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Exploring the Theoretical Gap on Knowledge Work of Knowledge and Skilled Workers in TVET Practices: A Literature Review

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Abstract: This article presents a literature review on the theoretical gap of knowledge work between knowledge and skilled workers. There are two primary reasons for conducting this literature review namely the lack of literature on knowledge work for skilled workers and, the poor understanding of their knowledge requirements. Although the requirements for the Industry 4.0 skilled-workers, knowledge work, and innovation are widely discussed in the literature for white-collar jobs, there are scarcely mentioned for blue-collar jobs. Also, the theoretical gap of knowledge between skilled workers and knowledge workers has not been yet addressed, leading to poor public perception of the role of knowledge work in TVET skilled workers. The findings from this literature review may provide insights into the understanding of the theoretical gap and the role of knowledge work for skilled workers and knowledge workers. Seventy-seven articles were reviewed, and inductive thematic analysis was conducted with ATLAS.ti resulting in three major themes, namely, 'qualification and employment requirement', 'management control', and 'theoretical and contextual perspectives. The findings indicate that there are differences in knowledge work identified in two groups of workers, nonetheless, support the conclusion that knowledge works are equally crucial for skilled workers to optimise their role. The findings of this study imply that the role of the two groups of workers could not be described interchangeably within a similar working-class and these findings could be used to create clear distinction in the definition and descriptions of work practices of knowledge and skilled workers within the TVET sectors.

Keywords: Knowledge worker, skilled worker, knowledge work, Industry 4.0, TVET

1. Introduction

In 1959, Peter Drucker, who first coined the term 'knowledge worker, discovered the critical role of theoretical and analytical knowledge within the individual to face the technology transition towards becoming a knowledge society (Davenport, 2005; Jacobs, 2017). The term knowledge worker is often used to refer to educated or experienced personnel, who can work independently (Mládková, 2012) and who tend to hold white-collar jobs such as "teachers, lawyers, politicians, scientists, social workers, accountants and computer programmers" (Benson & Brown, 2007, p.31; Darr & Warhurst, 2008). Furthermore, Bell, the first sociologist to coin the term 'knowledge worker' acknowledged in 1979, also acknowledges that the economy is driven by new professional and technical workers' information and knowledge (Darr & Warhurst, 2008). Thus, throughout the centuries, the term 'knowledge worker' (k-worker) is not used exclusively to refer to white-collar workers but also to include blue-collar workers such as semi-skilled and skilled workers (Jacobs, 2017). Nowadays, producing knowledgeable workers who could apply theoretical and analytical knowledge are deemed as crucial in facing the Fourth Industrial Revolution (or known as Industry 4.0) as knowledge is a critical resource for

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productivity and innovations(Teo-Dixon & Monin, 2007). Therefore, competent workers who are capable of applying knowledge work (employing the individual's thinking process that is influenced by the nature of work behaviour that is necessary either for routine or non-routine manual and cognitive tasks required in the workplace) are highly demanded and often constitute the criteria for hiring (Holford, 2019). Despite the generally accepted importance of knowledge work and knowledge workers in industrial practices, there are limited literature and empirical evidence of the specific knowledge work that a 'knowledge worker' in TVET practices would need, as illustrated by existing literature. In Malaysia context, for instances, Ismail and Hassan (2013) summarised twelve key challenges in Malaysia TVET for knowledge worker-driven. These twelve key challenges in Malaysia TVET are: i) curriculum structure and multiple provision; ii) certification and standard; iii) TVET poor perception and recognition among the public; iv) the shortage of technical instructor; v) flexibility requirement in TVET lecturers' scheme of service, vi) high cost of technical education; vii) feedbacks on graduates employability; viii) self-initiative to gain flexible access to TVET; ix) continuous TVET opportunities for lifelong learning, weak monitoring and evaluation; x) mismatch supply and demand, lack of efficiency and quality; xi) low participation from other race and ethnic groups as Malays mostly dominate TVET, and xii) the issues related to attrition and completion rate. To date, the key issues continue, as described by Yusoff et al. (2020) in their research on capabilities and challenges as feasible pathways and educational achievement in Malaysian TVET. Meanwhile, in a broad context, in the past centuries, the reluctance to use the term skill to conceptualise the role of knowledge in the workplace (Hislop, 2008); and the lack of knowledge work for integrating theoretical knowledge and skills to support the conceptualisation of work identified (Warhurst & Thompson, 2006; Cully, 2003). Present, Surawski's (2019) research also highlighted similar concerns, highlighting the fact that the phrase remains imprecise, widely construed, and used with hazy or no meaning albeit being well-known in management terminology. Much research has been conducted on knowledge work for knowledge workers but not for skilled workers as Surawski's (2019) emphasised that only a few attempts have been made in the literature to thoroughly define working groups, making it easier to identify and analyse knowledge workers on a large scale, at the national level, and within individual organisations. Therefore, this systematic literature review was conducted to fill the theoretical gap of knowledge work between skilled workers and knowledge workers in TVET practices. The findings would contribute to a better understanding of the theoretical gap of knowledge work between knowledge workers and skilled workers. Specifically, the insights gained can better promote the need and role of knowledge for skilled workers, which are just as crucial as for knowledge workers, and increase the positive view of public perception on TVET skilled workers. There are sixth sections in this article - the first section discusses the concepts of knowledge work, knowledge worker and skilled worker as found in the literature, to be followed by an elaboration on Drucker's Theoretical Framework. The second section explains the strengths and weaknesses of Drucker's theory. The third section explains the methodology, including sampling procedure for literature review and inductive thematic analysis using ATLAS.ti. Then, the fourth section presents data analysis and results, followed by the extended discussion of results in the fifth section. The sixth section concludes the overall literature review and highlights the literature review's limitations and recommendations for future work.

1.1 What is Knowledge Work?

Several scholars define knowledge work as the knowledge used to achieve a high level of rational thinking from routine operational tasks to a more complex scenario (Alvesson, 2004; Benson & Brown, 2007). Knowledge work is conceptualised for white-collar jobs (or also known as professional jobs) (Duffy, 1995; Hislop, 2008); who can apply theoretical and analytical knowledge as well as intelligence, rationality, wisdom and understanding (Teo-Dixon & Monin, 2007). Knowledge work is often used in uncertain work situations (Jacobs, 2017); characterised by ambiguity, complexity and a long feedback cycle which demanding the knowledge worker's ability to think and require a high degree of autonomy(Whicker, 2004). Knowledge work is commonly associated with white-collar jobs (or also known as professional) while less so with blue-collar jobs (Hislop, 2008). Some scholars, however, acknowledge that knowledge work may also be required for routine tasks, and not all white-collar workers are using knowledge work for their tasks (Benson & Brown, 2007). Also, the term knowledge workers have evolved and expanded to include white-collar jobs and some blue-collar jobs (Jacobs, 2017). Following this, the importance of knowledge work is required to be emphasised and therefore, the clear differences of knowledge work in knowledge worker and skilled worker can be achieved.

1.2 Who is a 'Knowledge Worker' and 'Skilled Worker'?

A knowledge worker refers to a worker who is highly educated and qualified to work on the intellectual tasks (Michel, 2011) that deal with high-tech equipment (Gordon, 1997), demonstrates a high level of creativity in work, possesses intellectual skills and ability to apply theoretical instead of contextual knowledge (Hislop, 2008). Meanwhile, Benson and Brown (2007)described knowledge workers as those who are capable of performing complex tasks. Further, Drucker (1994) described knowledge workers as individually dependent and creative, whereas in another Drucker's (1985) publication, the manual worker is referring to low margin initiative and creativity (Turriago-Hoyos *et al*., 2016). In Drucker's model, he proposes two types of workers; manual workers and knowledge workers (Turriago-Hoyos *et al*., 2016). Most of the scholars viewed Drucker's knowledge model is favourably referring to the white-collar jobs instead

of blue-collars as the manual workers' are viewed from the lens of managerial capitalism (Dufty, 1966; Surawski, 2019). In contrast, knowledge workers are viewed from the lens of entrepreneurial capitalism (Turriago-Hoyos *et al*., 2016).

Based on Hislop's 2008 analysis on previous scholars' works; the occupations that are deemed associated with knowledge work are lawyers, consultants, IT and software designers, advertising executives, accountants, scientist and engineers, architects and artists and art directors or producers. Meanwhile, in contrast, "the term 'skilled worker' is applied to workers in occupations requiring a formal apprenticeship" (Dufty, 1966, p.197) which implies greater emphasis on hand-works instead of knowledge work. However, recently skilled workers have been described as part of the human resources that currently hold leadership or management, professional or technician or associate professional positions (Institute of Labour Science and Social Affairs, 2014). Thus, an overlapping or blurring of definitions between skilled workers and knowledge workers is emerging, leading to the need for further clarifications. There is currently limited literature on knowledge work for skilled workers as the skilled worker is distinguished by their skill level which is determined by their academic qualifications. For instance, the term high-skilled refers to a university degree holder (Kunze, 2004 & Bulat 2019). According to Bulat (2019), traditionally, low and highly skilled workers are distinguished primarily by their level of education (academic credentials), salary, and work sector, or a combination of all three. However, Bulat's theory is based on an understanding of low and high skilled workers within the migrant skilled context (Bulat, 2019). Irrespective of the contextual differences, the knowledge work required for manual workers has been identified to be the basis of routines and productivity-based work by skilled workers (Turriago-Hoyos *et al*., 2016). Furthermore, even though manual (skilled) workers only perform routine tasks, Braverman (1974) asserted that knowledge is still essential for the skilled worker as the worker is "the master of a body of traditional knowledge" and own decision-making of the methods and procedures (p.109). Braverman's view is later supported by Hislop's (2008) research on the needs of both concepts of skills and knowledge to conceptualise work.

Nowadays, in the era of the Fourth Industrial Revolution, each individual is viewed as the source of innovation due to knowledge work that they possessed within the context of their work experiences and working context and thus, the knowledge worker and skilled worker are equally important in the Fourth Industrial Revolution. However, the skills and knowledge requirements are frequently mentioned across the literature for knowledge workers (which refers to the high-skilled worker) and there are blurry boundaries in the context of knowledge work for skilled workers. A clear understanding of knowledge work is required as Borrás and Edquist (2015) (as cited in Rapini *et al*., (2017)) emphasised that successful innovation is dependent not only on the mix of a range of competencies that individuals and firms possess (via a collection of knowledge, skills, and expertise), but also on the process by which competencies are formed, maintained, and developed.

The relation between theory and practice presented in the theory of knowledge work is few discussed for the skilled worker. Living in the era of Industry 4.0 where demanding knowledge society, each individual is viewed as the source of knowledge. Drucker firstly identifies the role of the knowledge worker in 1969, where he discovered the uniqueness of knowledge workers and challenges in managing them (Vohra & Mukul, 2009). In Drucker's theoretical framework of the knowledge worker, knowledge is described as an individual asset to the society, whereas innovation plays a prominent role in generating knowledge (Turriago-Hoyos *et al*., 2016). Several strengths of Drucker's theoretical framework of knowledge workers are identified. Firstly, Drucker's concept and analysis are still cogent and highly influential to date (Teo-Dixon & Monin, 2007). For example, to date, the Fourth Industrial Revolution highly requires innovation skills and is a requirement in the technical and management structure (Beier *et al*., 2020). Having high creativity, innovation skill, decision-making skills are the attributes that are frequently mentioned as Industry 4.0 workforce requirements (Kamaruzaman *et al*., 2019). All professional levels are encouraged to play a role in supporting the transformation process towards Industry 4.0. Secondly, the workers have a significant autonomy as they are the source of the knowledge creation process and the asset to the work organization (Benson & Brown, 2007; Turriago-Hoyos *et al*., 2016). Turriago-Hoyos *et al*. (2016) further added that Drucker's theory empowers the worker's role in becoming a knowledge society. Drucker predicts that empowering knowledge workers will improve a country's productivity from 3.5 per cent to 4 per cent annually if knowledge is the primary solution to work-related problems(Jacobs, 2017). For instance, in India, the key contributor to India's economic and industrial development is the knowledge workers in the Information Technology (IT) services industry (Premalatha, 2016). As IT is one of the key drivers of digitalisation in Industry 4.0 (Haseeb *et al*., 2019), having a knowledge worker to perform IT tasks are highly mentioned in the literature.

However, Drucker's theoretical framework of knowledge workers also raised several concerns among scholars. First, the term 'knowledge work' and 'knowledge worker' is highly associated with white-collar jobs (or also known as professional jobs) (Surawski, 2019), which caught the attention among the scholars who conduct studies on knowledge work of the labour workforce (or also known as manual workers or routine workers) (Turriago-Hoyos *et al*., 2016). Several scholars argued that knowledge work could also be found in manual or routine works (El-farr, 2009). Meanwhile, other scholars claimed that the knowledge work in the professional role does not necessarily fall into the category of knowledge work (Caddy, 2007). Secondly, some of Drucker's writings on knowledge work theory and concepts are not clear – where Teo-Dixon and Monin (2007) claimed as "lack the same incisiveness and clarity" (p.15) and the concepts of the knowledge worker, and knowledge work are poorly defined (El-farr, 2009).

Following the strengths and weaknesses of Drucker's theoretical framework on knowledge work, the need to address the theoretical gap on knowledge work is required to understand the theory of knowledge work for the knowledge

worker and skilled worker. Addressing the theoretical gap in knowledge work may enhance our understanding of knowledge work and the vital role of knowledge work for both knowledge and the skilled worker in TVET practices. The need to address the theoretical gap is further ascertained by Carr (1980), who emphasised the importance of finding the gaps between theory and practice so that the issues in reality (which in this study, refer to the context of knowledge work between knowledge workers and skilled worker) can be solved by bridging the theoretical gap between theory and practices. As there is always a gap in the social science between theory and practice (Hofius, 2020), by conducting a literature review, the gap in the theory of knowledge work can be identified to understand the differences of knowledge work theory for the role of the knowledge worker and skilled worker. In this study, a literature review aims to explore the theoretical gap of knowledge work between knowledge worker and skilled worker. The central question is - what is the theoretical gap of knowledge work between knowledge and skilled worker?

2. Methodology

Methodologically, inductive thematic analysis was conducted with ATLAS. ti for this study. Thematic analysis was chosen because it is flexible, does not require comprehensive theoretical and technological knowledge of techniques, and is more accessible (Braun & Clarke, 2006).

2.1 Research Design

The literature review was conducted in exploratory mode, where the search strategy is flexible and contributes to the themes in literature (Synder, 2019). Exploratory design was chosen instead of explanatory because this research seeks for comparison in the similarities and distinctions between knowledge works of knowledge and skilled workers based on the available literature. A literature review is not a qualitative method, but the approach used to analyse and evaluate data in literature review is a qualitative (Synder, 2019).

2.2 Sampling and Data Collection

At the initial screening, 104 articles were identified, and seventy-seven articles were selected based on several criteria. The selected articles were obtained from the SCOPUS database (such as the SAGE website and Science Direct database). These full articles are open access and purposive sampling was used with the keywords such as ‘knowledge work’, ‘knowledge worker’, ‘skilled worker’ and ‘TVET’. Similar to Handa et al.’s (2016) literature search, the searching is made by title, abstract and keyword using the aforementioned keywords, followed by removing articles that are only abstracts and not related to TVET. The year of publications ranges from 1961 till 2020, as shown in Table 1.

Table 1 - Year of publications

Year of publications	Number of publications
1961	1
1983	3
1990	1
1992	1
1995	3
1997	1
1998	2
1999	1
2000	4
2001	1
2003	2
2004	4
2005	1
2006	3
2007	4
2008	2
2009	3
2010	3
2011	5
2012	2
2013	3

Table 2 - Continue

Year of publications	Number of publications
2014	1
2015	1
2016	6
2017	7
2018	4
2019	4
2020	2
No date	2

The number of publications by sector is illustrated in **Table 3**. The highest number of publications refers to no mention sector, as most previous scholars discuss the terms of knowledge work, knowledge worker and the skilled worker in the general context. Therefore, no specific sectors were mentioned (see work Warhurst and Thompson, 2006 and Reinhardt *et al*., 2011). Another identified sector is 'various', which means various sectors – due to some of the literature discussing knowledge workers in various sectors (for example, see work Surawski, 2019). Further, nine main sectors were identified in this literature review: services, manufacturing, IT, human resources and management, healthcare, government, energy, education and banking and finance, while the rest are grouped into discussing either knowledge work, knowledge workers or skilled workers.

Table 3 - Number of publications by sectors

Sectors	Number of publications
Various sectors	6
Services	3
Manufacturing	5
Information Technology	5
Human Resources and Management	9
Healthcare	7
Government	2
General (sectors were not mentioned in the articles)	29
Energy	1
Education	8
Banking and Finance	2

2.3 Data Analysis

Similar to Pope's (2016) coding using ATLAS. ti in her literature review, over seventy articles were reviewed for literature review purposes. In this study, Braun and Clarke's thematic analysis was selected as a method for data analysis, in which six phases of the inductive thematic coding process were conducted (Braun & Clarke, 2006). As shown in

Fig, in Phase One, the literature review was conducted – repeated reading on textual data and memo was written during the coding process.

In Phase Two, two types of codes were used in the inductive coding process to generate the initial codes. The first type of code is the in-vivo codes for years of publications and type of publication – resulting in a descriptive graph, as previously shown in **Fig. 1.** The second type of code is the open codes that were used for generating the initial codes relating to knowledge work for the knowledge worker and skilled worker. Any quotations that contain keywords of the knowledge worker, skilled worker, knowledge work, history of knowledge work and issues and challenges in both skilled and knowledge workers were searched. At this phase, there are two reasons for the coding process. The first reason is, the coding process was conducted to understand the definition of the knowledge worker, skilled worker, and knowledge work before actual data analysis, which resulted in nine pattern codes defined as a category. Each pattern code shares a similar meaning and, therefore, is defined as a category. Nine categories are 'Who is a knowledge worker?', 'Why knowledge worker' 'Knowledge worker: History', 'Who is a skilled worker?', 'Why skilled worker?', 'Knowledge work definition', 'Why knowledge work?', 'Drucker: Power of knowledge', and 'Knowledge work: Characteristics'. The second reason is, the coding process was conducted for actual data analysis, where aimed to explore the theoretical gaps of knowledge work between both skilled and knowledge workers, which resulting two categories (known as issues and challenges in skilled workers and issues and challenges in knowledge worker) based on the keywords of "issues and challenges" in both skilled and knowledge workers.

Next, in Phase Three, based on the pattern codes (or known as the category), each category was defined to search for potential themes. The category of 'who is a knowledge worker describes a knowledge worker's characteristics and their significant role as a knowledge worker. The category of 'who is a skilled worker describes a skilled worker's characteristics and significant roles as a skilled worker. The category of 'knowledge work: definition' describes the role of knowledge work and its significance to both knowledge worker and skilled worker. Meanwhile, the category for issues and challenges in the skilled worker and knowledge worker describes the issues and challenges that emerge in the research on knowledge work for the skilled workers and the knowledge workers.

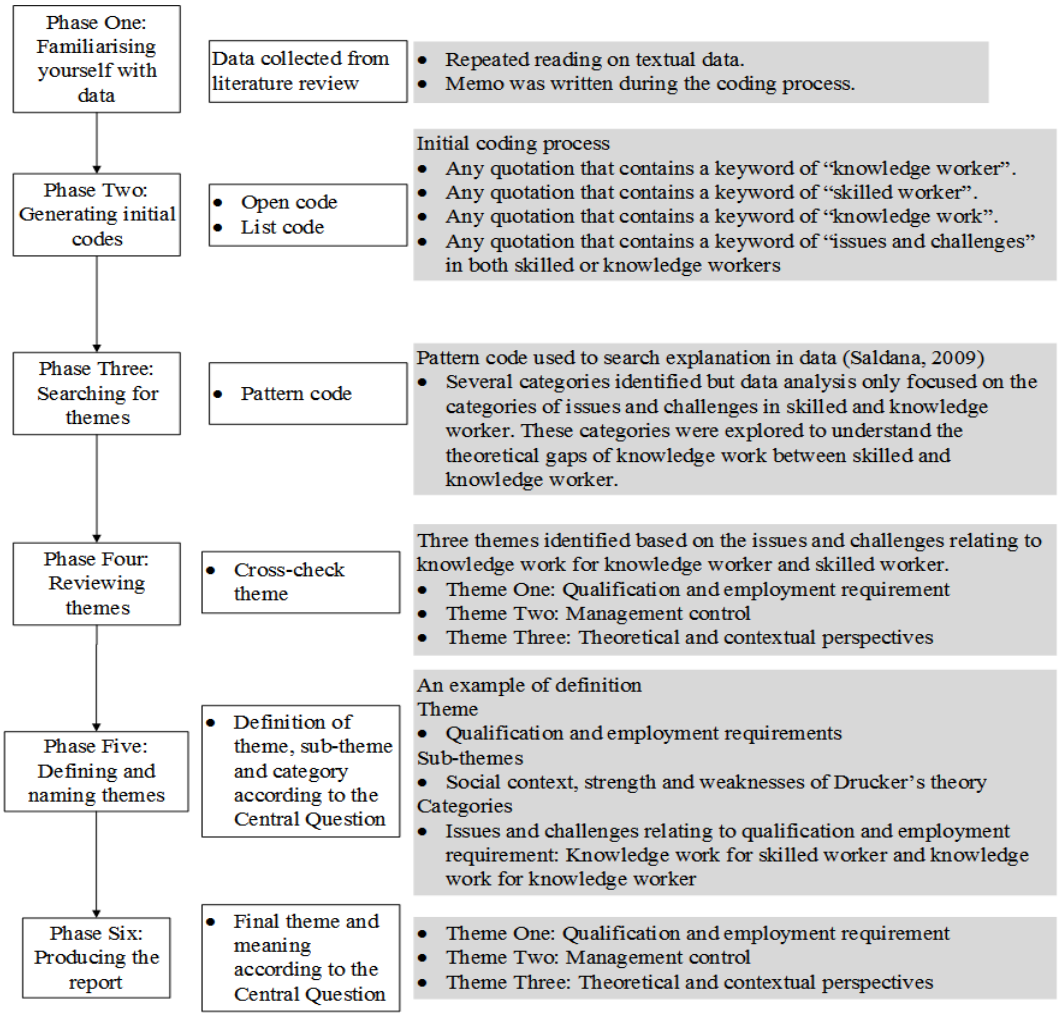

Fig. 1 - The phases of thematic analysis

Afterwards, in Phase Four, the potential themes were reviewed. Several pattern codes such as 'Qualification and employment requirement', 'Management control', and 'Theoretical and contextual perspectives' were identified inductively for potential themes, based on the similar pattern identified from the issues and challenges of knowledge work in the skilled workers and the knowledge workers.

Next, these themes are refined and defined at Phase Five. Several themes are classified as sub-themes as the answers are not directly answering the central question. However, the sub-themes are equally crucial to the final theme as it provides supporting literature to produce a thick description (through the answer to the central question). The final themes for the central question are 'Qualification and employment requirement', 'Management control' and 'Theoretical and contextual perspectives. These themes are further elaborated by the sub-themes that consists of the category of 'Knowledge worker: History) that contains details of the previous scholar discussing the role of knowledge work and the category of 'issues and challenges in skilled worker and knowledge worker' which illustrates the social context (or the reality of TVET skilled worker). The other final themes identified are derived from the category of 'who is a knowledge worker, 'who is a skilled worker' and 'knowledge work: definition'. These themes are further elaborated by the sub-themes. For instance, for themes of 'Who is a knowledge worker' and 'who is a skilled worker' contains details of why knowledge worker and why skilled worker respectively. Also, more details on knowledge worker's history than the skilled worker when relates to the knowledge work. Finally, the theme of 'knowledge work: definition' contains details derived from each category that was previously identified in Phase One.

The final themes are management control, theoretical and contextual perspectives and qualification and employment requirement. These final themes indicate the theoretical gaps of knowledge work and discovered through the issues ad challenges found in knowledge worker and skilled worker. Braun and Clarke (2006) described the final phase as producing a report, which in this study, the findings are further elaborated in Section 4: Data analysis and results and Section 5: Discussion. Three themes of the theoretical gap: qualification and employment, management control and theoretical and contextual perspectives support the existing issues highlighted by previous scholars on the theory of knowledge work and based on the reality of knowledge worker and the skilled worker in TVET practices. The theme of qualification and employment requirement explains the differences of the knowledge worker and skilled worker that are distinguished by the knowledge profile and skilled profile stated in the existing accreditations, and thus, influences the employment requirement. Then, the theme of management control explains the differences between knowledge worker and skilled workers that are distinguished by the level of autonomy, which is greatly influenced by the management. Finally, the theme of the theoretical and contextual perspectives that describes the differences between knowledge worker and skilled worker are distinguished by the challenges relating to theoretical and contextual perspective. A few examples of verbatim quotations from the literature (known as data) are illustrated in **Table 4,Table 5** and **Table 6 - Continue**

[Theme 2] Management control: The differences of knowledge work for knowledge worker and skilled worker are distinguished by the level of autonomy and this level of autonomy is greatly influenced by the management.	**Examples of Verbatim Quotations from the Literature [Data]**
	managing their engagement and commitment to the work and the organisations remains a challenge"
Pattern 2: Knowledge work for skilled worker: issues and challenges relating to management control	[D43] "Taylor's objection to employee discretion, however, was that he simply did not trust workers to use this know-how for the good of the organisation. Thus, the fear of shirking, free-riding or 'soldiering' won out over the potential productivity benefits of allowing any employee discretion. Thus, it became the manager's 'duty' to first set and then rigorously enforce work rules" [D31] "In this respect, importantly, there is no engagement with past skill development initiatives and no attempt to draw lessons from them. In skill development policy documents, the past appears to be a tabula rasa. There is no awareness of very similar issues and challenges faced by skill policies and industrial training institute (it is) in the past". [D12] "...data from the case study suggest specific innovation factors that discourage technicians from adopting the knowledge tools."

Table *7.* The pseudonym DX, refer to several works of literature, for instance, D8 is the eighth journal reviewed.

Table 4 - Data analysis for theme one

[Theme 1] Qualification and employment requirement: The differences of knowledge work for knowledge worker and skilled worker are distinguished by the knowledge profile and skill profile stated in the existing accreditations, and thus, influence the employment requirement	**Examples of Verbatim Quotations from the Literature [Data]**
Pattern 1: Knowledge work for knowledge worker: issues and challenges relating to qualification and employment requirement.	[D8] "…the decline of the knowledge worker and full-time permanent jobs particularly in high-tech and knowledge-based manufacturing as a threat to professional work" [D25] "The adoption of this definition means, however, that the little we know about the commitment of knowledge workers may now be inaccurate as research on knowledge workers has focused on employees of 'new economy' sectors or occupations such as scientists and IT experts"
Pattern 2: Knowledge work for skilled worker: issues and challenges relating to qualification and employment requirement.	[D31] "Two major concerns have come to haunt the Skill Mission—the inability to train workers according to the expectations of industrial interests and the failure to provide jobs to those who have undergone skill

	training. Only 15 per cent of newly skilled workers are reported to have found jobs between 2015 and 2018". [D32] "We cite two main reasons that may explain why skilled workers are unable to find decent jobs. First, the low quality of technical education and vocational training produce low-skilled workers, who remain unemployable even after obtaining technical and vocational training".

Table 5 - Data analysis for theme two

[Theme 2] Management control: The differences of knowledge work for knowledge worker and skilled worker are distinguished by the level of autonomy and this level of autonomy is greatly influenced by the management.	**Examples of Verbatim Quotations from the Literature [Data]**
Pattern 1: Knowledge work for knowledge worker: issues and challenges relating to management control	[D71] "The findings suggest that the motives for achievement, creativity, and aggression of these knowledge workers are not significantly related to the same kinds of organisational climate dimensions" [D19] "Given the extent to which Indian educated youth are entering the workplace as knowledge workers,

Table 6 - Continue

[Theme 2] Management control: The differences of knowledge work for knowledge worker and skilled worker are distinguished by the level of autonomy and this level of autonomy is greatly influenced by the management.	**Examples of Verbatim Quotations from the Literature [Data]**
	managing their engagement and commitment to the work and the organisations remains a challenge"
Pattern 2: Knowledge work for skilled worker: issues and challenges relating to management control	[D43] "Taylor's objection to employee discretion, however, was that he simply did not trust workers to use this know-how for the good of the organisation. Thus, the fear of shirking, free-riding or 'soldiering' won out over the potential productivity benefits of allowing any employee discretion. Thus, it became the manager's 'duty' to first set and then rigorously enforce work rules" [D31] "In this respect, importantly, there is no engagement with past skill development initiatives and no attempt to draw lessons from them. In skill development policy documents, the past appears to be a tabula rasa. There is no awareness of very similar issues and challenges faced by skill policies and industrial training institute (it is) in the past". [D12] "...data from the case study suggest specific innovation factors that discourage technicians from adopting the knowledge tools."

Table 7 - Data analysis for theme three

[Theme 3] Theoretical and contextual perspective: The differences of knowledge work for knowledge worker and skilled worker are distinguished by the challenges relating to theoretical and contextual perspective faced by the knowledge worker and skilled worker.	**Examples of Verbatim Quotations from the Literature [Data]**
Pattern 1: Knowledge work for knowledge worker: issues and challenges relating to theoretical and contextual perspectives	[D25] "…. more attention must be focused on understanding the key attributes of knowledge work and how these characteristics are played out in the work setting. This will allow for further refinement of the definition and measure of knowledge work used in this article".

	[D24] "…the typicality claim about knowledge workers rests on a particular reading of occupational categorization weightings - that is, economic change is assumed from aggregate occupational change. This is a misreading of such changes that has three facets…."
Pattern 2: Knowledge work for skilled worker: issues and challenges relating to theoretical and contextual perspectives	[D8] "The poor definition of knowledge activities, which are uncritically identified with service activities and creativity of all types, including low-skilled/wage occupations, suggests that the service-dominated economy has significantly challenged the classical concept of professions" [D41] "The lack of use of the term skill to conceptualize work is to some extent symptomatic of the lack of cross-fertilization that has typically occurred between the knowledge and labour process theory literatures"

3. Results

The thematic analysis was conducted in this study, three major themes identified known as 'qualification and employment requirement', 'management control', and 'theoretical and contextual perspectives. Based on the literature review, three main themes of theoretical gaps of knowledge work were identified between knowledge workers and skilled workers: qualification and employment, management control and theoretical and contextual perspectives of knowledge work. These three theoretical gaps are highly debated among scholars and thus lead to a different meaning of knowledge work between knowledge worker and skilled worker.

3.1 Theme One: Qualification and Employment

One of the theoretical gaps of knowledge work discovered is qualification and employment. The knowledge work for the knowledge worker and the skilled worker is distinguished by the academic qualification and employment requirement. The characteristics of knowledge work for the knowledge worker is mainly oriented in its knowledge profile and requirements. The findings are further supported by Davenport (2005) and Jacobs (2017) findings on the theoretical and analytical knowledge within the knowledge worker. Meanwhile, the characteristics of knowledge work for the skilled worker are based on skill profile and have been identified as the basis of routines and productivity-based work (Turriago-Hoyos *et al*., 2016).

The existing accreditation for skilled workers or, specifically blue-collar jobs, is mainly oriented to skill profile. On the contrary, the existing accreditation for white-collar jobs is mainly referring to the knowledge profile. For skilled workers, knowledge work required for manual workers has been identified to be the basis of routines and productivity-based work by skilled workers (Turriago-Hoyos *et al*., 2016). To date, the knowledge work for a skilled worker, specifically low-skilled and semi-skilled workers, is an unexplored area and therefore, a need for exploring the knowledge work among those low-skilled and semi-skilled workers is inherent. Acknowledging the crucial role of knowledge work for both types of workers can enhance the public's perception of the important role of knowledge work between knowledge worker and skilled worker. The positive image of low-skilled and semi-skilled workers can be established by acknowledging their ability rather than academic qualification. Further, Marks and Baldry (2009) claimed that knowledge workers are referred to all types of occupation, despite differences in employment and qualifications. Although numerous research emphasises the skilled worker's capability despite qualification (see Marks and Baldry, 2009; Pfeiffer, 2017 research work on low-skilled workers), however, the knowledge work is vital in distinguishing the skill level.

Moreover, current literature showed no detailed research of knowledge work between skilled and knowledge workers as Marks and Baldry's (2009) discovered no concrete definition of knowledge worker due to various roles, occupations and social identities held by white-collar jobs and blue-collar jobs. The complex view can be seen between qualification and skill (Warhurst & Thompson, 2006); as within the context of employment, Benson and Brown (2007) and Blackler (1995) share a similar view that the definition of knowledge worker can be further understood by knowing what they do instead of who they are. Thus, a better understanding of the commitments of both skilled and knowledge workers can be gained. By understanding what the knowledge worker and skilled worker can do, may lead to a better understanding of the commitments possessed by knowledge workers and skilled workers.

3.2 Theme Two: Management Control

Another difference between knowledge work for the knowledge worker and the skilled worker is the level of autonomy given by the top management in the work organisation, as the high-skilled workers have more autonomy than the low-skilled worker. Management control refers to "the persistence of managerial control" which is usually seen in the work organisation (Sewell, 2005, p.685). Taylor's (1912) first impression was that the employee was qualified to incorporate

'know-how' skills, as he recognised that the workers had 'know-how' skills compared to the managers (Sewell, 2005). The knowledge work within the knowledge worker and skilled worker can be further established if the workers are being trusted to work on their tasks (Sewell, 2005). As knowledge worker has the autonomy to manage themselves (Drucker, 1999), the skilled worker (specifically low-skilled and semi-skilled) is less having the autonomy to manage themselves (Wheatley, 2017). Drucker (1999) further clarified that this scenario (of less having the autonomy) restrict the innovation requirement among the skilled worker specifically for low and semi-skilled because innovation must be part of the work, task and responsibility. Otherwise, the term of knowledge workers and skilled workers will continue to remain two separate terms.

3.3 Theme Three: Theoretical and Contextual Perspectives of Knowledge Work

Finally, the knowledge work for the knowledge worker and the skilled worker is distinguished by different types of challenges that occurred from the theoretical and contextual perspectives of knowledge work faced by the knowledge worker and skilled worker. For a knowledge worker, the challenges occurred in articulating theoretical and contextual knowledge. Meanwhile, for a skilled worker, the challenges occurred on how each individual understood the contextual knowledge, as restricted by limited theoretical knowledge and working experiences. The theoretical and contextual perspectives greatly influence the theoretical gap of knowledge work between a knowledge worker and a skilled worker. The theoretical perspectives are possessed mainly by the white-collar jobs as they can integrate and apply knowledge to solve a problem, where the main challenge is to articulate the theoretical and contextual knowledge. However, for the blue-collar jobs, the contextual perspectives significantly influence the skills acquired to solve the problem, but restricted by each individual on how they understood the contextual knowledge as Gourlay (2001) emphasise "that knowledge can be understood in terms of how individuals acquire, interpret, remember, use and share what they know and can do" (p.181).

Nonetheless, in the general context, the theoretical gap in knowledge work occurred due to several reasons. Firstly, the insufficient detail on the core features of knowledge work (Jacobs, 2017). According to Jacobs (2017), some scholars refer to knowledge work as knowledge-based tasks because they believe that examples of knowledge work should be viewed as discrete units of work behaviour. Meanwhile, Bosch-Sijtsema *et al*. (2011), Mladkova (2012) and even Jacobs (2017) argued, not every scenario is a knowledge-based task as the knowledge work itself could be tangible and intangible, complex, and many different approaches can be applied to reach the output. Nonetheless, the knowledge work demanded is greatly influenced by the context in which knowledge workers carry out their tasks (Bosch-Sijtsema *et al*., 2011).

Secondly, theoretically, the skilled worker also possessed knowledge work as Turriago-Hoyos *et al*. (2016) highlighted that the people who live in the knowledge society – entrepreneurs, managers, executives and workers are all knowledge workers. Acknowledging the role of knowledge work for skilled workers and knowledge workers may enlighten those workers' actual practices, which significantly reduces the boundaries between classes (Darr & Warhurst, 2008).

Thirdly, the lack of definition of knowledge activities – especially service activities and low-skilled/wage occupations (Švarc, 2016). The meaning of knowledge is acquired to understand the role of knowledge work for skilled workers and knowledge workers as the meaning of knowledge needs to be viewed in two perspectives – theoretical and contextual (Jacobs, 2017).

4. Discussion

The results indicate three themes of the theoretical gap in the theory of knowledge work that explain the differences of knowledge work for the knowledge worker and skilled worker's role. Based on the theoretical gaps identified, the role of theory on knowledge work and the differences of knowledge work between knowledge workers and skilled workers are further elaborated.

The role of knowledge work is highly required in the Fourth Industrial Revolution. Knowledge is central to innovation (Pickett, 1998), which is highly required to transform Industry 4.0 successfully(Laudante, 2017). However, the role of knowledge work is restricted by the level of skill and academic qualification. For instance, the high-skilled worker is commonly associated with a higher education level (Prifti *et al*., 2017), whereas the semi-skilled and low-skilled worker is distinguished by their lower educational background. In TVET, the role of knowledge work is highly important in the semi-skilled and low-skilled workers. The significant role of semi-skilled and low-skilled workers has been emphasised by Hirsh-Kriensen (2016), where the low-skilled workers also contribute to the Fourth Industrial Revolution. However, the need to understand to what extent that knowledge is required and can be utilised is another concern that needs to be considered (Warhurst & Thompson, 2006). Aside from that, the qualification may remain as the indicator of the skill level but may not expose the reality of knowledge work in the workplace. There is a need to bridge the theoretical gaps of knowledge work between the skilled and knowledge workers by identifying and promoting knowledge work in skilled workers. The theoretical gap of knowledge work between knowledge workers and skilled workers can be reduced in two ways. For knowledge workers – more information is required about the occupational, organisational, sectoral, and context of the knowledge worker as the knowledge worker can vary by the situation (Darr

& Warhurst, 2008). Further research on the nature of knowledge work is required as knowledge work often occurs in unclear work situations(Jacobs, 2017), rather than research on knowledge worker themselves. Most important to note, knowledge work is equally essential for skilled and knowledge workers as it has a significant influence on future socio-economic, particularly in the developed nation (Whicker, 2004).

Knowledge worker including the high-skilled worker is highly associated with a high level of autonomy. Higher levels of autonomy and trust are required for specific groups of technical and professional workers (Warhurst & Thompson, 2006), in comparison to the low-skilled and semi-skilled worker that is highly associated with TVET (Spottl & Windelband, 2020)The low-skilled worker and semi-skilled worker rely on the work instruction, thus indicating the low autonomy possessed by these workers. Regarding Drucker's theory of knowledge, each worker is the source of innovation and knowledge and thus contributes to the effective operation in the work organisation. The trust given by the managers for the low-skilled and semi-skilled workers can increase their sense of responsibility level to assist the company, as well as to encourage their creativity in utilising their contextual knowledge obtained from the workplace surroundings. In Benson and Brown's (2007) research, the findings imply that supervision must account for a greater degree of freedom to allow knowledge workers to perform tasks unhindered. Benson and Brown's view is further supported by Ackroyd *et al*. (2005)(as cited in El-farr, 2009), where knowledge workers' influence and self-esteem are not always reliable, because they are continually losing autonomy, being appraised by superiors, and being pushed into a conflict related to knowledge management trends.

The difference of knowledge work for the knowledge worker and the skilled worker is distinguished by different types of challenges from the theoretical and contextual perspectives of knowledge work. The theoretical and contextual perspectives greatly influence the theoretical gap of knowledge work between a knowledge worker and a skilled worker. In TVET practices, the level of skill is referred to years of working experiences (see Ministry of Human Resources Malaysia, 2013), and thus, the skilled worker is viewed as an individual who gains more access to contextual knowledge. On the one hand, the years of working experiences of skilled workers give more benefits to the skilled worker as they are well immersed with the workplace's contextual knowledge and requirement. On the other hand, the challenges occurred on how each individual understood the contextual knowledge. The challenges exist because the decision-making process is limited by the absence of theoretical knowledge and depends on working experiences. As consequence, it leads to a poor perception of skilled workers. A few examples could be seen in nowadays scenarios, such as the technician role is often going unrecognised (Lewis, 2019)and the skilled workers' difficulties in getting decent jobs (see Narayanan and Nandi's 2017 research work). In reality, despite the difference in skill levels and academic qualifications, every individual can manage the knowledge work due to their role as the source of knowledge, even at a minimum amount of knowledge (Collins, 1997; El-farr, 2009). Although most of the knowledge work is referring to the white-collar jobs, Caddy (2007) (as cited in Jacobs, 2017), however, revealed that not all jobs done by the scientists are knowledge work – as some of the routine tasks within knowledge worker occupation may not be reflecting the actual knowledge work. Jacobs (2017)further claimed that not every work scenario entails a knowledge-based task. Thus, the term knowledge worker, mainly referred to as the high-skilled worker, can also be applied to the semi-skilled and low-skilled worker.

5. Conclusion, Limitation and Recommendation

In a nutshell, the exploratory research via the literature review reveals that the identified theoretical gaps of knowledge work are the qualification and employment requirement, management control and theoretical and contextual perspectives. These theoretical gaps lead to differences in knowledge work between knowledge worker and skilled worker. Despite the differences in knowledge work between knowledge workers and skilled workers, the literature review discovers that knowledge work is equally important for the knowledge workers and skilled workers in TVET practices. This study provides two insights into the theoretical gap of knowledge work between knowledge and skilled workers. Firstly, although most previous research highlights the role of knowledge work for white-collar jobs, knowledge work is equally necessary for blue-collar jobs. Secondly, the skill bias in public perception can be reduced, and thus, within the context of knowledge work, the blue-collar jobs (employing skilled workers) can also be similarly defined as a knowledge worker. This is to note with great emphasis that skilled workers are also capable of contributing towards the innovation required in Industry 4.0 as they are also the source of knowledge creation within the context of their workplace.

It is essential to note here the limitations identified from this literature review. First, there is not much information on the skilled worker's knowledge; for instance, the characteristics of knowledge work for the low-skilled and semi-skilled worker—most of the literature only mentions routine tasks and refers to skilled workers as manual or routine workers only. Secondly, there is no empirical evidence of knowledge work characteristics found in any research for the low-skilled and semi-skilled workers. Thirdly, some scholars mentioned a few white-collar occupations that are not classified as knowledge work, but no details are provided of the white-collar jobs. Nonetheless, the literature review's most significant limitation is the lack of information on the extent to which knowledge work is assigned for blue-collar jobs.

Following that, this study recommends further research on knowledge work for skilled workers is required to understand the reason for the differences in knowledge work requirements between skilled workers and the knowledge workers. Thus, the findings can contribute towards a more explicit definition of knowledge work for the knowledge workers, and the skilled workers can be established.

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