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Developing sustainable competitive advantages from the lens of resource-based view: evidence from IT sector of an emerging economy

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ABSTRACT

The present study examines the IT industry's sustainable competitive advantages (CAs) from a resource-based view (RBV). Therefore, a list of CAs in three areas of the triple bottom line (TBL), including economic, social, and environmental, are extracted by thoroughly studying the relevant literature. These attributes are then evaluated by small and medium enterprises (SMEs) managers in the IT sector by implementing a Multi-level hybrid Decision-Making approach. This step employs a modified Delphi technique combined with linguistic z-numbers. Further, by reviewing the literature, the list of intangible resources is counted, and the importance of these resources is measured via the linguistic z-number BWM (Best Worst Method). Finally, the degree of the controllability of critical CAs is prioritised by z-number TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) and then classified found on the resources. Consequently, different classes are discussed, and appropriate strategies for dealing with each are presented.

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Sustainable competitive advantage; resource-based view; linguistic z-numbers; BWM; TOPSIS; modified delphi

1. Introduction

In today's modern world, accidents, disruptions, crises, technological changes, environmental fluctuations, disasters, and diseases have negatively impacted the economy, society, and the environment by creating an uncertain environment (Ewertowski, 2022). Hence, following a sudden increase in uncertainty, the performance of companies is affected, and they face failure more likely (Amankwah-Amoah et al., 2021). As an illustration, in late 2019, with the outbreak of the COVID-19 pandemic, it was predicted that global trade would decline by about 13 to 23% by 2020. Many companies were forced to suspend operations, lay off their employees, close down temporarily, or slow their business processes (Sharma et al., 2020). The destructive condition includes various small businesses that had face-to-face contact with customers, e.g. shops and restaurants, to large businesses such as the travel industry, the global supply chain, tourism, and manufacturing firms. They were all affected by quarantine and border closures (Amankwah-Amoah et al., 2021). This would lead to catastrophic economic events with

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long-term effects on countries' economies (Ewertowski, 2022). The mentioned case and similar events demonstrate that to avoid the impact of uncertainty and unawareness of possible future cases. Companies should put strategies on their agenda to identify, predict and reduce uncertainty (Sniazhko, 2019). Therefore, to manage environmental change and system dynamics, businesses must have the flexibility to create change and improvement strategies tailored to their specific circumstances to enhance their ability to grow and prosper in an uncertain environment (Stachowiak & Pawłyszyn, 2021). As it is clear, one of the crucial strategies for the success of companies is to create a competitive advantage (CA) (Severo et al., 2020). Porter first presented and developed CA in strategic management (Teoh et al., 2021). Organisations create a competitive position in their business by producing distinctive products, expertise, and growing intellectual property (Martin & Mykytyn, 2010). CAs are achieved by creating lower costs and consequently more profit and obtaining unique resources and capabilities over competitors (Shan et al., 2019).

Besides, resources are highlighted components of an organisation (Huang et al., 2015); hence, CAs can be evaluated from the viewpoint of resources (Varadarajan, 2020). According to resource-based theory (RBT), CA has a fundamental relationship with a company's resources and capabilities to effectively improve companies performance (Shan et al., 2019). For instance, using the capabilities of information technology, communication networks, and the internet is a fast, secure and convenient way to learn, share and store knowledge that improves the performance of organisations (Mao et al., 2016). Moreover, the RBT emphasises that having scarce, irreplaceable, and non-imitable resources leads to a different performance for organisations and provide strategic advantage and efficiency above average, so identifying essential resources can create a sustainable CA for the organisation (Donnellan & Rutledge, 2019). Concentrating on resources and considering sustainability is also critical for firms. With increasing environmental concerns about creating a CA, companies must strike the right balance between their business's economic, environmental, and social dimensions (Pratono et al., 2019). As a result, companies must be cost-effective and consider their operations' environmental and social impact (Darvish et al., 2019). With the advancement of technological innovations worldwide, the economy is developing rapidly while the environment is severely damaged; thus, companies must make environmentally friendly decisions in addition to increasing profits (Ge et al., 2018; Jafari-Sadeghi et al., 2023). Numerous researchers have studied sustainable CA. As a case in point, Pratono stated that promoting green entrepreneurship leads to a CA by creating knowledge and sharing knowledge (Pratono et al., 2019; Rezaei et al., 2022). Furthermore, Donnellan investigated the strategic changes in the internal and external environment of the commercial bank in the United States of America using resources and competencies (Donnellan & Rutledge, 2019). Moreover, Gellweiler argued that information technology leads to value creation and CA for companies (Gellweiler & Krishnamurthi, 2021).

Although previous researchers have addressed the issue of sustainable CA and resource-based CA (Tate & Bals, 2018), this has not been seriously investigated with modern uncertainty approaches. Uncertainty management can affect CAs; therefore, it is essential to review them, particularly after the increasing instability of the environment. On the other hand, novel decision-making frameworks that have been developed aligned with uncertainty conditions have been applied less in previous research to assess resource-based CA. In addition, previous scholars have not examined sustainability alongside resources adequately. Eventually, the IT industry in emerging economies is also seen as a turning point in the economy that has not received much attention so far. This research aims to study the sustainable CAs in the IT sector found on an RBV by (i) extracting the initial list of CAs and intangible resources, (ii) determining the importance of resources/capabilities, and (iii) presenting reliable and controllable CAs considering the uncertainty of the environment. As a result of this research, a specific path for selecting CAs based on the resources available in the organisation is presented. This election considers the controllability of these CAs regarding uncertainty management. At the beginning of drawing this path, the resources and CAs are identified, and significant elements have been extracted to support the self-awareness of the organisation.

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature in the two areas of CAs in the context of sustainability and the organisation's intangible resources. Next, Section 3 introduces Z-numbers concepts, decision-making tools, and the research framework. The results, findings, implications, discussions, and conclusions have been presented in Sections 4 to 6.

2. Literature review

Competitive Advantage (CA) is a business's ability to create more economic value than competitors. CAs can be sustainable or temporary. For most organisations, CA is achieved temporarily. However, if the organisation's competitors cannot imitate or replicate that advantage, it is possible to maintain it long-term (Mahdi et al., 2019). With the advancement of public awareness of the environment and the enhancement of the need to respond to degradation, the definition of CA has been revised to consider other highlighted dimensions besides profit (Darvish et al., 2019). Hence, companies must balance their business's economic, environmental, and social dimensions (Gürlek & Tuna, 2018). By using green innovation, companies increase resource efficiency through saving materials, reducing energy consumption, increasing waste recycling, using fewer resources (Chang, 2011; Hooley et al., 1998; Onjewu et al., 2022), and providing a CA by monitoring costs (Gürlek & Tuna, 2018). The concept of CA has also been discussed by proponents of RBV (Huang et al., 2015). According to this view, if companies have resources with valuable, scarce, unrepeatable, and irreplaceable features, they have a sustainable CA. If they have only valuable and scarce features, they have a temporary CA (Carnahan et al., 2010; Sadraei et al., 2022; Shiri & Jafari-Sadeghi, 2022). Table 1 elaborates on numerous highlighted CAs.

According to the RBV, organisations are essentially composed of specific resources. The ability of an organisation to manage resources enables it to take advantage of market opportunities to improve its performance. RBV assumes that resources are a company's assets and its CA depends on its resources and strategic capabilities. Resources are divided into tangible and intangible categories (Khan et al., 2020). Tangible resources are physical features that are easy to manage and control and increase productivity.

In contrast, intangible resources are soft resources such as human intelligence, innovation, company reputation, quality service, and products. According to Porter, companies choose a strategy to create a unique and defensible position in their industry (Porter, 1997). Then, prepare the required tangible and intangible resources to implement its

Table 1. The initial list of CAs.

Code	Competitive Advantages	Two Sample Recent References
CA1	Fast and secure knowledge sharing at an optimal cost	(Shayganmehr et al., 2021)
CA2	High safety and health of staff	(López & Ruiz-Benítez, 2020); (Badri Ahmadi et al., 2017)
CA3	High-skilled staff	(Hannibal & Kauppi, 2019)
CA4	High product diversity	(Gong et al., 2018); (Zhang & Song, 2020)
CA5	Optimal geographical distance	(Shayganmehr et al., 2021)
CA6	Proper compliance with national regulations and policy	(Venkatesh et al., 2020)
CA7	Innovative culture of an organisation	(Orji et al., 2020); (Zhao et al., 2019)
CA8	High ability to provide personalised customer care	(Zhao et al., 2019); (Gong et al., 2018)
CA9	Increasing communication channels with customers	(Zhao et al., 2019)
CA10	Active identification of customer needs	
CA11	Capability to offer customised services	
CA12	Professional business strategies	
CA13	Development of extensive data analysis	
CA14	Digital marketing enhancements	
CA15	High financial strength	(Badri Ahmadi et al., 2017); (Brock & Khan, 2017)
CA16	Proper access to technological facilities	(Wang & Hu, 2020); (Ilinova et al., 2021)
CA17	Sufficient privacy and security	(Yadegaridehkordi et al., 2018); (Ozbekler & Ozturkoglu, 2020)
CA18	High government support and policies	(Mahdiraji et al., 2020)
CA19	Satisfied customers	(Yadegaridehkordi et al., 2018); (Gardas et al., 2019)
CA20	Proper communication among partners	
CA21	High team commitment and involvement	(López & Ruiz-Benítez, 2020); (Hannibal & Kauppi, 2019)
CA22	High top management commitment and support	(Gardas et al., 2019); (Agyemang et al., 2018)
CA23	Optimal access to an entrepreneurial resource	(Cao etal., 2019)
CA24	Developed learning organisation	(Gong et al., 2018); (Agyemang et al., 2018)
CA25	High e-commerce capability	(Ilinova et al., 2021)
CA26	Dynamic capability	(Luo et al., 2018)
CA27	Competitive Pricing	(Cao et al., 2019); (Darvish et al., 2019)
CA28	Flexible system and capacity	(Shan et al., 2019); (Venkatesh et al., 2020)
CA29	Proper corporate reputation/image	(Ozbekler & Ozturkoglu, 2020)
CA30	High corporate accountability/transparency	
CA31	Appropriate investment	
CA32	Reliable organisation	(Ozbekler & Ozturkoglu, 2020); (Shayganmehr et al., 2021)
CA33	Increasing the recycling rate	(Ozbekler & Ozturkoglu, 2020); (Hannibal & Kauppi, 2019)
CA34	Low energy and resource utilisation	(Ozbekler & Ozturkoglu, 2020); (Tuni et al., 2020)
CA35	Customer retention	(Mao et al., 2016); (Ilinova et al., 2021)
CA36	Sales growth	(Ozbekler & Ozturkoglu, 2020); (Cao et al., 2019)

strategy (Morgan et al., 2009). Researchers have considered RBV in various areas, such as entrepreneurship, marketing, international trade, and strategic management (Biancone et al., 2022; Satyanarayana et al., 2022). Numerous studies of RBV indicate that intangible resources are identified as the most likely resource of CA. At the same time, it is believed that tangible resources have a minimal share in the company's overall performance (Barney, 2012). The significant intangible resources are presented in Table 2.

The world today is evolving fast and is facing rapid change and ambiguity. Uncertainty is unpredictable and disrupts companies' performance (Hosseinzadeh et al., 2022; Koh et al., 2002). In other words, uncertainty refers to a situation where there is a lack of information, knowledge, understanding, and awareness of an event (Scholten & Fynes, 2017). Uncertainty management includes strategies that either decrease or counteract vagueness (Sniazhko, 2019), e.g. implementing an appropriate pricing strategy will reduce fluctuations in customer demand (Wagner & Bode, 2008). In some cases, these

Table 2. The significant intangible resources.

Resource Category	Sub-Categories Example	Sample Reference(s)
Technical Resource (TR)	• Knowledge • Information • Technology • Patent • Process • Breakthrough • R&D • License	(Liu et al., 2019)
Corporate Social Responsibility (CSR)	• Strategic Posture • Culture • Sustainability	(Yazdani et al., 2020); (Ayuso & Navarrete-báez, 2018)
Intellectual Capital (IC)	• Synergy of Knowledge • Formal and Informal Knowledge Sharing • Skill Management • Brand Value	(Anwar, 2018); (Ferreira da Silva et al., 2020)
Intangible Financial Capability (IFC)	• Financial Credit • Fund Raising Ability • Optimised Financing • Rational Investment Decision Capabilities	(Yazdani et al., 2020)
Organisational Resources (OR)	• System • Slack • Organisational Culture • Traditions • History	(Jancenelle, 2021)
Human Resources (HR)	• Employees' Skills • Employees' Expertise • Employees' Experience • HR Information Flow	(Jancenelle, 2021); (Liu et al., 2019)
Relational Resources (RR)	• Attentive Relations with Internal/ External Stakeholders	(Liu et al., 2019)

'uncertainty coping strategies' contain strategies that do not attempt to influence or change the source of uncertainty but also try to find ways to adapt and minimise the impact of uncertainty (Sharma et al., 2020). Various studies have focused on uncertainty management in a highly competitive business environment. Despite the mentioned fact, the gap between these studies can be seen in various areas of strategic management, including marketing. From a methodological point of view, previous studies have both addressed the problem of uncertainty management qualitatively as an explanation (Cumming et al., 2019) and literature review (LR) (Coenen et al., 2018) and used quantitative techniques such as structural equational modelling (SEM) (Matsunaga, 2021) and Multi-Criteria Decision-Making (MCDM) tools (Ghorui et al., 2021). This research (i) analyses the CAs from the perspective of the RBV, considering the role of intangible resources under uncertainty, and (ii) evaluates the importance of resources via a linguistic z-number MCDM framework proposed to deal with uncertainty.

3. Methodology

3.1. Uncertainty approaches

Zadeh first introduced fuzzy sets in contrast to binary logic to deal with uncertainty (Zadeh, 1965). In this approach, an element belongs to a set by a membership degree, while in the binary approach, an element is a member of a set or not. Since then, numerous extensions of fuzzy sets have been developed. As an illustration, intuitionistic fuzzy (Atanassov, 1994), type-2 fuzzy sets (Rickard et al., 2009), and hesitant fuzzy sets (Torra, 2010). Besides, various approaches have been proposed recently, e.g. neuromorphic sets (Ji et al., 2018), Pythagorean fuzzy sets (Mohagheghi & Mousavi, 2021), Z-numbers (Zadeh, 2011), etc. Likewise, these approaches have been offered multiple combinations, for instance, interval-valued intuitionistic hesitant fuzzy sets (Narayanamoorthy et al., 2019). In this research, linguistic Z-numbers are applied. Z-number is a novel approach to dealing with uncertainty. They take reliability into account in addition to uncertainty. Thus, they ensure the confidence of the evaluations and make the results more decisive for uncertain conditions. Furthermore, by employing linguistic terms for assessments, the experts more easily express their views (Mokhtarzadeh et al., 2020).

3.2. Linguistic Z-numbers

Let X be a universe of discourses, $S = \{s_0, s_1, s_2, \ldots, s_{2l}\}$ and, $\acute{S} = \left\{ \acute{s}_0, \acute{s}_1, \acute{s}_2, \ldots, \acute{s}_{2k} \right\}$ be a finite and ordered set of linguistic terms where l and k are non-negative integer values. Linguistic Z-number set Z in X can be defined as $Z = \{ \left(x, A_{\phi(x)}, B_{\varphi(x)}\right) | x \in X, A_{\phi(x)} \in S, B_{\varphi(x)} \in \acute{S} \}$. Notice that $A_{\phi(x)}$ is a fuzzy restriction on the values that the uncertain variable is allowed to take and $B_{\varphi(x)}$ is the reliability of the first component. The score of a linguistic z-number α is obtained via Equation (1) (Wang et al., 2017). Notice that in Equation (1), f^* and g^* are the functions that denote the semantics of the linguistic terms.

$$S(Z_\alpha) = f^*\left(A_{\phi(\alpha)}\right) \times g^*\left(B_{\varphi(x)}\right) \tag{1}$$

3.3. Delphi

The Delphi technique is a structured way to aggregate expert opinions (Linstone & Turoff, 1975). Experts' opinions are gradually approached in this method to reach a consensus. Accordingly, each expert will present their opinion after forming the Delphi panel of experts. Next to collecting these opinions, reaching a consensus is examined by various methods. If a consensus is reached, Delphi will be stopped. Otherwise, another round of Delphi will take place. In this round, the experts are asked to review their opinion by presenting the mean and standard deviation of the opinions in the previous round. Delphi rounds are repeated until the final consensus is reached (Kermanshachi et al., 2016). Delphi methods have been developed by applying uncertainty approaches, e.g. fuzzy Delphi (Zhang, 2017) and hesitant fuzzy Delphi (Mahdiraji et al., 2021). In this research, a modified linguistic Z-number Delphi with a novel way to investigate the consensus is scheduled.

Table 3. Consistency index values (Rezaei, 2015).

a_{BW}	1	2	3	4	5	6	7	8	9
CI	0.00	0.44	1.00	1.63	2.30	3.00	3.73	4.47	5.23

3.4. Best worst method

BWM is an MCDM technique to extract the weights of the criteria proposed by Rezaei (Rezaei, 2015). This method is a subjective tool that employs experts' opinions. Using experts' opinions, the best and worst criteria are selected. The preference of the best criterion over other criteria and the preference of other criteria over the worst criterion is determined. BWM uses a comparative method such as Analytical Hierarchy Process (AHP). Nonetheless, these comparisons are reduced to comparing each criterion with the best and worst criterion instead of pairwise among all the criteria. As a result, the number of comparisons is diminished significantly (Mahdiraji et al., 2020). Fewer comparisons lead to more consistent results. Moreover, using an objective function in this method, the gap between the resulting weights and the comparisons made is minimised, which is unique compared to other techniques. BWM steps are illustrated as follows.

[1]. The set of criteria is extracted ($\{C_1.C_2 \ldots .C_n\}$).

[2]. The best/most important (B) and the worst/least important (W) criteria are determined.

[3]. Each expert/panel determines the preference of the best criteria over other criteria $(A_B = \{a_{B1}, a_{B2}, \ldots, a_{Bn}\})$.

[4]. Each expert/panel determines the preference of other criteria over the worst criteria $\left(A_W = \{a_{1W}, a_{2W}, \ldots, a_{nW}\}^T\right)$

[5]. The criteria weights are obtained by solving the Equation (2) model.

$$\begin{aligned} &\min \xi \\ &\text{Subject to} \\ &\left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \xi, \textit{for all } j = 1, 2, \ldots, n \\ &\left|\frac{w_j}{w_W} - a_{jW}\right| \leq \xi, \textit{for all } j = 1, 2, \ldots, n \\ &\sum_j w_j = 1 \\ &w_j \geq 0 \end{aligned} \tag{2}$$

[6]. The consistency ratio is computed via Equation (3).

$$\textit{Consistency Ratio} = \frac{\xi^*}{\textit{Consistency Index}} \tag{3}$$

In Equation (3) consistency index (CI) is determined found on the preference for the best over the worst criteria (a_{BW}) applying the values of Table 3. Lower values of CR are acceptable; otherwise, the expert/panel opinion is not consistent and reliable for further investigations, and the data gathering should be repeated.

Since the introduction of BWM, numerous extensions have been developed. In this research, linguistic Z- BWM is designed and employed (Aboutorab et al., 2018).

3.5. Technique for order of preference by similarity to ideal solution

TOPSIS is a technique to prioritise alternatives found on some criteria. The TOPSIS method is based on evaluating alternatives by multi-profit/cost factors. In fact, in this method, the distance of each alternative from the ideal (maximum amount of profit and minimum amount of cost) and anti-ideal (minimum amount of profit and maximum amount of cost) is measured. This technique uses a mathematical approach to solve the problem by computing the Euclidean distance, and the output scores are effectively comparable. In this method, there is no need to remove any criteria or alternatives, and all are taken into account in the geometric space of the decision. Operationally, unlike methods such as AHP, this technique also allows for many alternatives and criteria. The steps of this method are mentioned below (Tang et al., 2019).

[1] The decision matrix is formed ($D = [x_{ij}]$) where x_{ij} is the evaluation of ith alternative based on jth criteria.

[2] The decision matrix is normalised by applying Equation (4).

$$R = [r_{ij}] = \left[\frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}\right] \tag{4}$$

[3] The weighted normalised matrix is obtained by the multiplication of weighing vectors attained by BWM by the normalised decision matrix (Equation 5).

$$v_{ij} = R \times W^T \tag{5}$$

[4]. The ideal (v_j^+) and anti-ideal (v_j^-) solutions for each criterion are determined. For the benefit criteria, the ideal is the maximum, and the anti-ideal is the minimum value. In the case of cost criteria, these values are reversed.

[5]. The distance from each alternative's ideal and anti-ideal solution is computed via Equation (6) to (7).

$$d_i^+ = \sqrt{\left(v_{ij} - v_j^+\right)^2} \tag{6}$$

$$d_i^- = \sqrt{\left(v_{ij} - v_j^-\right)^2} \tag{7}$$

[6]. The similarity index (CI) is calculated by Equation (8). The closer the value of the similarity index to 1, the higher the ranking of the alternative. This research applies the combination of TOPSIS with linguistic Z- numbers.

$$CI = \frac{d_i^-}{d_i^- + d_i^+} \tag{8}$$

3.6. Research steps

The present study is performed by a mixed method in four phases. The first phase of the research, which is implemented qualitatively, includes a literature review (LR) in two parts, (i) identifying CAs and (ii) recognising intangible sources. Next, three quantitative phases

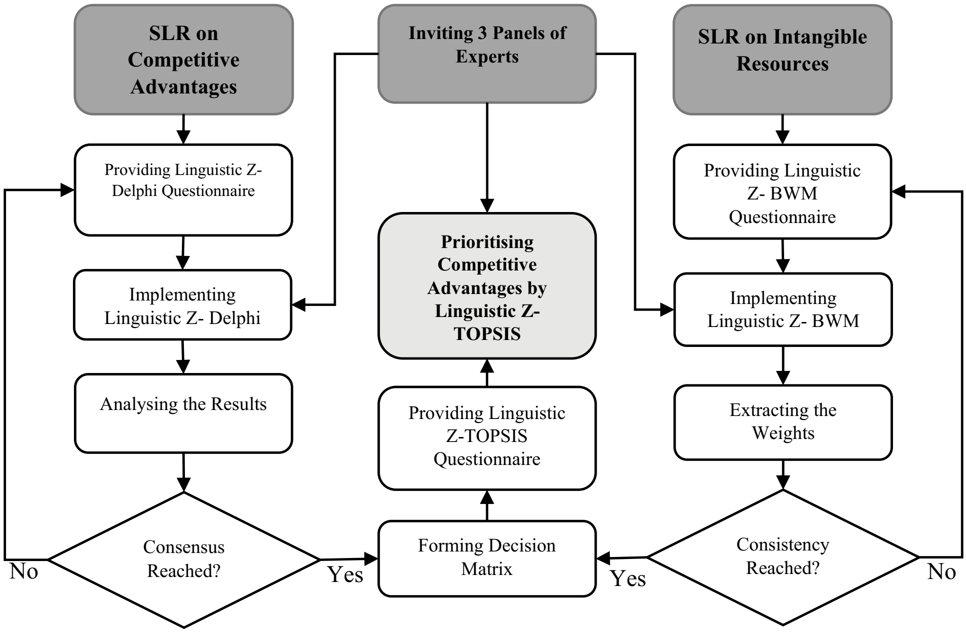


Figure 1. Research framework (start with dark grey and end with light grey).

were run to investigate the results of the LR to answer the research questions. However, numerous types of research have employed statistical tools in the following literature review (e.g. Secinaro et al., 2021). The current study has used an MCDM framework. Hence, in the second phase of the research, due to the variety of the CAs, critical CAs are screened based on the opinion of experts by applying the Linguistic Z-Delphi technique. In other words, Delphi has been employed for various points in previous studies (Alarabiat & Ramos, 2019). The current paper (i) helps to analyse the CAs from the perspective of SMEs in the IT sector (Kavoura & Andersson, 2016). Moreover, it makes a consensus among panels of experts (Mokhtarzadeh et al., 2020; Sadeghi & Biancone, 2018). In the third phase, the importance of intangible resources is calculated by the Linguistic Z-BWM. Afterwards, in the fourth phase, the controllability of each key CAs based on intangible resources is computed using the Z-numbers TOPSIS. Figure 1 demonstrates the research steps.

3.7. Phase I

The literature is reviewed systematically to obtain the list of CAs and intangible resources.

3.8. Phase II

Three panels of experts were invited to take participate in this research. Each panel includes five members containing academia, officials, and SME managers of the IT sector. They were selected by judgemental snowball sampling. All experts have at least 15 years of work or research experience in strategic management, particularly in the information

Table 4. Experts' profile.

Expert No.	Gender	Age groups	Education	Area	Minimum Experience (yrs)
1	M	40_s	PHD	Academician	15
2	M	50_s	MSC	Industry Expert	25
3	F	40_s	MSC	Officials	15
4	M	50_s	BA	Officials	30
5	F	40_s	DBA	Industry Expert	15
6	M	50_s	PHD	Academician	25
7	F	40_s	MSC	Industry Expert	15
8	F	40_s	MSC	Officials	20
9	M	40_s	BA	Officials	12
10	F	40_s	DBA	Industry Expert	10
11	M	50_s	PHD	Academician	25
12	F	40_s	MSC	Industry Expert	20
13	F	50_s	MSC	Officials	25
14	M	50_s	BA	Officials	25
15	F	40_s	DBA	Industry Expert	15

Table 5. Delphi's linguistic Z-number terms (Wang et al., 2017, modified by authors).

Restriction	Sign	Semantic Order	Reliability	Sign	Semantic Order
Very Significant	VS	6	Certain	C	4
Significant	S	5	Slightly Certain	SC	3
Slightly Significant	SS	4	Medium	M	2
Fair	F	3	Slightly Uncertain	SU	1
Slightly Insignificant	SI	2	Uncertain	U	0
Insignificant	I	1			
Very Insignificant	VI	0			

technology industry. The profile of the experts is demonstrated in Table 4. Each panel was managed and coordinated by one of the scholars. Initially, a one-hour briefing session was arranged for each panel to inform them of the research objectives (Table 5).

The first session was held for 3 hours for each panel, during which the experts were asked to express their assessment of the existence of each CA with linguistic Z-numbers (Questionnaire A). These terms and their semantic orders are given in Table 6.

Next, the scores of the evaluations were computed via Equation (1). Notably, the semantic value was obtained by Equation (9) (Wang et al., 2017). Notice that in Equation (9), $\phi(\alpha)$ is the semantic order on the scale of 2t terms.

$$f^*\left(A_{\phi(\alpha)}\right) = \frac{\phi(\alpha)}{2t} \tag{9}$$

In the following, the average of three panels was measured. The standard deviation of three panels for each CA was calculated to examine the consensus. The consensus is obtained if the average standard deviation is less than one and Delphi stops. Otherwise, the next round of Delphi will be repeated. Finally, after the Delphi stop, the CAs that received the highest average scores were screened and will be the key CA of the Phase IV decision matrix input.

3.9. Phase III

The second session was held for 2 hours for each panel to fill out the BWM questionnaire (Questionnaire B). Experts were first asked to determine relatively the most and the least

Table 6. BWM's linguistic term sets (Aboutorab et al., 2018).

Reliability Preference		Very Low VL	CI	Low L	CI	Medium M	CI	High H	CI	Very High VH	CI
Equally Important	**EI**	(1,1,1)	3	(1,1,1)	3	(1,1,1)	3	(1,1,1)	3	(1,1,1)	3
Weekly Important	**WI**	(0.21,0.32,0.47)	2.07	(0.37,0.55,0.82)	2.7	(0.47,0.71,0.82)	3.11	(0.56,0.84,1.26)	3.42	(0.63,0.95,1.43)	3.68
Fairly Important	**FI**	(0.47,0.63,0.79)	2.64	(0.82,1.10,1.37)	3.6	(1.07,1.42,1.78)	4.22	(1.26,1.68,2.10)	4.71	(1.43,1.90,2.38)	5.11
Very Important	**VI**	(0.79,0.95,1.11)	3.17	(1.37,1.64,1.92)	4.44	(1.78,2.13,2.49)	5.27	(2.10,2.52,2.94)	5.92	(2.38,2.85,3.33)	6.45
Absolutely Important	**AI**	(1.11,1.26,1.42)	3.68	(1.92,2.19,2.47)	5.24	(2.49,2.84,3.20)	6.27	(2.94,3.36,3.78)	7.07	(3.33,3.80,4.28)	7.74

Table 7. TOPSIS's linguistic Z-numbers terms (Wang et al., 2017, modified by authors).

Restriction	Semantic Order	Reliability	Semantic Order
Very Controllable	6	Certain	4
Controllable	5	Slightly Certain	3
Slightly Controllable	4	Medium	2
Fair	3	Slightly Uncertain	1
Slightly Uncontrollable	2	Uncertain	0
Uncontrollable	1		
Very Uncontrollable	0		

significant intangible resources, known as the best (B) and worst (W) criteria. Next, they evaluated the preferences of the best criterion over other criteria ($\widetilde{A_{Bj}}$) and the preference for other criteria over the worst criterion ($\widetilde{A_{jW}}$). The terms were translated into fuzzy triangular numbers applying Table 6 (Aboutorab et al., 2018).

In the following, the weights of the opinions ($\tilde{w}_j = (l_j, m_j, u_j)$) were calculated by solving the Equation (10) model via GAMS software.

$$\begin{aligned} &\min \tilde{\xi} \\ &\text{Subject to} \\ &\left|\frac{\tilde{w}_B}{\tilde{w}_j} - \tilde{A}_{Bj}\right| \leq \xi, \ \textit{for all } j = 1, 2, \ldots, n \\ &\left|\frac{\tilde{w}_j}{\tilde{w}_W} - \tilde{A}_{jW}\right| \leq \xi, \ \textit{for all } j = 1, 2, \ldots, n \\ &\sum_j R(\tilde{w}_j) = 1 \\ &0 \leq l_j \leq m_j \leq u_j \end{aligned} \tag{10}$$

Notice that in Equation (10), $\tilde{\xi} = (k, k, k)$ and $R(\tilde{w}_j)$ are the defuzzification functions. In this research, fuzzy values were defuzzied by Equation (11) (Guo & Zhao, 2017). Consequently, the consistency of the preferences was computed via Equation (3) applying CIs of Table 6.

$$R(\tilde{w}_j) = \frac{l_j + 4m_j + u_j}{6} \tag{11}$$

3.10. Phase IV

The decision matrix included the key CAs obtained in Phase II as alternatives and intangible resources as criteria. Hence, the third session of the panels was held for 2 hours each, and experts were asked to evaluate the controllability of each CA using each intangible resource by a linguistic Z-number term in Table 7 (Questionnaire C).

In the following, the score of each evaluation was measured by applying Equation (1) and Equation (9), and the average of the panels' scores was obtained. Next, the decision matrix was normalised via Equation (4), and the weighted normalised matrix was formed using the wights extracted in Phase III by Equation (5). As all the resources were benefit criteria, the maximum and minimum values were considered as the ideal and anti-ideal solutions, and the distances were computed via Equation (6) and (7). Next, Equation (8) investigated the similarity index, and the CAs were prioritised.

4. Results

After implementing **Phase I** and extracting the list of the CAs (Table 1) and intangible resources (Table 2), in **Phase II** (Delphi stage), panels of experts were asked to evaluate the CAs by linguistic Z-numbers (Table 5/Questionnaire A). Next, the score of each factor was computed via Equation (1) and Equation (9). These scores, the average, and the standard deviation of three panels of experts were measured and demonstrated in Table 8.

CAs with a mean score greater than 0.5 were screened as crucial advantages, highlighted in Table 8 (grey cells). The standard deviation of three panels for each advantage was calculated to assess the consensus in this round. The average of these deviations was 0.207, which is less than one and indicates that a consensus has been reached. In **Phase III**, each panel was asked to determine the most and the least essential resource amongst

Table 8. Linguistic Z-delphi results for CAs.

Competitive Advantage	Average Score of Panels	The standard deviation of Panels
CA_1	0.736	0.105
CA_2	0.139	0.105
CA_3	0.542	0.505
CA_4	0.236	0.229
CA_5	0.181	0.188
CA_6	0.431	0.296
CA_7	0.653	0.334
CA_8	0.139	0.173
CA_9	0.139	0.173
CA_{10}	0.542	0.260
CA_{11}	0.167	0.150
CA_{12}	0.583	0.520
CA_{13}	0.153	0.105
CA_{14}	0.375	0.232
CA_{15}	0.333	0.083
CA_{16}	0.500	0.500
CA_{17}	0.458	0.191
CA_{18}	0.333	0.315
CA_{19}	0.917	0.144
CA_{20}	0.097	0.048
CA_{21}	0.333	0.191
CA_{22}	0.625	0.125
CA_{23}	0.278	0.168
CA_{24}	0.139	0.127
CA_{25}	0.750	0.217
CA_{26}	0.333	0.144
CA_{27}	0.389	0.251
CA_{28}	0.181	0.064
CA_{29}	0.375	0.232
CA_{30}	0.056	0.096
CA_{31}	0.250	0.250
CA_{32}	0.250	0.220
CA_{33}	0.139	0.096
CA_{34}	0.083	0.144
CA_{35}	0.333	0.167
CA_{36}	0.417	0.289

Table 9. Linguistic Z-BWM results for resources.

	Weight			
Resources	Panel 1	Panel 2	Panel 3	Average
TR	0.149	0.172	0.251	0.191
CSR	0.113	0.086	0.101	0.100
IC	0.094	0.119	0.122	0.112
IFC	0.268	0.260	0.174	0.234
OR	0.170	0.147	0.093	0.137
HR	0.102	0.107	0.178	0.129
RR	0.104	0.109	0.081	0.098

Table 10. Linguistic Z- TOPSIS for evaluating capabilities/resources.

CA/Resource	TR	CSR	IC	IFC	OR	HR	RR	CI	Rank
CA_{19}	0.066	0.029	0.004	0.090	0.038	0.035	0.005	0.331	8
CA_{25}	0.083	0.026	0.039	0.102	0.046	0.017	0.015	0.480	5
CA_1	0.052	0.012	0.064	0.063	0.061	0.045	0.054	0.534	2
CA_7	0.045	0.033	0.047	0.066	0.056	0.050	0.048	0.523	3
CA_{22}	0.062	0.057	0.039	0.054	0.046	0.071	0.036	0.568	1
CA_{12}	0.045	0.040	0.016	0.090	0.043	0.025	0.024	0.362	7
CA_3	0.059	0.020	0.012	0.090	0.032	0.063	0.033	0.451	6
CA_{10}	0.050	0.037	0.024	0.063	0.041	0.021	0.014	0.263	9
CA_{16}	0.093	0.026	0.046	0.066	0.043	0.021	0.032	0.484	4

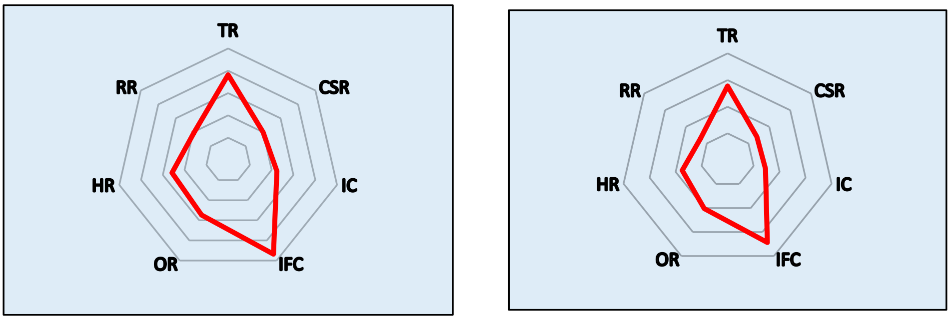
other resources. Next, they expressed the preferences of the best criterion over other criteria and the other criteria over the worst criterion by applying linguistic z-number terms of Table 6 and the Z-BWM method. In the following, the evaluations were translated into triangular fuzzy numbers (TFNs), and the weights were extracted by solving the model of Equation (10). The results are presented in Table 9.

As illustrated in Table 9, the intangible financial resource was elected as the most significant resource among the others. In contrast, relational resources, corporate social responsibility, and intellectual capital have the least importance. In **Phase IV**, The decision matrix was constructed. The essential CAs obtained in Phase II were the alternatives, and the intangible resources were the criteria. Three panels evaluate the controllability of each CA by each resource using the linguistic z-number terms of Table 7 and the Z-TOPSIS method. The score of the evaluations was computed via Equation (1) and Equation (9). The average of the panels' assessments was obtained via TOPSIS (Equation 4-8). The result is demonstrated in Table 10.

Table 10 demonstrates that the high-top management commitment and support, fast and secure knowledge sharing at an optimal cost, and innovative culture of organisations are the most controllable CA under the condition of uncertainty that can be concentrated. Moreover, intangible financial capability and technical resources are the most controller resources to manage uncertainty.

5. Discussion

The current state of the contemporary world has caused unpredictable events to flow uninterruptedly, resulting in increasing uncertainty (Schulman, 2021). In this regard, organisations' internal and external factors have also been subject to many doubts (Katsaros & Tsirikas, 2022). Therefore, managing uncertainty in organisations is vital. This



2a The net importance of resources

2b The importance of resources considering the controlling effect on CAs

Figure 2. Importance of resources.

is especially important in emerging economies due to greater instability. The problem of uncertainty is not limited to a specific process and covers all aspects. In the present study, this issue has been investigated from the perspective of resources for CA. Although all resources can effectively achieve the organisation's CA, the importance of these resources is not the same. Figure 2 illustrates the importance of each resource.

Figure 2 illustrates the significance of the resources for firms. Figure 2(a) demonstrates the net weights in which the controlling effect of the resource under uncertainty is not considered, while Figure 2(b) considers the controlling impact of CAs. This elaborates that the significance of the resources under vagueness is aligned with other situations, and firms do not need to modify and plan distinct resource management to deal with uncertainty. Moreover, IFC was identified as the most highlighted resource. IFC also affects financial resources such as cash which are tangible (Adomako & Ahsan, 2022). Other resources, e.g. HR (Subramony et al., 2021) or CSR improvement, depend on IFC as a prerequisite for development. However, IFC has a significant effect on the economic dimension of TBL, but also investing in environmental and social aspects can be facilitated by IFC. In the IT sector, CA is entirely dependent on the TR resource, and organisations need a direct and continuous focus on this resource to advance toward sustainable CAs. Figure 3 demonstrates the final scores of Cas according to Z-TOPSIS.

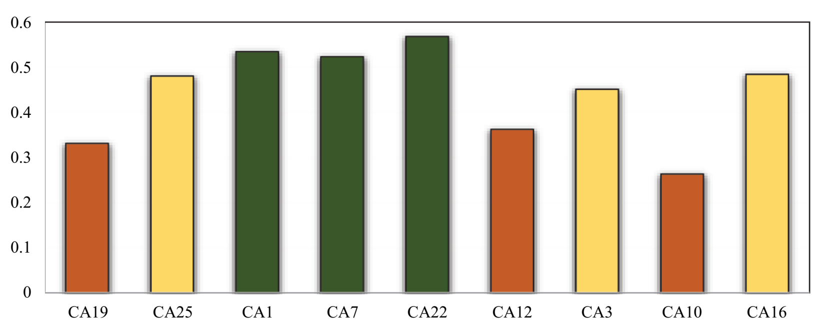
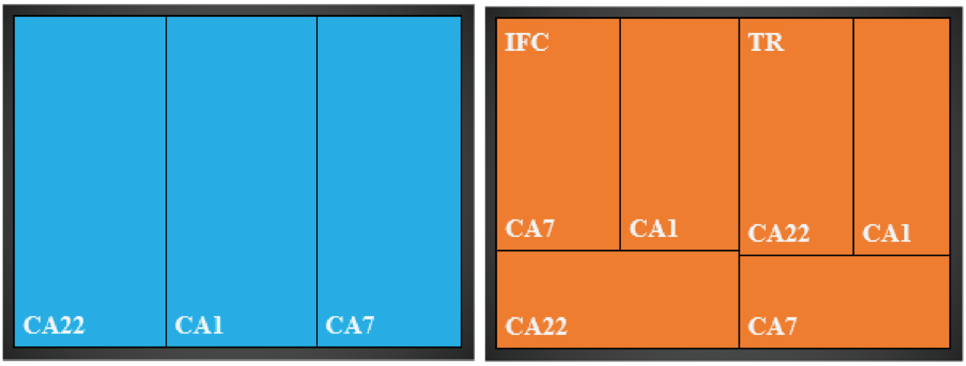


Figure 3. Competitive advantages ranking.



4_a Share of each Key CA

4_b Share of each Key CA based on primary resources

Figure 4. Proposed leading resource investment portfolio on critical CAs.

The first class of CAs (green columns of Figure 3) includes high top management commitment and support, fast and secure knowledge sharing at an optimal cost, and innovative culture of organisations. Hence, if the organisation invests resources in developing these CAs, it will show more stability in conditions of uncertainty. These advantages can also well reflect the TBL view. As an illustration, the commitment of top management to the community and the environment can be well-formed in addition to economic issues. Figure 4 presents the leading resource investment portfolio on essential CAs.

Figure 4 elaborates on the Treemap of the portfolio share of investment on CAs. Figure 4(a) illustrates that the share of CAs should be homogenous. In addition, it is proposed to apply relatively similar resource ratios for each CA.

Organisations should allocate their limited resources optimally to achieve sustainable CAs (Maritan & Lee, 2017). The present study provides practice for SMEs in the IT industry. This framework helps managers to make allocations more efficient. Since, in recent years attention to sustainability has been one of the most highlighted concerns of all organisations (Haseeb et al., 2019), this issue has been considered in the present research. It should be noted that the proposed framework can also be benchmarked in other industries and organisations. In addition to the framework, a comprehensive approach to variables such as competitive advantages that were not evaluated in an integrated manner can respond to the organisation's planning more completely.

Furthermore, from the theoretical point of view, considering uncertainty and probability, two facts that cannot be ignored in the contemporary world, makes the current framework more effective for implementation. These methods were previously developed using simpler theories, e.g. fuzzy sets (Dong et al., 2021; Padilla-Rivera et al., 2021) that currently do not meet the needs of the organisations. More complex organisational issues require more complex models that provide the necessary results.

6. Conclusion

Due to the increasing ambiguity following human and non-human events in recent years, the importance of managing uncertainty has dramatically increased. In this regard, the pursuit of CA sustainability is highlighted in this situation. One way to sustain these CAs is to investigate them from the RBV. In the present study, an attempt has been made to identify these CAs and resources through two streams of the systematic literature review. Next, the leading CAs were screened by a modified Z-Delphi, and the resources' weights were extracted employing Z-BWM.

Consequently, a Z-TOPSIS approach was applied to prioritise the CAs found on the controllability of resources. In addition, the controlling effect of the resources was determined. Experts of SMEs illustrated that high top management commitment and support, fast and secure knowledge sharing at an optimal cost, and innovative culture of organisations are the most highlighted CAs that can be sustained. Furthermore, intangible financial capability and technical resources are the most influential.

Experts' opinions in this study were based on the SMEs of the IT sector in the emerging economy of Iran. This study can be applied to other sectors and underdeveloped economies for benchmarking. On the other hand, the uncertainty framework of this research has been implemented employing Z-numbers. Other uncertainty conditions, such as intuitionistic fuzzy (IF) and hesitant fuzzy (HF), can be examined, and the results can be compared. Furthermore, other techniques for extracting weights, e.g. analytical hierarchy process (AHP), step-wise weight assessment ratio analysis (SWARA), and other techniques for prioritising the alternatives, such as complex proportional assessment (COPRAS) and evaluation based on distance from average solution (EDAS) can be applied, and the results can be compared. In different circumstances, the influence of resources can be evaluated using data-driven methods, and the decision space can be changed from a subjective approach to an objective approach. In this regard, techniques such as Shannon entropy can be used to extract weights. In addition, in this study, resources are considered at the general level, where in the future, scholars can also investigate the components of each of these resources in detail.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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