



Linkages between PISA Results and E-Working

Jozef Hvorecký¹, Michal Beňo^{1*}

¹*Institute of Technology and Business in Ceske Budejovice, Ceske Budejovice 370 01, Czech Republic*

Abstract

The PISA tests are considered as a quality measurement for education. If it is so, then their high results might influence the proportion between blue and white collars. As the intellectually demanding functions can be more easily executed over the internet, in a long term, this fact should be reflected in a growing proportion of e-working. To study this assumption, we examine adopting e-working within selected thirty-five countries. Research questions were formed as follows: Is there a demonstrable influence of favorable PISA results on the overall rates of e-working in certain states? Is it possible to sustain different components with e-working? Can appropriate e-working legislation contribute to the overall rates of e-working at a state's level? Our study adopted Spearman's Rho correlation using 4 numerical variables to measure the strength of association between pairs of variables – the proportion of e-working and four country's PISA averages in Mathematics, Science, Reading and Financial Literacy. Its results indicate a positive correlation: the probability of e-working increases with the PISA results growth. Further, Qualitative Content Analysis was used. Based on our data e-working will not go away and it is time to update law on e-working. Governments should formalize rights and duties. Face-to-display work is likely to be an unstoppable evolution at workplace. These components affected higher e-workability. These results draw attention to how e-working is becoming major element in common life with some challenges and difficulties and that we need to study these two influencer factors in order to optimize its arrangements.

Keywords:

E-working;
PISA Results;
Legislation;
Correlation;
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1- Introduction

The detachment of work from place is a growing trend [1] but e-working progressed slowly and unevenly before the Covid-19 explosion [2]. Dingel and Neiman (2020) [3] suggest unequal opportunity impacting some industries and regions while leaving others unscathed. The growth rose on both part-time and full-time basis, hybrid or fully. Suddenly, the pandemic shut down businesses and schools. The hygienic regulations implemented social distancing to workforce and students. Some of them have thrived in this face-to-display situation, others have struggled and some still continue to struggle. Similarly, some parents have embraced remote learning, while others remain concerned about their children's education and emotional well-being.

A recent JRC study provides a rough estimate of around 25% of employment in teleworkable sectors in the EU as a whole [4]. E-working situations depend directly on the industry and specific job requirements allowing completing the assigned tasks. Data show that in Australia 41% of full-time and 35% of part-time jobs can be done from home [5].

Hatayama et al. (2020) [6] findings indicate the amenability of jobs to working from home increases with the level of economic development of the country. Middle-income countries see the largest declines as they feature a relatively large share of employment in non-essential sectors and a relatively low work-from-home ability [7]. Additionally, an

* **CONTACT:** Beno@mail.vstebc.cz

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IMF study highlights the dependency between the level of economic development and the ability to work remotely. This suggests that workers in emerging and developing economies could face daunting challenges in continuing to work during periods of hard lockdowns [8]. Further findings indicate that the extent to which jobs are amenable or responsive to being done from home increases with the level of economic development of the country [9]. It seems that, in general, countries with higher GDP per capita also tend to have a higher share of teleworkable jobs [10]. Nicholas (2009) [11] found that the level of education had a significant association with an interest in e-working: “Partial support was found for the effect of autonomy and work/life balance toward the preference to telework.” Men were more interested in teleworking than women [11]. Anghel et al. (2020) [12] emphasize that not all workers are going to be able to take advantage of e-working arrangements since those with a lower level of educational attainment will find it difficult to be able to benefit from them. Possibly, they miss direct instruction and control because the 2018 Future Workforce Report says that “nearly 63% of companies today have remote workers, yet a majority lack remote work policies” [13]. Prior the hit of the pandemic, e-working was relatively unusual in European Union and therefore largely unregulated.

At the same time, Seneca said: “Luck is what happens when preparation meets opportunity.” Based on his quote, one can estimate that countries with more relevant education and legislation were prepared better and struggled less. As a result, the effect of e-working on education and legislation received limited attention. The main goal of this paper was to examine the conditions for the successful implementation and expansion of e-working within selected countries. First, we study whether the PISA (Program for International Student Assessment) 2018 results relate to the spread of face-to-display work. In particular, the correlations of e-working intensity with the PISA subjects were used to find answers to the following research questions: Is there a demonstrable influence of favourable PISA results on the overall rates of e-working in certain states? Is it possible to sustain different components with e-working?

Then, Qualitative Content Analysis (QCA) was used to find an answer to the next question: Can appropriate e-working legislation contribute to the overall rates of e-working at a state’s level?

The second section provides an account of the concept of e-working. The third one outlines the methodology used in this research. The fourth section gives a short overview of our results and the ways to them. Then a section presenting our discussion and research limitations follows. The last one presents conclusions.

2- E-working: Conceptual Framework

Telecommuting was first introduced by Jack M. Nilles in 1970s [14]. The main driver was then to let employees save costs of commuting to work [14-15]. Later, working at home was linked with the savings of gasoline [16]. In this vein, Zhang et al. (2020) [17] affirm telework as the traffic demand management policies to mitigate congestion during rush hours and decrease work-related trips. Recent paper work discusses the potential advantages and disadvantages of e-working [18]. E-working is not only economically essential (triple win option [18]) it is a helpful tool in Covid-19 times and future pandemics. Similarly, latest data indicate a positive acceptance of work-from-home concept by the people [19]. There is still no uniform definition of teleworking/telecommuting. The classic definitions of teleworking are outdated being too narrow or explicit [20]. There are broader approaches of this kind of work, some requiring specific regularity and location, while others are fairly traditional about regularity and location. The concept of ICT (information and communications technology) enabled work from afar or telework, also known as remote work, virtual work or telecommuting [21]. “Since the idea of telecommuting has been around for decades now, it makes sense that new words and phrases would come to replace what is, in theory, a not-so-new workplace concept” [22]. Beno and Hvorecky (2021) [23] describe e-working concept as method of working by making use of ICT technology in a situation in which the work is not bound to any particular location.

We define e-working as performing job-related activities outside the office premises using the electronic data transfer to the head office, customers or business partners. According to Nilles (1994) [24] telework includes more than just working at home and communicating with the office via telecommunication tools, for example working in work centers (an office area for employees from several companies) in the teleworkers neighborhood or in satellite offices (office of the company located in an area where there is a concentrated number of its teleworkers). Kurkland and Bailey (1999) [25] define the four different teleworking types as follows: (1) The Home Office, (2) The Satellite Office, (3) The Neighborhood Work Center and (4) Mobile Working. Thus, face-to-display work can be located at any distance from headquarters, work center, during a travel or in the virtual world.

There are four factors that influence telework [26]: individual factors, job factors, organizational factors, and family/home factors. Belzenegui-Eraso and Erro-Carcés [27] add technology because technology infrastructure is necessary while e-working. Different authors pay different attention to them. The War for Talent [28] changed how companies manage talent worldwide because the skilled talents are a critical driver for corporate performance. The rise of e-working in this way relates to low unemployment, especially of knowledge workers [29]. The rising costs of living with no additional value play their role, too [30]. The increasing commuting distance is the next element. In 2018, more than 1 in 5 European workers will spend 90 minutes or more of their time on their way to and from work. On average, European workers spend 1 hour and 24 minutes a day commuting, travelling 28.56 km in total [31]. 70% of Europeans

think their commute has a strong ecological footprint with the cars being the kings of the commute [32]. Moreover, Millennials are growing up [33], moving out and boomeranging back [34]. As stated by Beno and Ferencikova (2019) [33] technology, global changes, globalization and Generations Y and Z have an immense influence on the employment picture, which is changing very fast.

3- Research Methodology

Figure 1 presents the flowchart of the research methodology used in this study. Our research is based on processing secondary data and deriving relevant conclusions.

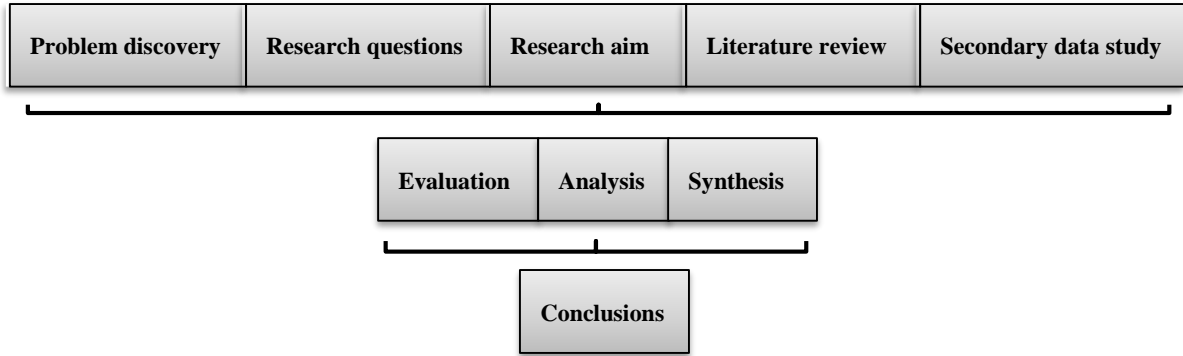


Figure 1. Flow chart of the research methodology.

The descriptive statistics method was used to analyse and to describe the basic features of the data in developing results and drawing conclusions, and the information processed in Table 1 was identified and summarised. Examined data in cross-tabulation between categorical variables of e-working in 2018 [2] and Pisa results from 2018 [35] were evaluated. Financial Literacy was not tested in all surveyed countries due to its voluntary character.

Table 1. E-working Ratio (2018) and PISA Results (2018).

Country	E-working in %	Mathematics	Science	Reading	Financial literacy
Austria	10.0	499	490	484	
Belgium	6.6	508	499	493	
Bulgaria	0.3	436	424	420	432
Croatia	1.4	464	472	479	
Cyprus	1.2	451	439	424	
Czechia	4.0	499	497	490	
Denmark	7.8	509	493	501	
Estonia	7.6	523	530	523	547
Finland	13.3	495	493	493	537
France	6.6	495	493	493	
Germany	5.0	500	503	498	
Greece	2.0	451	452	457	
Hungary	2.3	481	481	476	
Iceland	6.5	495	475	474	
Ireland	6.5	500	496	518	
Italy	3.6	487	468	476	476
Latvia	2.9	495	487	479	501
Lithuania	2.5	481	482	476	498
Luxembourg	11.0	483	477	470	
Malta	5.8	472	457	448	
Montenegro	6.4	430	415	421	
Netherlands	14.0	519	503	485	
North Macedonia	1.9	394	413	393	
Norway	5.5	501	490	499	
Poland	4.6	516	511	512	520
Portugal	6.1	492	492	492	505

Romania	0.4	430	426	428	
Serbia	3.3	448	440	439	444
Slovakia	3.6	486	464	458	481
Slovenia	6.9	509	507	495	
Spain	4.3	481	483	506	492
Sweden	5.3	502	499	506	
Switzerland	4.1	515	495	484	
Turkey	2.2	454	468	466	
United Kingdom	4.4	502	505	504	

To determine the existence of dependency between e-working and individual dimensions, Spearman's rank-order (nonparametric) correlation was applied measuring the strength and direction of relationship between two ranked variables. To disclose these potential correlations, answers to the next research questions were sought: Is there a demonstrable influence of favorable PISA results on the overall rates of e-working in certain states? Is it possible to sustain different components with e-working?

In the next step, we applied a qualitative content analysis (QCA) to find an answer for next research question: Can appropriate e-working legislation contribute to the overall rates of e-working at a state's level? There are many definitions of QCA. For the purpose of the current paper, we apply the QCA definition being "the systematic reduction of content, analysed with special attention to the context in which it was created, to identify themes and extract meaningful interpretations of the data" [36]. We have looked for a relationship between higher positions in the e-working saturation and the presence of legal guidance of countries where such legislation was introduced prior to the pandemic.

4- Findings

4-1- Correlations Results

The purpose of conducting this analysis was to prove the different rate of e-working in the surveyed thirty-five countries and the e-workability of each component. Table 2 shows Spearman's Rho correlations that test relationships among the study variables.

Table 2. Correlations results

		Mathematics	Science	Reading	Financial literacy	% e-working
Mathematics	Correlation Coefficient	1.000	0.926**	0.813**	0.886**	0.624**
	Sig. (2-tailed)	---	0.000	0.000	0.000	0.000
	N	34	34	34	11	34
Science	Correlation Coefficient	0.926**	1.000**	0.898**	0.973**	0.595**
	Sig. (2-tailed)	0.000	---	0.000	0.000	0.000
	N	34	35	35	11	35
Reading	Correlation Coefficient	0.813**	0.898**	1.000**	0.870**	0.544**
	Sig. (2-tailed)	0.000	0.000	---	0.000	0.001
	N	34	35	35	11	35
Financial Literacy	Correlation Coefficient	0.886**	0.973**	0.870**	1.000**	0.761**
	Sig. (2-tailed)	0.000	0.000	---	0.000	0.007
	N	11	11	11	11	11
% e-working	Correlation Coefficient	0.624**	0.595**	0.544**	0.761**	1.000**
	Sig. (2-tailed)	0.000	0.000	0.001	0.007	---
	N	34	35	35	11	35

** Correlation is significant at the 0.01 level (2-tailed).

An overview of results data reveal moderate strong positive correlation (data marked in yellow). It means that link is strong, those data are linked and increase together. Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Iceland, Ireland, Malta, Norway, Portugal, Slovenia and Sweden are seen to provide better performers in the triennial PISA, therefore higher rates of e-working (over 5%). This also confirms data from US News of Best Countries for Education [37]. Interestingly, the US News Best Countries list ranks United Kingdom an overall #2 for Education, but has lower (4.4%) ratio of e-working. Mas and Pallais [38] emphasize that college graduates have a 28% point higher rate of homework. The higher education system experienced significant changes [39]. Technological advances and competitiveness resulted to workforce being available anytime [40-42]. Similarly to Abulibdeh (2020) [43] who emphasize that the difference in adopting and implementing teleworking between countries is the differences in technology (digital divide) and the economic characteristics (postindustrial, industrial, transitional, or developing) of these countries. Obviously, low adoption of ICT, low rates of educational attainment [44-45] is linked in adaptation of e-working practices.

Our data confirm the statement of Anghel et al. (2020) [12] that higher education means higher share of e-workers. Further research confirms that higher-paying jobs that require more education have a higher capacity to become remote jobs, highlighting concerns about inequality [46]. Lund et al. [47] found that the potential for remote work is highly concentrated among highly skilled, highly educated workers in a handful of industries, occupations, and geographies. Education level also has a high impact on a worker's likelihood of working from home. Based on recent data, "among 25 and over, those with an advanced degree were more likely to work at home than were persons with lower levels of educational attainment, 42% of those with an advanced degree performed some work at home on days worked, compared with 12% of those with a high school diploma and no college [48]." In pre-Covid time, remote work in America was a luxury reserved for just 7% of the workforce, mostly highly educated and highly paid knowledge workers [49]. Recent study discovers that those who are not able to carry out their work duties remotely are more likely to lose their occupation [50]. Yassenov [51] further adds that immigrants, younger adults, and those who are with lower levels of education are less likely to do their tasks remotely.

Romans' [52] perspective to Covid-19 pandemic time is viewed as an option to activate students perception about the world they live in, its interlinking, and consider a myriad of questions to help young people to recognize and evaluate the potential impacts they might see from a community that works and educates itself remotely. The educational sector has been impacted by Covid-19 at all levels, from preschool to tertiary education [43].

4-2- Qualitative Content Analysis

Since the outbreak of Covid-19 pandemic, many employers and employees have converted to full-time or hybrid (partly remote and partly in the office) e-worker status. Some of them still remain in that status in which fully in-person and e-work will be two ends of a fluid spectrum of work options and anticipate continuing working remotely. In some cases, e-working employees' homes are in different jurisdictions than their assigned offices. Numerous employers are more likely to have e-workers who live in different states. In other words, taking inventory of each e-worker and the jurisdictional implications for each state involved.

Before discussing the legal issues related to e-working, a global survey found that Finland, Sweden, Australia, Thailand, New Zealand, the Netherlands, Switzerland, the United Kingdom, the United States and Ireland were offering highest workplace flexibility [53]. Legislative approaches to workplace flexibility vary across countries [54]. In Table 3 we summarized some of the important Flexible working policies (FWP) for regular employees in Europe.

Table 3. Flexible working policies for regular employees.

Country	FWP	E-working %
Finland	Working Hours Act (605/1996) has empowered Finns to adjust their working day by starting or finishing up to three hours earlier or later [55].	13%
Netherlands	Flexible Work Act (2016): Employees with at least 26 weeks of service who work for a company of 10+ employees have the right to ask for a change, increase, or decrease in their working hours as well as the ability to work from another location [56].	14%
Norway	Working Environment Act (2006) establishes the right to flexible working hours if this can be arranged without major inconvenience to the employer [57].	5%
Italy	Legge 22, n.81 (2017) regulates "smart working (lavoro agile)" and establishes the equality of workers performing the same duties, even if done remotely [58].	3.6%
Luxembourg	Two main legal sources: A framework agreement at European level (2002) and A Grand Ducal Regulation of 15 March 2016 making mandatory the agreement by and between the social partners [59].	11.0%
United Kingdom	The Fair Work Act (2009): All employees that have worked for the same employer for at least 26 weeks may "make a statutory application" for flexible working [60].	4.4%

In Table 3 we present countries which started building their legislative support prior to the pandemic. Its middle column indicates the year when the law was published and its outline. The right column shows the proportion of e-working (copied from Table 1). The median of the particular column in Table 1 is 4.6. With the exception of Italy, all countries are above the median. Possible explanation is "managerial culture" as stated by Durieu. She further explains than in the Nordic or Anglo-Saxon countries, including Belgium, cultivate management by objective. In Latin and Eastern countries, a culture of the face-to-face work is preferred. In other words managers have the impression that employees do not work if managers do not have them in front of them [61].

Nordic countries (Finland, Denmark and Sweden) have a legacy of encouraging work-life balance and flexible working policies [62]. Finland has always been ahead of the flexible working policies among European countries. It passed a law in 1996 requiring companies to provide their employees with a start time and end time that is flexible within three hours to accommodate family and personal obligations. Due new Working Hours Act which came into force in 2020, gave the majority of full-time employees the right to decide when and where they work for at least half of their working hours [63]. Finnish economy survived the coronavirus crisis better than expected [64] and a million Finns started working from home like it is business as usual [65].

As for many countries, different European countries have recently seen a marked increase in the number of e-workers as part of social distance and curb the Covid-19 pandemic. As the Covid-19 crisis makes a pressure on governments, there are legal initiatives that will likely increase the proportion of e-working after the pandemic end.

Germany desires to offer employees a legal right to work from home [66]. With the new law, which is in the drafting process, Germany wants to legalize that right to work remotely and enact regulations to bring structure to this new and at-times nebulous way of working [67, 68].

In Spains' Royal Decree-law 28/2020 [69] are still some areas where the decree does not provide the level of detail and clarity that employers might reasonably expect to help them to implement these arrangements in practice. First key aspect is its definition. Further, the main thrust of the decree is to require remote working arrangements to be formalized through written agreements. Second key aspect is voluntariness. The decree makes clear that remote working must be voluntary for the employee and that any refusal to work remotely will not justify the termination of that individual's employment. The law applies only remote working that is carried out on a regular basis. Remote working will only be "regular" if over any three months at least 30% of the employee's total hours are carried out remotely. Third key aspect is the equal rights as face-to-face workers. Remote employees shall have the right to exercise their collective rights as the rest of the employees.

Additionally, the rule concerning hardware has changed. While, in the case of regular teleworking, the employer is still obliged to provide an employee with tools needed for the job (an internet connection, for example) hybrid solutions may be decided in the case of exceptional practice (less than 10% of the annual time), to avoid doubling costs. The right for the employer to inspect the workplace of his employee, considered invasive, has been abolished. The newest laws is neither a right, nor an obligation, but remains on voluntariness [70].

5- Discussion

E-working has been broadly adopted globally during the pandemic. The spread of relevant legislation indicates that trend will remain a key component of the post-pandemic workplace. To follow Seneca's suggestion, all country parliaments should examine promptly whether it is actually subject to potential jurisdiction for legal claims in each state where it has an e-employee. The question is whether they can equally fast also facilitate their education systems to support the same direction.

Our data show that education and rate of e-working correlate. Finland scores for a high educated population, is one of the top performers in PISA, has one of the highest e-working rates. Some countries follow the Finns' way but most European countries do not. Still, there is a rather strong positive correlation in Mathematics and Science. The Reading skills are also supportive but not as big as the previous ones. The relation to Financial Literacy seems to be the strongest one. Unfortunately, the number of countries is not sufficient for building a strong argument.

Let us revert to the questions: Will we think differently about online learning? Will online learning be proactive Trojan horse for university-business collaboration? [71]. Based on Clancy [72] those with the skills to work in the knowledge economy largely reside in cities, since that is where the jobs are. To skill up the kind of people who would most benefit from remote work, we need to offer online degree programs. The author further emphasize that the kinds of students who excel at online education are more likely to excel as remote workers too [72]. The next question is, would move to more e-working enable others to spend more time differently? Can the resources that will be saved by having fewer offices be invested back into education? And how much money would be saved? Recent study stress that firms expect working from home to triple [73].

Will e-working become the norm? On a regular basis or not occasionally? At home or any other place? Will the next world be built outside the cubicles? Sectors that do not require the employee's physical presence have combatively adopted e-working in knowledge-intensive sectors and in industries with well-understood processes. Germany is going to introduce of a minimum of 24 days of Home office [74]. Change has been made also in Spain where the culture of e-working was almost absent before Covid-19. In Austria Home office rules will be presented in March 2021 [75]. In many countries around the world, the Covid-19 health crisis has prompted a rethinking of the implementation of e-working, often with reservations despite the health situation. Full-time employees were allowed to carry out their tasks from home. But there are concerns that the shift away from the salaryman model will experience problems [76]. Generally, it is still a long way to go to make e-working a universal rule.

6- Conclusions

The main research questions investigated in this paper are:

RQ1: Is there a demonstrable influence of favourable PISA results on the overall rates of e-working in certain states? Is it possible to sustain different components with e-working?

Data reveal moderate positive correlation. It means that relationship is present, the studied data are linked and increase together. Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Iceland, Ireland, Malta, Norway, Portugal, Slovenia and Sweden are seen to provide better performers in the triennial PISA, therefore higher rates of e-working.

RQ2: Can appropriate e-working legislation contribute to the overall rates of e-working at a state's level?

Yes, Nordic countries (Finland, Denmark and Sweden) have a legacy of encouraging work-life balance and flexible working policies. Moreover, the countries posing their legal standards soon will occupy position in the higher half of ranking.

Whether motivated by higher productivity, employees' well-being, cost reductions, health issues or other motives almost every industry will adopt Face-to-Display work but the question remains when. Currently, the pandemic is forcing every industry to adopt some form of flexibility, not always leading to the best results. Sometimes employee morale suffers. Other times the process performance suffers. Authors of the paper see education as the best tool to combat anti-face-to-display policies. Generally, some of the education system has years of experience in optimizing distance education with know how it works and how to do it. Authors stress that these experiences of online education managing provide some insight into the potential of e-working.

Just like online learning, e-working means giving up daily interactions with people who are working in the same position. In higher education, we have seen that for some types of students (especially for adult working professionals), combined (onsite and online) learning and solely online learning is preferred as only possibility to complete or continue courses or education. For some students, such as recent high-school graduates, an experience of learning and living in campus is preferential. Education especially online learning gives students greater flexibility in what classes they can take, when they can take them, and where they have to be in order to take them. Compared to face-to-face to face-to-display discussions through available ICT those interactions can take still place. As with education, e-working may not be most appropriate solution for every occupation. It depends on skills, sort of work and who is doing it.

Also, the cultivation of management by objective seems to play its role here. In other words, managers' impression that employees do not work if they do not have them in front of them seems to be reverting. It is time to update laws on e-working policy. Can other countries implement Finland's e-working best example? In few words, a new ecosystem is needed to create best in class working environment and education.

Contributions in this paper work can lead to new lines of inquiry in the area of e-working and education. Several new questions emerge: Disruption in work environment and education accelerated by Covid-19 but is there more work to be done? How education and e-working may go best in class? Both work and education's new normal will be hybrid, more virtual?

This research has so far highlighted some limitations. Firstly, we are considering only linear relationships. There may be variables other than x that have not been studied, yet do influence the response variable. A strong correlation does not necessarily only imply a cause and effect relationship. Moreover, it is the generality of the findings in correlational research. Further, Spearman's rank correlation is not as precise as the common method. This is due to the fact that all the information concerning the data is not utilized. Finally, missing data of financial literacy from other countries for building strong arguments.

7- Declarations

7-1-Author Contributions

M.B. conceived of the presented idea, was engaged in the investigation, literature search and selection, verified the analytical methods, writing original draft, preparation, and finishing the last version. J.H. was involved in proof reading and contribution to the last version. All authors discussed and derived the results and contributed to the final manuscript.

7-2-Data Availability Statement

The data presented in this study are available on request from the corresponding author.

7-3-Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7-4- Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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