Portfolio Analysis in the Field of Strategic Knowledge Management

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ABSTRACT This article describes possible applications of existing controlling tools of portfolio analysis in the field of strategic knowledge management. In this course the author has chosen a hermeneutical and conceptual approach. Starting points for the development of innovative tools for portfolio analyses in knowledge management are the Boston Matrix, the McKinsey Portfolio, the life cycle analysis and the SWOT analysis. The new instruments are discussed regarding their adequacy for the evaluation and long-term development of knowledge in organizations. The author introduces the innovative Knowledge Advance & Growth of Importance portfolio (the "Knowledge Matrix") linked to the life cycle model of intangible assets. Finally, the SWOT analysis is adapted for strategic knowledge management. Moreover, some existing tools for strategic portfolio analyses in strategic knowledge management are described.

KEYWORDS: innovation management, controlling, evaluation, organizational learning, intangible assets

JEL CODES: M00, M10, M19, M49, O32

Introduction

Knowledge management (KM) has become established as a multidisciplinary field of research in social sciences and management studies since the turn of the new millennium. Numerous scientific publications underpin the importance of KM. In this context KM is able to improve productivity and sustainability of

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organizations (Zheng, & Wang, 2018, pp. 110–111). In contrast to the optimistic view of the academic literature, KM is often reduced to the level of information and communication technologies (especially databases), which is not appropriate for its multilayered nature regarding the dimensions *man – organization – technology* (Brandt, & Massing, 2002, pp. 235–249). The practical application of a holistic understanding of KM is often neglected (Seyr, 2015). Therefore, KM is unable to unfold its full potential and it achieves only marginal effects. Technology should only be seen as a (necessary) tool to enable the processes of KM, but it should not replace KM itself (Sharma, & Deb, 2019, p. 763).

In order to implement sustainability within information management and KM, Erek and Zarnekow (2009, p. 424) introduce a regulator circuit containing the following phases: identification of resources, evaluation of resources, identification of measures, prioritization, implementation, action and controlling. The second and last phases (shaded grey in the graph) emphasize the importance of evaluation tools in the field of information management and KM. Such evaluation tools will be the main focus of this article.

Fig. 1: **Regulator circuit for information and knowledge management**
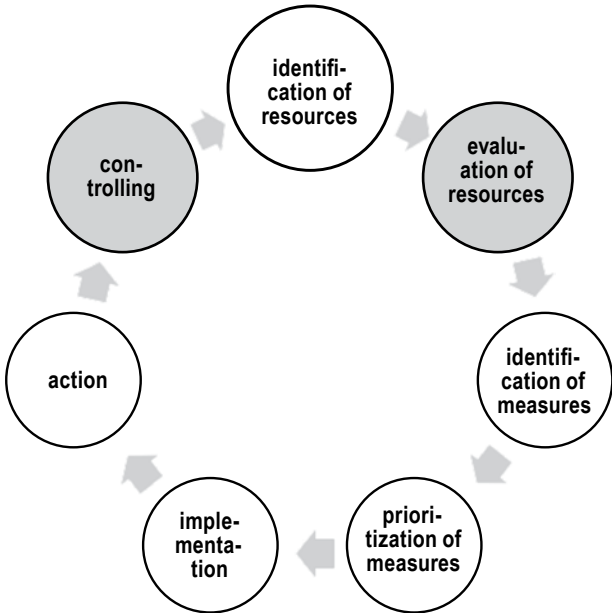
Source: own graph, inspired by Erek and Zarnekow, 2009

This article shall help to expand KM in organizations beyond the technological level and enable a critical evaluation of the organizational knowledge base. Moreover, such evaluation tools shall facilitate strategic KM. In the KM model of Probst, Raub and Romhard (2006, p. 58) the critical evaluation of knowledge is integrated in the following modules: assessment of knowledge, identification of knowledge (according to the knowledge targets) and knowledge development (following the acquisition of knowledge).

This goal should be reached by the adaption of well-known methods of portfolio analysis such as the Boston Matrix, the McKinsey Portfolio, the life cycle analysis and the SWOT analysis for strategic KM. In this way, it is made possible to visualize existing knowledge bases in a "cockpit system" in order to establish a clearly laid out basis for decision making in strategic (knowledge) management. Moreover, the portfolio analysis enables a meta-view on existing knowledge bases. Thus KM can be more efficient and effective in contributing to the organization's success. The establishment of a powerful reporting system in KM can also build the basis for an internal and external benchmarking of intangible assets (Catalfo, 2015, p. 642). In this sense, academic literature emphasizes the importance of the close co-operation between controlling and strategy. Connected to this fact, the performance measurement of KM strategies is crucial for an organization's future (Weber, Schaeffer, Goretzki, & Strauß, 2012, pp. 34–35).

Botthof (2012, pp. 83–90) proves in his paper the high importance of reporting tools that must be clearly structured, forward-looking and standardized. In line with these postulates, this paper introduces some newly adapted controlling tools for strategic KM.

The application of portfolio analysis in strategic KM

General remarks

Traditional instruments of portfolio analysis in strategic management are usually based on the factors of market and/or product with regard to the marketing. For instance, the Boston Matrix has on its x-axis the relative market share and on its y-axis the market growth rate. Similar to this concept is the McKinsey Portfolio that allows general strategic conclusions like divest/harvest, protect/select or invest/expand depending on the competitive strength and the market attractiveness associated with products or strategic business units. The life cycle analysis is connected to products and markets and illustrates the development of turnovers during a certain period of time.

In contrast to these instruments, the SWOT analysis can be seen as a tool for the internal and external organization analysis that can be easily adapted to the needs of strategic KM.

As the above mentioned tools of the portfolio analysis are well known for more than half a century, the author may omit their detailed discussion. In fact, the paper discusses the adaption of these tools according to the characteristics and needs of strategic KM in detail.

As the focus is not set on marketing, KM tools do not directly refer to the factors *market* and *product.* In contrast to marketing, KM has to provide informational bases for processes in organizations in a wider perspective. The factors *environment* (especially the stakeholders of the organization like competitors and customers) and *contents of knowledge* (as products of KM) can be seen as important points of origin in this paper.

Appropriate controlling tools of strategic KM are cornerstones to ensure the organization's ability to react, coordinate, learn and innovate in order to survive in a dynamic environment (Gueldenberg, 2001, p. 318).

The Knowledge Advance & Growth of Importance Portfolio (Knowledge Matrix)

The Boston Matrix (the Boston I portfolio) as well as the McKinsey Portfolio (Baum, Coenenberg, & Guenther, 2013, pp. 224–230; Thommen, & Achleitner 2009, pp. 1021–1023; Baum, Coenenberg, & Guenther, 2013, pp. 230–237) serve as bases for the author's *Knowledge Advance & Growth of Importance Portfolio* by combining and adapting them to the needs of KM.

The Boston Matrix categorizes strategic business units or products, according to their relative market share and the market growth rate, into one of four quadrants.

The Poor Dogs have a low market share and a low market growth. The recommended generic strategy in this field is "divest". The Question Marks are those with a low market share but a high market growth. They should be monitored and carefully developed. The Stars have a high market share and a high market growth. On one hand they generate high turnover, on the other hand they consume their cash flows due to their expansion costs. The Stars should be treated as the basis for the current and future success. In contrast, the Cash Cows are distinguished by a high market share but a low market growth. They generate positive cash flows and should serve as long as possible. The generic strategy says "harvest".

The McKinsey Portfolio also analyzes products or business units. The x-axis shows the competitive strength of a product or a business unit. Its y-axis

demonstrates the attractiveness of an industry. The McKinsey Portfolio consists of nine fields and can be seen as an enhancement of the Boston Matrix. From the McKinsey Portfolio can be deduced three general recommendations:

1. If the competitive strength is low as well as the industry attractiveness, or one factor is low and the other is medium, a divesting strategy should be applied – similar to the Poor Dogs.
2. With high competitive advantages in a field *or* high industry attractiveness a selective strategy should be implemented. This can be realized by improving the market position (offensive strategy) or by a defensive strategy in order to avoid further deterioration. A selective strategy can also be used as a transition strategy between a divestment and an expansion strategy.
3. For medium positions at a certain factor combined with a high value at the other factor, or with high values at both factors, the generic strategy should be "expand" in order to generate growth for the price of investments.

In the course of the adaption of these portfolios for the KM the axes have to be modified. Knowledge has no measurable relative market share like a product or a strategic business unit (see the Boston Matrix). Therefore the factor "relative market share" is replaced by "relative knowledge advance". In this sense the variable on the x-axis is similar to the McKinsey Portfolio that shows the competitive strength on this axis. The relative knowledge advance is understood in a certain area of knowledge or skills in comparison to the competitors. The knowledge advance can also be negative if the analyzed organization has a competitive disadvantage in a certain area.

The market growth rate of the Boston Matrix (on the y-axis) is replaced by "growth of importance" in the Knowledge Matrix of the author of this paper. The growth of importance shows whether the analyzed knowledge field of the organization will gain more interest in future or not. Here also the factor can be negative if the knowledge field is losing importance. In some aspects this value corresponds with the industry attractiveness in the McKinsey Portfolio.

Instead of strategic business units (or products) the Knowledge Matrix displays strategic fields of the organization's knowledge by circles. It is possible to show the volume of investment in these fields by the radius.

This form of graph conforms to the principles of the portfolio technique where the importance of the strategic business units (the turnover) corresponds to the radius of the circles. Also in the usual sense of the portfolio analysis the

x-axis shows the organization's dimension and the y-axis displays the environmental dimension (Baum, Coenenberg, & Guenther, 2013, p. 223).

Fig. 2: **The Knowledge Matrix**

		Seeds	Diamonds
Growth of Importance	negative	Old Hats	Work Horses
	positive		
		Knowledge Advance negative positive	

Source: concept and graph of the author

For the allocation of the different items (resp. strategic areas of knowledge) within the portfolio internal and external analytical and empirical studies can be used. Moreover, market surveys, expert interviews, experts and practitioners' experience may help to *estimate* the positions. The restriction of the portfolio may lie in the difficulty to determine exact positions on the axes – but this methodological problem is comparable to other portfolio tools where factors like e. g. the "industry attractiveness" also cannot be exactly determined. In spite of that the portfolio technique allows a first overview in order to facilitate strategic decisions.

The value of the Knowledge Matrix lies in the evaluation of knowledge bases regarding long-term oriented KM. During the evaluation or specification of the knowledge and information strategies, generic strategies shorten the decision processes (Heinrich, & Stelzer, 2011, p. 117). In this context a restriction of the portfolio technique can be seen in the reduction of the complex reality to only two attributes in the case of a two-dimensional portfolio.

From the Knowledge Matrix the following generic strategies can be deduced:

Old Hats: These knowledge bases are not important for the future success of the organization. Moreover, the organization has no relevant strengths in this area of knowledge. Thus these areas should not be fostered in future. No additional investments should be made. These knowledge bases are disposable resources that should be sold, outsourced or given up (Johnson, & Scholes, 1999, pp. 153–155).

Seeds: These knowledge bases should be cultivated and carefully watched. Investments make sense because an increase regarding the strategic importance of the seeds can be expected but the organization has no actual knowledge advances in this area at the time. Seeds belong to "innovative knowledge" (Maier, 2004, p. 99) and should be developed to *Diamonds*.

Diamonds: These are distinguished by outstanding competences in the associated area as well as a high growth of importance. Diamonds are current and future core competences of an organization. Further investments are recommended in order to strengthen these future critical factors of success. Diamonds belong to the core resources building competitive advantages and ensuring a sustainable organizational profile (Johnson, & Scholes, 1999, pp. 153–155).

Work Horses: Work Horses are important knowledge bases that keep the organization running without having a future potential. They consist of necessary basic knowledge and skills to run a business according to the state of the art. Work Horses should be maintained without sacrificing resources for long-term investments. Work Horses do not possess the potential for improving the organization's competitive position (Johnson, & Scholes, 1999, pp. 153–155). In a mid- or long-term view Work Horses may develop into *Old Hats*.

Alternative approaches of portfolio analysis in strategic KM
An alternative portfolio for strategic KM was introduced by Probst, Raub and Romhardt (2006, p. 51). This portfolio also aims to offer generic strategies for knowledge managers but it differs from the above mentioned Knowledge Matrix in its fundamental design: Probst, Raub and Romhardt (2006, p. 51) measure on the x-axis the *use of knowledge* and on the y-axis the *knowledge advance*. Therefore, the interpretation of the quadrants is also different. If both variables are low the generic strategy says "outsourcing" as the knowledge has no high value for the organization. In situations with a low use of knowledge but a high knowledge advance the strategic conclusion suggests the stronger application of the unused skills in order to improve the competitive position. At a strong use of knowledge but a low knowledge advance the knowledge base should be upgraded. This competence should be enhanced due to its importance for the organization. If both use of knowledge and knowledge advance are high the leverage effect should be exploited in order to transfer the knowledge to new products and markets.

Another portfolio model for the evaluation of resources was designed by Grant (2005, pp. 477–479). It shows on the x-axis the importance of the organization's resource for the competitive situation and on the y-axis the external effects of the resource. External effects are seen as ecological and social aspects. If both factors are low the generic strategy says "keep it running" which implies no further investments in this resource. If both factors are high the future potential is also valued as high. That makes further investments necessary. For resources in the middle field a selective strategy is recommended.

The technology portfolio which has been introduced by Baum, Coenenberg and Guenther (2013, pp. 265–267) is similar to the McKinsey Portfolio because it displays the strength of the resource on the x-axis and the attractiveness of the resource on the y-axis. The generic strategies also correspond to the McKinsey Portfolio (that means a divestment, selection or investment strategy regarding the analyzed technology).

Life cycle analysis
KM is especially important for the success of companies with short product life cycles. (Disterer, 2007, p. 170). In close connection with the author's Knowledge Matrix and the Boston Matrix stands the life cycle model. Within the well-known model of the product life cycle (Baum, Coenenberg, & Guenther, 2013, pp. 225–228) the product life is displayed within ideal type phases in the time lapse by a graph – usually showing the generated turnover and profit. Upon application of this model in KM no product is displayed by the graph, but a strategic, relevant field of knowledge in connection with its importance as a factor of success. The view can be from the perspective of the organization itself or from the whole industry sector. According to the life cycle model the following typical phases are given in strategic KM:

Innovation: The field of knowledge is relatively new and unknown. It is unclear whether the knowledge will gain importance as a success factor in future. Such knowledge areas regularly belong to the "Seeds" in the Knowledge Matrix.

Growth: Knowledge bases in this phase gain more and more importance and attention and are growing rapidly. Such knowledge bases belong to the "Diamonds" in the Knowledge Matrix as they are meaningful for current and future success.
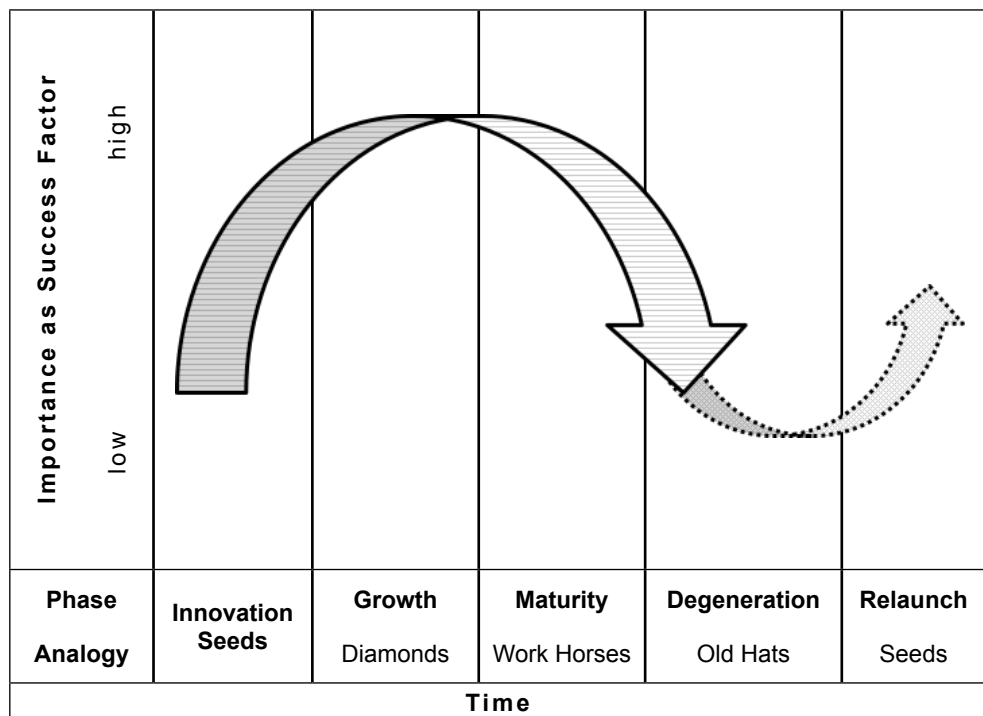*Maturity:* In this phase the importance of the particular knowledge base

reaches its peak. Knowledge bases in the maturity phase are part of the status quo, actually important but mostly known in the industry. Such knowledge capital corresponds to the "Work Horses" in the Knowledge Matrix. Everyday business relies on this knowledge but its innovative potential is low.

Degeneration: This type of knowledge has become out of date with no visible future relevance. Knowledge in the degeneration phase belongs to the "Old Hats" in the Knowledge Matrix.

Relaunch: Maybe old knowledge can be activated to solve new problems, newly combined or developed. In this case a relaunch of such knowledge would be possible. Then its importance could grow again. In the Knowledge Matrix such relaunched knowledge could be part of the "Seeds" again.

Fig. 3: **Life Cycle of Knowledge**

Phase	Innovation Seeds	Growth	Maturity	Degeneration	Relaunch
Analogy		Diamonds	Work Horses	Old Hats	Seeds
Time					

Source: own concept and graph

SWOT Analysis

The SWOT analysis (Kotler, Berger, & Rickhoff, 2010, p. 30) is based on strengths, weaknesses, opportunities and threats. It is an instrument for strategic planning regarding an organization or regarding single business units. Its internal analysis detects current strengths and weaknesses, the external analysis refers to future opportunities and risks.

SWOT analysis can also be transferred into KM:

Within the internal analysis of KM, strengths are units where the organization can take advantage of core competences or deep knowledge. In contrast, weaknesses are units where the organization has no deeper knowledge or strategic knowledge advances compared with its rivals.

The external analysis regarding the environment of an organization can detect opportunities and threats. Opportunities can be given by changes in the environment that can be useful or positive for the organization. These can be positive political, economic, social, technological, ecological or legal changes (see the PESTEL factors). For example, it can be an opportunity for a cardboard producer if disposable plastic products are banned and the cardboard producer can offer substitutes. In the Knowledge Matrix, knowledge about such substitutes can develop into Diamonds that are in their phase of growth within the product life cycle.

Threats are changes in the environment that may harm the organization. In this case, for a producer of disposable plastic products the current legal development is a threat. Knowledge bases in the area of disposable plastic will not be a competitive advantage anymore, and will belong to both the "Old Hats" in the Knowledge Matrix and to knowledge in the degeneration phase.

The strategic target of the combination of strengths and opportunities (SO) means, from the view of KM, that the organization takes advantage of opportunities that fit the core competences in order to fulfill a matching strategy.

At WO combinations (weaknesses and opportunities), weaknesses shall be reduced and transformed into strengths by a transformation strategy which takes advantage of new opportunities. In terms of KM, that means that knowledge bases in areas with good prospects will be enlarged.

The neutralization strategy is recommended for ST combinations (strengths and threats). Strengths will be used to fight against threats. The organization can use its strong core competences in this case.

For WT combinations (weaknesses and threats), the most adverse combinations, a defensive strategy is recommended. From the perspective of

KM these are circumstances where little or no expertise is available within the organization but there are massive threats in this field at the same time. In the example of the producer of disposable plastic articles this means no knowledge about eco-friendly materials in the event of a plastic ban. A defense strategy could be to try to sell the plastic products in regions where it is still allowed, or to exploit legal loopholes.

Fig. 4: SWOT-Analysis in Knowledge Management

	Strengths **S** Core competences	Weaknesses **W** Knowledge gaps
Internal Analysis		
External Analysis	Opportunities **O** Growth of importance of organizational knowledge	Threats **T** Loss of importance of organizational knowledge

*Source***:** own concept and graph

Conclusion

The article shows applications of portfolio analysis for strategic KM, thereby facilitating a link between controlling and strategy and creating a basis for internal and external benchmarking.

In this context the author has developed a Knowledge Matrix displaying the knowledge advance and the growth of importance. This matrix adapts the Boston Matrix and the McKinsey Portfolio to the needs of strategical KM. The Knowledge Matrix can be used as a "cockpit system" for intangible assets and facilitates the evaluation of different knowledge bases. Moreover, the paper introduces applications of the portfolio technique in the management of technology, information and knowledge based on a short literature review.

Additionally, the article combines the life cycle analysis with the portfolio analysis in KM to deduce strategic conclusions. Besides that, the application of the SWOT analysis is recommended in long-term oriented KM in order to detect strengths, weaknesses, opportunities and threats linked with intangible assets. Thus, also, potentials for success can consequently be pursued and risks can be minimized.

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