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Cleantech: State of the Art and Implications for Public Procurement

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This paper explores opportunities for utilising cleantech in framing research on sustainability-oriented innovations in public procurement. Research objectives include a critical examination of whether cleantech is a distinct sector through a systematic literature review and synthesis of findings with public procurement research. The final analysis involved 31 peer-reviewed academic papers along with additional publications obtained with the snowball-approach. The results suggest that cleantech could be used to analyse sustainability related research in the public procurement context. Cleantech is also helpful in enhancing research on public procurement of innovations and addressing societal benefits through local development. Findings unveil new opportunities in investigating better access of SMEs to public contracts through intermediaries, networks, and public-private partnerships. This paper is the first academic paper to analyse academic cleantech literature and link cleantech and public procurement fields. Such an approach is helpful in framing sustainability in public procurement research and stresses new ways of involving SMEs in public contracts.

Key Words: cleantech, innovation, public procurement, sustainability
JEL Classification: H57, Q56

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Introduction

A gradual increase in using management fads and different concepts originating from practitioners has become a natural tendency among the academic community. Some concepts have indeed carved a niche in academia, while others are under discussion as to whether they represent new valuable techniques or are just new terms that relabel existing phenomena. 'Cleantech,' which did not exist as a concept before early

2000s, emerged and gained momentum as a socio-technical sector encompassing an immense range of environmental technologies and services (Caprotti 2012). While the term is being widely used in the industry, cleantech as a concept is still overlooked by scholars, especially in comparison with other recent trends in technology and management, such as blockchain.

In the meanwhile, public procurement, originally evolving as an operational activity, has itself become an academic discipline. Defined as 'the designated legal authority to advise, plan, obtain, deliver, and evaluate government's expenditures on goods and services that are used to fulfil stated objectives, obligations, and activities in pursuant of desired policy outcomes' (Prier and McCue 2009, 329), public procurement has been used as a strategic lever towards achieving specific economic, political, and social goals, which can be traced back to the 19th century (McCrudden 2004). Scholars have acknowledged the relevance of public procurement as a tool for stimulating markets and increasing demand for innovative solutions in general (Guerzoni and Raiteri 2012; Hommen and Rolfstam 2009), and reducing environmental impact by transition to low carbon procurement (Correia et al. 2013) as well as influencing markets of green and environmentally friendly products and services (Cheng et al. 2018). Purchasing, used throughout this study synonymic to procurement, is considered the most feasible process of supply chain management to incorporate a sustainable agenda (Ashby, Leat, and Hudson-Smith 2012). Notwithstanding the various benefits society can obtain by economic utilization of taxpayers' money, there are still challenges prevailing in the context of public procurement research. To date, public context and related policies add considerable complexity in assessing both economic and environmental aspects of procurement (De Giacomo et al. 2018). Despite increased academic attention to the field (Eßig and Glas 2016), the findings accumulated to date are rather dispersed (Snider and Rendon 2008; Telgen, Harland, and Knight 2007; Thai 2001; Uyarra and Flanagan 2010). However, there is an indication of shortages of green (Testa et al. 2016) and innovative (Uyarra and Flanagan 2010) public procurement literature, whereas evidence on innovative effects of public procurement is fragmented (Georghiou et al. 2014). In the light of the lack of both theoretical- and empirical-based research, more specific and systematic studies on the appearance of sustainability in public procurement research are required (Cheng et al. 2018).

Cleantech tends to be discussed on various levels. In practice, policy-

makers recognise and employ the concept. Examples include the Finnish government's resolution on promoting cleantech solutions through public procurement and recommendations for municipalities on its adoption (Ministry of the Environment 2013), and setting up a Government Programme to become a pioneer in cleantech, and the circular- and bioeconomy (Prime Minister's office 2015). Despite the relevance of interconnecting cleantech and public procurement, such a research direction has not yet been explored widely, with only one scholarly paper (Alhola and Nissinen 2018) containing 'cleantech' and 'public procurement' as the keywords, unveiling the evidence of successful cleantech cases in innovative public procurement, and focusing on practical implications.

This paper, therefore, strives to systematise insights examining cleantech literature and research, considering the potential of cleantech and its presence in governmental agendas. An assumption is that cleantech can take the role of a tool transferring general sustainability goals into more measurable metrics, which is one of the biggest challenges in contemporary public procurement research (Cheng et al. 2018; De Giacomo et al. 2018) and framing the research on public procurement of innovations (PPI).

This paper has two main objectives. Firstly, the aim is a critical overview of whether cleantech is an independent sector, as specified by some scholars (see Caprotti 2012). For this purpose, underlining prevalent definitions, determining the boundaries of a sector, and examining interrelations with other sustainability-related terms will be done by systematic review of academic literature. Secondly, research agenda and specific directions synthesising the key features of cleantech and public procurement streams of literature will be outlined.

The paper is structured as follows. An overview of the interrelation between public procurement and innovations will initiate the paper, followed by methodology. Consequently, key findings from selected cleantech-related literature according to the main objectives will be presented. Finally, these insights will be applied to the field of public procurement in order to depict further research directions.

Public Procurement, Innovations, and SMEs

This section demonstrates the interrelation between public procurement, stimulation of innovations and the specific role of small- and medium-sized enterprises (SMEs). These insights will then serve as a prerequisite for consequent mapping of the systematic literature review findings.

The notion of positive impact public procurement on innovations is not new, as it originates in the 1970s (Edler and Georghiou 2007). The emphasis of policymakers has been put on the potential of public demand to stimulate innovation development, new technologies diffusion and commercialization (Uyarra et al. 2017). Public policy is defined as all direct and indirect state actions that have an impact on citizens (Snider and Rendon 2008), and innovative public procurement represents only one type of governmental innovative public policy instrument. Research and Development (R&D) subsidies, along with universities and research units, are the direct governmental instruments, while public procurement and regulations are the demand-side tools (Aschhoff and Sofka 2009). R&D subsidies are a recognised alternative to innovative public procurement (Guerzoni and Raiteri 2012); however, from the long-term perspective, public procurement shows more efficiency in stimulating innovations than direct R&D investments (Edler and Georghiou 2007). 'Pulling' innovations by creating demand and markets for further commercialising has proven more efficient than directly 'pushing' these technologies to markets with a lack of demand.

Taxonomic issues of innovative public procurement have been discussed widely. Uyarra and Flanagan (2010) highlight the homogeneity of academic attempts towards classification that consolidate current products and services and advances in transmission of existing services. Research streams and topics related to the synthesis of public procurement and innovation on a global scale have been further categorised by Obwegeser and Müller (2018) as Public Procurement for Innovation (PPFI), Public Procurement of Innovation (PPOI) and Innovative Public Procurement (IPP). Intensity of public demand and tendencies to procure innovative products and services (Hommen and Rolfstam 2009) also implicitly affects the innovative agenda of companies by cherishing modernisation of current products and services despite existence of public orders. Furthermore, project volume, technological ramification and legal barriers ought to be considered and analysed adequately within any specific context. However, Chicot and Matt (2018) differentiate between catalytic PPI, whereby innovation development and diffusion are enhanced, and diffusive PPI, which boosts innovations uptake without addressing supply-side disruptions. Similarly, Gee and Uyarra (2013) discuss the important role of public procurement, specifically in local contexts, and the impact of power asymmetry on system innovation orchestration, while Uyarra et al. (2017) pinpoint the thin line between regular and innovative

public procurement, as in practice the concepts do not represent anything notably different. The reviewed research indicates cities and municipalities as platforms of public procurement capable of creating new markets. Such platforms are more attractive for piloting and experimenting new solutions. Likewise, an innovative agenda is applicable to green public procurement (GPP), in which incorporation of environmental criteria to public products and services is the cornerstone. GPP can boost innovations by setting environmental criteria for public procurement, though recent findings indicate an absence of both theoretical and empirical investigations on the topic, as well as a lack of attempts to connect it to cleantech (Cheng et al. 2018). Thus, GPP and PPI do not represent different concepts, as they complement each other.

The above-mentioned parallel is particularly relevant from the perspective of small- and medium-sized enterprises (SMES), whose higher innovative performance correlated with public sector demand (Saastamoinen, Reijonen, and Tammi 2018). The rationale for higher involvement of SMES from an innovative perspective has been acknowledged by public procurers because of several factors. Firstly, SMES are considered more innovative than their larger counterparts, especially in emerging technological fields (Frietsch, Neuhäusler, and Rothengatter 2013), and among technology-based SMES and start-ups (Myoken 2010). Secondly, the flexibility and agility of smaller entities play a valuable role in innovations delivery (Karjalainen and Kemppainen 2008). Considering the interweaving nature of innovations and sustainability, addressing sustainability through local procurement is particularly successful in construction, social services and healthcare, industries that are the most comfortable for SMES (Kivistö and Virolainen 2017). Moreover, local procurement is helpful for minority- and women-owned business (Karjalainen and Kemppainen 2008; Loader 2015).

Nevertheless, there are still considerable challenges related to SMES as public innovators, as only 29% of above-threshold contracts are secured by SMES in the EU single market (Flynn 2017). The reasons are rather systemic, as they have remained similar for over 20 years (Loader and Norton 2015) and are relevant for both the purchasing and selling sides. Public procurement entities tend to face political and institutional pressure to procure collaboratively (Meehan, Ludbrook, and Mason 2016). Despite the advantages for suppliers, such as predictable and stable income, reliability, and the opportunity to commercialise new products and services (Flynn 2017; Loader and Norton 2015), only 7% of the UK SMES

were interested in selling to the public sector (Karjalainen and Kemppainen 2008). Moreover, 78% of small companies in the UK have never bid for nor performed public orders (Loader and Norton 2015), suggesting that the problems and barriers hindering access of SMEs to public contracts are not one-sided, but dyadic in nature.

Methodology

This paper presents a critical analysis of cleantech literature with subsequent application of the results through the lens of public procurement to outline further research agenda. The methodology is based on the systematic literature review (SLR) and content analysis.

Literature reviews are of vital importance in any scientific inquiry process, as they stand for an 'essential first step and foundation when undertaking a research project' (Baker 2000, 233), while Seuring and Gold (2012) argue that literature reviews represent the backbone of any fragment of scholarly work. Typically, the focus of the review is placed on achieving the two following goals: (1) encapsulating existing research by identifying common patterns and arguments, and (2) consequently determining the conceptual content of the area (Seuring and Müller 2008). Applying a systematic scope to the reviews underlines conducting a structured procedure of inquiring into available evidence in a transparent and reproducible manner to achieve reliable and genuine results (Rousseau, Manning, and Denyer 2008). The essential starting point of an SLR is setting the basic criteria and delineating the boundaries of a research (Denyer and Tranfield 2009). The dominant challenge of such reviews stems from the inability to read everything and, hence, the higher importance of proper boundary setting.

Therefore, it is possible to provide holistic and all-inclusive reviews only within very narrowed and emerging fields (Seuring and Müller 2008). Scopus was used to search for papers with the keywords 'cleantech' or 'clean-tech.' However, word collocations such as 'clean technologies' and 'cleaner technologies' were not included, as the main objective of the research is to comprehend the substance of 'cleantech' as a key concept. The decision is also supported by consideration of growing use of this concept by businesses in corporate responsibility matters, while 'clean technology' is almost absent in corporate sustainability communication (Frig et al. 2018). For the same reasons, journals from all disciplines were included.

The initial search resulted in 845 papers in total. The main criteria of

TABLE 1 Papers: Descriptive Information

Area/journal	Number of papers	Time period
Energy and Sustainability	16	2009–2018
Carbon Management	1	2011
Wood: Research Papers, Reports, Announcements	1	2016
Energy Economics	1	2017
Energy Policy	3	2009–2017
Energy Procedia	1	2014
Energy Research & Social Science	1	2018
Environment and Planning C: Politics and Space	1	2017
Environmental Economics and Policy Studies	1	2016
Environmental Innovation and Societal Transitions	1	2018
Global Environmental Change	1	2013
International Journal of Global Warming	1	2012
Journal of Cleaner Production	1	2011
Sustainability	1	2017
Sustainable Cities and Society	1	2014
Geography and General Management	6	2012–2017
Economic Geography	1	2014
Journal of Business Economics	1	2013

Continued on the next page

inclusion for further review were related to document type and paper relevance. Limiting to peer-reviewed journal publications revealed 53 papers, and resultant evaluation allowed excluding purely technical (such as chemistry-related) and irrelevant papers. Finally, 31 papers were selected, and utilised following a scrupulous review conducted independently by two researchers. Table 1 represents a descriptive summary of the sources of the journals selected for the review with information on journal categories and timeframes.

Relevance of papers was determined by initial screening of titles, abstracts, and keywords. The contents of the papers considered relevant were then analysed to determine the set of papers for review. Afterwards, additional papers were identified using the snowball approach by checking the references used within the selected papers. The final set of 31 papers was reviewed by the advanced content analysis method that provides a categorising technique of examining information by revealing patterns

TABLE 1 *Continued from the previous page*

Area/journal	Number of papers	Time period
Regional Studies	2	2015–2017
Small Business Economics	1	2017
Transactions of the Institute of British Geographers	1	2012
Interdisciplinary	7	2008–2020
Industry and Higher Education	1	2016
International Review of Financial Analysis	1	2016
Nanotechnology Law & Business	1	2008
Science and Public Policy	1	2017
Science of the Total Environment	1	2020
Technology Review	1	2009
The Journal of High Technology Management Research	1	2010
Supply chain, Operations and Purchasing	2	2015–2018
Industrial Marketing Management	1	2015
Journal of Public Procurement	1	2018

and directions of its elemental aspects (Seuring and Gold 2012). More specifically, selected papers were cross-checked, determining definitions of cleantech, common research directions and intersections with public procurement and policies. Moreover, the results of cross-checking appear in a measurable way (Harwood and Garry 2003), which is specifically important within a review comprising different research areas. The main modes of categorising papers and areas of focus are: *Defining cleantech, Governmental involvement and policies, Cleantech firms and networks.* These modes have been determined by in-depth analyses of the papers and consequent extraction of common topics of discussions.

Cleantech and Governmental Involvement

The main goal of this section is to analyse cleantech-related academic publications. Investigation starts with examining definitions in order to grasp the essence of the concept to link cleantech to the model of governmental innovative policy tools. Such an approach will allow better understanding of cleantech concept positioning from an academic perspective to the public sector needed for consequent analysis of cleantech actors and their roles in knowledge creation, taking into consideration relevance of public policies.

CLEANTECH DEFINITIONS

The variety of papers underlines the importance of identifying the term of cleantech systematically, as it differs from other similar or overlapping sustainability-related terms, given the fact of the absence of a commonly accepted definition (Cumming, Henriques, and Sadorsky 2016; Davies 2013). To begin with, Guziana (2011), from the top-down perspective, indicates that cleantech stands apart from the concept of environmental technology, as the latter is a collective term comprising various sectors. Similarly, Hermelin and Rämö (2017, 131) argue that even though the overall nature of the concept is a part of a broader green economy idea, the difference stems from the point that cleantech stands for 'specific ideas of economic-environmental efficiency, green growth and market environmentalism.' Fragmented context-specific uses of the concept also take place, such as the complementary use of cleantech and greentech by means of sustainable technologies in the energy sector (Laurens et al. 2016), limiting meaning to renewable energy solely (Knuth 2018), and convergence of cleantech and nanotech in the case of greening nanotechnologies (Wexler, Murr, and Weber 2008). Nevertheless, the general interpretation of cleantech underlines comparable logic among scholars. Giudici, Guerini, and Rossi-Lamastra (2019) specifically underscore the key difference between greentech, referring to it as a small and regulatory-driven market adopting 'end-of-pipe' technological solutions, and cleantech, which is characterised by approaching fundamental environmental challenges and working on innovations to a large number of processes. A line between cleantech and bioeconomy, which utilises an idea of economically sustainable use of biomass, is also to be noted (Heräjärvi and Marttila 2016).

To date, there is no unified and internationally agreed definition of what cleantech is. For instance, Koch, Sørensen, and Wildner (2012) suggest that cleantech comprises activities which advance, manufacture, or enforce new or upgraded processes or products related to renewable energy and materials, better resources, and energy efficiency through the reduction of the use of natural resources and in overall reduced pollution. Meanwhile, various sources refer to the practical definition provided by the Cleantech Group, under which the term is represented as a wide spectrum of 'new technologies and related business models that offer competitive returns for investors and customers while providing solutions to global challenges' (Doganova and Karnøe 2015, 22). The definition has

persisted over time, and its limited focus on sectoral social construction (Caprotti 2012), market economics and the related financial side (Guziana 2011) clearly calls for a more comprehensive interpretation.

Several sources define cleantech as an independent sector and investment category comprising the range of innovative products, services and processes designed to achieve long-term commercially- and environmentally- sustainable industrial development through the optimised use of finite and renewable natural resources (i.e. Cumming, Henriques, and Sadorsky 2016; Davies 2013; Gray and Caprotti 2011; Hermelin and Rämö 2017; Vauterin and Virkki-Hatakka 2016). There is also a pattern of attempts towards delineating cleantech firms, which are depicted as technology-oriented actors that produce, facilitate, and commercialise cleantech products, services and processes (Bjornali and Ellingsen 2014; Cumming, Henriques, and Sadorsky 2016). Firms within all industries can be part of the cleantech sector, though the major share represents actors from renewable energy and green construction (Hansen 2014). There are also several alternative attempts to classify industries. Cumming, Henriques, and Sadorsky (2016) and Cumming, Leboeuf, and Schwienbacher (2017) indicate four dominant industries: energy, transportation, water and materials and, subsequently, present a range of different energy efficient technologies, such as renewable energy technologies, recycling, and green chemistry, while Hansen (2015) lists renewable energy, smart grid, green construction, transportation and waste and water as five prevailing industries within the cleantech industry. Binz, Tang, and Huenteler (2017), by focusing on similar categories, highlight their fast development and from a spatial shift' perspective focus on specific patterns of advantages to the first movers in manufacturing and knowledge creation. More detailed categorization covers renewable energy, carbon capture and storage, green IT, sustainable construction, and smart and electric transportation (Gray and Caprotti 2011). Such industries are frequently part of the services offered by governments or are in the interest of national and local policies.

GOVERNMENTAL USE OF INNOVATIVE POLICY TOOLS

One of the main distinctions of cleantech in comparison with the traditional sectors is the high level of governmental support (Basse-Mama et al. 2013; Binz and Anadon 2018). Thus, the following sub-section presents and analyses methods of public actors' involvement in the cleantech development, based on the taxonomy of governmental innovative instru-

ments (Aschhoff and Sofka 2009) – direct technology-push (R&D subsidies and research units) and indirect demand-pull (regulations and public procurement).

In the following part, the outline of how contemporary cleantech fits into the model of governmental innovative policy tools and subsequently the link to public procurement is also presented.

Technology-Push

The rationale behind technology-push policies is the incremental growth of new technologies supplied to the market by investments. In the notion of mandatory governmental participation as a prerequisite of cleantech sector creation, public subsidies have become a major driving force (Basse-Mama et al. 2013). Whereas estimates vary significantly (Davies 2013), Basse-Mama et al. (2013) reveal approximate numbers of $46 billion as the worldwide subsidies for renewable energies in 2009 and consequently $194 billion as the clean energy stimulus funding, which together spurred interest in other private forms of investments, with an example by Davies (2013) illustrating growth by 220% between 2008 and 2010 up to $243 billion. By means of relative numbers, Heräjärvi and Marttila (2016) represent the higher prominence of cleantech on a long-term basis, with the Finnish government spending 40% of all public research, development, and innovation funding to assist the cleantech sector. In the meanwhile, universities have begun recognising the value they can bring to bolstering cleantech, specifically in the early stages of the innovation process. However, at the current stage, universities tend to step in as traditional technology transfer actors (Kivimaa, Boon, and Antikainen 2017).

Demand-Pull

Cleantech technologies are still immature in nature and, hence, demand considerable long-term supportive policy frameworks to compete with traditional technologies based on a free market (Gray and Caprotti 2011; Yang, Nie, and Huang 2020). Such a proposition is also supported by the claims that cleantech is a public good (Cumming, Henriques, and Sadorsky 2016; Giudici, Guerini, and Rossi-Lamastra 2019) and society is the main beneficiary of the activities of cleantech firms. Companies which invest in innovative business models and develop new technologies are, therefore, particularly dependent on governmental assistance (Bjornali, Giones, and Billstrom 2017).

While these aspects illustrate the incentive for supportive public policies, there are also restrictive policies aimed at stimulating companies to reduce their environmental footprint. For instance, Laurens et al. (2016) argue that negative environmental effects caused by larger enterprises tended to be enormously high. Thus, under national policies, there are larger investments in cleantech and overall attempts to incorporate it into organizational strategies.

Although the technology-push approach seems effective, lack of demand on the market results in the so-called 'valley of death,' wherein technologies stuck in the middle phase between innovation and market commercialisation stages (Gaddy et al. 2017). Similar concerns are shared by Bürer and Wüstenhagen (2009), stating that the technology valley of death can become a serious obstacle to cleantech, and governments need to pay higher attention not only to pushing technologies, but also to fostering demand. Better cooperation with local authorities and identification of public procurement as a prospective market creator for cleantech should be one of the key points in the agendas of universities focused on cleantech (Kivimaa, Boon, and Antikainen 2017). At the same time, from the industry perspective, empirical evidence suggests that governmental contracts as the first orders allow companies not only to secure financing, but also to complete the full process of supply with a product's better tests and representations leading to opportunities for future orders (Koch, Sørensen, and Wildner 2012).

CLEANTECH KNOWLEDGE CREATION

Cleantech SMEs and Start-Ups

SMEs technologically outperforming their larger rivals has been frequently mentioned among cleantech papers. Evidence indicates varying performance among large companies, whereby US and European large firms are related to approximately 1/4 and 1/3 of all cleantech patents, in comparison to all Japanese cleantech patents being produced by large companies solely within the scope of the transport energy sector (Laurens et al. 2016). In contrast, indications of SMEs as the driving force are present. The environmental technology sector is distinguished by the preponderance of SMEs (Guziana 2011). Concepts of SMEs and start-ups tend to be used interchangeably in the context of cleantech, with the start-ups argued to be mitigating the impact on the environment and leveraging new technologies towards environmentally friendly products and services (Giudici, Guerini, and Rossi-Lamastra 2019). Whereas

some papers focus on smaller companies (Hansen 2014; Koch, Sørensen, and Wildner 2012; Vauterin and Virkki-Hatakka 2016), other evidence stems from the practice. That is, small start-ups are typically more inclined to deliver disruptive innovations (Basse-Mama et al. 2013) and constitute major shares of markets and sectors, with examples of Finnish SMEs from the wood sector (Heräjärvi and Marttila 2016) and the Irish cleantech sector, with a small number of large enterprises (Davies 2013). At the same time, the flexibility of SMEs in comparison with the larger companies is considered another advantage, allowing them to enter new markets, such as low-carbon cities (Kapsalyamova et al. 2014).

Networking and Public Involvement

Governance of their affairs takes an important role for SMEs and start-ups; as companies unable to prosper in isolation, they need to collaborate and create networks. State actors, while remaining substantial participants, are not the only actors in such networks, with the main stakeholders involving public, private, and civil actors (Davies 2013). Considering the complexity of the cleantech sector, value chains are more unsettled and the key inputs to the innovation process can be dispersed among unobstructed networks (Binz and Anadon 2018). Traditional dyadic industry-government relationships affected by the hybridisation of private and public actors have resulted in the 'triple-helix model,' where triadic university-industry-government allocation of power creates an emerging type of intermediary (Hermelin and Rämö 2017) which can further be supported by governments in the form of public-private partnerships (PPPS) (Cumming, Henriques, and Sadorsky 2016).

The impact of collaboration and networking in cleantech knowledge creation is stressed by scholars (Vauterin and Virkki-Hatakka 2016). Heräjärvi and Marttila (2016) pinpoint goals of clusters aimed at support of SMEs, Davies (2013) discusses cleantech clusters as heterogeneous entities with the concurrence of power within economic and political sides as the core driver and consequent meta-clustering on a transnational level, and Gray and Caprotti (2011) argue over various governance systems and tiers and types of innovations. Geographical proximity is also important for better networking and partnering with large companies, where small cleantech companies take the lead in the process (Hansen 2014). Apart from clusters, close physical location is likewise reflected by urban sustainability and small closed-loop systems with the examples of zero-emission cities in the desert (Bullis 2009), eco-districts (Weber and

Reardon 2015), transitions towards sustainability in regional development (Gibbs and O'Neill 2017) and alignment of different actors to common decentralised cleantech projects and initiatives under city ecosystem orientation (Horwitch and Mulloth 2010).

Discussion

This chapter presents dominant findings from selected papers and discusses them systematically in accordance with the research objectives. The categorisation is made based on the research design, and it encompasses both academic and practice points of view.

CLEANTECH ACADEMIC RELEVANCE AND DEFINITION

It can clearly be seen that the specificity of academic cleantech appearance outlines various avenues for future research. The latter can be achieved by appropriate synthesising of the key results with the public procurement research frameworks and, thus, areas can be mutually beneficial by narrowing one another's gaps. Alongside the relevance of public procurement and fragmented pieces of evidence supporting the claim, cleantech can be interlinked with both research streams of public procurement and industries, in which public orders are particularly prominent. Referring back to Cheng et al. (2018), cleantech can indeed be identified as a tool of framing academic investigations on environmental sustainability in public procurement. Moreover, based on a review of previous research, the following cleantech definition is proposed: *Cleantech is a sector encompassing products, services and processes striving to deliver and diffuse sustainability-oriented innovations with the focus on the holistic regenerative design of processes across various industries.*

More specifically, emphasis is put on the evolving importance of sophisticated design of products and services. Cleantech products and services represent key parts of networks and local clusters, whereby enhanced performance can be achieved by two key actions. Processes in such networks should supplement each other, and services should align the performance of various products within such networks. Given the variety of industries taking place, the role of such services is even more vital.

PUBLIC DEMAND AND COMMERCIALISING INNOVATIONS

Apparent indications imply the relevance of PPI as a tool for overcoming the technological valley of death, wherein technologies stuck in the

middle phase of innovation stage and face lack of demand in attempts to commercialising. Whereas governments 'push' the technologies, mainly by financial investments, a gap between emerging cleantech innovation and successfully commercialised cleantech innovation remains (Vauterin and Virkki-Hatakka 2016). Given the overall level of governmental involvement in the cleantech sector, stimulating the demand, and thereby assisting in commercialising and diffusing of cleantech innovations, is a logical continuation of ongoing state supportive incentives. Moreover, it is a way of delivering societal benefits in the light of remarks on cleantech being a 'public good.'

ENHANCING ACCESS OF SMES TO PUBLIC CONTRACTS

Beyond delivering societal benefits, cleantech also unveils opportunities to achieve sustainability benefits through local public procurement. Cleantech companies tend to work in clusters in close geographical proximity; thus, procurement from locally located companies can ensure that taxpayers as stakeholders can be satisfied, since the public funds are invested locally.

Apart from geographical aspects, there is an issue of SMES as suppliers for public contracts. Although there is no unified taxonomy categorising the main barriers and challenges SMES face in attempting to compete for public contracts, the specificity of the cleantech context allows testing of cleantech clusters and triple-helix models. Such entities are found to be the dominant forms of networks as intermediaries between small suppliers and public customers, aligning efforts and synchronising resources and capabilities. To the extent of the inability of small single companies to overcome obstacles at each stage of the procurement process, involving intermediaries can be helpful within earlier stages of procurement. Coordinating resources and capabilities supplemented by technical, legal and language skills commonly lacked by SMES (Jurčík 2013; Loader 2015) may become the key element in overwhelming impediments such as bureaucracy, entry mode requirements and large contract volumes. Such challenges especially relevant to the pre-tendering stage have been acknowledged by SMES as the most troublesome (Jurčík 2013). Hence, public procurement of cleantech products involving intermediaries can boost performance of SMES and foster macro-economic objectives. Findings also suggest that public-private partnerships should attain higher recognition in the context of cleantech networks. PPPS appear to be an attractive mechanism for bolstering assets and efforts towards synchronis-

ing expertise and technological advances, specifically through the myriad of administrative issues. At this point, proper application of the phenomenon through the lens of public procurement research can ensure higher explanatory power and lead towards the wider applicability of the results.

INDUSTRIES AND SCOPES

While public procurement is an important tool for energy efficiency and infrastructure projects (OECD n. d.), future academic studies should shed light on the mutual dependence of cleantech products and services since findings advocate that cleantech is rather a paradigm than yet another sustainability-related term. For instance, smart transportation is not tantamount to electric vehicles per se. Instead, the concepts represent a sophisticated nature whereby environmental aspects also ought to be included in design and use of vehicles, infrastructure, and logistics services. That is, procuring organisations should broaden the focus to services optimising the efficiency of products rather than these products solely. Scant cleantech empirical evidence reveals importance of pairing renewable energy production and smart transportation based on this energy, which can further be elaborated within public procurement research. At the same time, sectoral interlinkages, coupled with geographical proximity, outline spacious directions for urban sustainability and eco-districts research. For instance, zero-emission buildings, green IT, smart transportation, and other cleaner technologies in the context of urban development towards better delivery of enhanced values to society should further be investigated.

Conclusion

There is no unified and internationally agreed definition of cleantech. However, there is common agreement that it is an independent sector and investment category, which includes organisations focused on delivering innovative products, services, and processes. The focus is on sustainability, with the stress on environmental impact.

Thus, in the paper following definition was proposed: *Cleantech is a sector encompassing products, services and processes striving to deliver and diffuse sustainability-oriented innovations with the focus on the holistic regenerative design of processes across various industries.*

Unlike other sectors, cleantech has a high level of governmental support. This is because cleantech is considered as one of the governmental

innovative policy tools. Both pull- and push approaches to innovation were identified. However, cleantech innovations are also meeting problems; the key issue is the valley of death, as cleantech is unable to move from innovation to the commercialisation stage. To change such a situation, a higher level of cooperation between government and other actors is required. This should be relatively easy since most of the cleantech companies are grouped into local clusters, thus there is opportunity for local procurement and cooperation. Increased cooperation will stimulate demand, and assist in commercialising and diffusing cleantech innovations. A large part of cleantech actors are SMEs, thus inclusion of SMEs in public contracts will also allow improvement in cleantech commercialisation. However, SMEs do not frequently participate in public contracts. Therefore, focus on SMEs' participation may, in turn, improve commercial success among cleantech products and services, after procurement by and diffusion to the public sector.

As cleantech is a relatively new concept in academia, there are opportunities for future research on public procurement within the context of cleantech. Such research should answer the following research questions:

- How can public demand for innovations stimulate commercialisation of cleantech products and services and consequent market diffusion?
- What are the implications of public procurement of cleantech products and services for local development?
- How can cleantech clusters and public-private partnerships as intermediaries improve the access of SMEs to public contracts?
- How can public procurement of cleantech products and services advance development of smart cities and eco-districts?

Future research could apply both qualitative approaches, analysing not only single organisations, but also local and industrial clusters. Comparative case studies could look at different national and regional policies and their impact on cleantech commercialisation, while quantitative work might reveal similarities and differences across locations, organisations, and sectors.

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Leadership in the Context of a New World: Digital Leadership and Industry 4.0

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This paper attempts to address and critically examine a current concept of leadership in business studies: digital leadership. Researchers often say that this is a new leadership style and that there is a necessity for such a new style because the entrepreneurial environment has changed considerably with digitisation, but also with Industry 4.0, which to a certain extent coincides with digitisation, and the concept of a so-called VUCA (Volatile, Uncertain, Com-plex and Ambiguous) world. The conclusion drawn here could be summarised as follows: a changed business environment forces companies to react, namely with a new way of leading – digital leadership. This study will show that such a concept is by no means new, as research claims, but rather has been in existence for more than 150 years. What many researchers understand by digital leadership, apart from the demand for driving forward digitisation, coincides with the leadership principle introduced by Prussian General Moltke, known as 'mission-type tactics.' One of the aims of this paper is to demonstrate this. It will also be shown that digital leadership, in contrast to transformational leadership, can be acquired and that digital leadership cannot be classified in the opposition to transformational or transactional leadership, but is rather to be held and understood as a third variant. Only a prescriptive method based on understanding seems to be a suitable method.

Key Words: digital leadership, industry 4.0, smart factory, digitisation, VUCA, transactional leadership, transformational leadership, mission-type tactic, ambidexterity, competence
JEL Classification: D23, J81, L20, M12, O15

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Introduction

Rapid technological progress that has taken place in recent years and decades, and above all the accompanying change in the economic world,

has left its mark on economic research. Due to the constant increase in the degree of digitisation, new possibilities are arising in production today; this is being discussed in research under the heading 'Industry 4.0' (Deckert 2019). The emergence of this new type of industry is correlated with a world that has become more uncertain and volatile; this phenomenon is being discussed in research under the keyword 'VUCA (Volatile, Uncertain, Complex and Ambiguous) world' (Mack and Khare 2016). From the perspective of a company, this means that the external world is not only in a constant state of flux, but that economic activity as a whole has become more risky, and at the same time the internal world is changing, insofar as digitisation not only opens up new production methods, but virtually demands them.

Both factors, Industry 4.0 and a VUCA world, require a new way of leading. This new way of leadership is being discussed in research under the keyword 'digital leadership' (Wagner 2018). This study aims to show that digital leadership is by no means as new as most people claim; what is also congruent with this is the fact that a VUCA world is also by no means as new as it is claimed. Only Industry 4.0 seems to open up new perspectives, but here, too, we should not speak of a truly new industrial revolution.

Method

Economics in general and business studies in particular must be understood as a social science or part of the humanities, since its object is the order, processing and interpretation of a sphere of life and thus differs from the natural sciences, whose objects of study are physical objects (Bardmann 2019, 85). To a certain extent, all humanities are interdisciplinary in orientation, but business studies in particular is interdisciplinary, which can be seen in its proximity to psychology (Kahneman 2012) or even the social sciences (Bardmann 2019, 86); likewise, the term 'economic sociology' indicates a general proximity of these two sciences. Questions about what leadership is, for example, can be treated scientifically in neither economic nor psychological terms, but can nevertheless be looked at from a sociological point of view, because sociology does look – though not only – at the foundations of human coexistence. Therefore, it should not come as a surprise that works dedicated to this topic, whether explicitly or implicitly, always return to sociology.

In German sociology, the early 1960s saw the so-called 'positivism dispute,' led mainly by Adorno on the one side and Popper on the other

(Adorno, Habermas, and Popper 1972). Popper gave preference to an empirical method, drawing on Hempel and Oppenheim's research: to grasp a fact scientifically means to deduct it from scientific laws, taking conditions of application into account (Hempel and Oppenheim 1948), which is also understood as 'explaining.' An explaining interpreted in this way was rejected by Popper's antagonists, since this was a 'positivistically halved rationalism' (Habermas 1972, 235). Now it seems that, according to what has been said, Popper's antagonist, Adorno, should provide the methodology to be brought into play here. However, it quickly becomes clear to those who study Adorno more closely that the dialectics of the Frankfurt School can hardly solve the issues to be discussed here. This work does not intend to take a position on the positivism dispute; nevertheless, it should be noted that this dispute has never been resolved. This suggests that both empirical and non-empirical methods, i.e. traditional methods in humanities, certainly have a right in sociology and thus also in economics. And indeed, the question of what leadership is cannot be answered, either by economic science or empirically. It cannot be deduced from scientific laws what leadership is. As a consequence, it cannot be explained exactly what leadership is.

Explaining something therefore means establishing a causal connection, which at the end will lead to a proper explanation. However, explanations always presuppose that what is to be explained has already been understood and is thus prior to explaining. The art of understanding has a long historical tradition, beginning with Dilthey (1959) and extending through Heidegger (1993), Gadamer (1965) and finally Hösle (2018) to the present. While the early representatives of the art of understanding, or hermeneutics, related it primarily to texts, with Heidegger at the latest, understanding also and above all relates to the world. Hermeneutics is not only the art of understanding texts or works of art; it is not only the foundation of the humanities (which it certainly is, too), it also refers to understanding the world and what people encounter in the world. It becomes clear: people are and have always been capable of understanding the world. Nevertheless, there are different degrees of understanding. Hermeneutics is the attempt to make clear what is to be understood and, precisely through this, to arrive at a better understanding of what is to be understood. As such, it can also be made fruitful for non-philosophical areas, such as business administration.

In addition to the positivism dispute, reference must also be made to the 'value judgement controversy' that broke out in the early 1900s. On

the one side there is the position that no recommendations for action can be derived from a constant expansion of knowledge about causal relationships. The other side claimed exactly this (Bardmann 2019, 75). This dispute can ultimately be reduced to the following question: should economics be descriptive or prescriptive? (Bardmann 2019, 76). What becomes clear is that this dispute, too, is at its core a methodological dispute, and like the value judgement controversy, it has by no means been resolved to this date. This suggests that both prescriptive and descriptive methods can be quite scientific, depending on what the question is.

Especially in German research on business administration, there has been an approximation to the methods of the humanities in recent decades (Julmi 2020, 96); this is by no means to be seen as a devaluation of a method based on the natural sciences, but rather as a necessary complement to them. German business studies in particular, in contrast to Anglo-American business studies, seeks a uniform foundation for its discipline. Anglo-Saxon business studies, on the other hand, is so fragmented into its sub-areas (e.g. marketing, management or materials management) precisely because it does not seek such a foundation that it is hardly possible to speak of a systematic connection between these sub-areas (Julmi 2020, 97). This work, insofar as it understands itself to be in the German tradition, attempts to methodically join the humanities, more precisely hermeneutics, in order to understand what constitutes leadership in general and digital leadership in particular. Hermeneutics in the context of business management cannot therefore consist of gaining cognitive goals and hypotheses or suggesting explanatory explications of facts; rather, it attempts to consider facts in their relationship to higher-level systems (Julmi 2020, 109).

The following work is thus dedicated to the concept of leadership; it follows from what has been said that the method is one of understanding. Furthermore, it cannot be the task to approach leadership in a purely descriptive way. Against the background of Industry 4.0, as well as a VUCA world, it is by no means sufficient to merely describe leadership techniques and styles. In this respect, it is prescriptive in the broadest sense. The methodology of the present work is therefore prescriptive and based on understanding.

Industry 4.0, Smart Factory and VUCA

The question of leadership and the accompanying question of a new leadership style is connected with changes that not only the business world

has experienced in recent years and decades. These changes can be described by using the following three terms: Industry 4.0, Smart Factory and VUCA. These terms will be briefly explained first.

INDUSTRY 4.0

With the onset of digitisation in the 1970s, a profound change in the world of work began. In this respect, it is not surprising that this is often also viewed as another industrial revolution. Open-plan offices, for example, are the exception today, but they used to be the rule, at least in large companies. Industry 4.0 is often referred to as the fourth industrial revolution (for example, in Pistorius 2020, 5). It is the logical continuation of a previous digitisation, which began with the advent of computers and the second step of which was the Internet. 'By digitising classic industrial companies, the aim is to increase automation and networking in production' (Pistorius 2020, 5). In other words, while digitisation has so far mainly taken place in the office and then in sales, in the course of Industry 4.0 production will also be digitised. The aim, as Schuh et al. (2020, 469) say, in the context of the vision of an 'Internet of Production' (IoP) developed at RWTH Aachen University, is 'to reach a new level of cross-domain collaboration that, by means of semantically correct, context-aware data is not just unique, but is achieved continuously and highly iteratively in real time with the appropriate granuality.'

According to industry associations such as Bitkom, VDMA and ZVEI, Industry 4.0 can be described as follows (Pistorius 2020, 6):

> The term Industry 4.0 stands for the fourth industrial revolution, a new level of organisation and control of the entire value chain over the life cycle of products. This cycle is based on the increasingly individualised customer requirements and extends from the idea, the order, through the development and production, the delivery of a product to the end customer [. . .], including the associated services.

SMART FACTORY

In addition to Industry 4.0, the term 'Smart Factory' is often used. Although this term appears frequently in research, it has different connotations; thus, it can be understood as a 'ubiquitous factory,' a smart factory of the future, a technological approach or a paradigm (Radziwon et al. 2014, 1185). Radziwon et al. (2014, 1187) give the following definition:

A Smart Factory is a manufacturing solution that provides such flexible and adaptive production processes that will solve problems arising on

a production facility with dynamic and rapidly changing boundary conditions in a world of increasing complexity. This special solution could on the one hand be related to automation, understood as a combination of software, hardware and/or mechanics, which should lead to optimization of manufacturing resulting in reduction of unnecessary labour and waste of resources. On the other hand, it could be seen in a perspective of collaboration between different industrial and nonindustrial partners, where the smartness comes from forming a dynamic organization.

On the one hand, this definition makes it clear that there is a connection between Industry 4.0 and Smart Factory. On the other hand, this definition establishes the connection to the VUCA term in the following sub-chapter, which characterises today's world in more detail.

VUCA

VUCA is an abbreviation meant to characterise today's world, which is mainly defined by four factors (Unkrig 2020, 6; Mack and Khare 2016, 5):

- *Volatility* – indicates the rapid rate of change in the pattern of dynamics observed in socio-economic systems. This also includes the strong fluctuations in macro-economic conditions, the financial markets and raw material prices. In this context, it is not insignificant that volatility develops unexpectedly.
- *Uncertainty* – the effects of uncertainty manifest themselves primarily in unpredictability, uncontrollable developments, and a lack of understanding of relationships. In particular, the uncertainty and feedback and interactions that are inherent in social systems are particularly evident. There are several factors that act as a further reason for the uncertainty or at least as a catalyst: past mistakes, rejection, social fears and finally perfectionism.
- *Complexity* – is fundamentally dependent on the number of factors, the type and number of interrelationships, the number of unknowns and, finally, the degree of uncertainty. Complexity often relates to network structures and the dynamic connections between the components of the system.
- *Ambiguity* – is the blurring of reality and the potential for misinterpretation. This is often incomprehensible and can no longer be planned. What could be relevant in the future is uncertain, ambiguous and hardly predictable. It becomes clear that the various points mentioned are interdependent: uncertainty also results from volatil-

ity and complexity, and these two points also have an impact on ambiguity. At the same time, there should be a connection between volatility and ambiguity. If one wanted to summarise VUCA accordingly, one would have to say that a VUCA world does not offer absolute certainties, which represents a fundamental risk for all economic activities.

With Industry 4.0 and VUCA, problems and challenges that modern executives are faced with become clear. The changes in production processes, which in the near future every bigger company will have to carry out before the horizon of a VUCA world, seem to require different types of management.

VUCA and Industry 4.0 are not systematically related, but it is clear that these two terms indicate supposedly new challenges that managers are faced with. Roughly speaking, one could say that VUCA names the environment of a modern company; Industry 4.0, on the other hand, affects the (coming) inner world of modern companies.

A New Way of Leading People: Digital Leadership

Against the backdrop of Industry 4.0, VUCA or Smart Factory, the question of a new way of leading seems almost necessary: due to the changed internal and external environment of companies, it is no longer possible to lead in the same way as before. Changed environments require different ways of leading. Leadership must adapt to this. But what is leadership? Kauffeld (2011, 68) elucidates: 'Leadership serves to individually and purposefully influence, motivate and/or enable others to contribute to the achievement of collective goals in organisations.' Bea (2011, 2) also defines the term in this sense: 'Leadership is a goal-oriented shaping of companies (= corporate management) or goal-oriented influencing of people.'

In the classic literature on leadership, two leadership styles are distinguished from each other: the transactional and the transformational leadership style. The transactional leadership style understands leadership as an exchange relationship. The leader rewards performance on the basis of a contract, in the form of money, promotion, praise, appreciation, etc. The manager rewards performance or punishes when predetermined performance is not met. Burns (1978, 19), who introduced the term, defines it in these terms. One can speak of transactional leadership 'when a person takes the initiative in making contact with others for the purpose of an exchange of valued things. This exchange can be economic,

political or psychological in nature.' This is to be distinguished from the transformational leadership style. This style attempts to increase performance through transformations of values, attitudes, etc. Leaders who use this style try to control the behaviour of their subordinates through vision. They possess charisma and exude great self-confidence. The implementation of their vision is at the centre of their activities. They are able to create an atmosphere of trust and confidence, which is necessary to achieve high goals. Subordinates can be characterised by a high degree of loyalty and personal dedication. It should be emphasised, however, that the success of charismatic leaders depends to a large extent on whether the lofty goals can actually be achieved (Dems 2015).

There are therefore two points at which leadership starts: (a) Leadership is understood according to the *do ut des* principle (Latin for: 'I give in order that you may give'). One could also say that the leader does not want to reach the core of the subordinates, but only proceeds externally: achieving predetermined goals is rewarded, if employees fail to achieve these goals they are punished. (b) Leadership wants to do exactly that: to influence the person being led in such a way that their motivation is not primarily fed by expected reciprocity. One could also say that the motivation of the person led in the first case is extrinsic, while in the second case it is intrinsically fed.

Digital leadership is to be distinguished from these classic leadership principles. First of all, however, it should be noted that a completely different style of leadership seems to be necessary: with the digitisation of the world of work and life, the two principles mentioned above are proving to be outdated. In this sense, Kollmann (2020, 34), for example, says that the digital leader 'is now characterised by wanting a digital transformation (digital mindset), mastering the use of digital technologies (digital skills) as well as consistently implementing the resulting measures within the framework of the digital transformation.' Digital leadership thus includes a focus on new technologies; in this sense, it should be emphasised that digital leaders anticipate technical developments and communicate this internally as well as externally through a meaningful vision. Digital leaders can integrate phenomena that relate to society as a whole into their business model (Kreutzer, Neugebauer, and Pattloch 2017, 46).

Doyé (2020, 211) believes that digital companies should not be led traditionally, but instead need a different style of leadership, one that involves more cooperation, understanding, inclusion, and mediation, i.e.

collaborative leadership. For digital leaders, the rule is: 'Give up control, but retain leadership' (Doyé 2020, 212).

As Doyé and many other authors emphasise, digital leadership means giving employees responsibility and not only maintaining freedom, but also creating it if necessary. Digital leaders rely on employees and no longer on a top-down structure (Doyé 2020, 213). They want to be involved when it comes to important decisions. Furthermore, it is about making the performance of individual team members more transparent and introducing a more results-oriented remuneration. For Generation Y and also Z, work-life balance has a completely different meaning than for the generations before (Doyé 2020, 214).

Creusen, Gall, and Hackl (2017, 210) take a somewhat different view. They also emphasise that it is no longer possible to lead transactionally and that changes are imminent due to digitisation. However, in their view, change comes from the leader. They further point out that the success of the group as well as the whole company ultimately depends on the attitudes and values of the members. Therefore, for them, digital leadership is linked to the values and culture that are lived in the company. Above all, the question of power and how leaders deal with it comes up in this context (Creusen, Gall, and Hackl 2017, 210).

Overall, it becomes clear that digital leadership differs above all from transactional leadership. Following this, two aspects can be identified that distinguish digital leadership from other types of leadership.

1. Digital leadership means that the digital transformation is driven forward. New technologies are introduced into the company. This first point is directed, if one wants to use a metaphor that is certainly not misleading in this context, at the hardware of the company.
2. Digital leadership also means that subordinates must be given more freedom. This metaphorically refers to the company's software.

Digital leadership, therefore, focuses on the entire company and not just on the expansion of the digital infrastructure. While the first point refers to Industry 4.0 and Smart Factory, the last point is directed at a VUCA world. Only companies whose employees are not managed transactionally can be successful in such a world in the long term. It now seems obvious that digital leadership would have to fall back on transformational leadership. However, it must be stressed here that this depends on the personality of the leader. Charisma, the central aspect of a transformational leadership, is something that cannot be learned.

A Truly New Way of Leadership?

What is it that distinguishes leaders from their subordinates? First of all, one might think of the hierarchy in companies. Leaders are on a higher level in the hierarchy than their subordinates. It should be noted here that the hierarchy is a hierarchy within the company. Sociologically speaking, a company is an organisation. First of all, this is a special form of social entity that differs from other social entities such as families, groups, networks, protest movements or even the nation state (Kühl 2011, 13). Abraham and Büschges come up not only with a negative, but also a positive definition. They call organisations associations of people that have three characteristics in common: they have given themselves the tasks of realising specific purposes, they are structured according to the division of labour, and they are equipped with a governing body that is responsible for representing the organisation internally and externally (Abraham and Büschges 2009, 21). The crucial point here is that hierarchies belong to every organisation and thus also to the enterprise, which the authors call a management authority. Accordingly, to have a leadership function in a company means also to have a leadership function within an organisation.

Leaders, however, can only act as leaders because they possess certain characteristics that enable them to do so, at least in an ideal scenario. These characteristics are usually called competencies. First of all, it should be noted here that every employee must of course have certain competences, because only those who have them can also fulfil the tasks imposed on them. Therefore, the focus here is on the so-called leadership competences. The general characteristic of competences is that they enable action, which distinguishes them from skills and abilities, among other things (Heyse, Erpenbeck, and Ortmann 2015, 13).

Inasmuch as leadership is always related to action, ultimately leadership always means acting; leadership competencies can be discovered that are clearly different from employee competencies. Hardegger, Boss, and Siano (2018) list a total of 13 competencies, which they divide into four dimensions. These are: values, thinking, acting and interacting.[1] They then

1. It should be noted here that action as a competence dimension and the ability to act must be distinguished: Action as a dimension does not so much refer to the ability to act, but to the way in which action takes place. Acting at all is therefore not yet a leadership competence; acting in the sense of the company requires specific competences that are defined in the dimension of acting and determine the manner of this action.

place these dimensions in the context of the most well-known types of leadership in economics, namely a transactional and a transformational one.

A look at these competence dimensions now reveals that one – in many ways important – dimension seems to be missing: in times of VUCA and above all of Industry 4.0, should not the aforementioned competence catalogue be expanded to include the dimension of 'digital competence'? In any case, it is obvious that digitisation will change the world of work. For example, one prediction is that the external framework conditions of companies will change, as markets or even the relationship with customers change. More importantly, however, the internal framework conditions will also change; a flexibilisation of the working world, both in terms of location and time, will increase, which will have an impact on corporate culture (Fleig 2020, 7).

The concrete competences are of less interest in this context; however, it can hardly be denied that the general handling of PCS, mobile devices or data protection and security will become even more important than they already are today. Therefore, digital competences will play a major role within future companies. More important in this context, however, is whether this will be accompanied by a fundamental change in management culture. In other words: will fundamentally different competences have to prevail among management personnel due to a foreseeable intensification of digitisation? Furthermore: will a completely different leadership style have to be established due to the predicted VUCA world, which is definitely related to Industry 4.0?

When it was said above that digital leadership means that digital change is driven forward and that employees give their subordinates more freedom, from the perspective of leadership competences digital change is a comparatively minor problem. Allowing employees greater freedom, however, seems to point to a much bigger problem. In a certain sense, one could say that competencies of leaders consist of not acting themselves in a narrower sense, but rather letting them act. One could also put this differently: the task of leaders is to set goals that the subordinates have to achieve with the resources allocated to them. How they achieve these goals, however, is not specified by the leaders. The only thing that is important is that they are actually achieved.

In the context of a VUCA world, companies are facing major problems. On the one hand, they must continue to focus on their core business, but on the other hand, it is equally necessary for them to be or become

competitive in terms of new business areas. In concrete terms, this means that on the one hand they must be able to efficiently manage and maintain the current existing business (exploitation) and on the other hand maintain an agile approach to changes in the innovation business, if not even become a player in this field themselves (exploration). Kollmann calls this double task, which companies already have to face today, 'digital ambidexterity' (Latin for 'using both hands') (Kollmann 2020, 33). This ambidexterity must go hand in hand with different leadership styles. The current core business might require different leadership methods than driving digital innovations and their marketing. What Kollmann diagnoses here is that at least larger companies cannot be managed with just one leadership style, since every company is always already faced with two tasks: on the one hand, to continue to expand the existing and core business and, on the other hand, to react to change or to drive it forward. These two aspects of entrepreneurial activity are not, or only with difficulty, compatible in the leadership style of one person, because this would mean that the same person would apply different standards to their subordinates, depending on whether they drive innovation or the core business.

Kollmann, who has also recognised this problem, names transactional, directive and expert-oriented leadership styles that have proven themselves in the area of existing business, while transformational, ethical, strategic and ultimately digital leadership styles are necessary for the innovation business.

After what has been said, it can first be stated that digital leadership cannot be used to manage the entire company. Digital leadership makes a company fit for the future. It is the answer to a VUCA world, or one could also say that digital leadership is required in the context of what Schumpeter understands by 'creative destruction.' Digital leadership is thus the answer to a dynamic market in which companies try to establish themselves on the market with new products or new production methods. However, in a market that is less dynamic and more static, where products meet consumer demands, digital leadership could be detrimental because, as should be mentioned here, the introduction of new products and new production methods is always associated with a risk.

This, however, should not be discussed here in any more detail. There is no question that at least larger companies must face up to the digital transformation. But what exactly is digital leadership? Is it really about driving forward the digital transformation? The distinction has just been

made between two leadership styles, with transformational leadership and digital leadership sorted into one class and transactional leadership into the other, which ultimately leads to the question as to why transactional leaders should not be able to drive digital change. It turns out that digital leadership actually means more than that. As already said above, digital leadership involves a completely different style of leadership. Digital leadership also means leading collaboratively, handing over responsibility, etc., as mentioned before. Digital leadership is therefore by no means necessarily associated only with the digitisation of companies. Rather, it is a way of leading that is practised above all – at least it seems so – in companies based in Silicon Valley. This way of leading, however, does not necessarily require a digital background. Digitisation is therefore a necessary but by no means sufficient condition for digital leadership.

What can be considered a necessary condition for digital leadership, i.e. what makes a digital leader, will now be briefly considered. Leading is always about leading people. This also applies to leaders who see themselves as digital leaders, who also lead people. This is also illustrated by the fact that companies are organisations. According to the above, an organisation is an association of people that want to achieve specific purposes. However, purposes are not set by computers, but by people. In this sense, the desired digital transformation of a company is a purpose; this also shows that digital leadership cannot be reduced to implementing digitisation in a company. This has already been said above. It was emphasised that digital leadership also means giving up control and yet retaining leadership.

In that respect, a way of leading seems to become apparent that can by no means be described as new; on the contrary, it is quite familiar, even if this was introduced in a completely different field, namely in the military. The Prussian General Moltke, who contributed significantly to Prussia's success in the German wars of unification (the German-Danish War of 1864, the Prussian-Austrian War of 1866 and finally the German-French War of 1870-1) by his way of leading troops, writes in the *Verordnungen für die höheren Truppenführer* (ordinances for senior troop leaders): 'In general, one will *not give any more orders than is absolutely necessary,* not to plan beyond any circumstances, which can be overlooked, for these change quickly in war and rarely will orders that go far ahead and into detail be fully carried out in time' (Moltke 1993, 443; original emphasis).

In the context of interest here, it is above all decisive that Moltke urges

his subordinates to order only what is necessary, since in a war the situation can change quickly. War is certainly an example of a VUCA world, although this is not to say that every VUCA world is in a state of war. Nevertheless, the reference that only what is absolutely necessary should be ordered, since one can never view everything that is essential, is also quite important in a business context, because at least for larger companies it is also true that the leaders can never view everything that is important and therefore it can also be assumed here that orders that go into great detail will either not be carried out fully or, if they are, the risk that they are rather disadvantageous for the company is extremely high.

Moltke (1993, 443) continues: 'It shakes the confidence of the subordinate leaders and gives the troops a feeling of insecurity when things turn out quite differently from what the higher command had foreseen.' Moltke thus draws attention to psychological consequences when directives and orders seem pointless because they do not correspond to the situation. Again, this can be applied to companies: trust in management is also likely to be shaken if orders do not fit the current situation and thus appear to be meaningless. Moltke goes on to say, 'Moreover, it must not go unnoticed that when one gives a lot of orders, it is very easy for the important things, the things that must absolutely be carried out, to be obscured by the mass of secondary things and things that are only valid under certain circumstances, and to be carried out only incidentally or not at all' (Moltke 1993, 443). The more orders are given, especially if they obviously refer to secondary matters, the higher the probability that the orders will not be carried out at all or will be carried out inadequately. Instead, the leader of a military unit must focus on what is important. This, too, can easily be transferred to the leadership of companies.

Following Moltke, it can be said that leadership consists of concentrating on what is essential. Leaders are encouraged to order only what is absolutely necessary. As a result, orders are general and do not go into detail. This way of leading is known as 'leading by mission' (or mission-type tactics) and is different from 'leading by orders' (order tactics). Leading by mission means that the subordinates understand the meaning of an order and are therefore not only able to act on their own authority if the situation changes, but are actually encouraged to do so. Leading by orders is in complete opposition to this. Here the subordinate has to carry out the order literally.

It becomes clear that mission-type tactics means giving subordinates an order and then having confidence in them that the goal will be

achieved. Mission-type tactics therefore mean relinquishing control and yet leading. However, this was stated above as one of the definitions of digital leadership. According to what has been said so far, digital leadership – especially in the context of a VUCA world – seems to be the right way of leadership, because it can be used to react flexibly to new challenges, even and especially those that had not been foreseen. If, however, the thesis is accepted that in the end there is no difference in the decisive aspects between digital leadership and leading by mission, then it has been made clear that these two ways of leading are one and the same. And thus digital leadership is by no means as new as many authors believe.

The fact that digital leadership, as explained here, and transformational leadership overlap in large areas, has become obvious. The question remains whether digital leadership can also be transactional. As said, transactional leadership is based on the *do ut des* principle, i.e. on the principle of performance and return. As a matter of fact, there is no reason why transactional leadership and digital leadership should exclude each other, because transactional leadership in fact does not mean giving instructions down to the smallest detail, which then have to be implemented by the subordinates. The concept of digital leadership is actually at odds with the distinction between transactional and transformational leadership.

When we come back to digital ambidexterity, it now becomes clear what is meant by this: digital leadership can be used both in the existing business and in the innovation business. This means not only – and this should be emphasised once again – that digitisation is driven forward, but also that leadership hands over power and responsibility to subordinates in order to benefit in return from their creativity, flexibility and sense of responsibility. It makes no difference whether the subordinates' motivation is primarily a material one or primarily driven by the visions of their superior.

Finally, something else should be pointed out. It was said above that transformational leadership cannot be learned because it depends on the charisma of the leader. Although digital leadership and transformational leadership overlap, they are not identical. Digital leadership does not require a charismatic leader. Rather, it requires specific competencies; but these can be learned. In other words, while only a relatively small number of leaders can actually lead in a transformational way, in principle anyone can lead in a digital way, albeit under certain conditions.

Conclusion and Prospects

This paper shows that digital leadership and leading by mission are one and the same. So when scientists talk about the need for a new way of leading in the context of a VUCA world or Industry 4.0, they disregard the fact that the required new way of leading is by no means new, because it coincides with mission-type tactics. The only new aspect that can be mentioned is the advancement of digitisation. But ultimately, this can only be described as something new from a material point of view, not from a formal one; after all, this illustrates exactly what Schumpeter tried to capture under the term 'creative destruction' (Schumpeter 2018, 113).

Digital leadership and leading by mission are the same thing; that is one result of what has been examined in this paper. The other result, even if it is just a secondary result, is that digital leadership, unlike transformational leadership, can be learned. Insofar as leadership is always linked to competences, the question naturally arises as to which competences are decisive here and should therefore have to be acquired. This question, as important as it is, cannot be answered at this point and must therefore be postponed to a later date.

Another result of this work is that the two categories with which leadership styles are usually characterised, i.e. transformational and transactional leadership, are perhaps too simplistic to capture the phenomenon of leadership scientifically. It should be noted here that research naturally knows far more leadership styles; however, as was the case in this work, these are often assigned to one of the two styles mentioned. The term digital leadership, on the other hand, introduces a style that defies such categorisation. Both transactional and transformational leadership are compatible with digital leadership.

Finally, it should be pointed out that digital leadership, understood as leading by mission, does have certain similarities with 'management by objectives' introduced by Drucker (1954). Nevertheless, attention should be drawn here to an important difference: Drucker's management concept is clearly to be assigned to the transactional style. In this respect, this management concept and digital leadership are not the same. The perhaps only small but nevertheless decisive differences between these two styles, however, cannot be discussed here in any more detail.

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Precarious Work and Mental Health among Young Adults: A Vicious Circle?

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An increasing number of studies and practical experience confirm that employment quality and security affect the mental and physical wellbeing of workers. This applies even more to those who are included in precarious types of work, as these are marked by work process inclusion uncertainty and lower quality in several dimensions of work performance. The purpose of this article is, therefore, to analyse mental health self-perception in individuals who have described their work as precarious. The study involved 201 participants aged 18 to 40 years old working in Slovenia. This is one of the first studies focusing on this topic on a Slovenian sample. Results evidence that those performing precarious work report low life satisfaction, including higher depression, anxiety and emotional exhaustion symptom incidence, confirming that performing precarious work is connected with poorer emotional health indicators in young adults.

Key Words: mental health, precarious work, young adults, Slovenia
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Introduction

As most people spend a large part of their life at work, this may significantly affect their health and wellbeing. Workplaces can be an important protective factor with regard to mental health (Jeriček Klanšček, Hribar, and Bajt 2017), and supporting mental health at workplaces beneficially affects worker productivity, and the economic growth and global competitiveness of organisations and society. In recent years, we have witnessed an increase in mental illness among young individuals doing insecure types of work (Julia et al. 2017; Jonsson et al. 2020; Vancea and

Utzet 2017). Unemployment, low pay, dangerous working conditions, insecure employment types, fixed-term contracts and part-time work have been increasing among young adults with various levels of education (Toivanen et al. 2020; Mrozowicki and Trappman 2021; Domadenik et al. 2020).

Precariousness is present in various types of work where there is a tendency to reduce costs (Forde and Slater 2006; Močnik 2010) and better enable employment flexibility (Debels 2008). Precariousness takes many forms, including lower job security, lower pay, lower social security and poorer working conditions, and studies confirm that these are harmful for individuals' mental health (Vives et al. 2011), which is the focus of our research work. Many studies highlight that work-related stress and health issues are caused by precarious work (Gash, Mertens, and Gordo 2007; Quinlan, Mayhew, and Bohle 2001). Likewise, numerous studies have demonstrated the link between non-standard forms of work and poor working conditions (Eurofound 1998; Eichhorst and Tobsch 2017); additionally, precariousness and perceived job insecurity have been associated with several adverse health (Quinlan, Mayhew, and Bohle 2001; Employment Conditions Knowledge Network 2007) and occupational safety consequences (Quinlan, Mayhew, and Bohle 2001). The list of negative health outcomes is varied and includes an increase in mental health problems, including clinical depression, health self-assessment deterioration and sleep disorders (Mai, Jacobs, and Schieman 2019), and an increase in the use of psychotropic drugs (Glavin 2013; Lam, Fan, and Moen 2014; Moscone, Tosetti, and Vittadini 2016; Virtanen, Janlert, and Hammarström 2011).

Although the use of the term *precarious work* has been increasing internationally, the definition of precariousness is multifaceted and remains unclear. The situation is further complicated by the fact that precariousness is defined differently, depending on the state, region, economic and social structure of political systems and labour market (Utzet et al. 2020). As a multidimensional phenomenon (Kalleberg 2014; Broughton, Green, and Rickard 2016; Jetha et al. 2020; Kreshpaj et al. 2020; Padrosa et al. 2021; Allan, Autin, and Wilkins-Yel 2021; Valero et al. 2021), operationalisation of precariousness demands a variety of methodological approaches and indicators. The lack of a clear definition and proper measurement instrument are the main research challenges in the field of precarious employment (Benach and Muntaner 2007). Slovenian researchers (Kresal Šoltes, Strban, and Domadenik 2020) came to a similar conclusion

and accordingly defined precarious work as work marked by insecurity, whereby insecurity is not a result of a worker's free choice and the work is so intense it represents a risk to the worker's health and wellbeing, and this is one of the premises for our study presented below.

In Slovenia, atypical types of work, which may include elements of precariousness, have lately been particularly evidenced for young adults (18–40 years old), as their shares of fixed-term and part-time employment are among the highest in the European Union (Kanjuo Mrčela and Ignjatović 2015), and they are also at the forefront in terms of working as sole proprietors (Domadenik and Redek 2020). This is why the phenomenon of precarious work and mental health is studied in this population upon their entry into the labour market.

This article includes a presentation of the fundamental features of precarious work, followed by its relationship to selected mental health factors in young adults and a presentation of research and results, which is the basis of our discussion and conclusion preparation.

Labour Market Precariousness Features

The socioeconomic and political change that started at the end of the 1970s led to the collapse of the normative employment model; standard types of employment with indefinite duration contracts, regular and 'sufficient' pay and employment rights being replaced by insecure and flexible types of employment and work (Standing 2011). This increase in labour market flexibility has been justified as a necessary action to preserve jobs, but it decreases job security (Standing 2011; Brady and Biegert 2017; Kresal 2020). Despite the lack of clarity with regard to a definition of precarious work, certain basic features are evidenced. In general, precarious work enables employers to transfer risks and responsibilities to workers, and is marked by various levels and degrees of the objective and subjective features of unreliability and insecurity (International Labour Organization 2011).

Although precarious work takes various forms, it is usually defined in terms of insecurity regarding employment duration, a higher number of possible employers, concealed employment relationships, lower levels of social security and benefits usually connected to employment, lower income, and legal and practical obstacles to trade union association (International Labour Organization 2011; Vives et al. 2011). Precarious workers are in weaker labour and social positions, and have poorer security networks and bases; they also have fewer possibilities for in-house training

and promotion. This is often accompanied by periods of unemployment and possibly higher personal and family life planning uncertainty (Meehan and Strauss 2015; Eichhorst and Tobsch 2017). The increasing number of precarious types of employment coincides with the increasing risk of poverty. It is furthermore connected to the phenomenon of poor workers, as such work does not always enable a decent living (Van Lancker 2013; OECD 2015). Precarious workers often face financial and employment insecurity. Their income is lower, so they are often uncreditworthy, and face difficulty attaining independence, planning families and purchasing real estate, and this instability does not enable them to plan their lives in the long term (International Labour Organization 2011).

In the last two decades, Slovenian legislation has increasingly supported flexible employment practices. As a result, employment and security protection is weaker, and the number of precarious types of work has increased (Domadenik et al. 2020). For certain workers, increasing employment flexibility means that their social security, rights and autonomy are reduced. Their ability to defend their own rights are severely weakened, and in this way their futures become increasingly insecure and risky (Smolej 2009). The prevailing basic type of work in Slovenia is still indefinite duration employment, although an increasing trend and incidence of atypical types of employment and other types of work that may contain elements of precariousness have been seen in recent years (Laporšek, Franca, and Arzenšek 2018; Domadenik and Redek 2020). This particularly applies to young adults, as their shares of fixed-term and part-time employment are among the highest in the European Union (Kanjuo Mrčela and Ignjatović 2015), and they are also at the forefront in terms of working as sole proprietors (Domadenik and Redek 2020); and this is why we decided to analyse the precarious work phenomenon in relation to mental health in young adults aged 18–40 years who face this when entering the labour market.

Precariousness and Mental Health: Literature Review

Exposure to insecure types of work may negatively affect an individual's physical and mental health (Jonsson et al. 2020; Employment Conditions Knowledge Network 2010; Vives et al. 2020). Precarious work affects health by means of various mechanisms, including stress at the workplace (Vives et al. 2013), social and material deprivation (Domadenik et al. 2020; Benach and Muntaner 2007), personal life limits, such as the inability to plan for the future (Clarke et al. 2007), dangerous work envi-

ronments (Benach and Muntaner 2007), low work and safety standards (Quinlan, Mayhew, and Bohle 2001), periods of unemployment, employment pressure because in most cases they must continuously look for new work (Clarke et al. 2007), and presentism (Virtanen et al. 2005). The incidence of many health issues related to the various types of work including elements of precariousness is also confirmed by the findings of a Slovenian study by Domadenik et al. (2020), which found that such workers often report mental health issues, with digestive disorders and disease being very common.

Many studies on the harmful effects of unstable employment on the health of individuals have been conducted. Job instability has been primarily assessed using two approaches, the first being perceived job security, that is, general anxiety regarding the continued existence of jobs in the future (De Witte 1999) in relation to atypical, conditional and nonstandard temporary employment (Virtanen, Janlert, and Hammarström 2011; Quinlan, Mayhey, and Bohle 2001). Such studies have evidenced a consistent connection between job instability and various health conditions, especially weakened mental health. Although job instability is one of the main features of precariousness, studies in the context of unstable work have some important conceptual limitations, which is why their outcomes cannot be fully applied to precarious work (Vives et al. 2013; Vives et al. 2020). This one-dimensional approach is inappropriate because precarious work is a multidimensional construct (Kalleberg 2014; Broughton, Green, and Rickard 2016; Benach et al. 2016), which does not necessarily or merely include job instability. To be more precise, standard employment is often identified as the ideal employment standard and as such precariousness in such types of employment is often underestimated and overlooked (Employment Conditions Knowledge Network 2007; Julia et al. 2017; Vives et al. 2020), and elements of precariousness may also appear in such types of employment.

Based on our review of articles in the field of unstable types of work, including those relating to precariousness and mental health, we have included four mental health constructs in our study, namely life satisfaction, depression, anxiety and emotional exhaustion (Llosa et al. 2018). Empirical data evidences that subjective wellbeing and increased life satisfaction improve mental health and work performance. A high level of satisfaction with life and positive emotions, such as happiness, are connected to a large spectrum of important life factors related to physical and mental health, and social relationships (Pavot and Diener 2008). The

young adults in different European social security systems doing precarious work reported lower life satisfaction in a study conducted by Vancea, Shore, and Utzet (2018). A negative connection between insecure types of work and life satisfaction was confirmed in a study which researched the connection between life satisfaction and resilience pertaining to stress resulting from unstable types of work (Mauno, Ruokolainen, and Kinnunen 2013). The fact that unstable types of work negatively affect life satisfaction was also confirmed by Silla et al. (2009).

Based on such empirical findings, we assumed that young adults engaged in precarious work would report lower life satisfaction when compared to workers engaged in non-precarious work (H1).

There is no single explanation for the relationship between insecure work and depression and anxiety thus far. D'Souza et al. (2003) evidenced that insecure work is positively related to the incidence of depression and anxiety as did Boya et al. (2008) when they researched the effects of perceived work insecurity on the incidence of depression and anxiety symptoms. Moreover, participants with insecure work achieved higher scores on the Depressions Scale than they did on the Anxiety Scale (Boya et al. 2008). Researchers have also stated that work insecurity may be more stressful and harmful than unemployment (Llosa et al. 2018). In a study by Nella et al. (2015), workers with high levels of work insecurity reported higher levels of perceived stress, anxiety, depression and negative emotions compared to workers in more stable types of employment; as many as 97% of the workers engaged in insecure types of work reported anxiety symptoms and 86% depression symptoms.

De Cuyper et al. (2012) researched and analysed the connection between insecure work and emotional exhaustion in terms of *perceived external employability,* which refers to workers' beliefs on how simple it is to find a new job with another employer, finding a causal link between perceived external employability, insecure work and emotional exhaustion, thereby confirming that insecure work affects emotional exhaustion incidence.

Insecure work reduces welfare by increasing emotional exhaustion, as those engaged in such work believe they have no control over the inherent dangerous working conditions. This corresponds to Stress Coping Theory and findings in the field of insecure work thus far. Workers who perceive their employment situation as insecure, the 'primary rating' being threat, most likely assess their ability to manage such dangerous working environments as insufficient, the 'secondary rating,' which might lead to

lower welfare and increased emotional exhaustion incidence (Vander Elst et al. 2014).

Based on the findings of the above research, we assumed that individuals involved in precarious forms of work will report a higher incidence of symptoms of anxiety and depression (H2) and emotional exhaustion (H3) compared to employees in non-precarious forms of work.

Method

PARTICIPANTS

The study included 201 participants from Slovenia, a quarter of whom were men and three quarters women. A condition for participation in the study was that they were aged between 18 and 40 years old, as our focus was the early adulthood period. Another condition was that they were engaged in one of the types of work we were studying. The majority, 42.3%, were aged between 26 and 30 years old, and just over a third were aged between 18 and 25 years old; the smallest group, that is, a tenth of our participants, were aged between 36 and 40 years old. 35.3% of our participants had indefinite duration contracts, 30.8% had student contracts and 17.9% had fixed-term employment contracts. 47.3% of our sample stated that the type of work they performed was precarious.

MEASUREMENT

The first scale we use is the Satisfaction with life scale – SLWS (Diener et al. 1985), which is designed to measure an individual's overall life satisfaction by means of representing cognitive life satisfaction. It consists of five items that individuals assess on a 1–7 scale (from 1 – strongly disagree to 7 – strongly agree). All scale items are positively oriented and the final result is the sum of the five item scores. The range of the achieved scores is 5 to 35, whereby a score of 20 is neutral. The life satisfaction scale has a high coefficient of internal consistency measure, with values in studies ranging from 0.79 to 0.89, pointing to the scale's good reliability. The authors of the scale evidence its good reliability in time as: test–retest = 0.54–0.84 (Pavot and Diener 2008).

We measured depression and anxiety using the Depression Anxiety Stress Scale – DASS-42 (Lovibond and Lovibond 1995), which is composed of 42 items designed to measure depression, anxiety and stress. Individuals give their answers on a four-level scale, from 0 – does not apply to me at all (never) to 3 – applies to me very much or most of the

TABLE 1 Research Participant Characteristics

Variable	Category	(1)	(2)
Gender	Male	52	25.9
	Female	149	74.1
Age	18–25	70	34.8
	26–30	85	42.3
	31–35	26	12.9
	36–40	20	10.0
Type of work	Indefinite duration contract	71	35.3
	Fixed-term contract	36	17.9
	Civil contract	5	2.4
	Sole proprietor	15	7.5
	Part-time contract	4	2.0
	Student work	62	30.8
	Other	8	4.0
Precariousness	Yes	95	47.3
	No	106	52.7

NOTES Column headings are as follows: (1) number of participants, (2) percentage. Under other types of work, participants stated undeclared work (2.5%), self-employed person in culture (1 %), and managing an association concluding contracts with companies for the purpose of performing work (0.5%).

time (almost always). Each of the scales includes 14 items; for the purpose of our research, we only used items from the scale for depression and anxiety, by which participants assess the presence of various symptoms for the previous week. The scale is not intended to assess presence or absence of a disorder, but to assess intensity and occurrence of symptoms, and monitor treatment progress (Henry and Crawford 2005). The internal consistency coefficient of the depression scale is 0.96, whereas it is slightly lower for the anxiety level at 0.89 (Lovibond and Lovibond 1995).

The last component of our mental health model is emotional exhaustion, which we measured using the Maslach Burnout Inventory – MBI (Maslach, Jackson, and Leiter 1997). This scale measures burnout in the workplace based on three dimensions: emotional exhaustion, depersonalisation and personal accomplishment, and is composed of 44 items; for the purpose of our research work, we focused solely on the emotional ex-

haustion component. In the first part, respondents score the frequency with which they experience the researched feelings on a scale from 1 (a few times a year) to 6 (every day); intensity of experience is scored in the second part, from 1 (very weak) to 7 (very strong); in both cases, 0 can be selected, meaning that respondents have never experienced such feelings (Lamovec 1994). The reliability coefficients for individual scales range from 0.76 to 0.90, and of the three scales, the emotional exhaustion scale has the best reliability measure at $\alpha = 0.90$ (Maslach, Jackson, and Leiter 1997).

Pursuant to the absence of an instrument to measure precariousness, we provided the respondents with a short basic definition of precariousness and they accordingly stated whether they considered their work precarious or not, our definition of precarious work being: *Precarious work is unreliable, of a small scale, temporary and legally not protected in the sense of the accompanying rights (the right to a minimum pay, break, holiday leave, social security contributions, etc.).* Using the general definition of precariousness, on the basis of which individuals judged the precariousness of their own work, we investigated the subjective assessment of working conditions faced by individuals, as the subjective perception of working conditions determines the well-being and behaviour of individuals.

PROCEDURES

We customized the scales of the online survey platform Enka (www.1ka.si) accordingly for our purposes. We activated the questionnaire for our survey between May and August 2020 to avoid distorted results pursuant to the current pandemic. We invited participants to cooperate by means of various online social media platforms. First, we posted it on the Facebook group Through the Eyes of Precariousness; soon afterwards, we posted and shared it on Delozlom on Instagram, which has around ten thousand followers. Sampling was executed according to the voluntary participation principle and included a random sample of participants. The conditions for participating in the study were relevant work type participation and ages between 18 and 40. The data was arranged and analysed using Microsoft Excel and SPSS Statistics 27.0.

Results

We also assessed how individuals defined precariousness in the context of different types of work to better understand study participant features

TABLE 2 Precarious Elements within Different Types of Work (in %)

Type of work	(1)	(2)	(3)
Indefinite duration contract	5.5	29.8	35.5
Fixed-term contract	6.0	11.9	17.9
Civil contract	2.5	0.0	2.5
Self-employed	6.0	1.5	7.5
Part-time	1.5	0.5	24.0
Student work	23.3	7.5	30.8
Other	2.5	1.5	4.0
Total	47.3	52.7	100.0

NOTES Column headings are as follows: (1) precariousness, (2) no precariousness, (3) total. Under other types of work, participants stated undeclared work (2.5%), self-employed person in culture (1%), and managing an association concluding contracts with companies for the purpose of performing work (0.5%).

(table 2). The majority of our participants, that is, 23.3% of the student workers, believed that their work included elements of precariousness; such elements were also found in work by means of indefinite duration contracts (5.5%); 6% of participants on a fixed-term contract stated that the type of work they carried out included elements of precariousness; and most of the individuals working on civil contracts stated their work included elements of precariousness, as did sole proprietors.

Table 3 shows data on types of work according to age group. The majority of those aged between 18 and 25 years old carry out student work (23.8%), with slightly fewer regularly employed in other types of work. Older groups evidence slightly different trends. Those aged between 26 and 30 years old have increased rates of fixed-term employment (11.9%) and indefinite period employment (17.9%), with others being sole proprietors (3%) and student workers (7%), and this share is significantly lower than that for the previous age group. Among older participants, a notably higher number of people with indefinite duration employment is evidenced, that is, 8.5% for those aged between 31 and 35 years old, and 6% for those aged between 36 and 40 years old, who also evidence a dramatic decrease in fixed-term employment when compared to those aged between 26 and 30 years old.

We used SPSS Statistics 27.0 to evaluate the internal consistency measures, i.e. reliability, of the individual scales used (table 4), whereby the Emotional Exhaustion Scale proved most reliable at $\alpha = 0.965$. A high in-

TABLE 3 Types of Work According to Age Group (in %)

Type of work	(1)	(2)	(3)	(4)	(5)
Indefinite duration contract	3.0	17.9	8.4	6.0	35.5
Fixed-term contract	3.5	11.9	1.0	1.5	17.9
Civil contract	0.0	1.0	0.2	1.0	2.5
Self-employed	2.0	3.0	2.0	0.5	7.5
Part-time contract	1.0	0.5	0.0	0.5	2.0
Student work	23.8	7.0	0.0	0.0	30.8
Other	1.5	1.0	1.0	0.5	4.0
Total	34.8	42.3	12.9	10.0	100.0

NOTES Column headings are as follows: (1) 18–25 years, (2) 26–30 years, (3) 31–35 years, (4) 36–40 years, (5) total. Under other types of work, participants stated undeclared work (2.5%), self-employed person in culture (1%), and managing an association concluding contracts with companies for the purpose of performing work (0.5%).

TABLE 4 Measures of Internal Consistency of Scales Used

Type of work	(1)	(2)	(3)
Life satisfaction	0.839	0.851	5
Depression	0.960	0.961	27
Anxiety	0.958	0.958	26
Emotional exhaustion	0.965	0.966	18

NOTES Column headings are as follows: (1) Cronbach's alpha coefficient, (2) standardized Cronbach's alpha coefficient, (3) number of items.

ternal consistency coefficient was achieved by the scales for depression at $\alpha = 0.960$ and anxiety at $\alpha = 0.958$.

We conducted the Kolmogorov-Smirnov normality test prior to testing our hypotheses and the coefficient for all variables used was less than 0.05, pointing to the fact that our data is not normally distributed, which is why we used the nonparametric Mann-Whitney U test for further analysis and because we are interested in differences between individuals who reported precarious work and those who believed their work did not include elements of precariousness. The use of the Mann-Whitney U test was most appropriate for testing the research hypotheses. Table 5 shows statistically important differences in the variables related to life satisfaction ($p = 0.025$), depression ($p = 0.004$), anxiety ($p = 0.011$) and emotional exhaustion ($p = 0.000$). We can see that the participants who state their work had features of precarious work achieved lower results in relation to

TABLE 5 Test Statistics: Mann-Whitney U Test and Individual Scale Range Values

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Life satisfaction	Yes	95	91.29	8673.00	4113.000	0.025
	No	106	109.70	11628.00		
Depression	Yes	95	113.40	10773.00	3857.000	0.004
	No	106	89.89	9528.00		
Anxiety	Yes	95	111.96	10636.00	3994.000	0.011
	No	106	91.18	9665.00		
Emotional exhaustion	Yes	95	116.85	11100.50	3529.500	0.000
	No	106	86.80	9200.50		

NOTES Column headings are as follows: (1) precariousness, (2) number of participants, (3) range average, (4) range sum, (5) U-test, (6) p – level of properties ($p \leq 0.05$).

life satisfaction compared to those who did not report the presence of precariousness elements in the type of work they performed; furthermore, they achieved higher results in relation to depression, anxiety and emotional exhaustion. Our results highlight the higher presence of symptoms related to depression and emotional exhaustion.

Discussion and Conclusion

Precariousness can indirectly affect health by means of various psychological and behavioural coping mechanisms (Vives et al. 2013). The presence of 'chronic' employment insecurity is often connected to psychosocial stress reactions, leading to poorer physical and mental health (D'Souza et al. 2003; Jonsson et al. 2020; Employment Conditions Knowledge Network 2010; Vives et al. 2020); it may also cause problems in terms of social inclusion, as such workers have difficulty socialising with people from their social environment because of their poorly distributed working times, leading to them often feeling socially isolated (Domadenik et al. 2020). The companies with policies to employ workers for longer periods of time and willing to provide stable employment offer better working environments. Workers with indefinite duration contracts are better affiliated to employers and more productive, and have better relationships. Workers constantly worried about whether they will earn enough to survive spend a great deal of time looking for regular employment and other income, and find it difficult to identify with the companies they work for. Weaker affiliation to employers and co-workers affects relationships as well as productivity (Brinkmann et al. 2006).

Pursuant to previous findings, we assumed that individuals engaged in precarious work would report lower life satisfaction (H1), higher occurrence of anxiety and depression symptoms (H2) and emotional exhaustion (H3) when compared to workers engaged in non-precarious work. Our research results evidence statistically important differences between the two groups. Young adults engaged in precarious work on average achieved lower scores for life satisfaction, highlighting poorer life satisfaction. Our research results are consistent with the findings of previous studies in the field of insecure/unstable work and life satisfaction, that is, subjective wellbeing (Hsieh and Huang 2017; Mauno, Ruokolainen, and Kinnunen 2013; Vancea, Shore, and Utzet 2018), meaning that young adults engaged in precarious work report importantly lower levels of quality of life and perceived life satisfaction is an important element of mental health self-rating.

The correlation between depression and anxiety symptoms with precarious work incidence has been highlighted in several studies (D'Souza et al. 2003; Llosa et al. 2018; Toivanen et al. 2020; Wang et al. 2009; Wang et al. 2011). Our second hypothesis is also confirmed because *the young adults who stated their work included elements of precariousness achieved higher scores on the depression and anxiety scales compared to the young adults who did not report the presence of elements of precariousness.* Constant worry about monthly income, looking for future employment and a wide range of social and personal issues, including finding an apartment, day-care for children, and maintaining friendships and romantic relationships, harmfully affect the physical and emotional health of those engaged in precarious work. Many precarious workers report experiencing several health issues, such as stomach problems, sleep disorders and high blood pressure, and an important proportion of such workers report anxiety and depression issues directly attributable to their employment (Clarke et al. 2007).

Our final mental health dimension, emotional exhaustion, is the central element of burnout, and we evidenced statistically important difference in relation to the groups of young adult worker participants to confirm our third hypothesis. Precarious workers evidenced higher scores on the emotional exhaustion scale when compared to workers who did not report the presence of elements of precariousness. This is consistent with the findings of De Cuyper et al. (2012), who found that insecure work positively influences emotional exhaustion occurrence.

Based on our results for the second and third hypotheses, a question

arises as to whether society as a whole really benefits from precarious work in terms of business savings being reflected in increased public health system expenditure: those whose health is damaged due to their work are forced to seek medical and psychological help several times at different levels, thereby further burdening health systems. Emotional exhaustion also reduces activity in other spheres of life, which increases the possibility of emotionally exhausted individuals being less actively involved in family and social processes. Other studies correlate insecure work with sleep disorders (Boya et al. 2008; Toivanen et al. 2020), anxiety and depression (D'Souza et al. 2003; Toivanen et al. 2020; Wang et al. 2009; Wang et al. 2011), psychosomatic stress symptoms (Mauno and Kinnunen 2002), family relationship problems, a lack of motivation, weaker immune systems, exhaustion and dissatisfaction with work (Boya et al. 2008).

A major limitation of this study is the lack of a suitable measurement instrument for precariousness. Spanish researchers developed The Employment Precariousness Scale (EPRES) (Vives et al. 2011; Vives et al. 2013) to measure employment precariousness. An additional limitation arising from the lack of a measurement instrument is that participants had to assess the precariousness of their own employment based on the general definition provided in our survey; we trusted their self-assessment but should nevertheless ask ourselves about the actual precarious work situation.

The next limitation is the uneven distribution of participants according to gender, age and type of work, and this should be eliminated in the future to obtain the most realistic image of sample properties related to work precariousness as possible, including theoretical sampling of participants with certain properties; dedicated sampling would be of the greatest utility, as it would facilitate the selection of more appropriate participants (Hlebec and Mrzel 2012).

In summation, precarious work is a broad phenomenon and there is no universally accepted definition. Our research findings evidence that precarious work plays an important role in life satisfaction, including depression, anxiety and emotional exhaustion symptom occurrence. The young adults who assessed their work as precarious are not satisfied with their lives, do not understand it as well as they could, and do not balance their aspirations and values. Life satisfaction as a component of subjective wellbeing is important because it may beneficially affect an individual's mental health. We found a negative correlation between life satisfaction

and depression development: respondents who ranked their work as precarious reported a higher presence of depression symptoms, which may eventually lead to depression disorder development. We also researched anxiety symptom development and it was reported more by participants engaged in precarious work. Such workers largely suffer emotional exhaustion resulting from the extreme emotional requirements of their precarious work. Results show that such individuals face feelings of being overburdened and exhausted because they are often stressed and highly agitated.

The need for such research is great, as the phenomenon of atypical types of employment which may lead to precariousness has been on the rise, no more so than in Slovenia, which lacks sufficient research on this pressing topic. First of all, a step forward must be taken to recognise and measure precarious types of work. Furthermore, we have found that the current epidemiological situation has further increased the burden carried by workers engaged in precarious work, as they are generally the first ones to lose their jobs in crisis situations, and the current crisis is no different in this regard.

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Start-up Capital Source and Credit Access Participation of Household Nonfarm Enterprises in Nigeria: Evidence from Logistic Regression Model

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The main focus of this study is to estimate the influence of the main start-up capital source on credit access participation by household nonfarm enterprises. The General Household Survey data for 2018 was adopted to construct a measure of credit access participation. Through binary logistic regression estimation, the result shows that main start-up capital source positively and significantly influences credit access by household nonfarm businesses in Nigeria. This also implies that household nonfarm enterprises that borrowed as main start-up capital source have better chances of credit access participation when compared to those household nonfarm enterprises who do not borrow. However, this study suggests that there is a need for policies that motivate individuals or a group of individuals to borrow as their main start-up capital source in Nigeria, with a view to strengthening their operations on a sustainable basis.

Key Words: credit access, household, enterprise, binary logistic regression, Nigeria
JEL Classification: E51, G5

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Introduction

Nigeria is a developing nation among lower/middle income economies that largely depends on the production and distribution of goods and services (Kpokiri, Taylor, and Smith 2020). Such business activities are predominantly among individuals of low per capita income in the country.

These categories of individuals are believed to be very poor and, as well, need financial support as start-up capital for business investment. It has been found that Nigeria, having been endowed with natural and human resources, is presently known as the poverty headquarters of the world with more than 93 million people in the population living in poverty (Urama and Iheonu 2019). The state of poverty in developing countries like Nigeria should have guaranteed individuals borrowing as a source of start-up capital for business investment. In spite of the fact that borrowing as a source of start-up capital contributes to expansion of business, promotes investment and guarantees profit, it has been found that enterprises in Nigeria are still facing challenges of access to finance resulting from the inability to provide collateral for robust and adequate business investment. Several researchers have argued that deprivation in household enterprises to credit access as a source of start-up capital for investment has been found to be a serious problem that is confronting efficient and effective business activities in Nigeria. The trickledown effect originating from inadequate access to finance has created a serious impediment to firms' or enterprises' performance, and includes decreasing output production, decreasing employment opportunities and a high level of poverty. These impediments have also negatively affected the willingness of enterprises to have access to credit as the main source of start-up capital for investment (Chauke et al. 2013). Often, these challenges of start-up capital have been traced to asymmetric information as a cause of poor performance of household nonfarm enterprises (HNES) (Hoff and Stiglitz 2000; Erasmus and Scheepers 2008; Aver 2008).

Indeed, main sources of start-up capital and access to credit by HNES in Nigeria have been a major issue of concern in the Nigerian economy. This issue of concern requires attention to ensure that small and medium enterprises (SMES) are promoted in the Nigerian economy. Additionally, studies by Ali and Peerlings (2012), Haggblade, Hazell, and Reardon (2007), Lanjouw (2007), Bigsten et al. (2003), and Beck and Demirguc-Kunt (2005) show that access to credit plays a pivotal role in the performance of HNES in Nigeria, such as creation of employment opportunities, supporting enterprises to catch up with urgent needs, and enhancing start-up capital for investment as well as relief for payment of debt.

However, considering the present outbreak of the Covid-19 pandemic and low per capita income in developing countries, the willingness for credit access as a main start-up capital source is likely to be significant. This, however, implies that if household nonfarm enterprises eventually

have access to credit, it will go a long way in boosting output production, increasing consumption, and creating employment as well as reducing the poverty rate. The reduction in poverty rate will motivate investment that will boost economic activities such that the impact can reduce the widespread consumption inequality among household nonfarm enterprises.

The Nigerian government in 2015, under the government of former President of the Federal Republic of Nigeria, Dr. Goodluck Ebele Jonathan, made enormous efforts to ensure that the issue as concerns credit access policies are made available to guarantee borrowers easy credit access participation or any other form of support to promote entrepreneurship. Some of these policies included the establishment of the National Collateral Registry and Credit Control policies to ensure that borrowers or enterprises are provided with credit at reasonable interest rates. These policies were promulgated by the government primarily for poverty alleviation and empowerment of small and medium enterprises in Nigeria. The surprise point is that all these policies as instituted by the government appear not to handle the problems associated with credit access participation and main start-up capital sources in Nigeria. The large population of HNES in Nigeria still suffer a serious problem in participation in credit access and such problems include provision of collateral and surety in case of default to pay back the loan (Ugwuanyi 2012). It is evident that the main start-up capital source for HNES has been a serious issue in most low income countries like Nigeria (Etumeahu, Okekeke, and Ukwandu 2009). The majority of these enterprises have decided to look for financial freedom elsewhere due to their inability to meet the conditions that will guarantee them the ability to borrow. The deprivation of credit access appears to be widening in Nigeria over the past one and a half decades following the emergence of Covid-19 and a stagnant real sector that could intervene to share the benefits of growth to all population groups (Akanni and Gabriel 2020).

This study departs from previous studies in the literature that have been carried out on credit access in Nigeria from various perspectives. Many such studies, for instance Rahji and Adeoti (2010), Haruna (2007), and Olagunju (2007), focused on how access to credit influences employment creation performance. A few, like Chinanuife et al. (2019), Nwosu and Orji (2016), Nwosu and Orji (2017), and Orji et al. (2019) conducted studies on access to credit based on aggregate enterprises in Nigeria. Further studies such as Adepoju, Omolade, and Obayelu (2019), Loening, Ri-

jkers, and Söderbom (2008), Nwosu et al. (2020), and Ojonta and Ogbuabor (2021), carried out studies on how access to credit influences the performance of nonfarm enterprises using cross sectional data. These studies have not considered the opposite, how access to credit could be influenced by other factors in Nigeria. To date, the influence of main start-up capital sources on credit access performance of HNES in Nigeria is yet to be investigated using logistic regression model estimation. It is the goal of this study to fill this important gap in the literature in order to provide evidence that can support government policies for the household nonfarm sector in the country. Thus, the main objective of this study is to examine how the main start-up capital source influences credit access of HNES in Nigeria.

Other studies, such as Rahji and Adeoti (2010), Ajani and Omonona (2009), Anyanwu (1994), Essien and Arene (2014), Haruna (2007), Oboh and Kushwaha (2009), and Ugwuanyi (2012) were very close to the present study. These studies examined the determinant factors that influence credit access using cross sectional data but, however, failed to consider the important role of main start-up capital sources of household nonfarm enterprises in influencing participation in credit access.

The remaining sections of this paper proceed as follows. The next section presents an overview of the extant literature from both theoretical and empirical perspectives, while Section 3 provides the data and the method of analysis employed in this study, detailing the model specification. The empirical results are shown and discussed in Section 4, while Section 5 concludes the paper.

Review of Literature

THEORETICAL LITERATURE

Many theories established in the literature support this investigation on the relationship between main start-up capital source and access to credit participation by household non-farm enterprises (HNES). These economic theories include credit rationing theory, financial intermediation theory, and imperfect information theory (Hoff and Stiglitz 1990; Stiglitz and Weiss 1981; Benston and Smith 1976).

Credit Rationing and Constraint Theory

Stiglitz and Weiss (1981) propounded a theory of credit rationing and constraint. The theory was established to understudy the risk of rationing

loans by lenders on business activities. It explained that when there is rationing in issuing loans to an individual or a firm, such rationing could cause a serious constraint on business expansion. It explained that the consequences of rationing loans to borrowers could lead to various forms of shocks such as unbalanced inclusiveness and distorted growth in business transactions.

The theory also explained that loan discrimination among borrowers either as an individual or group of individuals, even when such individuals have the willingness to pay back at higher interest, is a serious impediment to business expansion. The theory as proposed by Stiglitz and Weiss (1981) established that individuals or firms would like to borrow provided the lender is willing to offer such credit with a lower interest rate and collateral.

Information Asymmetry Theory

The theory of information asymmetry was propounded by Hoff and Stiglitz (1990). It was developed to address issues of information on business transactions. It established that when there is imperfect information on business transactions, such imperfection has the likelihood to result in an information problem. The theory explained that the effect of such imperfect information within the financial market could lead to various factors such as moral hazard and adverse selection. The theory as proposed by Hoff and Stiglitz (1990) defined the effects of information problems in three categories within the financial market: screen, incentive and enforcement problems. The screen problem is used to measure the determination of the extent of the default while the incentive and enforcement problems are used to measure the cost conceived in ensuring credit contracts are honoured and the cost incurred in monitoring of credit beneficiaries to ensure loan repayment, respectively.

Transaction Cost Theory

The transaction cost theory was propounded by Benston and Smith (1976). The theory portrayed the argument that financial intermediaries are in business to maximize profit and utilize economies of scale with the aid of technological innovation. The major characteristics associated with transaction cost theory are the costs involved in processing and gathering data (information) that is required to reach a decision during the transaction process, policing and enforcement of contracts.

EMPIRICAL LITERATURE

Many studies on credit access and the performance of household enterprises have been conducted and documented in the literature for both developing and developed economies. For example, in the developing economy, Chisasa (2019) performed a research on how factors like the capital structure of the farmer, family net worth and household income influence a farmer's access to bank credit, using a cross sectional dataset in South Africa. The results show that they positively and significantly influence the farmer's access to bank credit.

In Sri Lanka, Gamage (2013) used the binary logistic regression model to estimate how location of the firm, availability of audited financial statements and the owner-managers' perception of access to finance influence access to bank finances for small and medium-sized enterprises. The study found that these variables positively and significantly influence access to bank finances for small and medium-sized enterprises. In another study, Aga and Reilly (2011), using probit model estimation, stated that a firm's location, membership of a business association, age, size, the sector in which it operates, and accounting record maintenance are important factors that influence credit access in Ethiopia.

According to Ololade and Olagunju (2013), sex, marital status, lack of guarantor, and high interest rates are the important factors that influence credit access in Nigeria. Ojonta and Ogbuabor (2021) also conducted a study on how other factors of household nonfarm enterprises influence access to credit in Nigeria using multinomial model estimation.

Osano and Languitone (2016) used descriptive and inferential research design and found that the structure of the financial sector, awareness of funding opportunities, collateral requirements and small business support services are important factors that influence credit access by small and medium enterprises (SMES) in Mozambique.

Chauke et al. (2013) conducted a study of smallholder farmers in South Africa using logistic regression model estimation. The result reports that need for credit, attitude towards risk, distance between lender and borrower, perception of loan repayment, perception of lending procedures and total value of assets are the important factors that influence credit access.

In the case of studies in the developed economy, Quach and Mullineux (2007), Afrin, Islam, and Ahmed (2009), Mach and Wolken (2011), Bauchet and Morduch (2013), Luan and Bauer (2016), Chowdhury and

Alam (2017), Herkenhoff (2019), and Sahu (2017) focused on how credit access influences other indicators of household characteristics.

Indeed, the main focus of this present study is, firstly, to ascertain the influence of the main start-up capital source on credit access participation of household nonfarm enterprises using binary model estimation and a cross-sectional household survey dataset. Secondly, it is to ascertain other indicators that influence credit access participation of household nonfarm enterprises. Overall, this paper estimates the influence of the main start-up capital source on credit access participation of household nonfarm businesses in Nigeria.

Theoretical Framework

The subject of this study adopts the theoretical framework of credit rationing and constraint theory that was proposed by Stiglitz and Weiss (1981). The theory has been found most suitable to address the general content of this paper. The theory, however, explained how two different types of individuals are qualified to participate when dealing with credit rationing and constraint. The theory also found that such individuals are regarded as potential borrowers who have equal capacity to pay back, but while some have access to finance, others do not, even when they are willing to fulfil the agreement in terms of returns on investment with a higher interest rate. Thus, it is obvious that certain groups of individuals or firms have not adopted the position to guarantee them adequate access to credit, not regarding the prevailing level of interest rate existing in the current economy. Most importantly, the theorists, however, take note of the situations in which potential borrowers are deprived of the power to access the credit market completely by lenders, even when they have the capacity and willingness to pay back the loan for high rate of interest not considering the current prevailing interest in the market economy. These decisions on the part of lenders to advance inadequate access to credit by enterprises through credit advancement without taking into consideration the ability of an individual or firm in loan repayment at coverage of higher rate of interest can have a great influence on participation by enterprises borrowing as source of start-up capital.

Basically, when borrowing by enterprises as source of start-up capital is not given adequate attention and consideration as an important factor to promote access to credit, the trickledown effect could endanger the prospects of such enterprises. Such effects have the likelihood to develop serious problems of both moral hazard and adverse selection re-

sulting from price failure and poor market performance. The price failure and poor market performance in the market caused by moral hazard will jeopardise the positive performance of the firm or enterprise. However, when enterprises are able to have credit access as a source of start-up capital, it will enhance the building capacity to borrow and by doing so, there will be employment opportunities, offering financial freedom, poverty reduction and food security (Haggblade, Hazell, and Reardon 2007; Lanjouw 2007; Ali and Peerlings 2012) which will provide support for promotion of flexibility in allocation of resources and reduction of cash flow (Bigsten et al. 2003). Additionally, when enterprises are provided with credit access it will support job creation and drive capital for investment.

Thus, Stiglitz and Weiss's (1981) theory explained that lenders' inability to promote enterprises through borrowing could have the likelihood of affecting business transactions and access to credit. When business transactions are greatly affected, the trickledown effect, which includes high poverty, a high unemployment rate and high dependency ratio, will largely increase. If not given adequate attention it could also cause a serious impediment to expansion of businesses in underdeveloped economies like Nigeria (Ugwuanyi 2012). Thus, Stiglitz and Weiss's (1981) theory provided a better evidence of the underlying model of this study.

Data Descriptions and Methodology

DATA DESCRIPTION

The General Household Survey Panel, published in 2018–2019 by the National Bureau of Statistics (2018) in collaboration with the Federal Ministry of Agriculture and Rural Development and the World Bank, is the dataset used for analysis in this study. The survey is a fourth wave household field panel survey targeting all 36 federal states, plus Abuja, the Federal Capital Territory.

The sample studied was designed to use the Local Government Area as the reporting domain for the General Household Survey. The sample design for the survey, however, also enabled the provision of estimates at national, geo-political and state level. The sampling frame for all the local government area which is 774 in numbers in Nigeria employed the enumeration area partitioned by the National Bureau of Statistics. The survey used a multi-stage stratified sample design to capture observations for 3919 households. However, some of the observations that were missing from the place of their location during the survey contribute to the

sample size of 244 observations for credit access of household nonfarm enterprises.

Since this study focused on main start-up capital sources and credit access of household nonfarm enterprises, this paper will make use of the available data of a sample size of 244 as contained in the survey. To achieve a robust, and avoid getting a spurious, result, this study endeavours to take into consideration the outlier issues and homogeneity problems. In ascertaining that, 18 outliers were removed from the considered observations.

MODEL SPECIFICATION

The binary logistic regression model is a mutual exclusive event used when the dependent variable is categorised into two events, such that the occurrence of one event will affect the other while the independent variables take the value either discrete, continuous or both variables (Verbeek 2004). These assumptions are the reasons for adopting a binary logit model to estimate the influence of the main start-up capital source on credit access participation by household nonfarm enterprises in Nigeria. Since credit access participation by household nonfarm enterprises is a dummy variable with two categories (dichotomous), this study takes the modelling approach conducted by Astari and Kismiantini (2019). In the binary logit model adopted for this study, we code π to stand for credit access participation by household nonfarm enterprises, while x_i is coded to stand for the set of independent variables. Hence, the binary regression model for this study is coded as two outcomes in measuring the main start-up capital source. This implies that the binary regression model is suitable to determine the probability that a firm i has one of the j mutually exclusive events of credit access (1 = Yes; 2 = No).

Looking at probability assumption by Justino, Litchfield, and Pham (2008), the model can now be formally stated as:

$$P(\pi_{i=j}) = \frac{1}{1 + e^{-z}}, \tag{1}$$

where $Z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p; \beta_0, \beta_1, \ldots, \beta_p$ are regression parameters, $x_0, x_1, \ldots, x_p$ are explanatory variables, and P is the probability of household nonfarm enterprise operates with credit access (π_i), where e represents the exponential constant approximately 2.718.

All the independent variables in equation (1) are defined as shown in table 1. The variables are explained as follows:

- x_1 denotes TRADING, which defines the spending on purchase of

TABLE 1 Measure of Variables Used in the Binary Logit Regression

Variable Name	Variable label	Coding	Exp. sign
Dependent variable			
Credit access	CREDIT	1 = yes; 0, otherwise	n/a
Independent variables			
Spending on purchase of goods for sale (x_1)	TRADING	1 = yes; 0, otherwise	(±)
Physical capital stock (x_2)	STOCK	1 = yes; 0, otherwise	(±)
Gender of employee (x_3)	GENDER	1 = male; 0, otherwise	(±)
Main start-up capital source (x_4)	START-UP	1 = Borrow; 0, otherwise	(±)
Spending on other business costs (x_5)	COST	1 = yes; 0, otherwise	(±)
Purchase of raw materials (x_6)	MATERIAL	1 = yes; 0, otherwise	(±)

NOTES Based on data from General Household Survey (National Bureau of Statistics 2018).

goods for sale of a nonfarm enterprise. It is a categorical variable for which 1 denotes 'yes' if there is existence of spending on purchase of goods for sale by the household nonfarm enterprises, while '0, otherwise' represents that there is no existence of spending on purchase of goods for sale by the household nonfarm enterprises.

- x_2 denotes STOCK, which describes the current value of physical capital stock for household nonfarm enterprise. This is a binary variable that takes a value of 1 for 'yes' (if the enterprise has current value of physical capital stock) and '0, otherwise' (if the enterprise did not have current value of physical capital stock).
- x_3 denotes GENDER, which stands for the gender of the employee. It is also a binary variable that takes a value of 1 for 'yes' if the household nonfarm enterprise is a male employee and '0, otherwise' if the household nonfarm enterprise is female employee.
- x_4 denotes START-UP, which represents the main start-up capital source by household nonfarm enterprise. It is a dummy variable that takes a value of 1 = Borrow if the main start-up capital source is borrowed and if the main start-up capital source is not borrowed represents '0, otherwise'.
- x_5 denotes COST, which describes the spending on other business costs by household nonfarm enterprises. It is a binary variable taking a value of 1 for 'yes' if the enterprise has expenditure for other

TABLE 2 Distribution of Main Start-up Capital and Credit Access by Sector

Varisbles	Non-credit access		Credit access		Total	
	(1)	(2)	(1)	(2)	(1)	(2)
Borrower	23	15	9	14	32	29
Non-borrower	57	73	20	33	77	106
Total	80	88	29	47	109	135

NOTES Column headings are as follows: (1) urban areas, (2) rural areas. Based on data from National Bureau of Statistics (2018).

business costs and '0, otherwise' if Non-expenditure on other business costs.

- x_6 denotes MATERIAL, which describes the purchase of raw materials by household nonfarm enterprises. This is a binary variable that takes a value of 1 for 'yes' (if the enterprise had a purchase of raw material) while '0, otherwise' denotes that the enterprise did not have a purchase of raw materials.

The credit access which is denoted by CREDIT is a dependent variable. It is a binary variable taking a value of 1 for 'yes' (implying that the enterprise has credit access) and '0, otherwise' implying that the enterprise does not have credit access.

Results and Discussion

DESCRIPTIVE ANALYSIS

The quantitative analysis as indicated in table 2 describes the relationship between the main start-up capital source and credit access of household nonfarm enterprises. Table 2 reports that those household nonfarm enterprises who do not borrow for their main start-up capital source have more shares of participants in credit access while those that borrow as the start-up source have a very small share of participants in credit access in both urban and rural areas. This implies that those who do not borrow (non-borrowers) in household nonfarm enterprises are commonly found in both urban and rural areas.

Table 3 illustrates the percentage and relationship between the main start-up capital source and credit access of household nonfarm enterprises. Table 3 reports that the household nonfarm enterprises that are classified as 'non-borrower' concerning the main start-up capital source have a greater percentage of participants in credit access, but reports a

TABLE 3 Main Start-up Capital Source and Credit Access by Percentage Share

Varisbles	Non-credit access		Credit access		Total	
	(1)	(2)	(1)	(2)	(1)	(2)
Borrower	28.8	17.0	31.0	29.8	29.4	21.5
Non-borrower	71.2	83.0	69.0	70.2	70.6	70.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

NOTES Column headings are as follows: (1) urban areas, (2) rural areas. Based on data from National Bureau of Statistics (2018).

smaller percentage of participants in credit access for household nonfarm enterprises operating with borrowing in both urban and rural areas. Conversely, household nonfarm enterprises who do not borrow as a main start-up capital source have a greater percentage of participants in credit access than those of the households that borrow in both urban and rural areas. This implies that the household nonfarm enterprises whose main start-up capital source is through borrowing originating from sources such as a bank loan, NGO support, money lender, or remittance from abroad, among others, have less access to credit as the main source of start-up capital for investment.

RESULTS

Table 4 presents estimated results of the binary logit model of main start-up capital source and credit access of household nonfarm enterprises. The main focus of the result is to ascertain how main start-up capital source influences credit access participation of household nonfarm enterprises.

The table shows the results of the coefficient values and *p*-values of binary logit regression, with two categories of credit access, using 'No credit access' as the bench category variable. The estimated covariates in the study include trading, stock, gender, cost and material. The results indicate that the coefficient of main start-up capital source (START-UP) is a positive and relevant indicator influencing credit access of household nonfarm enterprises. The *p*-value of 0.073 indicates that it is significant at the 10% level. This finding suggests that higher the household non-farm enterprises borrowed as main start-up capital source, the higher will be the probability of household nonfarm enterprise to participate in credit access. This finding supports the empirical findings of Blanchflower and Evans (2004), which indicate that main start-up capital sources by household nonfarm enterprises do influence credit access participation by these

TABLE 4 Results of Binary Logit Regression

Variables	(1)	(2)	(3)	(4)
TRADING	0.597	0.381	0.117	1.817
STOCK	2.145	1.061	0.043**	8.544
GENDER	−0.537	0.488	0.272	0.584
START-UP	0.602	0.336	0.073*	1.826
COST	−0.718	0.311	0.021**	0.488
MATERIAL	−0.375	0.353	0.288	0.687
INTERCEPT	−3.201	1.117	0.004	0.041

NOTES Observation: 244, pseudo R^2: 0.116, correctly predicted: 76.6, dependent variable: credit access. Column headings are as follows: (1) *B* – relative risk ratio value, which represents the estimated coefficients, (2) robust standard error, (3) probability value of estimated model, (4) exponential of *B* (coefficient). ** and * indicate the significance level at 1% and 5%.

enterprises. Here main start-up capital source remains a way forward in obtaining such credit accessibility.

The results of the binary model also indicate that physical capital stock (STOCK) of household nonfarm enterprises influences credit access. The *p*-value of 0.043, which is significant at the 5% level, shows that physical capital stock is another important factor. This finding indicates that the higher the physical capital stock of the enterprise, the higher the tendency that household nonfarm enterprises would have credit access, which is consistent with Stiglitz and Weiss (1981). The results also revealed that spending on other business costs by household nonfarm enterprises has a negative and significant influence on credit access, with a *p*-value of 0.021, which is significant at the 5% level. This finding is in conformity with the study by Asimakopoulos, Samitas, and Papadogonas (2009).

However the results of this study show that several factors, such as spending on the purchase of goods for sale (TRADING), gender of employee (GENDER) and purchase of raw materials (MATERIAL) are not significant and do not influence household nonfarm enterprise credit access. At this present time of the pandemic, main start-up capital sources and credit access participation were getting worse for many household nonfarm enterprises in developing countries resulting from Covid-19, as the majority of the financial institutions are restricted in issuing credit for their operation. However, the finding of this study shows that main start-up capital source is a relevant factor that could influence credit access participation by household nonfarm enterprise in Nigeria. But at this

recent period of the pandemic, there was a serious meltdown in various sectors of the economy resulting from low turnout for credit accessibility by household nonfarm enterprises. This challenge of the pandemic has resulted in a great impediment to the performance of enterprises, such as high cost of commodities in the market, high dependence on the government for survival, and poverty.

All these have contributed to a serious negative impact on credit access participation by household nonfarm enterprises in Nigeria. However, numerous studies have been well documented in the literature about the challenges economies face as a result of the Covid-19 pandemic (Appiah-Otoo 2020; Polemis and Soursou 2020; Shen et al. 2020). Their studies show that the Covid-19 pandemic affected the operation of firms through production and distribution costs which negatively put a serious pressure on the part of supply, thereby undermining firms' ability to meet set targets for profit making and loan repayment to the lender with interest accrued on it.

Concluding Remarks

This study estimated the impact of main start-up capital sources on credit access participation by household nonfarm enterprises in Nigeria using the dataset contained in the 2018 General Household Survey (National Bureau of Statistics 2018). The study used quantitative measures such as descriptive analysis and binary logistic regression to unveil the factors that influence credit access participation by household nonfarm enterprise in Nigeria. The results reveal that the main start-up capital source, current value of physical capital stock and spending on other business costs are significant drivers for credit access participation by household nonfarm enterprises in developing countries like Nigeria. Other covariates estimated in the study under review are spending on purchase of goods for sale, other business costs and gender of employee. The results reveal that the roles of these covariates as drivers of credit access participation by household nonfarm enterprises have not shown any significant impact.

However, an important strategy noticed in the dataset shows that the household nonfarm enterprises whose main start-up capital source does not come from borrowing have more participants in credit access in urban and rural areas. These findings imply that there is a need for adequate policies that can put in order the issues of main start-up capital source, current value of physical capital stock and spending for other

business costs by household nonfarm enterprises in Nigeria. Such government policies are expected to provide for these enterprises not only to participate in credit access but also to sensitise the need for borrowing as a main start-up capital source. Lastly, where government financial support is made available to household nonfarm enterprises, there should be adequate and regular monitoring to ensure that such funds that were provided are not misused for other unimportant uses. This, in turn, will ensure the efficiency and sustainability of household nonfarm enterprises in Nigeria.

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