Making Sense of Knowledge Productivity
β-testing the KP-enhancer

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Abstract

Purpose – purpose of this article is to report about the progress of the development of a method that makes sense of knowledge productivity, in order to be able to give direction to knowledge management initiatives.

Methodology/approach – the development and testing of the method is based on the paradigm of the Design Sciences. In order to increase the objectivity of the research findings, and in order to test the transferability of the method, this article suggests a methodology for beta testing.

Findings – based on the experiences within this research, the concept of beta testing seems to fit Design Science Research very well. Moreover, applying this concept within this research resulted in valuable findings for further development of the method.

Research implications – this is the first article that explicitly applies the concept of beta testing to the process of developing solution concepts.

Originality/value – this article contributes to the further operationalization of the relatively new concept of knowledge productivity. From a methodological point of view, this article aims to contribute to the paradigm of the Design Sciences in general, and the concept of beta testing in particular.

Keywords – knowledge productivity, knowledge management, intellectual capital, innovation, design sciences, beta testing.

Introduction

The sources of productivity have always been the main subject of economic debate because it is the main determinant of profitability and competitiveness. In order to improve productivity we should be able to identify the sources of productivity. The past decades our production process has changed. Traditional factors of production, like natural resources, labour and capital have lost significance. At the same time the importance of intangible inputs, like information and knowledge, rose. Knowledge has become the main ingredient in products and services (Drucker, 1993; Nonaka and Takeuchi, 1997). Consequence of this transformation is that managers have lost sight of the sources of productivity and productivity growth, which leads to distorted resource allocation and poor (external) communication about organizational performance (CEC, 2006). Important underlying cause of these problems is the fact that we do not have the concepts to reveal and communicate about this new type of productivity. Moreover, management does not have the methods and tools to reveal the effectiveness of knowledge-based production processes (Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997) and subsequently they do not know how to improve knowledge productivity. The lack of available information about the effective use of knowledge hinders management to design effective policies aiming at improving organizational performance. It
is of vital importance that management and organizations have a clear sight on the drivers of productivity in order to explain and improve organizational performance.

**Objective and methodology**

Main objective of this research is to develop a practical management method that makes sense of knowledge productivity, in order to be able to give direction to knowledge management initiatives. As the major element of this research is to design a method, this research follows the paradigm of the Design Sciences developed by Van Aken (1994; 1996; 2004b; 2004a). The core mission of the Design Sciences is to develop general knowledge which can be used by professionals in the field in question to design solutions to their specific problems.

The typical research design is the multiple-case. Every case serves a specific purpose within the overall scope of inquiry and therefore follows a replication logic (Yin, 2003). ‘Through multiple case-studies one can accumulate supporting evidence which can continue until “theoretical saturation” has been obtained’ (Van Aken, 2004b: p.235). Moreover, the multiple-case study operates as a learning system, based on the reflective cycle: each case (or regulative cycle) is analyzed, lessons are drawn and improvements are made before the method is tested again. This process is repeated until sufficient supporting evidence has been obtained.

In the design sciences the typical research product is the solution concept. Although the research will be driven by and take place around local problems, the applicability of the solution concepts will be non-local. This means that the solutions can be used to solve similar problems in similar contexts.

Inspired by the software development process, it is suggested that, in order to test the transferability of the solution concepts, and in order to increase the objectivity of the outcome, the method should also go through a phase of beta testing (Van Aken, 2001; 2004b). The concept of beta testing refers to the second stage in a development cycle. The first phase of the development cycle – in which the product is tested by the developer himself – is usually referred to as the alpha (α) stage. The second phase – in which the product is tested by a potential user – is named beta (β). Beta testing follows alpha testing and refers to (a series) of tests which are performed in the context of application and by potential users of the product (solution concept). This concept of beta testing seems to fit Design Science Research very well.

Based on an analysis of 21 beta tests in software development programs, distinction can be made between three layers of beta test purposes (Dolan and Matthews, 1993). First, beta testing provides the opportunity to further test the functioning of the solution concept from a more objective perspective, which increases the reliability of the outcome of the research. Second, having the solution concept tested by potential users provides the opportunity to specifically test the effectiveness of the supporting material and the degree of transferability of the solution concept. Third, successful application of the solution concept may result in success stories and contribute to the credibility of the method.

The experiences with beta testing in software development programs, combined with a review of Design Science Research literature, resulted in a set of rules for beta testing solution concepts within the context of this research.

1. **Purpose**: recognize the full set of benefits – In order to fully exploit the possibilities of beta testing, the first rule is to recognize the full set of purposes as described by Dolan and Matthews (1993).

2. **Test-sites**: respect heterogeneity of the market – This second rule for beta testing refers to the diversity of both firms and people applying the method. Before releasing the final product, it is important to test it under as many as possible different

circumstances in order to explore the scope of application (Van Aken, 2004a). This implies that the test sites can go beyond the intended context of application.

3. Preparation: take necessary precautionary measures – This third rule for beta testing is about transfer of knowledge and preparing the beta testers. Taking the necessary precautionary measures increases the chance of successful application of the method (Halman, 1994).

4. Execution: monitor execution on a regular basis – Aim of this design rule for beta tests is twofold. First, close monitoring of the execution of the method reduces the risk of failure. Second, frequent communication with the beta testers improves the quantity and quality of the feedback (Dolan and Matthews, 1993).

5. Reflection: let the context speak back to you – In terms of contextualization (Gibbons et al., 1994), beta testing is the ultimate way of generating feedback. However, generating valuable feedback can not be taken for granted. Therefore, the fifth rule for beta testing aims at securing feedback from the test sites.

These five rules served as a starting point for beta testing the KP-enhancer. Before translating them to the specific context of this research, I will first elaborate on the concept of knowledge productivity and introduce the KP-enhancer.

Knowledge productivity
The past decades a resource-based view of the firm emerged. Authors like Penrose (1959), Hamel and Prahalad (1990; 1994), and Stalk et al (1992) contributed to this new strategic paradigm. The resource-based view of the firm is based on the assumption that firm-specific competencies have become the most important source of sustainable competitive advantage. The traditional competitive environment was relatively stable and transparent. It was characterized by clear defined markets, customers and competitors. Today’s competitive environment however, is characterized by dynamic changing markets and fast changing customer demands. More and more, competition has become the ability to anticipate on these changes and thus asks for a more dynamic strategic approach as an alternative to the traditional industry-based view.

The last decade, more and more authors have claimed that knowledge is de most important resource. This awareness resulted in a so called ‘knowledge-based theory’ (Grant, 1996; Spender, 1996) of the firm. Most important and fundamental difference between the resource-based view and the knowledge-based view is that the former only implicitly refers to knowledge, whereas the latter gives extensive elaborations on the nature and definition of knowledge and the way it should be managed. The concept of knowledge productivity is closely related to the concept of knowledge management. Both are founded in the knowledge-based view of the firm. Difference however, is the belief that the competitive advantage of organizations does not come from knowledge itself, but from the ability to make knowledge productive.

It was in The Production and Distribution of Knowledge in the United States that Machlup discovered the importance of knowledge as a product. In his recalculation of the national product of the United States, he discovered that total knowledge production in 1958 already accounted for almost 29 per cent of adjusted GNP (Machlup, 1972: original publication in 1962). Moreover, the “knowledge-industry” was not only the largest industry, but also grew faster than the traditional industries. These conclusions led to the observation that there should be some relationship between knowledge, value creation and economic growth.

It was Drucker who translated the macro-economic discovery of Machlup to organizational level, because ‘We know that productivities are created and destroyed,
improved or damaged, in what we call the “micro-economy”: the individual enterprise, plant, shop, or office’ (Drucker, 1981). Moreover, he realized that the real productive power of organizations is determined by the ability of the so called knowledge workers to make knowledge productive. Therefore, ‘knowledge-worker productivity is the biggest of the 21st-century management challenges’ (Drucker, 1999: p.92).

Closely related to and in line with Drucker, it was Joseph Kessels (1996; 2001) who introduced the concept knowledge productivity. ‘Knowledge productivity concerns the way in which individuals, teams and units across an organization achieve knowledge-based improvements and innovations’ (Harrison and Kessels, 2004: p.145). Whereas Drucker interpreted knowledge worker productivity as a management challenge, Kessels puts the individual in the centre of his theory. Main underlying assumption of this concept is that ‘the character of labour is changing: routine work is more and more taken over by machines and computers. The work that remains requires independent decision-making and creative thinking; the physical activities of employees are being replaced by mental and social activities. (...) As this change of the character of labour takes place, it is inevitable that the workplace turns into a learning environment. (…) The conditions for good work become similar to the conditions for good learning’ (Kessels and Van der Werff, 2002: p.20). So, knowledge productivity requires a good learning environment.

In order to help organizations improve their knowledge productivity, Kessels introduced the Corporate Curriculum: ‘the plan for learning to increase knowledge productivity, leading to constant improvement and radical innovation, and ultimately to economic advantage’ (Kessels, 1996; Kessels and Van der Werff, 2002). The Corporate Curriculum should not be seen as a formal educational or training curriculum. ‘Rather, it involves transforming the daily workplace into an environment where learning and working can be effectively integrated. It facilitates the creation of a rich and diverse landscape that encourages and supports employees in the learning they need to do in order to continuously adapt and to innovate’ (Harrison and Kessels, 2004: p.155). The Corporate Curriculum consists of all the intended and not intended conditions that affect the learning processes among workers in organizations (Van Lakerveld et al., 2000) and identifies seven critical learning functions (Kessels, 1996; Keursten et al., 2004):

1. Acquiring **Subject Matter Expertise** and professional knowledge directly related to the organization’s business and core competencies
2. Learning to identify and **Solve problems** by using the acquired subject matter expertise.
3. Cultivating **Reflective Skills** and meta-cognitions that contribute to finding, acquiring and applying new knowledge.
4. Securing **Communication Skills** that provide access to the knowledge network of others and that enrich the learning climate within the workplace.
5. Acquiring skills for **Self regulation of Motivation** and affection related to working and learning.
6. Promoting **Peace and Stability**, in order to enable specialization and incremental improvement.
7. Causing **Creative Turmoil** in order to stimulate innovation.

According to Van Lakerveld et al. (2000), distinction can be made to those learning functions that directly refer to the learning processes (1 to 5) and those that refer to the conditions of learning (6 and 7). Within the 5 functions that refer to the learning processes we can make another distinction between those that dominantly refer to the knowledge processes (1-3), and those that dominantly refer to the knowledge workers (4 and 5). The result is that we can
make a distinction between three different kinds of learning functions: those related to the individual (competences and motivation), those related to the knowledge processes (subject matter expertise, solve problems, reflection), and those related to the organizational environment or conditions (calm and stability, creative turmoil).

--- take in Figure 1 ---

This model tries to pay respect to the human-centred definition of knowledge of Kessels. ‘It gives centre stage to the person of the learner, active within a complex of relationships, engagements and commitments with others’ (Alred and Garvey, 2000). Therefore the inner circle represents the learning functions that are dominantly related to the individual. The outer circle represents the learning functions that are dominantly related to the organizational environment or conditions for learning. The circle in between can be seen as a combination of the inner and the outer circle and represents the learning functions which are dominantly related to the organizational learning cycle or knowledge processes as defined by the knowledge management literature (Nonaka and Takeuchi, 1997; Weggeman, 1997).

**Design of the KP-enhancer**
Main aim of the KP-enhancer is to make sense of knowledge productivity, in order to give direction to knowledge management initiatives. This objective has been translated into a series of functional and operational requirements of the method. Main functional requirements are that the method should increase awareness about the importance of KP, should create insight in the preconditions and results of KP, and reveal possibilities for enhancing KP. The main operational requirement is that the method should be practical in the sense that it does not take too much time, that it is easy to understand and that the method can be applied easily by others.

These requirements resulted in an initial design of the method, which has been tested four times in the period 2005-2006. The tests took place in Dutch medium-sized knowledge intensive professional service firms. After each test, the method was evaluated and improved. Together, this resulted in an improved version of the method. This beta-version of the KP-Enhancer consisted of three phases of each three steps.

--- take in Figure 2 ---

**Phase 1 – Problem definition**
Aim of this phase is to come to an agreement about the problem to be solved. After the scope has been determined, the problem is formulated with, and validated by the client.

*Step 1: Determine the scope* – Before investigating the problem at hand, it should be perfectly clear what the scope of the project (i.e. application of the KP-Enhancer) is. This can be the organization as a whole, but also a business unit or a department.

*Step 2: What is the problem at hand?* – The next step is to determine what problem has to be solved with the KP-Enhancer. In a formal conversation between researcher and client, the objective, expectations, and intended results are discussed. Main question to be answered is whether the problem at hand fits into the class of problems for which the method is designed.

*Step 3: Validate the problem statement* – Aim of the final step of the first phase is that the client validates the problem which has to be solved. The problem statement is the
Phase 2: Analysis preconditions knowledge productivity
Aim of this phase is to analyze the preconditions for knowledge productivity and to come to a set of shared findings about possibilities for improvement.

Step 4: Questionnaire – The first step within this phase is to assess the quality of the preconditions for knowledge productivity. All employees, within the scope of the project, are asked to participate in an electronic survey. The survey consists of about 80 items. The lead-time of the survey is two weeks.

Step 5: Processing data from questionnaire – After the deadline has expired, the data of the questionnaire is processed (SPSS and Excel) and used to prepare the first workshop.

Step 6: Collective interpretation of the data (Workshop 1) – Aim of this workshop is to introduce the concept of knowledge productivity to the participants of the workshop, to present the outcome of the questionnaire, and to collect shared findings about possibilities to improve the preconditions for knowledge productivity. The latter is facilitated by playing a board game. At the end of the workshop, participants are literally asked to put their cards on the preconditions that, according to them, have to be improved.

Phase 3: Formulating a KP-statement
Aim of the third phase is to translate the collective findings of the previous phase into a KP-statement. The KP-statement tells us which initiatives have to be put in place in order to improve the current situation from a knowledge perspective.

Step 7: Validate findings workshop 1 and prepare workshop 2 – Within this step, in between the two workshops, the findings of the first workshop are reported to, and validated by the participants. Moreover, the participants are asked to answer a series of questions, in order to enable the facilitator to formulate a concept knowledge strategy. Both, findings of the first workshop and the concept knowledge strategy, serve as starting point for the second workshop.

Step 8: Formulating a KP-statement (Workshop 2) – Aim of this step is to collect all the information needed to formulate a KP-statement. This step is based on the IC-statement model (STI, 2003) and consists of the formulation of a knowledge strategy, knowledge productivity challenges, knowledge management initiatives, and indicators that measure the progress of the initiatives.

Step 9: Validating the KP-statement – Finally, the outcome of the second workshop is put together in a KP-statement model. Again, the result is reported to, and validated by the participants of the workshop. Next it is presented to the client/management team.

After four iterations, the KP-enhancer seemed to be an effective method to make sense of KP and subsequently give direction to KM-initiatives. However, how to increase the objectivity of this conclusion? Moreover, aim of this research is to produce transferable design knowledge (solution concept). How to test the transferability of this solution concept? As
discussed above, beta testing seems to be an effective way of generating answers to these questions.

**Beta testing the method**

The beta tests of the KP-Enhancer took place in three sites (Table). The first and second site were two different units, within a single department of a Dutch ministry. The third site was the Dutch subsidiary of a multinational pharmaceutical company. These tests took place in the period January-May 2007.

<table>
<thead>
<tr>
<th>Company</th>
<th>Employees</th>
<th>Period</th>
<th>Main focus of tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Supporting material</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Requirements person applying the method</td>
</tr>
<tr>
<td>Regional office of department of Dutch Ministry</td>
<td>156</td>
<td>January-April 2007</td>
<td>4. Limiting conditions</td>
</tr>
<tr>
<td>Dutch subsidiary of pharmaceutical firm</td>
<td>400</td>
<td>January-April 2007</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Overview of beta test sites, period of testing and the main focus of the tests

These three tests were based on the five rules for beta testing, as suggested above. Before elaborating on the results of these beta tests, I will first apply these rules to the beta tests within this research.

*1. Purpose: recognize the full set of benefits*

Based on the suggestion that beta testing programs should recognize the full set of benefits, beta testing within the context of this research aims at different layers (objectives) simultaneously. The first layer (method functioning) aims at further testing the functional requirements of the method. Central question at this level is “does the method do, what it is supposed to do?”. Reference point for beta testing the functioning of the method are the functional requirements as described in the design of the method. This part of the testing should be seen as an extension of the previous iterations (alpha tests). The second layer aims at testing transferability and support material. This layer especially refers to the operational requirements of the method and the aim of this research to develop transferable design knowledge. Important element of investigation is the perception of the beta tester with regard to the ease-of-use of the method. Is the method practical and user friendly? Is the method easy to understand? Is the method easy to apply? The third layer aims at generating testimonials. Successful application will not only add to the theoretical validity, but also to the credibility of the practical applicability of the solution concept. To what extent has the application of the method been successful according to the firms?

*2. Test-sites: respect heterogeneity of the market*

The selection of the test sites is based on the suggestion to explore the boundaries of the application domain of the method and the suggestion to test the method under different circumstances. Whereas the focus of the alpha tests was on middle-sized professional service firms, the beta tests were performed in units of large organizations.

*3. Preparation: take necessary precautionary measures*

Main aim of this rule is to prepare the beta testers for their task. This means that knowledge about the method has to be transferred from the alpha tester to the beta testers. Important
element of knowledge transfer within this study was a guideline of the method. However, acknowledging that a guideline can only partly frame the experiences with the method, a workshop was organized to ‘demonstrate’ the method and to enrich the information in the guideline. Additional, the beta testers received a professional print of the board game, and a template of the PowerPoint presentations for the workshops.

4. Execution: monitor execution on a regular basis
Starting point of beta testing is that the beta testers apply the method themselves. In order to reduce the risk of failure and in order to generate high quality feedback, we established a structured mechanism of feedback. This means that the beta testers were asked to submit a written report after each phase of the method. After the first phase they were asked to give feedback about the problem statement. After the second phase they were asked to report the shared findings about the current situation. Finally, after the third phase they were asked to submit the finalized KP-statement. Submitting these reports would help the beta testers ‘to keep the eye on the ball’, as it forced them to formulate the intended products. Moreover, it would help to assess the extent to which the method was being applied according to plan and interfere if necessary. Finally, systematic monitoring would help to reconstruct the process and assess its effectiveness afterwards. Next to this structured feedback mechanism, the beta testers could, at any point ask the researcher for additional support.

5. Reflection: let the context speak back to you
Main objective of beta testing is to generate feedback about the effectiveness of the method, acquire further insight into its intended as well as unintended consequences, its indications and contra-indications, and the scope of its possible application. Moreover, as we have seen, beta testing provides the opportunity to test the transferability of the method to third parties. Based on the purposes of the beta test (rule one above) within this study, the beta testers were asked beforehand to focus on the following questions during the application of the method.

1. Does the method do what it is supposed to do?
2. Does the supporting material meet the needs of the user?
3. What knowledge and skills are required in order to be able to apply this method?
4. What are other preconditions for successful application?

The beta testers were asked to record their experiences in a logbook, which would improve the quality of the feedback and help to reconstruct events afterwards. After completing the method, the effectiveness was evaluated. This evaluation was a combination of the observations of the researcher, and interviews with the client and the beta tester.

Results from the beta tests
In a sense, all three beta tests had more or less similar problems and subsequent objectives. In all sites the topic of KM needed an impulse. Therefore, raising or maintaining awareness and advancement of existing initiatives were the main objectives. In all cases the outcome of the method was in line with these objectives, and therefore it seems as if the method functions well and does what it is supposed to do.

However, the perceptions about the success of the method largely differed between the first two cases (Ministry) and the last case (Pharmaceutical firm). Whereas the former acknowledged the contribution of the method in achieving these results, the latter stressed that the effects were not necessarily the merit of the method. Whereas the method had a stimulating effect in the first two cases, it was received with distrust in the last case.

After analyzing the cases, it seems as if the causes of the different perspectives have to be sought in different starting points, different degrees of acceptance of the person applying the
method, and different corporate epistemologies (Von Krogh and Roos, 1995). First, whereas the first two cases were problem-driven, the main driver for the third case was to create a platform for the person applying the method. Second, whereas the beta tester in the first two cases got full (blind) support, in the last case, the beta tester was viewed with distrust from the start. Third, whereas the method seemed to fit the autopoietic epistemology of the first two cases, it did not seem to fit the cognitivist epistemology within the third case.

With regard to the functioning of the method, the beta tests particularly highlighted two shortcomings. First, within these cases the innovation profile did not add much value. Second, step 7 (formulating a concept knowledge strategy) appeared to be too difficult to apply without assistance from the researcher. Beta testers particularly had difficulties with applying the concepts of ‘user value’ and ‘knowledge resources’. These difficulties were also reflected in step 8, as in all three cases, the beta testers had difficulties with explaining these concepts to the participants in the workshops, and as they needed far more time to complete this step.

In all cases the supporting material was highly appreciated and appeared to be very useful. However, the material should be extended with a guideline (or brochure) for the organization. What is the objective? What does the method look like? What are the consequences? Furthermore, the guideline should elaborate on how to interpret the data from the survey. And finally, the guideline should more extensively elaborate on the concepts of user value and knowledge resources.

With regard to the knowledge and skills that are required to apply the method, the three beta tests revealed that the person applying the method should not only have a thorough understanding of the concepts underlying the method, but also of the organization in which the method is applied. Furthermore, the person applying the method should have analytical skills, the ability to assimilate with the organization, and the ability to accompany all people involved through the process.

**Conclusion**

The concept of beta testing seems to fit Design Science Research very well. Beta testing design knowledge is about systematically involving the potential users of solution concepts in the development process. Main contribution of beta testing is that it adds to justifying the solution concept by generating additional evidence from a more objective perspective. This evidence about the effectiveness of the solution concept, combined with the results from the initial (alpha) tests, increases the reliability of the outcome of the research. Moreover, having the solution concept tested by potential users, provides the opportunity to specifically test the effectiveness of the supporting material and the degree of transferability of the solution concept. Finally, successful applications could result in success stories and thus contribute to the credibility of the method.

The initial testing of the KP-enhancer resulted in a beta version of the method, which has been tested in three cases. These tests, which were based on the five rules for beta testing as suggested in this article, resulted in additional evidence about the functioning of the method, and generated valuable suggestions for further improvement. Important findings seem to be that the application of the method should be problem-driven, not person-driven. Furthermore, successful application of the method seems to require that corporate epistemology is in line with the autopoietic epistemology of the method. In order to increase the effectiveness of the method, both issues should explicitly be addressed in the gold (or release) version of the KP-enhancer.

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Figure 1: Three layers of the Corporate Curriculum

Figure 2: Three phases of the KP-Enhancer