms of words, beliefs, and behaviors. However, differences in geographical location mean that internal and external factors that formulate entrepreneurial attitude, as indicated by the Theory of Planned Behavior (TPB), also differ. Thus, it is important for stakeholders to investigate the factors that influence entrepreneurship attitudes toward economic development in a particular region.

This study questions the role of open data implementation in shaping entrepreneurial attitudes towards establishing their own entities in Europe and Central Asia. According to the Open Data Barometer (ODB), Open Data Implementation is the extent to which accessible, timely, and open data are published by each country's government in the key 15 economic sectors (Likhacheva, 2020). According to the Global Entrepreneurship Development Index (GEDI), entrepreneurial attitude is the general sense of a country's population toward recognizing opportunities, knowing entrepreneurs personally, attaching high status to entrepreneurs, accepting the risks associated with a business start-up, and having the skills to successfully launch businesses (Inacio Junior et al., 2021). This study aims to ascertain the impact of open data on entrepreneurial attitudes. Investigating this nexus may help identify a key element in achieving the Sustainable Development Goals (SDGs), more specifically, SDG8.

Background Information

The categorization and focus on the countries of Europe and Central Asia is a broad approach—from Western, Northern, Eastern, and Southern Europe to Central Asia at various

levels in order to identify progress toward the Sustainable Development Goals, particularly SDG8. It also encompasses both EU and non-EU countries, offering insight into how open data implementation might impact entrepreneurial attitudes. This comprehensive approach will provide a nuanced understanding of the role of open data in fostering entrepreneurship infrastructure across these regions.

Entrepreneurship Attitude in Europe and Central Asia

Europe is considered a continent and subcontinent of Eurasia and is located in the Northern and Eastern Hemispheres. With a population of 446.8 million as of 2022 (according to Eurostat), it shares continental landmass of Afro-Eurasia with both Centra Asia and Africa. According to the European Institute of Innovation and Technology (EIT), a body of the EU, Europe needs more entrepreneurs because the economic outlook is likely to undergo dynamic changes by 2030 (Leceta, Könnölä, 2021). Central Asia is a subregion of Asia. This region had a population of 77 million by 2022 (according to the UN). It encompasses several former Soviet republics. Only one-third of the entrepreneurs in Central Asia are women (Franzke et al., 2022). It is thus important that the region's female demography as much as other demography are recognized as the region's human capital capability relative to entrepreneurial impact. However, for entrepreneurship to increase in this region, it is important that entrepreneurial attitudes be consciously induced to create behavioral intentions in pursuit of entrepreneurial opportunities and economic development (Ekundayo et al., 2023). In line with this, the Theory of Planned Behavior (TPB), inducing the behavior of persons in the region, would potentially provide a competitive edge in their pursuit of an updated Lisbon strategy and the current SDG 8 objectives.

Global entrepreneurship practices have been investigated, assessed, and indexed using the Global Entrepreneurial Development Index (GEDI). The GEDI 2018 (pre-pandemic) report posits that entrepreneurship practice in the EU's 26 of 28 member countries is lagging compared to that in the United States. The report cites the region's dwindling entrepreneurial attitudes in recent times as the root cause of this trend (Acs et al., 2018).

Understanding this regional variation in entrepreneurial attitudes in Europe forms the subject of a previous study (Bosma, Schutjens, 2011). Using data from the Global Entrepreneurship Monitor (GEM) for 127 regions across 17 European countries, the authors highlight that urban cities and regions in Europe tend to exhibit relatively high rates of early-stage entrepreneurship. The study further breaks down entrepreneurial attitudes into three dimensions in line with the GEM model, asserting that understanding these attitudes generally influences entrepreneurship. This underscores the need for varied instruments at different spatial scales and at different stages of entrepreneurship in order to foster the appropriate entrepreneurial attitudes for each stage and region. Nevertheless, Bosma & Schutjens (2011) do not identify the specific factors that contribute to the devel-

opment of entrepreneurial attitudes, despite acknowledging the significance of those attitudes in the early stages of entrepreneurial activity. In a different vein, Draghici et al. (2014) critique the EU's strategy for a knowledge-based economy aimed at fostering economic development. They argue that the strategy has not lived up to expectations, attributing this failure to the region's neglect of variables that stimulate entrepreneurial attitudes. The authors contend that the EU has not treated entrepreneurial attitude as a valuable asset or knowledge worth inducing or leveraging. Their position is substantiated by a regression analysis of entrepreneurial attitudes and activities indexing data sourced from the GEM. The findings reveal a positive correlation between entrepreneurial attitudes and activities within the EU. Consequently, the authors cite the disregard for entrepreneurial attitude as a key reason for the failure of the region's Lisbon strategy. However, similar to (Bosma, Schutjens, 2011), Draghici et al. (2014) do not identify the specific factors that can induce the appropriate attitudes for entrepreneurial activity.

Rusu and Roman (2017) make a compelling case that within the European Union, financial and economic aspects (such as access to credit, inflation rates, foreign direct investments, and total tax rates), significantly impact attitudes toward entrepreneurship. The emphasis on these factors has sparked a growing concern among stakeholders about the impact on existing and potential entrepreneurs. The quest to rekindle entrepreneurial attitudes in the face of these economic and financial determinants has therefore become a priority. However, while Rusu and Roman's research brings to light the economic and financial sub-elements that shape entrepreneurial behavior and attitudes, it does not delve into factors outside the financial sphere. This presents a void in comprehension, particularly because the Theory of Planned Behavior promotes a more encompassing perspective, proposing that the determinants of behavioral intentions span a wider variety of variables, not those strictly limited to economic or financial factors. Another important dimension comes to the fore in the work of (Bjerde, 2022), who argues that despite women constituting a significant proportion of human capital in Europe and Central Asia, they are considerably underrepresented in entrepreneurial activities. This raises critical implications about the need to effectively stimulate female entrepreneurial attitudes in order to contribute to economic revitalization in the region. Bjerde's findings further underscore the potential economic benefits of increased female participation in entrepreneurship, suggesting that such inclusion could potentially enhance GDP by 23%.

Overall, entrepreneurial attitudes have been identified as having an impact on entrepreneurship development, however factors inducing entrepreneurial attitudes have not been sufficiently investigated in the EU as it pursues its economic, Lisbon, and SDG8 objectives. This study investigated the impact of open data implementation as a leveraging element to induce entrepreneurial attitudes in Europe and Central Asia. If entrepreneurial attitudes can be effectively induced, Bosma and Schutjens (2011), Draghici et al. (2014), and the Theory of Planned Behavior can be validated accordingly.

Technology, Data and Entrepreneurship in EU

The nexus between technology, data, and entrepreneurship is a matter of constant debate, relative to expectations. For entrepreneurial ventures to sustain their impact on economic advancement in the modern economy, there is a need to continuously use technology and the data it provides to shape the attitudes of entrepreneurial stakeholders relative to the matters at hand. As Europe is one of the most technologically advanced regions in the world, the role of technology in entrepreneurial sustainability cannot be overemphasized. A noticeable effort to shape entrepreneurial/business attitudes in the region is the EU's General Data Protection Regulation (GDPR). The EU's regulatory framework, the General Data Protection Regulation (GDPR), is a guide for the formulation of data attitudes (Aseri, 2020). The European Union enacted the GDPR in 2015 to assert the use of personal data for creative purposes. This has become a model for the rest of the world (Zaeem, Barber, 2021). This encourages transparency in data implementation processes (Aseri, 2020). It ensures the correct use and deployment of open data because there is the possibility of incorrect use (Rhahla et al., 2021; Zaeem, Barber, 2021). The government's interest in regulating data implementation for business uses is not only for security; it is also to harness the potential of its economic contributions, thereby validating its key role in business and economic development (Li et al., 2019). Coincidentally, it could provide an opportunity for the region to shape the entrepreneurial behavior (via data behavior route) toward other economic objectives, such as the entrepreneurial attitudes toward the foundation, success, and sustainability of ventures. Therefore, it is important to determine how emerging concepts such as open data implementation, a sub-element of technology and data attested to and governed by the EU's GDPR, play a crucial role in the formation and expression of entrepreneurial attitudes (Tamburri, 2020). Understanding echnology, data, and entrepreneurship in EU allows this study to explore how data and technology interface with entrepreneurship in the European context, informing potential mechanisms by which open data might impact entrepreneurship.

Open Data and Entrepreneurship in Central Asia

Kossow (2016) provides a comprehensive analysis of open data initiatives in Eastern Europe and Central Asia (EECA), particularly focusing on their role in promoting peaceful, just, and inclusive societies, as prescribed by the Sustainable Development Goal (SDG) 16. The analysis consists of over 40 interviews with experts in Albania, Georgia, and Moldova. The experts include representatives from government agencies, civil society organizations, and technical experts. The interviews focused on the availability and utility of open data, and its contribution to transparency and government accountability. Apart from expert interviews, the study also provides an overview of government data available in open formats and an evaluation of the impact of open data on transparency and accountability. The analysis provides policy recommendations for promoting open data initiatives in the region. Kossow's study stresses the significance of open data implementation in enhancing transparency and gov-

ernment accountability and in fostering citizen engagement in economic activities such as entrepreneurship (Kossow, 2016). The study's extension by further exploring the influence of open data on entrepreneurship is a connection noted by the authors, however it was not elaborated upon.

Another study by Bespalyy et al. (2021), explores the expansion of social entrepreneurship in Kazakhstan, pinpointing the factors that drive this growth. Their quantitative analysis delves into the primary reasons for the emergence of social enterprises, revealing how these factors interact. The methodology of this study, grounded in economic and mathematical principles, forms a comprehensive analysis of social entrepreneurship in Kazakhstan, a key country in the region. By employing several economic indicators such as unemployment rates, population income levels, social protection expenditure in GDP, per capita GDP, and the consumer price index, Bespalyy et al. bring to light the diverse factors influencing the evolution of social entrepreneurship in the wider region. This study's insights fill an existing gap in our understanding of entrepreneurship in Kazakhstan and contribute to the current research by exploring the role of open data implementation in transforming entrepreneurial attitudes.

Seitzhanov et al. (2020) scrutinized the influence of the state's innovation policies on the innovative behaviors of business entities in Kazakhstan, underscoring the scarcity of empirical studies focusing on the micro-level impact of public policy. The study established the groundwork for a deeper exploration into the effects of public policy (on open data) on entrepreneurial activities within the region. This present research builds upon this groundwork, focusing specifically on how open data implementation, as a distinct data governance strategy, molds entrepreneurial attitudes across Europe and Central Asia. The potential insights from this study could provide valuable guidance to policymakers grappling with these pressing challenges. By weaving together three key threads—open data initiatives, entrepreneurial attitudes, and sustainable development—particularly with respect to Central Asia, this study adds a unique dimension to both the scholarly discourse and practical considerations surrounding these themes. Examining open data and entrepreneurship in Central Asia provides specific regional context and reveals the current state of open data practices and their relation to entrepreneurship, highlighting the areas where the study's findings may be most impactful.

Data Governance, Open Data and Open Data Implementation

Data governance represents a nation's regulatory framework for ensuring that data are accessible, timely, and usable (Mao et al., 2022). It incorporates activities such as Data Knowledge, Data Ownership, Data Quality, Data Accessibility, and Data Security to induce a data-centered attitude while ensuring that the use of data is successful. Open data is a data governance strategy that provides frameworks and principles to meet relative data objectives within a business or state (Corrales-Garay et al., 2020). Open data implementation became a practice as a data governance strategy after the Open Data Charter (ODC) themed conference in 2015,

spearheaded by the G7 nations. ODC stakeholders appointed the Open Data Barometer (ODB) as the official non-profit-making organization to evaluate 150+ nations and the organization's commitment to the agreed-upon, six (6) open-data principles. The goal was to tackle government corruption and to encourage transparency in global development. For an effective performance evaluation of ODC principles, ODB developed a methodology for the assessment of open data commitments within member countries, entities, and stakeholders. The methodology measures open data under a tri-subindex, namely open data readiness, open data implementation, and open data impact. Open Data readiness is the commitment of states, citizens, and businesses to pursuing open data; open data implementation is the scope, accessibility, and timeliness according to which open data for 15 listed key economic sectors is published; and Open Data Impact refers to the extent to which there is evidence that open data released by the country's government has had a positive impact upon different domains in the country (European Commission, 2021). ODB posits that this methodology provides simplicity to an otherwise complex data governance strategy that is regarded as 'open data.' However, as with previous studies, it creates a basis to measure this study's Independent Variable (IV) – "open data implementation." Familiarity with data governance, open data, and open data implementation provides a broad understanding of the principles, practices, and processes around open data, helping to frame how these can be implemented in the entrepreneurial sphere across Europe and Central Asia.

Conceptual Framework and Hypothesis Development

This study is based on the Theory of Planned Behavior, first known as the Theory of Reasoned Action. It was authored and formulated by Azjen et al. (1985). It proposes that a person's motivation to engage in a specific behavior is affected by three factors. More specifically, the theory hypothesizes that behavioral intent is a function of behavioral, normative, and control-belief systems. While behavioral beliefs represent personal nuances that form an individual's attitude, normative beliefs represent attitudes that are peculiar and different from the individual; control beliefs refer to abilities that can be controlled by the individual. The theory posits that to form behavioral intention in pursuit of an entrepreneurial objective (for instance), all these belief frameworks are induced by several background variables divided into a tri-spectrum, namely personal, social, and information, as shown in Figure 1.

In line with Ajzen's Theory of Planned Behavior (TPB) (1991), this study posits that the implementation of open data can significantly influence an individual's entrepreneurial intent and attitude, shaped by three primary factors: experience, knowledge, and media exposure. Individuals with experience in accessing, interpreting, and manipulating open data are expected to encounter fewer barriers in its use for entrepreneurial purposes. Knowledge enhancement, defined as a comprehensive understanding of the benefits and potential applications of open data, can foster positive entrepreneurial attitudes. Strategic media exposure
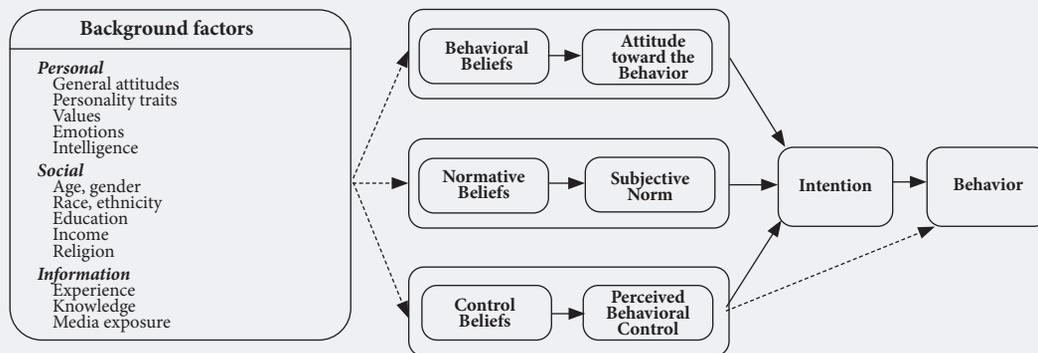
regarding open data, particularly through showcasing success stories of entrepreneurs who have benefited from it, can provide role models and cultivate a narrative that utilizing open data is a common and esteemed entrepreneurial practice. This combination of factors could stimulate the development of an entrepreneurial mindset, consistent with the principles of Ajzen's Theory of Planned Behavior.

Relative to this theory, several studies have attempted to investigate factors that contribute to entrepreneurial attitudes that determine entrepreneurial intentions (Yoon et al., 2011; Israr, Saleem, 2018; Izquierdo, 2013; Fragoso et al., 2019; Manneh et al., 2020; Melhem, Al-shaikh, 2018; Muhammad et al., 2015; Weiss, 2015).

In an empirical study, Tong et al. (2011) applied convenience sampling techniques and multiple regression analysis to investigate the influences underpinning the formation of an entrepreneurial attitudes among students. The study sample consisted of students from four distinct universities, which provided a range of perspectives and backgrounds to broaden the scope of their findings. The results indicate that entrepreneurial attitudes, and by extension, entrepreneurial intentions, are significantly shaped by factors such as the perceived potential for achievement and family business backgrounds. This, in turn, substantiates the Theory of Planned Behavior, suggesting that personal background variables are instrumental in fostering an entrepreneurial disposition, which can subsequently be channeled into entrepreneurial intentions. In the context of the study, the findings of Tong et al. (2011) underscore the importance of understanding factors that foster an entrepreneurial attitude. The results highlight the relevance of individual-level influences such as family background and achievement motivation, which are key variables that can shape entrepreneurial attitudes. This understanding is critical for the analysis of the effects of open data implementation on entrepreneurial attitudes in the specified regions. This could potentially provide insights on how open data implementation might interact with these individual-level factors to influence entrepreneurial attitudes, thereby contributing to the achievement of SDG 8.

Weiss (2015) embarked on an insightful research journey to unravel the factors that drive the intent behind entrepreneurial and creative attitudes. This study targeted Dutch and Indonesian students, establishing a cross-cultural landscape that enriched the diversity of the findings. The research underscored the roles of entrepreneurship education and a desire for success as pivotal elements in the formation of entrepreneurial attitudes that eventually culminate in entrepreneurial intentions. The Theory of Planned Behavior was leveraged to frame these findings, positioning entrepreneurship education as a social background variable that influences behavioral beliefs (attitude), normative beliefs (perception), and control beliefs (ability). Relative to this study, Weiss (2015) offers pertinent insights. The role of entrepreneurial education, as highlighted in Weiss's study, suggests the necessity of understanding the complex interplay between open data implementation and the educational structures that foster entrepreneurial attitudes in the target regions. The study emphasizes the importance of educa-

Figure 1. **Theory of Planned Behavior**

Background factors

Personal
General attitudes
Personality traits
Values
Emotions
Intelligence
Social
Age, gender
Race, ethnicity
Education
Income
Religion
Information
Experience
Knowledge
Media exposure

Behavioral Beliefs → Attitude toward the Behavior

Normative Beliefs → Subjective Norm

Control Beliefs → Perceived Behavioral Control

Intention → Behavior

Source: authors.

tional and motivational factors in shaping entrepreneurial attitudes, which might be relevant when exploring the influence of open data practices on the same. Additionally, the application of the Theory of Planned Behavior could help understand how the introduction of open data can impact social background variables, subsequently affecting entrepreneurial attitudes and intentions. This could provide valuable insights into the ways open data implementation could contribute to achieving SDG 8 in Europe and Central Asia.

Israr and Saleem (2018) embarked on a research investigation to understand entrepreneurial intentions among Italian university students. The crux of their study was to comprehend the reasons behind the inclination of these students toward employment rather than seizing entrepreneurial opportunities within Italy. The study used primary data collection methods and multiple regression analysis to ascertain the key factors influencing these preferences. The findings indicate that family background, entrepreneurial education, gender, extraversion, agreeableness, and openness to experience are key contributors to the development of entrepreneurial attitudes, which subsequently impact entrepreneurial intentions. Interestingly, variables like age, previous academic performance, and neuroticism were found to have no significant influence on entrepreneurship trends in the Italian context. The study accentuates the importance of background factors, including social and personal variables, in shaping behavioral beliefs (attitudes), normative beliefs, and control beliefs (abilities) that drive behavioral intentions in Italy. The findings of Israr and Saleem (2018) contributes significant insights. The study underscores the roles of various factors like family background, entrepreneurial education, personality traits, and gender, which influence entrepreneurial attitudes and intentions. This understanding is instrumental when analyzing how the implementation of open data could interplay with these factors to shape entrepreneurial attitudes in Europe and Central Asia. The highlighted importance of social and personal background variables aligns with the Theory of Planned Behavior, providing a comprehensive framework to analyze the effects of open data implementation on the formation of entrepreneurial attitudes. This could, in turn, provide insights into

how open data initiatives could contribute to the achievement of SSDG 8 in these regions.

In another 2020 study, Manneh et al. (2020) delved into the exploration of factors that shape entrepreneurial intentions among university students in Gambia, Western Africa. The study found that the business environment significantly influences students' attitudes toward entrepreneurial intentions. This finding adds weight to the Theory of Planned Behavior, as it underscores the role of social background variables – in this case the business environment – in shaping behavioral beliefs (attitude), normative beliefs, and control beliefs (ability). The research carried out by Manneh et al. (2020) places emphasis on the business environment as a crucial factor influencing entrepreneurial attitudes and intentions and further highlights the need to consider the influence of external business conditions when examining the impact of open data implementation. It suggests that the effects of open data on entrepreneurial attitudes might not be isolated, but rather intertwined with broader business environmental factors. This understanding can help one analyze how the implementation of open data interacts with the existing business environment in Europe and Central Asia to shape entrepreneurial attitudes and contribute to the achievement of SDG 8. The study reinforces the Theory of Planned Behavior, providing a robust theoretical framework for understanding the multifaceted influences on entrepreneurial attitudes.

Mansour and Omer (2020) delved into the investigation of how societal attitudes and perceptions shape individual behavior within Sudan's entrepreneurial landscape. This research contends that both personal and social background factors spur the formation of attitudes which, in turn, have an influence on entrepreneurial behavioral intentions within the Sudanese context. While this study reinforces the principles of the Theory of Planned Behavior, it does not specifically identify any background elements that contribute to this relationship. The research emphasizes the role of societal attitudes and perceptions, as well as personal and social background factors, in shaping entrepreneurial attitudes and behavioral intentions. This understanding is crucial when examining how the implementation of open data

may interact with societal attitudes and personal and social background factors to influence entrepreneurial attitudes in Europe and Central Asia. Even though Mansour and Omer did not identify specific background elements that contribute to this relationship, their research raises interesting questions about what other factors might be at play, including the potential role of open data. Furthermore, their validation of the Theory of Planned Behavior offers a theoretical lens through which the potential effects of open data implementation on entrepreneurial attitudes can be examined.

Wasilczuk et al. (2021) evaluated the entrepreneurial competencies and intentions of students at technical universities. The research spans five countries – Poland, Ukraine, Latvia, Bulgaria, and Lithuania, thereby providing a number of diverse perspectives. The primary data analysis revealed that the educational framework of technical universities does not inherently discourage entrepreneurial attitudes and intentions. Rather, it was observed that students possessing entrepreneurial attitudes and abilities tend to actively pursue entrepreneurial opportunities and intentions. While this study lends further support to the Theory of Planned Behavior, it does not pinpoint any specific background factor as contributing to this observed relationship. However, the findings of Wasilczuk et al. (2021) offer several valuable insights. The research underscores that the educational framework – in this case, of technical universities – does not necessarily obstruct entrepreneurial attitudes and intentions. This suggests potential for open data implementation within educational systems to influence entrepreneurial attitudes and intentions in Europe and Central Asia, even in technical domains. Additionally, the finding that students with entrepreneurial attitudes and abilities tend to pursue entrepreneurial opportunities and intentions highlights the importance of fostering such attitudes and abilities, possibly through open data implementation. Although Wasilczuk et al. did not identify a specific background factor contributing to the relationship, their research hints at the role of other unexplored factors, potentially including open data, in influencing entrepreneurial attitudes. This validation of the Theory of Planned Behavior provides a theoretical basis for understanding the complex interactions between these factors.

An empirical analysis of these studies shows that it is common to study the impact of background factors on attitude formation and development, from both personal and social perspectives. Studies investigating the information background (via open data) route as a factor inducing entrepreneurship attitudes are rare, indicating a gap in investigating the impact of information variables (sourced from open data) on entrepreneurial intentions. Almost no study has assessed the factors that impact entrepreneurial attitudes across a combination of Europe and Central Asia. As such, this study conceptualizes that open data implementation, as a source of information for potential entrepreneurs, is a potential impacting background factor on entrepreneurship attitudes in Europe and Central Asia, as shown in Figure 2.

This study hypothesizes the following:

H1: Open data implementation has a positive impact on entrepreneurial attitudes in Europe and Central Asia.

Methodology
Research Design

The aim of this study was to investigate the impact of open data implementation on entrepreneurial attitudes in Europe and Central Asia. The research design is based on that described by Saunders et al. (2007). These potential findings aim to provide an opportunity for stakeholders to leverage open data implementation in pursuit of the development of entrepreneurship attitudes in Europe and Central Asia.

To perform an investigative experimental study on this nexus, indexing data for Open Data Implementation and Entrepreneurship attitudes were sourced from 36 countries in Europe and Central Asia. An applicable research philosophy is positivism (the epistemological branch of philosophy). Positivist philosophy supports statistical examinations based on quantifiable observations. This philosophy posits that the result of scientific knowledge derived from a scientific process such as an experiment is valid and acceptable. An experimental research strategy provides a framework for testing the causal effects of phenomena (Saunders et al., 2007). This study experimentally tests the causal effect/relationship between open data implementation (as a data governance strategy) and entrepreneurship attitude. The open data implementation and entrepreneurship index dataset for this experimental test were sourced from the Open Data Barometer (ODB) indexing website and Global Entrepreneurship Development Index (GEDI) website, respectively. Both the ODB and GEDI use a combination of secondary and primary data sources to formulate their indices.

The Open Data Barometer indexing methodology uses a trisecondary data sourcing framework, such as expert surveys, government self-assessments, and secondary data from the UN and World Bank, for its data collection and indexing in pursuit of its open data evaluations. This framework collects 15 types of data from each of its indexing countries, ranging from issues of data availability, format, license, and timeliness to discoverability (WWWF, 2018). On the other hand, the GEDI framework gathers information on the attitudes, abilities, and aspirations of people living in a specific area and compares them to the available resources and infrastructure, such as internet access and transportation to other markets. This GEDI analysis results in 14 factors framework, deployed to evaluate the strength of a country's entrepreneurial environment. Both sets of data cover a 12-months period to create an annual report, making this study's time horizon cross-sectional (Steenekamp et al., 2018).

The quantitative nature of the dataset and the cross-sectional and philosophical paradigm of positivism primes the study of an experimental approach (Melnikovas, 2018). As we aim to validate the hypothesis by assessing the relationship between the variables, this study's reasoning is deductive. Deductive reasoning supports the validation of hypotheses and theories. This form of reasoning denotes general-to-specific reasoning. In contrast, inductive reasoning supports the development of theories.

Figure 2. **Conceptual Framework**

Source: authors.
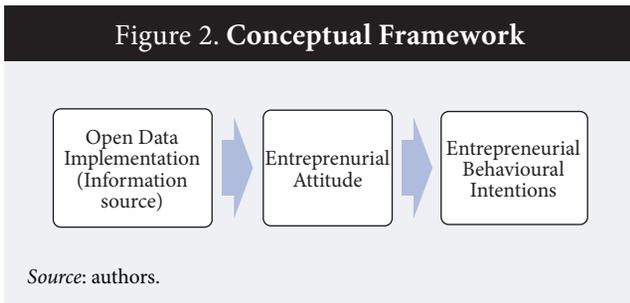
Data analysis – Model Construction

Developing a model to investigate the impact of open data implementation on entrepreneurship attitudes in Europe and Central Asia will be constructed in several stages.

First, matching datasets were selected for the understudied region to meet the correlation and regression requirements for the econometric analysis. Thus, only nations with open-data implementation and entrepreneurship attitude indices in Europe and Central Asia were selected. Countries with no reciprocating index were eliminated to create a balanced dataset for the analysis. This process included 36 European and Central Asian countries suitable for this experiment.

The variables employed in this study are as follows:

1. Open Data Implementation – ODI
2. Entrepreneurial Attitude – EAT

More details on these variables are presented in Table 1.

Second, this study implemented a correlation analysis between ODI and EAT to establish a relationship, if any.

Third, a regression analysis was conducted. This is to determine the causation (cause and effect) relationship between open data implementation and entrepreneurial attitudes in European and Central Asian countries. The ordinary least squares (OLS) model is considered suitable for inferring this relationship because it meets key criteria (Lee et al., 2022).

1. Indication of independent variables (IV) as X and dependent variable (DV) as Y. See Appendix 1[1].
2. The X and Y combinations showed random patterns on a scattered plot. See Figure 4.
3. The skewness of the Y-value falls between − 3 and + 3 and the kurtosis falls from − 10 to + 10. See Table 2
4. Variables should be measured using continuous data. They often carry decimal points, with the number stretching as far out as possible. See Appendix 1
5. Variables should be considered eligible for regression analysis. See Table 3

As such, the regression model is as follows

$$Y = a + bX \qquad (1)$$

where Y is EAT representing the unknown intercept of any country (Entrepreneurship Attitude); a is the intercept; b is the coefficients for every independent variable obtained

from the ODI index; X represents the level of ODI that guarantee a level of EAT

Due to the size of the dataset, regression type and the simplicity of presenting the results, as shown on Appendix 1, Microsoft Excel is used for this study's correlation and regression analysis. An alternative inferential analysis tool is SPSS and Python programming software. Regardless of analysis software, the outcome remains unchanged.

Results and Discussion

Descriptive statistics

Table 2 shows the descriptive statistics indicating a mean of 47.08 with a standard deviation of 18.48 for the independent variable, Open Data Implementation, and 48.43 with a standard deviation of 16.68 for the dependent variable, Entrepreneurial Attitude. This indicates that the average open data implementation index for the 36 countries in Europe and Central Asia selected from the ODB was 47 of 100 in 2016, and the average entrepreneurial attitude index selected from the GEDI for Europe and Central Asia was 48 of 100 in 2016. For both indices, the region was below average. Standard deviation is the amount by which the index differs from the mean value. For this study, the standard deviation is at 18.48 for Open Data Implementation (ODI) and 16.68 for Entrepreneurial Attitude (EAT). With a max of 100 and 87.1 for ODI and EAT, respectively, an empirical review of the nature of the data supports dataset linearity for Pearson correlation.

Standard error was calculated, where the accuracy of a sample mean is 3.09 for Open Data Implementation and 2.83 for Entrepreneurial Attitude. By implication, if several samples from the same population are extracted to calculate the mean, it will produce a mean comparable to the true population mean. A smaller standard error indicates that the sample and its analysis provide a more precise estimate of population value. The median is the midpoint at 46 for Open Data Implementation and 44.7 for Entrepreneurial Attitude.

Kurtosis is the peak sharpness of the frequency distribution curve. When the distribution is too high, the number is greater than +1. For these datasets, it is at 0.94 for Open Data Implementation and -0.76 for Entrepreneurial Attitude, respectively. Skewness is a dataset's measure of sym-

Table 1. **Description of the Studied Variables**	
Indicator	**Description**
Open Data Implementation (ODI)	Measures the availability, accessibility and use of open data in Europe and central Asia
Entrepreneurial Attitude (EAT)	Measures the general sense of a country's population toward recognizing business opportunities.

Note: measurement units for both indicators are from 1 to 100.

Source: (European Commission, 2001).

Table 2. **Descriptive Statistics**		
	ODI	**EAT**
Mean	47.08	48.43
Standard Error	3.09	2.83
Median	46	44.7
Standard Deviation	18.48	16.68
Sample Variance	341.36	288.19
Kurtosis	0.94	-0.76
Skewness	0.31	0.59
Min.	7	23.2
Max.	100	87.1
Source: authors.		

metry (if the number is greater than +1 or lower than –1, the dataset has a substantially skewed distribution). Skewed distributions are also when the data points cluster more toward one side of the scale than the other, thereby creating a curve that is not symmetrical, which means that both the right and left sides are shaped differently. For this dataset, it is 0.31 for Open Data Implementation and 0.59 for Entrepreneurial Attitude, respectively. The lowest values are 7 for Open Data Implementation and 23.2 for Entrepreneurial Attitude and the highest values are 100 for Open Data Implementation and 87.1 for Entrepreneurial Attitude, where the number of observations is 36 for both variables. Thus, it is evident that the dataset similarity meets the requirement for linearity analysis for the Pearson correlation coefficient and ordinary least squares (OLS) model regression.

The graphical representation of the datasets to show their respective nature is as follows:

Lee et al. (2022) indicate that, it is the correlational standard for the outcome to be within the range of -1 to +1, with 0 indicating no correlational significance. +1 indicates a positive correlation and -1 indicates a negative correlation. A positive correlation (+1) indicates that an increase in in the independent v ariable (in this case, ODI) would see a reciprocating increase in the dependent variable (in this case, EAB), and a negative correlation (-1) indicates the opposite. Zero indicates no movement or a connection of any sort between the variables.

For this study, the Pearson correlation value r = 0.57 for ODI and EAB in Europe and Central Asia was used for the 2016 experiment. This indicates a moderately positive (significant) relationship between the ODI and EAT in Europe and Central Asia in 2016. Thus, an increase in open data implementation in the region will lead to an increase in entrepreneurial attitudes in Europe and Central Asia.

Table 4 shows that the R-squared value is 0.32, which indicates that Europe and Central Asia's Open Data Implementation (IV) 2016 explains 32% of the entrepreneurial attitudes (DV). The Adjusted R squared value of 0.30 indicates that additional predictors (variables) would improve the model to determine entrepreneurial attitudes in Europe and Central Asia. The probability value of 0.00 indicates that the overall model is very significant and not subject to chance, and the Durbin Watson Statistics (P-value) of 6.47 indicates

that the sourced data has no autocorrelation of any sort (Lee et al., 2022).

For the model, the beta coefficient value for ODI was 0.45, with a significance probability of 0.00. This finding indicates the positive impact of open data implementation on entrepreneurship attitudes in Europe and Central Asia. A probability of 0% indicates that this is not subject to chance, which is significant. By implication, when the indexing score for ODI increases, entrepreneurial attitudes increase and vice versa. By extension, other factors potentially contribute to the impact of entrepreneurial attitudes in Europe and Central Asia.

Breusch-Pagan Test of Regression Robustness

To check the variance equality, the study conducts a Breusch-Pagan test to assess the error variance of a regression model. Breusch-Pagan test is a statistical test that checks for heteroskedasticity (unequal variance) in the residuals of a regression model (Sahudin, Bahrudin, 2023). For this test, the null hypothesis (H0) of the Breusch-Pagan test is that the error variances are all equal (homoskedasticity) and the alternative hypothesis (H1) is that the error variances are not equal (heteroskedasticity).

For this study, as indicated in Appendix 2, Breusch-Pagan test analysis for this study's regression analysis, indicates a heteroskedasticity as its p-value of is 0.166843021. According to (Zahariah Sahudin, Nur Zahidah Bahrudin, 2023), a p-value greater than 0.05 indicates that the dataset or analysis does not have enough evidence to reject the null hypothesis. In the context of the Breusch-Pagan test, the null hypothesis is that the error variances are equal (homoskedasticity) (see Appendix 2). Therefore, the population does not have sufficient evidence to reject the null hypothesis of

Box 1. **Key Economic Sectors for Open Data Implementation**
1. Map Data
2. Land Ownership Data
3. Detail Census Data
4. Detailed Government Budget
5. Detailed Data on Government Spending
6. Company Registers
7. Legislation
8. Public Transport Timetables
9. International Trade Data
10. Healthcare Performance
11. Primary and Secondary Performance Data
12. Crime Statistics
13. National Environmental Statistics
14. National Election Results
15. Public Contracts
Source: Open Data Barometer (ODB).

Table 3. **Pearson Correlation Coefficient**

	ODI	*EAT*
ODI	1	
EAT	0.565795455	1

Source: authors.

Table 4. **OLS Regression Output**

Variable	ODI
R. Squared	0.32
Adjusted R. Squared	0.30
F-statistics	16.01
Probability (F-statistics	0.00
Durbin Watson Statistics(P-value)	6.47
B (beta)	0.45
Std Error	0.11
t-Statistics	4.00
Probability	0.00

Source: authors.

homoskedasticity. This suggests that there is no problem of heteroskedasticity in this study's regression model's residuals. This is positive for the study, as heteroskedasticity can complicate the interpretation of one's regression results and can lead to inefficient (although still unbiased) estimators. By implication, Open Data Implementation has a statistically significant positive impact on Entrepreneurial Attitudes in Europe and Central Asia.

This study questions the role of open data implementation in shaping entrepreneurial attitudes toward establishing one's own commercial enterprises in Europe and Central Asia.

Open Data Implementation is the extent to which data are accessible, timely, and published by each country's government in 15 key economic sectors. Entrepreneurial Attitude refers to the overall perception of a country's population regarding identifying potential opportunities, having personal connections with entrepreneurs, holding entrepreneurs in high esteem, being willing to take on the risks that come

with starting a business, and possessing the necessary skills to successfully establish and operate a business. The analysis of secondarily sourced data shows a 57% positive relationship between Open data implementation (ODI) and Entrepreneurial Attitude (EAT) in Europe and Central Asia. This indicates the degree to which open data implementation and entrepreneurial attitudes moved in the same direction in Europe and Central Asia. This study's findings also show a regression relationship to the tune of 32% between open data implementation (ODI) and entrepreneurial attitude (EAT) in Europe and Central Asia. By implication, data that are accessible, timely, and published by each country's government in the 15 key economic sector have a strong positive relationship and positively impact the general sense of a country's population toward recognizing opportunities, knowing entrepreneurs personally and attaching high status to entrepreneurs, accepting the risks associated with a business start-up, and having the skills to successfully launch businesses by 32%.

This study hypothesis as follows, (H1): *Open data implementation has a positive impact on entrepreneurial attitudes in Europe and Central Asia*. This study accepts H1. This study also aims to numerically measure this impact. The results indicated an impact of 32%.

Conclusions and Recommendations

This study supports the findings of open data report emphasizing the need for improved open data initiatives in the Europe and Central Asia (WWWF, 2018; Davies, 2013, 2015). It also validates the findings of Ekundayo et al. (2023). Ekundayo et al. (2023) posit that the most important principle any data governance framework or its related initiative like open data should have is data transparency. According to the findings of Ekundayo et al. (2023), this impact could potentially contribute to economic development by 12%. Policymakers can leverage this insight into the development and deployment of open data or related policies, principles, and frameworks at the state level (Ekundayo et al., 2023). This will help shape entrepreneurial attitudes toward success in the region. Practicing entrepreneurs can also use this approach to shape their human capital attitudes by ensuring continuous and consistent open data implementation at the business level.

Figure 3. **Scattered Plots**

Source: authors.
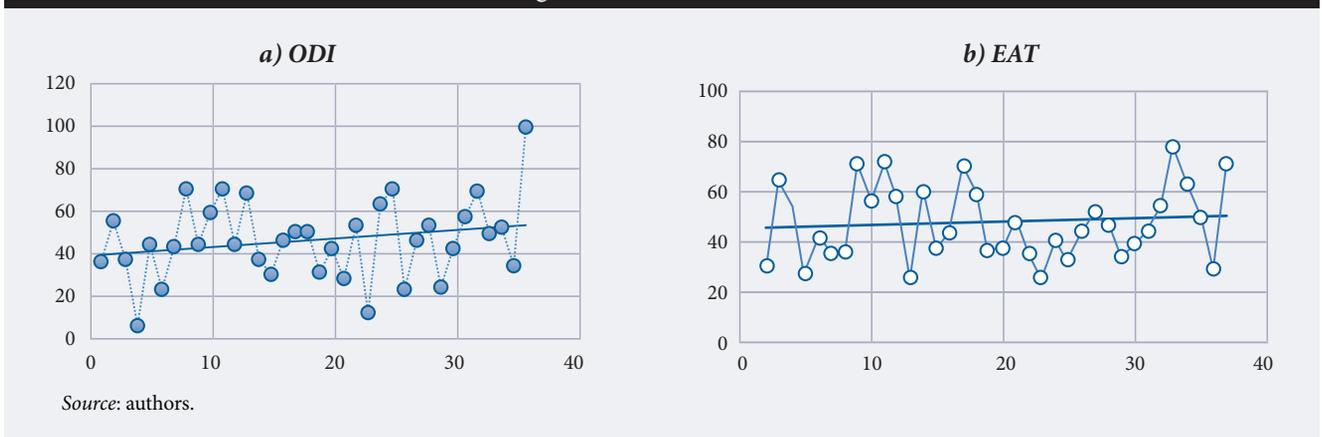
This will help the team recognize opportunities and be sensitive to entrepreneurial risk while developing much-needed skills for corporate entrepreneurship (Ekundayo et al., 2023).

Based on these findings, this study recommends the deployment and optimization of open data implementation for the change in entrepreneurial attitudes in pursuance of the updated Lisbon strategy, SDG 8.1 objective as well and other economic development initiatives. According to the Open Data Barometer (ODB), reports on Open Data Implementation (ODI) must be published in the 15 key economic sectors listed at Box 1.

According to the Global Entrepreneurship Index (GEDI, 2018), entrepreneurial attitudes are impacted by:

1. The perception and potential of entrepreneurial opportunities within a country's population is known as opportunity perception.
2. Start-up skills perception in a population by comparing the quality of education to determine the entrepreneurial potential.
3. The measure of the inhibiting effect of fear of failure on entrepreneurial action in a population, combined with the country's risk.

4. Attitude of potential or practicing entrepreneurs towards accessing resources and opportunities, as well as the ease of communication among them.
5. The way a country's residents perceive entrepreneurs is referred to as cultural support.

A key limitation of this study is the cross-sectional nature of the experimental datasets. This limited the data sources to those covering 2016. However, this study recommends further experimental investigations using a more recent dataset. In addition, a study's research methodology or design could share insights on the nexus of open data implementation and entrepreneurial attitudes in Europe and Central Asia.

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