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Sources of sustainable competitive advantage and direction of development: a study on pharmaceutical SMEs

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Keywords: **s**ustainable competitive advantage (SCA), small and medium-sized enterprises (SMEs), sense & respond, operations strategy, southern Vietnam.
Abstract: To cope, preserve market position, and achieve sustainable competitive advantage (SCA), companies should put operations strategy into action systematically and coherently. In this vein, the purpose of this study is to evaluate small and medium-sized (SME) pharmaceutical firms in southern Vietnam considering their current strategic orientation, development path, and sustanability of competitive advantage. The method used in this research is Sense and Respond (S&R), supported with combination of different tools. The data has been gathered from six companies utilizing two questionnaires: "Manufacturing strategy index (MSI)" and "S&R". The results show that, all case companies act as Analyzer both in the past and in the future when employing operations strategy. In all case companies, quality found to be the most important competitive priority in the past and future, and the main source of competitive advantage. Furthermore, spearhead technology and knowledge (T&K) found to be the main source of risk in operations strategy and SCA. The Weak Market Test demonstrates that the research results are consistent with the actual situations of the case companies. The research concludes that S&R method works well in evaluating the operative SCA of pharmaceutical SMEs.

1 Introduction

During the past decade, many studies have presented the considerable influence of market turbulence on the business world. In addition, due to the ongoing Covid-19 crisis, the changes and precariousness have been greatly accelerated [1]. Thus, to position themselves against the competition, companies should put operations strategy into action systematically and coherently, and more specifically, should create and develop a sustainable competitive advantage [2,3]. The concept of sustainable competitive advantage (SCA) was introduced by Porter in his pioneering books (1980, 1985) [c.f. 4] and it has since progressively developed. For example, SCA has been introduced as a resource-based theory which explains heterogeneously distributed resources and capabilities are the sources of SCA and the reason why certain companies consistently outperform others [5].

Businesses, especially SMEs, are struggling more than ever, both in terms of increasing competition in the market and responding to the needs of an ever-changing business environment [6]. In Vietnam, as an illustration, the healthcare market in general and the pharmaceutical industry specifically are growing rapidly [7] along with a shift in demand for medical goods driven by the Covid-19 pandemic [8]. As a result, to be able to compete in the large marketplace, pharmaceutical SMEs need to develop an effective competitive operations strategy. A similar suggestion has been made in the previous study, in order to remain competitive in the marketplace, companies should seek out the best approaches to match the requirements of a fast-changing business environment [9]. Despite the fact that it is right, the majority of pharmaceutical companies in Vietnam have yet to focus on developing a comprehensive development strategy [10] and there is currently no specific master plan for the long-term growth of Vietnam's pharmaceutical industry [11]. Furthermore, the authors concluded that research on the pharmaceutical industry in Vietnam has so far been fairly limited. As a result, the purpose of this article is to evaluate the sustainable competitive advantage of pharmaceutical SMEs in southern Vietnam in terms of their present orientation, development of strategy, and sustainability. The paper, on the other hand, may benefit pharmaceutical businesses by assisting decision-makers in better comprehending business climates and reacting more accurately and effectively in the turbulent business world.

To meet these objectives, this research tries to answer the following two questions:

1. What are the sources of pharmaceutical SMEs' competitive advantages and direction of development?
2. How sustainable is the pharmaceutical SMEs' operations strategy?

In this research, SCA is evaluated based on the Manufacturing strategy index (MSI) and Sense and respond methodology, integrated with various models and tools, such as Analytic hierarchy process (AHP), Critical factor indexes (CFIs), and Technology & Knowledge

(T&K) ranking and risk levels [2]. T&K is taken into account when evaluating SCA levels as it plays a big role in a company's value chain and can help businesses reduce costs and differentiate themselves from competitors [2,12].

The paper begins with an introduction of the theoretical background, methodologies, and tools connected to the researched topic, followed by the information regarding case companies, data collection procedures, and data analysis. The results are then offered. Finally, the discussion and conclusions are presented.

2 Theoretical background

2.1. Manufacturing strategy

Manufacturing strategy is described as a long-term plan of manufacturing decision-making which is compatible with the overall strategy of the company [13]. Strategy, accordingly, is interpreted as "a pattern or plan that integrates an organization's major goals, policies, and action sequences into a cohesive whole" [14, p.10]. Miles and Snow's strategy typology is a fundamental tool for analyzing different types of strategies based on external and internal dependent elements [15]. According to this typology, there are four categories of business strategy: Prospector, Analyzer, Defender, and Reactor, as shown below [16]:

- ***Prospector*** concentrates on innovative product development and actively looks for new product-market possibilities. Prospector's strategic priority lies in Quality.
- ***Defender*** puts emphasis on improving the efficiency of current operations and attempts to keep its market share. Defender's strategic priority lies in Cost.
- ***Analyzer*** combines elements of Prospector and Defender. Analyzer attempts to adjust to new market or industry developments while preserving its market position. Analyzer's strategic priority lies in Quality, Cost, and Time.
- ***Reactor*** concentrates on everything at once in an effort to adapt to the constantly shifting business environment; therefore, Reactor exhibits no strategic priority.

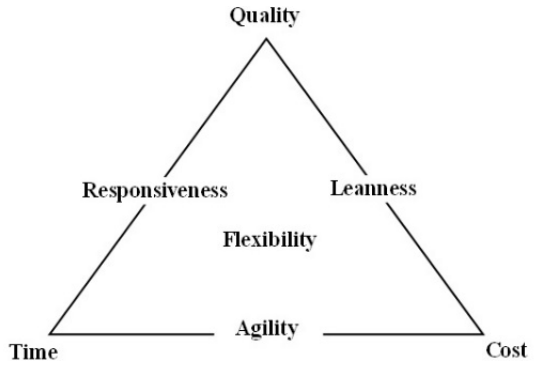

Figure 1 RAL model [23]

A successful manufacturing strategy is said to be created by identifying competitive priorities, which serve as a link between competitive strategy and manufacturing goals [17-19]. Previous studies have stated that the RAL (Responsiveness, Agility, and Leanness, see Figure 1) model has been used effectively to determine strategic priorities [20-22].

2.2. AHP, sense and respond, CFIs

The Analytical hierarchy process (AHP) is a decision-making method within multiple criteria. To use AHP in practice the decision makers are required to compare the importance of criteria, two at a time, and make a pairwise comparison between the decision variables considering relative importance on the scale of 1 to 9. Here, 1 indicates that both criteria are similarly important, whereas 9 indicates that one criteria is absolutely crucial over the other. In fact, AHP method helps to convert decision maker's evaluation into numbers that can be compared with the decision-making variables and finally, decision-maker set priorities and select the optimal choice among decision criteria [24].

Sense and respond methodology was introduced by Haeckel in 1992, then further developed by Bradley and Nolan in 1998, and later in 2000, Markides utilized it as the primary research method for studying dynamic business strategies [c.f. 25]. S&R methodology aims to provide a way to tackle the issues posed by disruptions or changes in a continuous process [26]. To put it another way, S&R method is used to assist with flexible decision-making by characterizing, assessing, benchmarking, and optimizing the allocation of resources to fulfill performance needs both inside and outside the firm [2].

The Critical factor index (CFI) method is a measurement instrument that identifies which process attributes are crucial and which are not, as claimed by the experience and expectations of the respondents [27]. The CFI model has been developed in three stages, which are known as the Balanced critical factor index (BCFI) model, the Scaled critical factor index (SCFI) model, and the New scaled critical factor index (NSCFI) model [2]. In this paper, NSCFI is employed to assess the business performance of the companies, as it outperforms the previous models in terms of accuracy and stability [22].

Additionally, a total of 21 attributes are used to define the technology & knowledge management, processes & work flow, organizational system, and information systems of the case companies [22]. In the Results section, the attributes are presented as numbers. The detailed names of each attribute can be found in Appendix 1.

2.3. SCA risk level

Sustainable competitive advantage (SCA) is a measurement of the level of risk at which the operations strategy needs to be enhanced so that companies can maintain operative competitiveness during the time period in question [2]. Three indicators are employed in this study

to measure the level of risk of the operations strategy over the long term, they are Mean absolute percentage error (MAPE), Root means squared error (RMSE), and Mean absolute deviation (MAD). The threshold value for the SCA risk level is 0.9 [20]. Closer the SCA risk level to 1 higher the consistency between the allocation of resources and operations strategy.

2.4. Technology & Knowledge ranking and risk levels

As a company's resources are not infinite, it is vital to determine a technology priority which is connected to its business strategy and can deliver a competitive edge and profitability. Technology is one of the key factors of completion and it turns into essential if it enables businesses to minimize costs, create differentiation, and increase product quality [28]. Furthermore, sustainable competitive advantages are primarily based on knowledge, which indicates that figuring out ways to do things is equally important as possessing access to specialized resources when establishing a value chain [29]. Therefore, to obtain information about the technology and knowledge rankings of a company, technology and knowledge requirements are included in the S&R questionnaire [2].

To evaluate the effect of knowledge and technology on a company's business strategy, each attribute related to the basic, core, and spearhead technologies is estimated as a percentage by respondents, with the total of all three being 100% [2]. Here, basic refers to the technology and knowledge that is most essential to the operation of a business, while core refers to company-specific technology and knowledge, and the spearhead is closely related to the future requirements of technology and knowledge. Risk levels then are calculated to identify which type of technology brings the most uncertainty to a company.

3 Materials and methods

3.1. Case introduction

The southern market in Vietnam has been identified as the greatest drug consumption market, and Ho Chi Minh is the primary municipality in southern Vietnam, consuming up to 55% of the country's drug products [30]. Therefore, this study considers the pharmaceutical SMEs from this region i.e. the case companies considered in this research has offices or principal operations in Ho Chi Minh City. These companies, in particular, have been in operation for 4-8 years, and their core businesses include retailing drugs, cosmetics, medical equipment, and hygiene items. Furthermore, some companies offer packing, drug storage, and testing services.

3.2. Data collection procedure

This research is conducted based on six pharmaceutical companies from southern Vietnam, and two representatives of each company join the interview. The interviewees are the middle or top managers, who thoroughly understand their companies' operations. The interviews are carried out via audio and video calls over the internet. The data are gathered utilizing two separate questionnaires: one relating to the Manufacturing strategy index (see Appendix 2) and another for the Sense and respond method (see Appendix 1). In the end, the Weak market test (WMT) is applied to assess the extent to which the obtained results relate to the real situations of the companies.

3.3. Methods of data analysis

The collected data are analyzed following the six steps, mentioned below:

Step 1: Find a case company and informant, and collect necessary data following MSI and S&R questionnaires.

In this step, it is very important to consider at least two respondents from the top or middle management level who has the good understanding of operations strategies of the case company and the business environment.

Step 2: Obtain parameters for MSI i.e. determine the criteria weight following the AHP method.

In this step, data are collected for the MSI questionnaire (see Appendix 2) and the criteria weight are determined by AHP method.

Step 3: Calculate values of critical factor indexes (CFIs) and evaluate resource allocations.

The resource allocations can be evaluated by following any of the methods: CFI, BCFI, SCFI, or NSCFI. However, in this study, the NSCFI model has been used to evaluate resource allocations, this is simply because NSCFI is the latest model that provides higher accuracy and stability than other models [22].

NSCFI is calculated using the following equation:

$$NSCFI = \frac{\sqrt{\frac{1}{n}*\sum_{i=1}^{n}[experience(i)]^2}*\sqrt{\frac{1}{n}*\sum_{i=1}^{n}[expectation(i)-11]^2}*Performance\ Index}{Gap\ Index'*Development\ Index'*Importance\ Index} \quad (1)$$

Here,

$$Importance\ Index = \frac{Average\ of\ expectation}{10} \quad (2)$$

$$Performance\ Index = \frac{Average\ of\ experience}{10} \quad (3)$$

$$Gap\ Index' = 2^{\frac{Avg(expectations)-Avg(experience)}{10}} \quad (4)$$

$$Development\ Index' = 2^{(worse\%-better\%)} \quad (5)$$

Sources of equations in step 3 are [31, 32].

An attribute is considered to be under-resourced if its CFIs value is less than one-third of the average resource level, and it is considered to be over-resourced if its level exceeds two-thirds of the average resource level. The optimal situation occurs when attributes are in the range of one-third to two-thirds of the average resource level i.e. the attributes are considered balanced [22].

In other words,

$$\text{Average resource level} = \frac{1}{21} \approx 0.047619$$

Here, the idea is that the total resource input is 1 which has been divided into 21 different portions.

$$\text{Under-resourced level} = \frac{2}{3} * \text{Average resource level} \approx 0.032$$

$$\text{Over-resourced level} = \frac{4}{3} * \text{Average resource level} \approx 0.063$$

Any resource value between 0.032 and 0.063 is considered to be optimum resource situation.

Step 4: Calculate Manufacturing strategy index (MSI) values and detect the strategic orientation.

To identify the strategy type adopted by a company, MSI uses Responsive, Agility and Leanness (RAL) model [23] (see Figure 1). Responsiveness means how quickly the system responds to unexpected requirements, Agility means how quickly the system adjusts to the ideal cost structure, and Leanness means to the elimination of waste in all resources and operations. The four elements of the RAL-model are Quality, Cost, Time, and Flexibility. An example to RAL model/MSI triangle is shown in Figure 1.

To identify the strategic orientation, following formulas are used.

The MSI model for Prospector is as follows:

$$MSI_P = 1 - \left[\left(1 - (Q')^{\frac{1}{3}}\right) * (1 - 0.9 * T') * (1 - 0.9 * C') * (F')^{\frac{1}{3}}\right] \quad (6)$$

The MSI model for Defender is as follows:

$$MSI_D = 1 - \left[\left(1 - (C')^{\frac{1}{3}}\right) * (1 - 0.9 * T') * (1 - 0.9 * Q') * (F')^{\frac{1}{3}}\right] \quad (7)$$

The MSI model for Analyzer is as follows:

$$MSI_A = 1 - \left[(1 - F') * \left[ABS[(0.95 * Q' - 0.285) * (0.95 * T' - 0.285) * (0.95 * C' - 0.285)]\right]^{\frac{1}{3}}\right] \quad (8)$$

Here,

$$C' = \frac{C}{Q+C+T} \quad (9)$$

$$Q' = \frac{Q}{Q+C+T} \quad (10)$$

$$T' = \frac{T}{Q+C+T} \quad (11)$$

$$F' = \frac{F}{Q+C+T+F} \quad (12)$$

Furtheremore, in equations 9, 10, 11, and 12, C is cost, Q is quality, T is time/delivery, and F is flexibility.

Sources of equations in step 4 are [31,32].

Step 5: Calculate the parameters for sustainable competitive advantage (SCA) level and evaluate SCA risks.

The SCA risk levels are identified in different methods: Mean absolute percentage error (MAPE), Root means squared error (RMSE) and Mean absolute deviation (MAD). The formulas of these three methods are shown below:

Mean absolute percentage error (MAPE):

$$SCA\ risk\ level\ following\ MAPE\ measure = 1 - \sum_{\alpha,\beta,\gamma} \left|\frac{BS-BR}{BS}\right| \quad (13)$$

Root means squared error (RMSE):

$$SCA\ risk\ level\ following\ RMSE\ measure = 1 - \left(\sum_{\alpha,\beta,\gamma} \left(\frac{BS-BR}{BS}\right)^2\right)^{\frac{1}{2}} \quad (14)$$

Mean absolute deviation (MAD):

$$SCA\ risk\ level\ following\ MAD\ measure = 1 - max_{\alpha,\beta,\gamma} \left|\frac{BS-BR}{BS}\right| \quad (15)$$

Where BS is the result of MSI and BR is the results of CFIs. Both BS and BR are the angles in radians. Here, BS represents the angles of MSI triangle formed by MSI values (calculated considering MSI questionnaire, see Appendix 2) and BR represents the angles of MSI triangle formed by MSI values (calculated from CFIs considering S&R questionnaire, see Appendix 1).

Sources of equations in step 5 are [12,33].

Step 6: Calculate and analyse technology and knowledge risks ($T\&K_{RISK}$).

Sixth step in implementing S&R in practice is to calculate the technology and knowledge risks ($T\&K_{RISK}$). $T\&K_{RISK}$ is determined in partial and in total using Root mean square (RMS) approach. Partial risks represent the $T\&K_{RISK}$ in relation to the basic, core, and spearhead independently, whereas total risks indicate the $T\&K_{RISK}$ relating to the whole effect of the basic, core, and spearhead T&K.

The partial risk is calculated using following equations:

$$T\&K_{RISK\ BASIC} = \sqrt{\left((Sum\ of\ CV^2)_Q\right)^2 + ((Sum\ of\ CV^2)_C)^2 + ((Sum\ of\ CV^2)_T)^2 + ((Sum\ of\ CV^2)_F)^2} \quad (16)$$

$$T\&K_{RISK\ CORE} = \sqrt{\left((Sum\ of\ CV^2)_Q\right)^2 + ((Sum\ of\ CV^2)_C)^2 + ((Sum\ of\ CV^2)_T)^2 + ((Sum\ of\ CV^2)_F)^2} \quad (17)$$

$$T\&K_{RISK\ SPEARHEAD} = \sqrt{\left((Sum\ of\ CV^2)_Q\right)^2 + ((Sum\ of\ CV^2)_C)^2 + ((Sum\ of\ CV^2)_T)^2 + ((Sum\ of\ CV^2)_F)^2} \quad (18)$$

Where,

Q = All quality attributes
C = All cost attributes
T = All time attributes
F = All flexibility attributes

$$CV = Coefficient\ of\ variance = \frac{Standard\ deviation}{Mean} \quad (19)$$

$$Standard\ deviation\ (\sigma) = \sqrt{\frac{\sum(X-Mean)^2}{N}} \quad (20)$$

Where X is a set of number, N is number of sets.

The total risk is calculated using following equations:

$$T\&K_{RISK\ TOTAL} = \sqrt{(T\&K_{RISK\ BASIC})^2 + (T\&K_{RISK\ CORE})^2 + (T\&K_{RISK\ SPEARHEAD})^2} \quad (21)$$

Source of equations in step 6 is [12].

4 Results

The data of all six companies studied are analyzed using the same procedure as presented in the section "Methods of data analysis"; therefore, this section provides details on the results for Company A while the results for Company B, C, D, E, and F are presented in summary and comparison tables.

4.1. Company A

Figure 2 shows that the expectations established by company A for the attributes mostly surpass past experience. The highest difference between future expectations and previous experience is 3 (see attributes 3, 7, 8 and 19 in Figure 2), while the smallest difference is 0.5 (see attributes 11, 14, 15 and 18 in Figure 2). Furthermore, attributes 16 shows no gap between future expectations and prior experience. This signifies that company A's data and information privacy policy appears to be effective.

Figure 3 depicts the resource allocation of company A in the past. Attributes 3, 6, 7, 8, 10, 19, and 21 are discovered to be under-resourced, whereas attributes 2, 14, and 18 are found to be over-resourced. This suggests that company A has had the greatest difficulties with knowledge and technology management, as well as processes and workflows, while concentrating too heavily on the performance of research and development. The number of balanced attributes in the future is exactly the same as in the past, yet the attributes themselves are not entirely the same (see Figure 4). Company A appears to be pessimistic about their company's resource utilization in the coming years, particularly in the areas of knowledge and technology management, along with processes and workflows. Nonetheless, it is clear that approximately half of the attributes show an increase tendency in resource allocations.

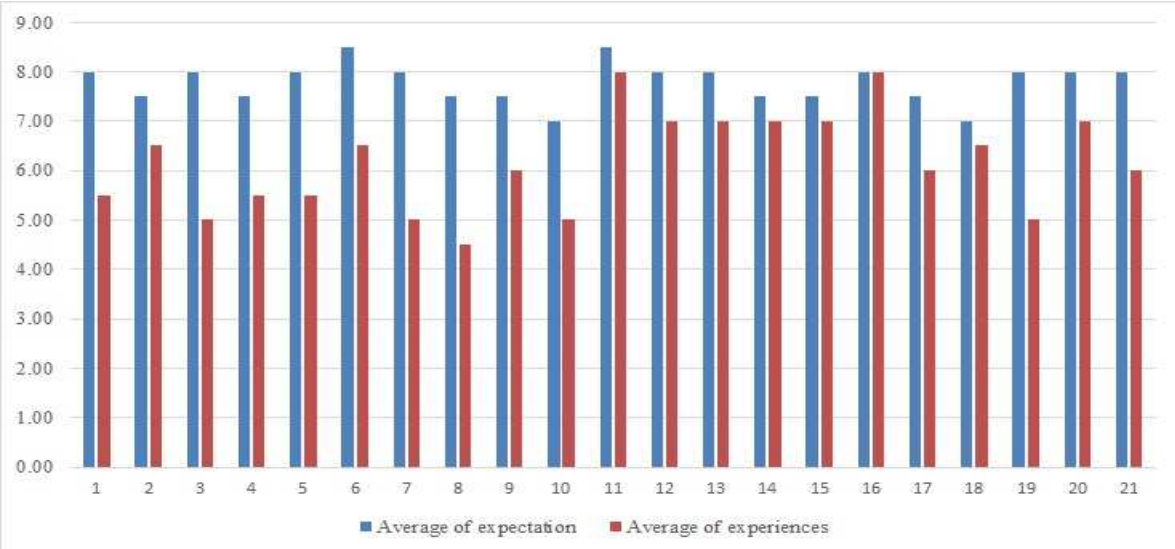

Figure 2 Average of Expectation vs Experience – Company A

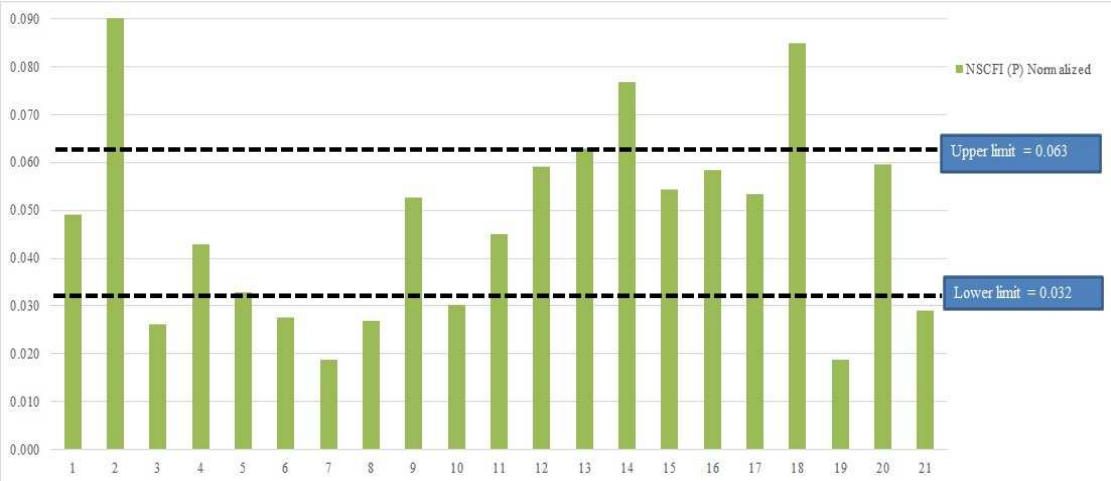

Figure 3 Resource allocation in the Past – Company A

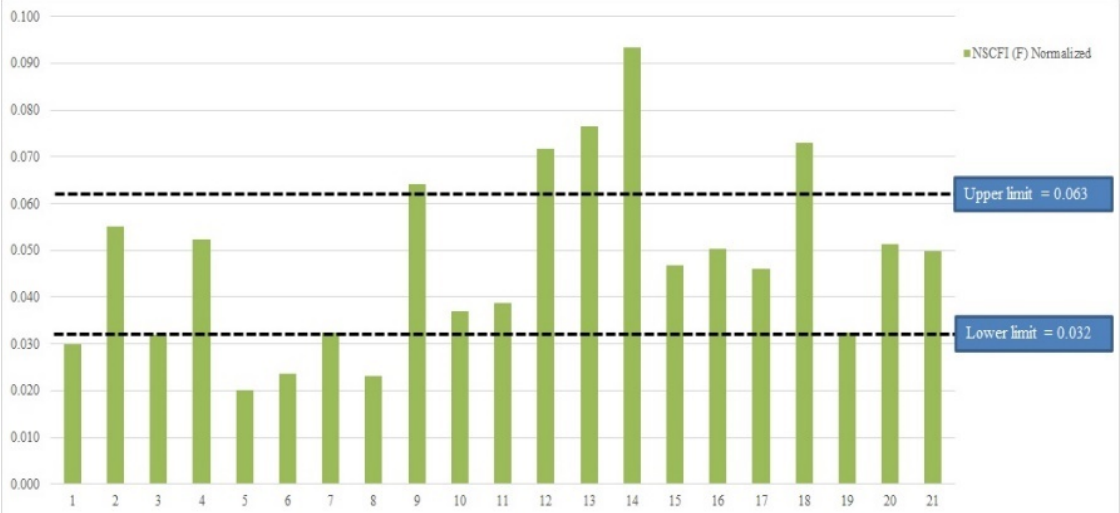

Figure 4 Resource allocation in the Future – Company A

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Table 1 and Figure 5 show the MSI values for company A. The nearer the MSI value is to 1, the more accurately it describes the strategy type of the company [33]. Table 1 shows that the MSI values for Analyzer are high both in the past and in the future, with a value of 0.99. This shows that Company A's past business strategy was Analyzer, and that the strategy for the future is still Analyzer, but a bit more dominant.

Table 1 MSI result – Company A

	Prospector	Analyzer	Defender	Reactor
Past	0.90	0.99	0.91	0.90
Future	0.91	0.99	0.90	0.90

The SCA values calculated based on past scenarios are greater than those determined based on future scenarios, as shown in Table 2. This indicates that resource allocations provided appropriate support for Company A's operations strategy in the past while in the future operations strategy gets less support from resource allocation, possibly making it less sustainable.

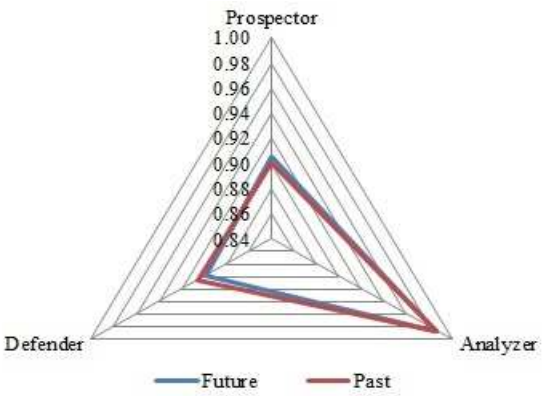

Figure 5 MSI triangle – Company A

Table 2 SCA result – Company A

	Measures of SCA risk level		
	MAPE	**RMSE**	**MAD**
Past	0.87	0.92	0.93
Future	0.80	0.88	0.91

In terms of technology and knowledge, Company A employs 31.74% basic T&K, 38.90% core T&K, and 29.36% spearhead T&K (see Figure 6). It can be concluded that company A prioritizes spearhead T&K the least while prioritizing core T&K the most.

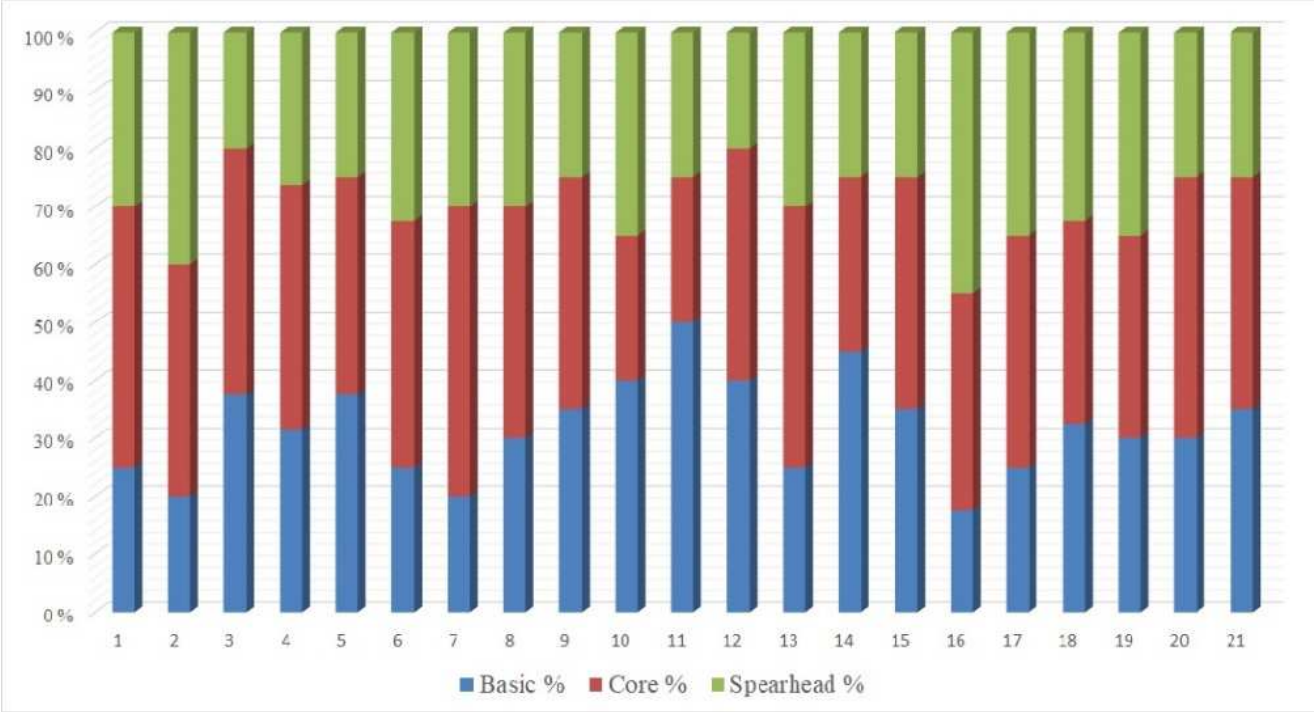

Figure 6 Ranking of Technology & Knowledge – Company A

T&K risks for basic, core, and spearhead are 1.743, 2.43, and 6.83, respectively (see Figure 7). Furthermore, total T&K risk is found to be 7.46 (see Figure 7). These risk values implies that spearhead T&K has the most risks, whereas basic T&K has the lowest risks.

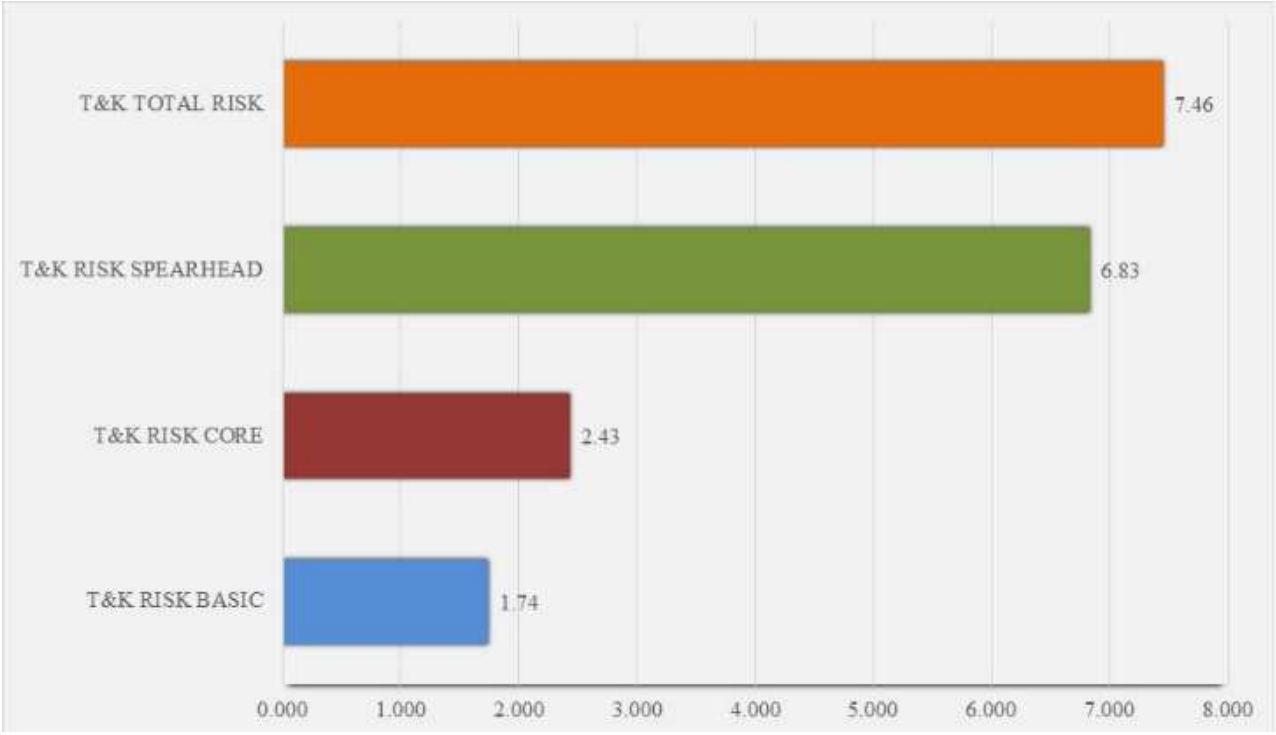

Figure 7 Technology & Knowledge risk – Company A

4.2. Company B, C, D, E, and F

Similarly to Company A, the expectations established by Company B, C, D, E, and F for the entire 21 attributes are higher than previous experience. In terms of the allocation of resources, it can be noticed from Table 3 that the number of balanced attributes for all five companies is greater than or equal to ten both in the past and in the future. Furthermore, it is shown that the number of balanced attributes tends to maintain or increase in the future, except for Company C with a slight decrease. These results demonstrate that respondents from these companies seem to be relatively positive about the usage of their companies' resources in the years to come. However, to strengthen any ineffective attributes that may currently exist, companies are required to develop a strategic plan wisely.

Table 3 is read as follows (example with Company B): Out of the 21 attributes (see Appendix 1), Company B has 5 under-resourced attributes, 10 balanced attributes, and 6 over-resourced attributes in the past. Other information in the Table 3 must be read in the same way.

For the MSI competitiveness, Table 4 points out that Analyzer results for all five companies was high in the past, ranging from 0.98 to 0.99, and will be high in the future, ranging from 0.96 to 0.99. This demonstrates that these five (B, C, D, E, and F) companies' business strategies have been Analyzer in the past and are expected to be Analyzer in the future, but with a slight decrease for company B.

Table 3 Resource allocation in the Past & Future – Company B, C, D, E, and F

		Under	Balance	Over
Company B	Past	5	10	6
	Future	3	17	1
Company C	Past	5	12	4
	Future	4	11	6
Company D	Past	3	14	4
	Future	4	14	3
Company E	Past	5	11	5
	Future	4	14	3
Company F	Past	3	15	3
	Future	1	18	2

Table 4 MSI competitiveness – Company B, C, D, E, and F

		Prospector	Analyzer	Defender	Reactor
Company B	Past	0.90	0.99	0.89	0.90
	Future	0.90	0.96	0.89	0.90
Company C	Past	0.91	0.98	0.91	0.91
	Future	0.91	0.99	0.90	0.91
Company D	Past	0.90	0.98	0.91	0.90
	Future	0.90	0.98	0.90	0.90
Company E	Past	0.90	0.98	0.89	0.90
	Future	0.90	0.98	0.90	0.90
Company F	Past	0.90	0.98	0.90	0.90
	Future	0.90	0.98	0.90	0.90

Regarding SCA values, Table 5 shows that over half of the values for Company B, C, and F are close to 0.9 and will increase slightly in the future. It means that the operations strategy of these companies was sustainable to some extent in the past but will become more sustainable in the coming years. The sustainability of Company D and E also follows an upward trend; however, the values found in the past are not very high. This indicates that in the past their companies' operations strategy might not have had adequate support from resource allocations.

Table 5 SCA results - Company B, C, D, E, and F

		MAPE	RMSE	MAD
Company B	Past	0.81	0.88	0.91
	Future	0.81	0.88	0.91
Company C	Past	0.83	0.90	0.92
	Future	0.86	0.91	0.93
Company D	Past	0.76	0.86	0.89
	Future	0.81	0.88	0.91
Company E	Past	0.77	0.86	0.89
	Future	0.79	0.87	0.90
Company F	Past	0.81	0.88	0.91
	Future	0.85	0.91	0.92

In terms of technology and knowledge categories, Table 6 indicates that Company B, D, and F give basic T&K the highest rank while giving the lowest priority to spearhead T&K. Company C also places the least weight on spearhead T&K, whereas it places the most value on core T&K. Company E, on the other hand, does not appear to prioritize one T&K above the others. This might indicate that, Company E should conduct more studies to see whether the allocation of such strategies impacts the competitiveness of the attributes.

As shown in Table 7, basic T&K has the lowest risks in Company B and D while core T&K has the lowest risks in Company C, E, and F. Spearhead T&K has the highest risks across all five companies.

Table 6 Ranking of Basic, Core, Spearhead Technology & Knowledge – Company B, C, D, E, and F

	% Basic	% Core	% Spearhead
Company B	49.52	29.05	21.43
Company C	39.05	42.62	18.33
Company D	41.90	38.57	19.52
Company E	33.10	33.21	33.69
Company F	40.95	40.00	19.05

Table 7 Technology & Knowledge risk – Company B, C, D, E, and F

	Basic	Core	Spearhead
Company B	0.24	1.01	1.52
Company C	0.93	0.32	1.05
Company D	2.52	2.53	4.31
Company E	1.40	1.13	3.83
Company F	2.39	1.85	4.18

5 Discussion and conclusion

The objective of this research is to assess the sustainable competitive edge of pharmaceutical SMEs in southern Vietnam on the basis of current orientation, direction of development, and sustainability of competetitive advantage. The present strategic priority of all six companies, according to the results, fits into Analyzer. As illustrated by Figure 8, although there is a difference in priority order, quality has been identified as the crucial element in the past and will continue to be so in the future, implying that quality is the primary source of competitive advantage for pharmaceutical SMEs in southern Vietnam. In a similar manner, among basic, core, and spearhead T&K, basic T&K is figured out to be the primary source of competitive advantage, and spearhead T&K is found to be the main source of risk in operations strategy and SCA (see Figure 9). In addition, it can be said that the direction of development of pharmaceutical SMEs in southern Vietnam is Analyzer because the MSI values for Analyzer reach the highest level. In other words, their strategic orientation in the future is toward quality, cost, and time (see Figure 5 and Table 4). This answers the research question 1.

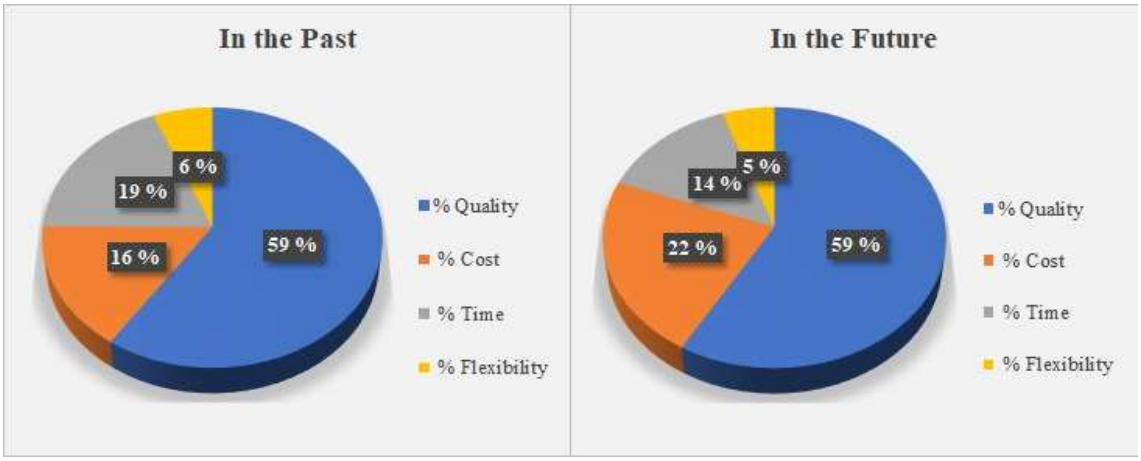

Figure 8 Percentage of Quality, Cost, Time, and Flexibility for all the 6 companies on average

The result is in accordance with the nature of pharmaceutical company, where product quality is always a top priority. Figure 8 also shows that, in the following years, cost will rise to second place, while time will fall to third place. Due to the Covid-19 pandemic, as well as the global energy crisis caused by the ongoing Russia-Ukraine war, Vietnam's pharmaceutical industry has been facing a number of challenges, including a broken supply chain, increased raw material and transportation costs, and changes in consumer habits and drug demand [7]. As a result, pharmaceutical companies have been attempting to cut costs and restructure operations and supply chains. However, the Covid-19 pandemic has also created a strong wave of innovation in the healthcare industry in general and the pharmaceutical industry in particular [7, 34], which has led to an increase in competition among enterprises in the industry. In light of this, pharmaceutical companies, especially small and medium-sized, tend to choose to be Analyzer in the upcoming years to adapt more easily to the new market development and also to maintain their position in the market. Since the studied companies favor a quality-cost-time (QCT) operating approach, they should aim to become more technologically adaptable in achieving higher satisfaction on on-time delivery and revenue target achievement.

In addition, most of the domestic pharmaceutical enterprises in Vietnam have previously focused on producing and trading popular drugs on the market with limited technology [11]. They also lack knowledge and high-quality human resources for product research and development. Therefore, the fact that enterprises aggressively race to innovate technology to gain market share will create enormous risks. Because of these matters, the companies should keep an eye on the risk levels connected with spearhead technology, as it was found to carry higher risk (see Figure 9).

From the NSCFI chart of resource allocations, it can be stated that in the past, more than half of six companies under-prioritized attribute 6 (Design and planning of processes and products), attribute 10 (Control and optimization of all types of inventories), and attribute 19 (Availability of information in information systems), while two attributes are over-prioritized, namely attribute 2 (Innovativeness and performance of research and development) and attribute 14 (Well-defined responsibilities and tasks for each operation). Regarding attributes that are over-prioritized and under-prioritized, the companies should think about balancing them according to their own points of view, internal business strategies, and market requirements. According to the trend, it is clear that respondents are confident about the future of their companies and that the companies' development path seems to be stable and is anticipated to stay the same or possibly get better.

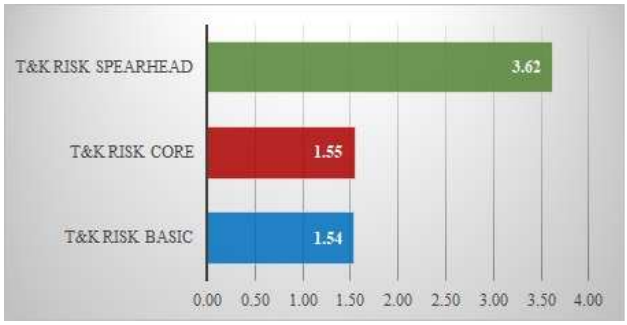

Figure 9 Technology & Knowledge risk for all the six companies on average

In terms of sustainale competitive advantage, all six enterprises agree that the MAD method, and maybe the RMSE method, outperform the MAPE method in identifying SCA risks. Nevertheless, if the MAPE method produces an index below 0.9, it could mean that there is a small inconsistency between the resources [2]. Furthermore, it should yet be tried with a larger number of businesses of various types and sizes to determine the optimal formula for validating the strategic decision (MAD, RMSE, or MAPE). Additionally, as seen from Table 5, over half of SCA values obtained using historical scenarios are close to 0.9 and will increase slightly in the

future. Hence, the operations strategy of pharmaceutical SMEs was sustainable to some extent in the previous years and will be slightly more sustainable in the coming years. This answers the research question 2.

Because the data was gathered from only two participants from each company, generalizing the results is problematic. However, one plus side is that, according to the respondents' own opinions, there is a strong correlation between MSI (Analyzer) and CFI (P). Regardless, the respondents are astonished by several of the unbalanced attributes. Another aspect worth emphasizing is that the descriptions of technology and knowledge questions were fairly hard for the respondents to fully comprehend; consequently, this may cause uncertainty in the results.

This research opens a new path for further studies. Some future research can be conducted by:

- increasing the size of the respondents as well as the companies participating in the study to increase the degree of reliability;
- comparing the results of the evaluation of sustainable competitive advantages using different methodologies;
- analyzing in-depth the impact of technology and knowledge on operations strategy or sustainable competitive advantages of either pharmaceutical SMEs or the pharmaceutical industry.

To sum up, this study demonstrates that research on sustainable competitive advantage is necessary for pharmaceutical SMEs as they could be regarded as a valuable resource for identifying the company's operational shortcomings and strengths and, as a result, taking the necessary actions to ensure the company's long-term success.

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Review process
Single-blind peer review process.

Appendix 1. Sense and respond questionnaire

QUESTIONNAIRE: Sense and Response (S&R)

Please complete the following table considering 2 to 3 years' experience in the past and 2 to 3 years expectation for the future. The sum of Technology and knowledge share should be 100% i.e. basic + core + spearhead = 100%.

ATTRIBUTES	Expectations	Experiences	Trend (Future)			Trend (Past)			Compared to competitors			TK share		
			Worse	Same	Better	Worse	Same	Better	Worse	Same	Better	Basic	Core	Spear Head
	(1-10)	(1-10)												
Knowledge & Technology Management														
1. Training and development of the company's personnel														
2. Innovativeness and performance of research and development														
3. Communication between different departments and hierarchy levels														
4. Adaptation to knowledge and technology														
5. Knowledge and technology diffusion														
6. Design and planning of the processes and products														
Processes & Work flows														
7. Short and prompt lead-times in order-fulfilment process														
8. Reduction of unprofitable time in processes														
9. On-time deliveries to customer														
10. Control and optimization of all types of inventories														
11. Adaptiveness of changes in demands and in order backlog														
Organizational systems														
12. Leadership and management systems of the company														
13. Quality control of products, processes and operations														
14. Well defined responsibilities and tasks for each operation														
15. Utilizing different types of organizing systems (projects, teams, processes...)														
16. Code of conduct and security of data and information														
Information systems														
17. Information systems support the business processes														
18. Visibility of information in information systems														
19. Availability of information in information systems														
20. Quality & reliability of information in information systems														
21. Usability and functionality of information systems														

Appendix 2. MSI Questionnaire

MSI Questionnaire

Please evaluate the following criteria in every pairwise comparisons what are more important in your opinion. Please circle (O) the evaluation values for past and future situation considering 2-3 years in the past and future. Here, 1 means both the criteria are equally important and 9 means the criteria is extremely important over other.

Main criteria	Pairwise comparisons	Main criteria
Costs	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Quality
Costs	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Delivery
Costs	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Flexibility
Quality	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Delivery
Quality	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Flexibility
Delivery	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Flexibility

Table1: Pairwise comparison of four main criteria considering 2-3 years' experience in the past.

Main criteria	Pairwise comparisons	Main criteria
Costs	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Quality
Costs	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Delivery
Costs	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Flexibility
Quality	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Delivery
Quality	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Flexibility
Delivery	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Flexibility

Table2: Pairwise comparison of four main criteria considering 2-3 years in the future.