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The threat of robots to career sustainability, and the pivotal role of knowledge management and human capital

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ABSTRACT

With the remarkable progress made in the field of artificial intelligence, there is growing concern about the possibility of robots posing a threat or danger to humans and the robot is crowding more and more people out of their jobs. The epidemic period also witnessed an unparalleled increase in the demand for technology products. This empirical study investigates several aspects of Knowledge Management (KM), Human Capital (HC) and Career Sustainability (CS): first, the relationship between KM dimensions, namely Technical, Cultural, Human and Structural Knowledge Management (TKM, CKM, HKM, SKM) on HC and CS in Malaysian public universities; and, secondly, the moderating role of HC on the relationship between these KM dimensions and CS. A research model was developed to test these hypothesized relationships. The model was tested on data from 251 lecturers, employing structural equation modelling PLS-SEM. The results show that TKM, CKM and HKM, but not SKM, have a significant impact on CS. HC moderates the relationship between TKM, SKM and HKM and CS but not CKM. The results provide useful insights for researchers and academics, outlining the practical and theoretical implications and future research.

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Introduction

As technology continues to advance and drive changes to business models, the role of all types of employees will need to be further developed and adapted at an accelerating pace (Margherita and Braccini, 2021; Lu et al., 2019; Sigala, 2018). The World Economic Forum's (2018) Future of Jobs Report predicted that, by 2022, 75 million employees could be laid off because of a shift in the division of labour between the human workforce and new technologies (WEF, 2018). In addition, according to the World Economic Forum, by 2025, the wave of robotics will damage 85 million global jobs (WEF, 2018). Undoubtedly, the most important challenges related to Career Sustainability (CS) facing employees in our current era involve the quest to preserve their jobs (Chin et al., 2019; Xu et al.,2018; Larivière et al., 2017), especially as the threat of technology to the labour market is becoming evident (Doeringer and Piore, 2020; Decker et al., 2017; Hanushek et al., 2017).

As we are in a highly competitive employment market, where each employee seeks to show all their talents and abilities to keep their job, the issue of CS has become of paramount importance. Organizations endeavour to retain employees who possess unique capabilities and exceptional skills that distinguish them from others (Richardson and McKenna, 2020; Tordera et al., 2020). Meanwhile, organizations are seeking to replace their human employees with robots for several reasons (Li et a., 2019), including: (a) Safety: as some jobs pose serious risks to human health, especially working with heavy machinery, high temperatures and sharp tools, delegating robots instead is appropriate (Galin and Meshcheryakov, 2021; Sparrow and Howard, 2017); (b) Perfectionism: robots are programmed to perform tasks with extreme accuracy, are less likely to make mistakes, and may monitor the quality of their work, leading to the

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highest quality standards (Hinz et al., 2019); (c) Speed: because robots are machines, they do not need to stop, are not distracted, and do not need times for rest and holidays (Pfeiffer, 2016; Gombolay et al., 2015); (d) Continuity: robots concentrate on a single task, and their work is not dependent on the work of others, so using them eliminates the idea of emergencies and unexpected events more reliably than using human labour (Tavakoli et al., 2020); (e) Pay: robots receive no monthly salary, although there are capital and maintenance costs beyond the initial guarantees (Aksoy et al., 2021; Rosemurgy et al., 2015); and (f) Robots require no insurance or post-retirement benefits (Straubhaar, 2017).

For all these reasons, the issue of employees' concern about the sustainability of their jobs has become of paramount importance to them (Coupe, 2019; Oosthuizen, 2019). Governments, too, are increasingly concerned that robots will replace human employees, which will increase unemployment and put great pressure on governments (Nam, 2019).

We live in the era of knowledge, and employees depend on knowledge to ensure the sustainability of their jobs (Ferreira et al., 2018; Barthauer et al., 2020; Chin et al., 2019). Over time, knowledge has become an important resource for all institutions and companies, especially in light of technological progress, where it plays a vital role in the success of both employees and organizations.

Empirical studies dedicated to KM have examined its direct effect on sustainability. However, the basis of such research can be traced back to business literature concerning the relationship between the two variables (Chopra et al., 2021; Martins et al., 2019). In addition, KM has been extended to other fields, covering additional KM dimensions (TKM, CKM, SKM and HKM), with special focus on organizational sustainability (Demir et al., 2021). This extends to KM factors (Bibi et al., 2021) with potential to be determinants of the conditions under which single KM dimensions may be suitably adopted over others.

In contrast, empirical studies concerning the direct relationship between KM and sustainability have attracted less attention, and this paper makes several contributions to knowledge and sustainability research. The first is to explain the conditions under which KM contributes to the science of CS. While research on dynamic knowledge capabilities is enhanced by advancing the capabilities and skills of employees, it is paradoxical that employees suffer from the anxiety of losing their jobs because of massive technological advances (Arntz et al., 2020; López-Cabarcos et al., 2020), and governments' and employees' fear of job loss and increased unemployment (Bhargava et al., 2021; Ionescu, 2019). To the best of the author's knowledge, this is a global pioneering study that tests the effects of KM dimensions on CS. It is the first to investigate the moderating role of HC on the KM–CS relationship. There is therefore little or no information on the influence of firms' performance, in terms of their actual activities and their resource investments, to address the knowledge generated. Thus, this study aims to fill this gap in the literature.

The main objective is therefore to investigate the role of HC as a moderating variable on the relationship between the KM dimensions (TKM, CKM, SKM and HKM) and CS. The study specifically focuses on HC activities connected to the knowledge mix and their interaction with the four KM dimensions. HC is referred to as optimal performance, where skills and experience views are linked to approaches to sustainability achievement. The moderating variable choice is built on the resource-based theory that considers HC and KM strategies as those that contribute to generating and enhancing knowledge to satisfy the requirements of the present era in light of sustainable careers.

Directed towards the above objective, this study is organized in the following way: in the first section, the introduction of the study is presented. The second section subsequently sets out the literature review, formulation of hypotheses and the development of the study framework (see Fig. 1). The third section provides a description of the methodology adopted, as well as a detailed description of the research design and data collection and analysis methods. In the fourth section, the empirical results from the data analysis are presented, while the fifth section discusses the implications of the findings and provides recommendations based on them. The paper ends by identifying the limitations of the study and makes recommendations for future studies. The paper's primary hypotheses are formulated from the study sample of Malaysian public universities. The results support some hypotheses and reject others. The analytical framework is validated in light of the moderating role of HC on the relationship between KM dimensions and CS.

Literature review

Knowledge management and career sustainability

The term CS is generally used to refer to how employees maintain their jobs with the same productivity and efficiency, and do not lose their job positions over time, even in the event of the emergence of new competitors: human or technological (Chin et al., 2022). According to De Vos et al. (2020), CS has recently become the subject of intense and growing empirical and conceptual research, while Tordera et al. (2020) claims that, although the use of the term in all aspects of management is not new, its specific meaning is still relative. Renn (2020) defined CS as continuing to do a specific job and develop in it without the existence or emergence of risks related to

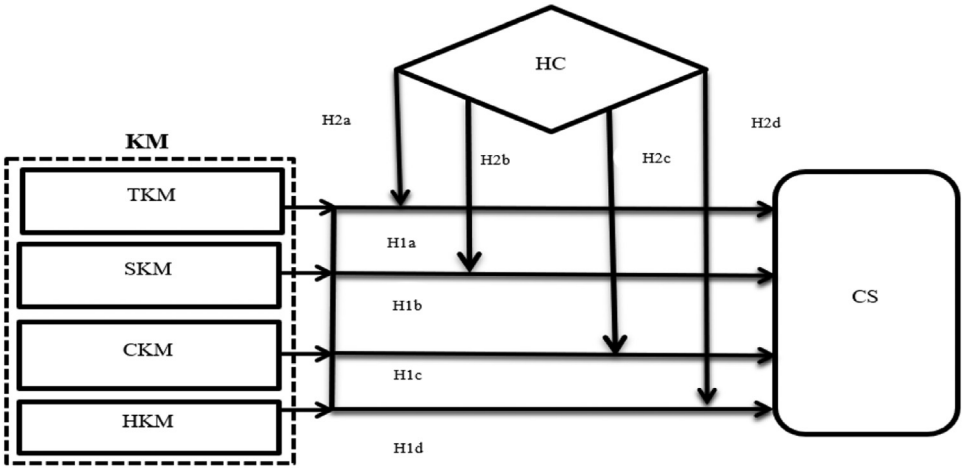

Fig. 1. Study model.

losing the position. Meanwhile, Richardson et al. (2017) noted that CS is the ability to maintain quality of work and a place of work that fosters growth, enabling skills and abilities to be distinguished from those of others.

Many studies have indicated that CS, thus identified as important, can only be put in place by increasing the knowledge of each employee. For example, Renn (2020) indicated that employees can achieve CS using unique knowledge that distinguishes them from others. Van den Groenendaal et al. (2022), meanwhile, indicated that employees who want to maintain their positions and do not wish to lose their jobs must work hard daily to increase and develop their knowledge, as well as to apply their knowledge to their assigned tasks.

In addition, previous studies have presented discussion of several concepts relating to KM. Based on the literature, we use Sigala and Chalkiti's (2015) definition of KM as the work that an organization performs in order to maximize the efficient use of intellectual capital in business activity, requiring networking and linking the best individual brains through collective participation and thinking. According to Soto-Acosta et al. (2018), KM is the exploitation of the skills and experiences of an organization's members through teamwork and brainstorming sessions, and the search for information necessary to achieve the goals of the organization and competitive advantage, thus ensuring survival and continuity despite competition.

Masa'deh et al. (2017) indicated the need for more studies into the interaction of KM with other variables. KM aims to provide increased knowledge content in the development and delivery of products and services, achieve shorter innovative cycles and product development (Donate and de Pablo, 2015), facilitate and manage innovation and organizational learning, benefit from the experiences of people throughout the organization, manage work environments, allow employees to obtain insights and ideas relevant to their work related to solving intractable problems, and manage intellectual capital and intellectual assets in the workforce such as the expertise and know-how that employees possess (North and Kumta, 2018).

The technology dimension (computers and software) has an important role in KM, especially in conjunction with the human dimension, managing the acquisition, dissemination and preservation of knowledge, and including document processing and decision support systems (Becerra-Fernandez and Sabherwal, 2014). The cultural dimension is related to the goals of the organization in terms of its culture and strategies, confronting and exploiting available external opportunities and internal analysis of projects, in terms of strengths and weaknesses, as well as looking at culture in KM in terms of tacit or apparent knowledge. Tacit knowledge consists of connecting people through development of networks to share knowledge and to reuse and benefit from it (Horban et al., 2021; Erwee et al., 2012). The structural dimension is related to the development of new work practices to achieve and increase interdependence between individuals working in the same team, develop programmes concerned with knowledge sharing, monitor the implementation of these programmes, measure results, reduce costs, and increase response speed, in addition to defining tasks and roles for collective or individual participation in KM (Birasnav and Rangnekar, 2010; Walczak, 2005). The human element itself is the main component of KM, as individuals represent the basis through which organizations move to organizational knowledge instead of individual knowledge. It includes personnel in information systems, KM, development and research, knowing that individuals manage knowledge through the process of evaluating inputs in terms of acceptance, rejection, converting them into knowledge, organizing, storing, linking and preserving them in technical systems (Chuang, 2004; Liao, 2003; Thomas et al., 2001).

A significant correlation has been evidenced between KM and sustainability, with the former described by researchers as a systematic and effective process of managing and activating the stores of knowledge in the organization and employing them in achieving the goals of the organization (Girard and Girard, 2015). In addition, previous studies that have investigated the relationship between KM and sustainability have found it to be positive. For instance, Kavalić et al.'s (2021) recent study proposed and tested an integrated model dedicated to the drivers and outcomes of KM in manufacturing enterprises, using a quantitative approach and involving 520 Serbian firms. The study used SEM to examine the constructs' validity and path relationships. The PLS-SEM analysis findings indicated that KM positively influenced manufacturing firms' sustainability.

Tseng and Lee (2014) argued for and illustrated the relationship between KM and sustainability, specifying boundary criteria and mechanisms in the relationship viewed from a knowledge-based dynamic capability perspective. The authors found KM to have positive effects on superior performance and sustainability, while knowledge-based dynamic capability is an important intermediate organizational mechanism for KM to lead to superior performance and sustainability.

López-Torres et al. (2019) studied the relationship between KM and sustainability among SMEs and found a positive relationship. Furthermore, Lopes et al. (2017) studied the relationship between KM and sustainability in Brazilian manufacturers of rubber products and found a significant positive relationship between the two concepts among the research population. Pietrosemoli and Monroy (2013) investigated the effect of KM on sustainability among firms consuming renewable energy in Venezuela, finding a positive relationship between them. Roxas and Chadee (2016) investigated whether KM contributes to SMEs' sustainability, drawing on the KBV theory and using a sample of 241 SMEs in the Philippines. The study showed a significant relationship between these important variables. Kordab et al. (2018) studied the relationship between KM and sustainability among audit and consulting firms in the Middle East region. The PLS-SEM analysis findings revealed a significant positive relationship.

It is important to note, however, that many of these studies considered only business sustainability rather than CS, a gap to be filled by the present study. While the arguments suggest that KM affects sustainability, it is not certain whether it will also affect CS especially in the population of our work, university lecturers. We therefore hypothesize that:

H1a: *There is a significant relationship between TKM and CS.*
H1b: *There is a significant relationship between SKM and CS.*
H1c: *There is a significant relationship between CKM and CS.*
H1d: *There is a significant relationship between HKM and CS.*

Moderating role of human capital

HC is the backbone of human development for all organizations (Munjal and Kundu, 2017; Fouarge et al., 2012) – a tool to enhance sustainability for organizations of all sizes and types because it is directly related to human development (Cameron and Green, 2019; Graff Zivin et al., 2018; McGuirk et al., 2015). HC cannot be neglected in achieving both short- and long-term sustainability (Nathaniel et al., 2021; Di Fabio and Peiró, 2018). It is known that all successful organizations that control the largest shares in the markets focus on promoting human development. Several recent studies show that organizations that value their HC outperform other organizations that lack it, enhancing their growth and sustainability in the short and long term (Zhang et al., 2021; Piva and Rossi-Lamastra, 2018; Dellink et al., 2017; Lutz et al., 2017; Pelinescu, 2015).

Confirming that KM affects sustainability requires consideration of other important factors (Martins et al., 2019; Lopes et al., 2017). Researchers have envisioned the human resource as one of the constructs of sustainability in that the suitability of different human

resource strategies depends on business competitiveness and achieving sustainable performance (Yong et al., 2020; Paillé et al., 2020). Hence, we suggest that the impact of KM on the sustainability of occupations varies through a moderating factor made up of resources. In our study, HC was set as a moderating factor for the relationship between KM and CS, in order to discover the extent to which HC is able to strengthen or weaken this relationship.

Section 2.1 above proposed a significant relationship between the dimensions of KM and CS in the context of Malaysian public universities. This direct relationship may be influenced in a positive/negative way based on the HC perceptions of the universities. Stated clearly, HC may have a moderating role in the relationship between the dimensions of KM and Malaysian public universities' CS. The assumption is such that firms whose employees are highly satisfied may cultivate better relationships between the dimensions of KM and their CS.

Additionally, the studies that focused on the KM–sustainability relationship (Reich et al., 2014; Gorelick and Tantawy–Monsou, 2005) reported inconsistent results, which is why a moderating variable affecting the relationship is likely to resolve the mixed findings. More specifically, moderating variables are generally introduced to foreteller-norm variable relationships that are weak/strong, shedding light on the situational values making the relationship weak/strong (Baron and Kenny, 1986).

The potential moderating role of HC on the relationship between variables has been touched upon in the literature. First, Alqershi et al. (2021) examined the moderating effect of HC in the Yemeni context and found it to play a significant role. In addition to the studies that indicate a relationship between KM and business success, optimum performance and sustainability (Chuang, 2004), this is a considerable new knowledge source for developing employment and thus the nature of the structure of firm employees may also act as a moderating variable (e.g., HC).

In particular, HC refers to the value that workers provide to their employers through their skills, knowledge, know-how and experience: a combination of human capability directed towards the resolution of issues in business (Sharabati et al. 2010). Such HC is within individuals and cannot be owned by the organization, although it covers the way organizations effectively utilize their resources. The level of HC is reflected through the high performance and sustainability of the firm. In a related study, Kurcharcikova et al. (2018) focused their investigation on the HC–sustainability relationship and their results supported a significant effect.

The World Bank Human Capital Index ranks Malaysia at 62 out of 163 nations (World Bank, 2020), indicating the need for Malaysian firms to enhance their employees' skills and know-how. With such enhancement, they will be capable of using KM, affecting their CS. This is consistent with prior studies such as that of Alqershi et al. (2022a), which supported the moderating effect of HC on the sustainability relationship. On the basis of the above review of the literature and discussion of findings, this study proposes the following hypotheses:

H2a: *HC moderates the relationship between TKM and CS.*
H2b: *HC moderates the relationship between SKM and CS.*
H2c: *HC moderates the relationship between CKM and CS.*
H2d: *HC moderates the relationship between HKM and CS.*

Method

This paper focuses on Malaysian public universities as the sample study and population frame. Public universities were chosen for several reasons. They have higher levels of government funding and support because they have access to modern technology, including robots. Second, the top universities in Malaysia are primarily public universities. Most importantly, CS in public universities is further developed than in private universities from data obtained from the 2021 Malaysian Educational Statistics, Ministry of Education Malaysia. A total of 31,740 lecturers are employed in Malaysian public universities. Based on Krejcie and Morgan's (1970) sample size determination table, sample size increases at a diminishing rate with increased population, remaining constant at 380 with a population numbering between 30,000 and 40,000. Thus, this study required at least 380 responses, although, because of poor survey response rates, 700 copies of the questionnaire were distributed. The study assumed that the larger the sample of the study, the more the results could be generalized to the population under study. The researcher adopted a sampling method that ensures the collection of authentic and accurate information from the population regarding the study variables (HC, KM dimensions and CS). A random sampling method was applied to the population and questionnaires were distributed using e-mail. Of the 400 sent out, only 279 were returned, of which 251 were found to be appropriate for further analysis.

Table 1
Demographic characteristics of the respondents.

Age	1= less than 26	1
	2= 26 to 30 years	37
	3= 31 to 35 years	64
	4= Above 35	149
Working experience	1= Less than 5 years	29
	2= 5 to 10 years	84
	3= 11 to 20 years	97
	4= Above 20 years	41
Gender	1= Male	149
	2= Female	102
Education	1= School certificate	0
	2= Diploma	0
	3= Degree	13
	4= Postgraduate degree	238
	Others	0

The stage after data collection was data analysis, but, first, the raw data collected from the field was screened and cleaned to ensure that it was suitable for the main analysis (Alqershi et al., 2022b). The data screening procedure was done to identify missing values and to detect mistakes committed by the respondents during entry of data. This stage was performed with the help of SPSS software. Descriptive analysis was then carried out, also utilizing SPSS in order to determine the characteristics of the sample in terms of age, working experience, education level, gender and number of employees. This is to ensure that the researcher understands the demographic composition of the sample (Huff and Tingley, 2015) (see Table 1). The hypothesis testing and data analysis were then carried out using Smart-PLS version 3, PLS-SEM.

Finally, with regard to measurement of the study variables, the moderating variable HC was adopted from Sharabati et al. (2010), while the KM measurement items were adopted from Chuang (2004), and the CS measurement items from Chin et al. (2021). Responses to all items were measured using a five-point Likert scale that ranged from 1, denoting strongly agree, to 5, denoting strongly disagree.

Results

Missing data

In any research, missing data may occur because of respondents' inability to comprehend questions or failure or unwillingness to answer (Sekaran and Bourgie, 2016). As noted by Hair et al. (2010), missing data normally occurs in the process of data collection. This researcher therefore took some pre-emptive actions to reduce the risk of missing data, and these actions were very successful. Many of

Table 2
Missing values.

Total questionnaires received	279
Questionnaires with missing data	28
Valid responses for further analysis	251

the questionnaires were retrieved on the spot, while others were collected at a later date. However, the research assistant was told to double-check returned questionnaires and to ask for completion of any missing answers. If the missing data occurred because the respondents had difficulty in understanding particular questions, the research assistant was instructed to provide help by interpreting and explaining the question.

Although this resulted in a very good response, there were still a few cases of missing data and incorrectly filled-out items. A total of 28 questionnaires were cancelled because of missing data and irregular responses. Although Hair et al. (2017) advised that missing data can be replaced, there was no need for this because, after dropping the incomplete copies, the remaining responses still met the requirement for adequate sample size according to Hair et al. (2017). Table 2 shows missing values.

Non-response bias

Non-response bias is described as the errors that are likely in estimating the characteristics of a population on the basis of the sample of survey data. Non-response bias can lead to under-representation of specific types of respondent. The bias arises when non-responders – those who fail to respond to the survey – differ from their responding counterparts (Barclay et al., 2002). Non-response bias thus refers to the differences in the answers of non-respondents and respondents (Parashos et al., 2005). In this regard, the time-trend approach for extrapolation is recommended in estimating the potential for non-response bias.

This approach compares the responses received early and late. Late respondents have common characteristics with non-respondents (Armstrong and Overton, 1977). The respondents in this study were divided into those who responded within 90 days (early) and those who responded after 90 days (late). A total of 147 (58.6 %) responses were received within 90 days of distribution and 104 (41.4%) responses after 90 days. Detection of non-response bias in an independent test was used on the study variables.

Common Method Variance (CMV)

The responses were gathered from a single source, so CMV could exaggerate the strength of relationships between the model variables. Such potential bias can be detected through use of Harman's Single Factor (Fuller et al., 2016) and the assessment of collinearity (Fuller et al., 2016). The analysis results showed seven factors to explain the cumulative effect of 79.18% of the variable. Podsakoff et al. (2003) suggested that the largest variance explained by an individual factor should be less than 50%. In this case, it was 27.62%, with the results showing the absence of threat from CMV.

Assessment of PLS-SEM path model results

Our work used the robust SmartPLS version 3.3.3 (Ringle et al., 2015), an effective analytical tool of model assessment as it mitigates type errors and handles a complex model with formative dimensions (Hair et al., 2017). We examined the study model using the two-step approach, first assessing the measurement model for item reliability and validity, and, secondly, the structural model via bootstrapping to testing our hypotheses.

Table 3
Loadings, *CR and AVE.*

Constructs	Items	Loadings	Composite reliability	Average variance extracted (AVE)
KM	TKM1	0.736	0.813	0.552
	TKM2	0.774		
	TKM3	0.782		
	TKM4	0.893		
	TKM5	0.851		
	TKM6	0.881		
	SKM1	0.785	0.865	0.560
	SKM2	0.788		
	SKM4	0.822		
	SKM5	0.881		
	CKM1	0.772	0.811	0.573
	CKM2	0.874		
	CKM3	0.816		
	CKM4	0.845		
	CKM5	0.700		
	HKM1	0.834	0.807	0.581
	HKM2	0.612		
	HKM3	0.788		
	HKM4	0.672		
HC	HC1	0.791	0.872	0.549
	HC2	0.806		
	HC3	0.737		
	HC4	0.850		
	HC5	0.875		
	HC7	0.786		
	HC8	0.866		
	HC9	0.753		
CS	CS1	0.805	0.833	0.568
	CS2	0.709		
	CS3	0.761		
	CS4	0.654		
	CS5	0.792		
	CS6	0.835		
	CS7	0.812		
	CS8	0.925		
	CS9	0.764		
	CS10	0.706		
	CS11	0.807		
	CS12	0.744		

Assessment measurement model

The assessment of the measurement model takes precedence over that of its structural counterpart, and this involves the testing of internal consistency reliability, convergent validity and discriminant validity. Construct reliability was tested using composite reliability: Table 3 shows values ranging from 0.706 to 0.925, all higher than Hair et al.'s (2017) recommended 0.70, which means that the measures had a satisfactory level of reliability. Convergent validity was examined through use of indicator loadings, composite reliability (CR) and average variance extracted (AVE). Table 3 tabulates the convergent validity values, all above 0.50, with CR higher than 0.70 and AVE of over 0.50, which all meet the recommended values of Hair et al. (2017). For convergent validity, two items were dropped as they were below the threshold.

To check discriminant validity, this study used the Heterotrait-Monotrait (HTMT) ratio, using Fornell and Larcker's threshold of 0.85 (see Table 5) (Henseler et al., 2009). The factor correlations are tabulated in Table 4, where they are all notably below the 0.90 HTMT value – the diagonal values in bold are higher than the off-diagonal values (Fornell and Larcker, 1981). Thus, a satisfactory level of discriminant validity exists. The constructs' VIF values are presented in Table 4 and meet the benchmark requirement established by Hair et al. (2017), indicating the absence of multicollinearity among the predictor variables.

The steps in evaluating the structural model are: 1) lateral collinearity (VIF), 2) the path coefficients involving p-value and t-value, 3) in-sample predictive power (coefficient of determination, R^2)

Table 4
Discriminant validity.

HTMT Constructs	CS	TKM	SKM	CKM	HKM	HC
CS						
TKM	0.311					
SKM	0.343	0.392				
CKM	0.723	0.192	0.229			
HKM	0.432	0.143	0.772	0.191		
HC	0.491	0.293	0.382	0.344	0.143	

Table 5 **Fornell and Larcker criterion**

Constructs	CS	TKM	SKM	CKM	HKM	HC
CS	**0.732**					
TKM	0.227	**0.793**				
SKM	0.282	0.124	**0.761**			
CKM	0.582	0.234	0.153	**0.782**		
HKM	0.399	0.432	0.620	0.243	**0.718**	
HC	0.389	0.310	0.583	0.664	**0.601**	**0.732**

Table 5
Results direct.

Relationships	Std. beta	Std. error	t-values	p-values	Decision
TKM -> CS	0.266	0.063	2.355	0.003	Supported
SKM -> CS	-0.392	0.059	0.873	0.581	Not supported
CKM -> CS	0.238	0.077	3.271	0.002	Supported
HKM -> CS	0.376	0.061	1.918	0.005	Supported

recommended by Hair et al. (2019), 4) the effect size (f^2) recommended by Cohen (1988), and 5) the predictive accuracy (Q^2 and PLS predict) recommended by Hair et al. (2019). In the first step, the VIF values did not exceed the cut-off score established by Hair et al. (2017) (see Table 4), showing the absence of multicollinearity problems.

The significance of the path coefficients in the structural model was examined using t-values, p-values and confidence intervals, with 93% bias-corrected and accelerated. The bootstrapping method with 5,000 sub-samples was used to test the hypotheses and the results are presented in Table 5 and Fig. 2: the TKM, CKM and HKM dimensions are significantly related with CS, indicating support for H1a, H1c and H1d (β = 0.266, t=2.355, p < 0.003), (β=0.238, t=3.271, p<0.002) and (β=0.376, t=1.918, p<0.005) respectively. However, SKM was found to have no significant relationship with CS (β=-0.392, t=0.873, p<0.581), rejecting H1b.

Table 6
Results Indirect.

Relationships	Std. beta	Std. error	t-values	p-values	Decision
TKM -> HC -> CS	0.209	0.087	3.801	0.001	Supported
SKM -> HC -> CS	0.188	0.072	6.091	0.000	Supported
CKM -> HC -> CS	0.372	0.053	0.728	0.807	Not supported
HKM -> HC -> CS	0.243	0.092	2.096	0.004	Supported

With regards to the moderating hypotheses, based on Table 6, HC had a moderating relationship between TKM, SKM and HKM and CS (β= 0.209, t=3.801, p<0.001), (β= 0.188, t=6.091, p<0.000) and (β= 0.243, t=2.096, p<0.004), meaning that H2a, H2b and H2d were found to be significant respectively, but no moderating relationship was found for CKM (β= 0.372, t=0.728, p<0.807), so H2c was not supported.

In the next step of the analysis, in-sample predictive power (coefficient of determination, R^2) was examined. According to Hair et al.'s (2010) rule of thumb, R^2 values higher than 0.25 are weak, those higher than 0.50 are moderate, while those higher than 0.75 are substantial. On the basis of our results, 44% of the CS variance was explained by KM dimensions and HC. In addition, 41% of the HC variance was explained by KM dimensions.

Following the above test, the constructs' effect size values were obtained through Cohen's f^2 (Cohen, 1988), where the author established that f^2 values exceeding 0.02 indicate small effects, those exceeding 0.15 indicate medium effects and those exceeding 0.35 indicate large effects. In this study, the values of the variables are presented in Table 7: the effect sizes for TKM (0.139), SKM (0.007), CKM (0.019), HKM (0.021) and HC (0.153), based on Cohen's guidelines, are small, non-existent and large respectively.

In addition, according to Geisser (1975), Alqershi et al. (2021) and Stone (1977), the structural model's predictive accuracy can be obtained using the Q^2 values calculation through the blindfolding approach. Table 8 contains the Q^2 values of CS (0.348), which are indicative of the model's predictive accuracy (Q^2 value >0).

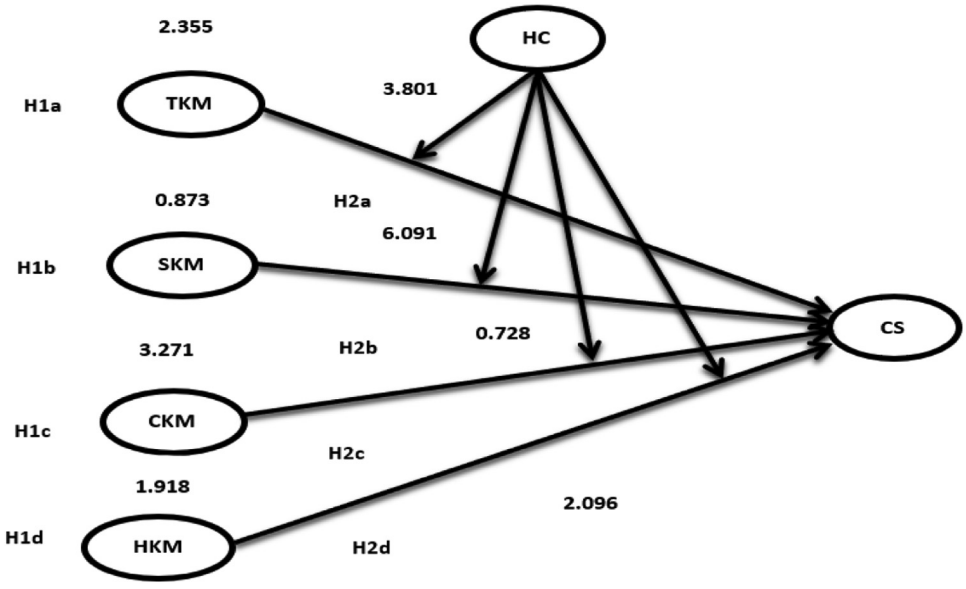

Fig. 2. Results.

Table 7
Effect size (f^2).

Constructs	F-values	Effect size
TKM	0.139	Small
SKM	0.007	None
CKM	0.019	None
HKM	0.021	None
HC	0.153	Small

Table 8
Predictive relevance (Q^2).

Construct	SSO	SSE	Q^2 (=1-SSE/SSO)
CS	3,146.00	1,499.31	0.348

Furthermore, the model's predictive accuracy was investigated through a new model out-of-sample prediction approach suggested by Hair et al. (2019). PLS prediction assessment values demonstrated that some of the values of Q^2 produced by PLS-SEM estimation exceed those of the LM model, supporting the model's predictive ability. Through the adoption of guidelines laid down by Hair et al. (2019), the summarized predictive results revealed that some of the endogenous variable items in the PLS model produced lower predictive errors than those in the LM model and that the model has medium-level predictive power.

Discussion

KM encourages changing culture and stimulating innovation by supporting freedom of thought, and contributes to helping employees adopt the approach of change and support ideas that result in so-called innovation. Innovation is linked with knowledge in building educational organizations, and, in the current economy, it is not possible for an organization to succeed without embracing and believing in a culture of knowledge, promoting and supporting new ideas and rewarding employees accordingly.

We found that TKM, CKM and HKM are significantly related to CS, while SKM is not. We can summarize the relationship between the KM and CS of universities as follows.

First, HKM is the most critical and important part of KM. Examples include employees' unique knowledge, expertise that can be used for creating wealth, management strategy and capacity for dynamic learning in a highly competitive environment. As HKM can significantly affect CS, we emphasize the need for long-term investment in it.

Second, optimizing TKM maximizes the benefits of CS. This resource can contribute to CS by interacting with CKM because it contains several factors, such as an organization's culture, mechanisms and essential, advanced and innovative knowledge that enables the company to lead its industry and its competitors and distinguish itself from them.

The third line of investigation is consistent with hypotheses 2a, 2b, 2c and 2d, looking into the moderating influence of HC on the relationship between TKM, CKM, SKM and HKM, and CS in Malaysian public universities.

The previous section discussed the direct relationships between TKM, CKM, SKM and HKM and CS, but, on the basis of the study's findings, such direct relationships can be enhanced or mitigated by HC in Malaysian public universities. Stated clearly, HC has a moderating role on the respective relationships between TKM, SKM and HKM and CS. This implies that the higher the HC level, the higher the performance, and this holds true in the opposite direction. The study's support for a moderating effect is a considerable contribution to literature on the study variables and the phenomenon under study.

The literature review found mixed results for the relationship between KM and CS (Reich et al., 2014; Gorelick and Tantawy−Monsou, 2005). Based on these inconsistent findings, this study found it appropriate to introduce a moderating variable to the relationships. It contributes by examining HC's moderating role in the dimensions of KM relating to CS. The rationale is that, in the current competitive and dynamic market, only the most useful elements of HC and knowledge enable establishments that strive to enhance their performance via the adoption of business processes and those that adopt sustainability have the most promising futures. In fact, knowledge and HC practices are the key solutions among universities desirous of pursuing unparalleled business performance.

In addition, to test the study hypotheses and answer the research questions, we formulated the previous moderating effect hypotheses. The result of the moderation test for HC on the relationship between KM and CS indicated that HC significantly moderates the relationship between TKM, SKM and HKM and CS, but not CKM and CS. This is in line with previous studies. Vaid and Honig (2020) argued that HC has a significant relationship with KM. However, ours is the only study which focuses on the direct relationship between this IV and DV, with HC playing an important role on KM and CS.

From the above results it is clear that universities build an educational environment in which knowledge is of paramount importance, as knowledge is a force in the era of the digital and knowledge economy. Universities must establish an environment in which a culture of learning and the production and sharing of knowledge spread in order to achieve benefit, creating an environment that encourages employees to learn from the flow of information and knowledge. Data is the raw material for information, converted by organizations and individuals into information, which in turn becomes knowledge by transferring, enhancing and enriching to provide an environment that supports this learning and exploits ideas, turning them into inventions and innovations and disseminating the results of these innovations in the organization for others to learn from and improve their skills. Building a culture of learning also allows employees to evaluate themselves and the units in which they work, organizing them with the aim of finding an approach to improvement and development, which in turn leads to the formation of distinctive knowledge that makes robots just an alternative for humans in providing knowledge to humans and in the education process. It remains the key to creating knowledge and it is the first provider in the educational and even administrative process. Finally, in preparing future-ready professionals, it will assist organizations and other actors in preparing personnel for future changes by promoting and enabling knowledge sharing, capacity building and thoughtful leadership.

Implications

Although all managers are encouraged to pay increasing attention to knowledge, our study indicates that it is not just knowledge that directly affects the sustainability of careers. The results of our study confirm the need to concentrate on keeping pace with technological progress through the human factor.

KM acts as a driving force that affects the development of employees' capabilities, which in turn has implications for the sustainability of careers. Managers should therefore not only focus their efforts on embracing a culture of knowledge but should also devote attention to the quality of the knowledge that their employees have to acquire.

Currently, individuals may have difficulty not only in obtaining a job but also in sustaining their careers. Hence, managers need to understand the relationship between unique knowledge capabilities and the sustainability of careers so that they can monitor the internal process and focus their efforts on developing the knowledge capabilities that will help their employees to work with technology, rather than being replaced by it.

Our study focused on the impact of KM dimensions on the sustainability of careers in public universities in Malaysia, a concern for all workers, especially with the technological developments that threaten the human element in all types of business. CS is thus an important and fundamental concept for employees and organizations in general, and all branches and fields of administrative work.

Given the scarcity of research dealing with the concept of CS, the topic has not been seriously addressed at university level or investigated through its connection with other elements such as KM and HC. This is because the focus of most studies on business sustainability is on organizations and not individual careers in an age of technological progress. This is especially true in the education sector, which is closely related to the goals and trends that employees seek to achieve.

As became clear through the spread of the coronavirus, millions of people lost their jobs because of the pandemic's impact on the world economy. However, the crisis does not lie only in the pandemic, as millions of employees lost their jobs during the last year as demand increased for robots. The robot is crowding more and more people out of their jobs, especially as it does not cost the project owner any salary, and can work accurately and precisely for a longer period.

The robot has been and will be resorted to, in light of the current crisis, because it is completely immune to the coronavirus, while the human employee remains vulnerable to infection. The epidemic period also witnessed an unparalleled increase in demand for technology products amid a focus on remote work to ensure social distancing.

As many services continued, in light of physical closure, through use of the internet and technology, this remarkable development will push university administrations and organizations as a whole to make fundamental changes in the future, as it is very possible to rely on robots in the education process. Our study offers an insight into the importance and role of knowledge, which all workers in the education sector and universities must consider in keeping pace with these changes, focusing on increasing their knowledge to the highest degree in order to retain priority in the educational professions.

Given that all studies indicate that robots will eliminate millions of jobs over the next few years, and as the pandemic has accelerated changes in the workplace, this is likely to exacerbate inequalities. It is certain that top management will accelerate plans for the digitization of work and implementation of new technologies. In this context, over the next few years, many workers will have to learn new skills. It is expected that, by 2025, employers will divide their work equally between humans and machines.

Finally, there are some tasks in which humans will retain their competitive advantage, including management, consulting, decision making, thinking and interaction, as well as functions related to the green economy, advanced data management, artificial intelligence, new roles in engineering, cloud computing and product development. Workers must prepare themselves with the cognitive capabilities to face the fierce war that will take place between them and robots and automated equipment.

Recommendations

Our work has very important recommendations. It has expanded the scope of existing knowledge of KM, HC and CS, and deepened our understandings of these areas. A major finding of this study relates to the moderating effect of HC variables on the relationship between KM and CS. No previous studies have investigated this relationship. The implication is therefore that the moderating effect of HC variables must be taken into consideration in order to understand the effect of KM dimensions on CS.

All workers must think about their strengths and be enthusiastic to add new knowledge and focus on KM instead of waiting for events to unfold, as this is related to a battle between machines and HC. It represents a union between the two parties – workers and organizations must therefore implement the method of continuous learning, increase human capabilities, improve the influence of people in organizations and keep pace with continuous changes in technical developments. In addition, unions and employers must search for practical solutions that encourage adaptation, flexibility and openness to new ways of working by:

- Preparing and equipping employees to keep pace with future changes by enhancing their technological capabilities.
- Enabling organizations to work to inform employees of the danger of technology to their jobs, as it is necessary to conduct intensive courses and programmes that explain in detail how digitization can take on a large part of future jobs, in order for employees to develop themselves and increase their knowledge to face these changes and maintain their jobs.
- Maintaining frankness with employees about the total number of jobs that can be given to technology, replacing employees.

Limitations and future studies

Our work is subject to several limitations that may be addressed in future studies. First, our study uses a measure of KM dimensions based on TKM, CKM, HKM and SKM. Extant studies on KM, however, indicate that other factors may impact their role. More work is therefore needed to test how other KM factors can play a significant role in CS in different contexts and populations.

Second, although universities and other educational institutions are two central factors that provide employees' knowledge, governments and international agencies also have responsibilities. Future studies may thus consider these factors in research frameworks and there is contribution to the field of knowledge.

Third, while responses to the survey were obtained from a wide range of Malaysian universities, future studies could focus on other countries in southeast Asia, Europe and America.

Fourth, the population of the study was limited to public universities in Malaysia. Our work recommends that other sectors of the Malaysian economy be investigated, such as CS in hotels and manufacturing.

Finally, it would be desirable to investigate other marketing performance metrics such as growth in sales, the successful launch of new products and customer retention. The benefits of KM may extend beyond CS, and we speculate that other potential dependent variables or other moderators, such as organizational learning and artificial intelligence, may be explored. In addition, our work used HC as a moderator. Future studies could test others key variables as moderators, such as organizational or innovation capital.

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