

HOW TO MEASURE COMPANIES INNOVATION CAPABILITY?

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SUMMARY

Although Innovation is defined by many classical sources (Schumpeter, Oslo Manual etc.) it is still remains a myth at companies what it really means. It is well understood that sustainable growth is not possible without proper innovation management. Lots of energy is invested to implement and setup well-structured stage gate processes – from idea generation till market launch with state of the art project management, however fundamental question is mostly ignored, neglected: what innovation culture matches to industries, markets certain companies serve.

This paper researches the literature of different innovation capability measurement systems Select one which has a fundamental new approach and shows the status of a model validation process at a new industry. The model main claim is that there is no good or bad innovation culture. The main question is how innovation culture/capability is matching to the company current and future targeted strategy and operational of excellence. During the validation process 2 strategic business fields are being selected similar in size and challenges (matured markets with stagnating product lifecycles, still need for 5-10 % of innovative growth within next 5 years which can be only reached via competence enhancement – not to be derived from current markets). These conditions provide excellent opportunity to validate the model at this industry and propose if applicable necessary adjustments.

INTRODUCTION

Studies have shown that companies conversion rate from initial idea to proof of concept is somewhere around 10%(Hansen et al. 2007) That is another way of saying that minimum around 90% of all innovation efforts are never commercialized or used in general. If any company could raise the ROII (return on investment on innovation) with just 10% this would give them a significant competitive advantage in global competition. It seems, however, that innovation is still in its infancy as a management discipline, and it seems that if companies start approaching innovation in a more systematic way – e.g. through the application of measured and managed innovation they could increase their ROI at no or small additional costs.

As a head of a Strategic Business Field (SBF) of a leading global German chemical company, generating closely triple digit million euro turnover annually I am facing a rather big challenge. There is a 3 % CAGR goal to be reached till 2020. Current markets served are matured and stagnating so innovative growth plays an important role in strategy.

In order to understand SBF's innovation capability several innovation measurement systems had been looked upon and one was selected for the test. Based on its standard questionnaire SBF mentioned above and another smaller SBF, similar in strategically growth challenge was

selected as benchmarking partner and the same questionnaire was applied. The both quantitative measurements were carried out August 2015. Results show that each unit have similar challenges with strong innovation barriers within structures and communication, however the weak innovation barriers such as available resources and risk taking needs also improvement to foster innovation. Currently a quantitative measurement, interviews are being prepared to validate the results of questionnaires Results will be presented to each business units board with concrete action plans..

The paper will first explain definitions used and provide a brief overview about the historical development of innovation measurement systems. Later it will introduce some of the major innovation models and tools which were developed based upon. One of these measurement models is chosen and introduced in more details and used. The initial results of quantitative measurement will be introduced. The scientific evaluation of the project can be finalized as soon as the interviews conducted; quantitative results are crosschecked with the output of the questionnaire. It is expected December 2015. This research enables to see how the selected model works on the industry and whether it needs further fine tuning. It helps to identify areas of improvement which increases the chance of innovative growth. It would enable to compare results of different SBFs within same company who share the same challenge: serving completely different markets with completely different technology, but having same strategically challenge.

DEFINITIONS

“An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.” (OSLO Manual 3rd Edition, 2005:47). When innovation meant or addressed this definition is being used in this paper.

The model which is finally chosen – Innolytics – is introducing 4 types of innovation characteristics which companies can be described.

‘Operational Innovators’ are companies which have a creative potential, however they focus on core operational business and processes. Normally there is hardly any detectable innovation strategy. Ideas are generated by individuals or teams during their operational activities.

‘Innovative Optimizers’ are focusing on incremental innovation. Innovations are controlled via processes and typically slow decision making. Typical companies are serving mid, long term stable markets.

‘Strategic Innovators’: Strong leadership via the whole company, small level of proactivity: Innovation is top down focusing of strategy, ambitious goals and values. Innovation culture is reactive. Typically fast follower strategy is conducted and avoidance of risk.

‘Proactive Innovators’: Pioneers for develop markets further. Very high readiness at all employees to drive innovation. Result oriented, strong innovation goals, high level of innovation speed. Able to handle complex, higher innovation grade.

BRIEF LITERATURE OVERVIEW

Historical development of innovation metrics

Innovation indicators (Gamal, 2011) over time can be split into four categories (Table 1). First generations of metrics were focusing on inputs such as R&D investment, education expenditure, capital expenditure, research personnel, university graduates, technological intensity.

Table 1. Historical summary of innovation indicators

First Generation Input Indicators (1950s-60s)	Second Generation Output Indicators (1970s-80s)	Third Generation Innovation Indicators (1990s)	Fourth Generation Process Indicators (2000s plus emerging focus)
• R&D expenditures • S&T personnel • Capital • Tech intensity	• Patents • Publications • Products • Quality change	• Innovation surveys • Indexing • Benchmarking innovation capacity	• Knowledge • Intangibles • Networks • Demand • Clusters • Management techniques • Risk/return • System dynamics

Source: Center of Acceleration Innovations, George University (2006)

The second generation extended input indicator pool with the intermediate outputs of S&T activities, like patents filed, scientific publications, number of new products, processes.

The third generation is focused on surveys and integration of publicly available data. The primary focus was/is on benchmarking and ranking a nation's capacity to innovate. Fourth generation metrics currently under development and including indicators about knowledge, network, and conditional (internal, external) factors.

‘Knowledge indicators’ are explaining how innovation is created, developed and diffused.

‘Network indicators’ describing interactions within and outside of the company. How different type of partners from the internal, external value chain can be integrated into the innovation creation process. Depending on level of innovation and cooperation capability of educational, government institutions are also considered.

‘Conditions for innovation’ indicators capturing infrastructural, cultural conditions, social attitudes, economical demand, political, regulatory impacts which are critical for innovation.

Measurement Models and Exploration Tools

Some major models are introduced including exploration tools based upon them. They differ how innovation is perceived as a process and which dimension are considered.

Diamond model

This model has 5 dimensions for innovation assessment: strategy, process, organization, linkages, learning (Tidd et. al, (2011)). The first dimension covers three components of 'Strategy' process: planning, how much innovation is embedded into strategy and finally how defined strategy is implemented. Second dimension 'Process' implementation: how new product development is part of the DNA of the company. Third dimension 'Organization' has two components. One explains how organizational structures enables top-down, bottom-up, lateral communication, the second addresses if management puts in place system to foster internal new product idea generation. Fourth dimension 'Linkages' describes how well companies connect with different external entities customers, suppliers, competitors, academe etc. and how these links can bring benefit to the company. Fifth dimension 'Learning' has four major aspects: first how organization is committed to learning and training its employees, second the ability to collect information from its 'Linkage', third how company can deal with lessons learned from good or failed innovation projects. Fifth how company can share these analyzed, collected information within the organization. A set of question is put into a questionnaire and all these 5 dimensions are measured it helps to decide how high or low (Figure 1.) a certain company is concerning innovation and helps to identify areas of development.



Figure 1. Diamond model Company with low innovation capability

Source: <https://technopreneurship.wordpress.com/2007/05/07/how-to-measure-a-firms-innovativeness/>

Innovation Funnel

Funnel model is describing innovation from end to end as a linear process. Usually split into 3 main, 7-9 sub steps (Table 2). 3 main faces are idea development, concept development, and concept to launch. It is also known as stage gate process. Two types of metrics considered to be used. First types are quantitative and focusing on understanding how work is carried out. Second type of metrics is quantitative and concentrating on conversion rate between different stages and other statistical data.

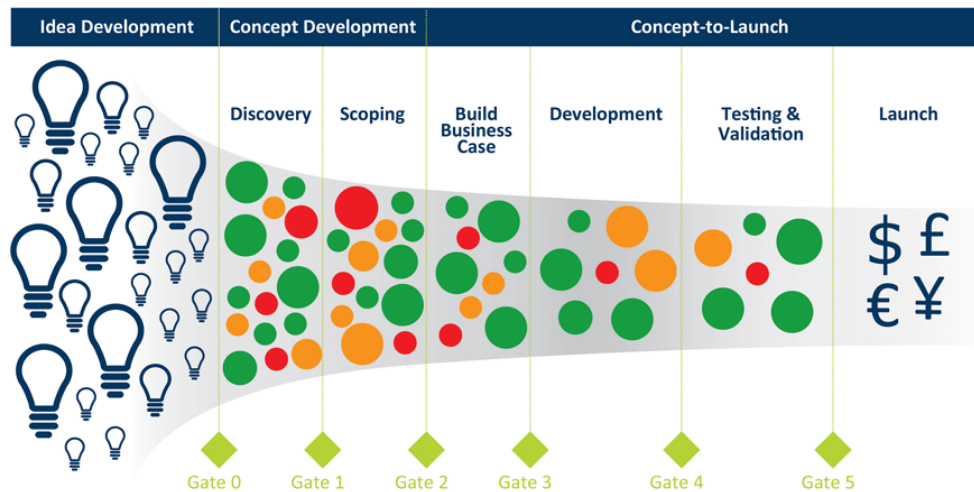


Figure 2. Innovation Funnel

Source: www.sopheon.com/idea-concept-development/

Innovation Value Chain

Innovation Value Chain (IVC) (Hansen et al. 2007) It represents innovation as a three phase process: idea generation, idea development (conversion), diffusion, spreading of developed concepts (Table 2).

Table 2. Innovation Value Chain different stages

	IDEA GENERATION			CONVERSION	DIFFUSION	
	IN-HOUSE Creation within a unit	CROSS-POLLINATION Collaboration across units	EXTERNAL Collaboration with parties outside the firm	SELECTION Screening and initial funding	DEVELOPMENT Movement from idea to first result	SPREAD Dissemination across the organization
KEY QUESTIONS	Do people in our unit create good ideas on their own?	Do we create good ideas by working across the company?	Do we source enough good ideas from outside the firm?	Are we good at screening and funding new ideas?	Are we good at turning ideas into viable products, businesses and best practices?	Are we good at diffusing developed ideas across the company?
KEY PERFORMANCE INDICATORS	Number of high-quality ideas generated within a unit.	Number of high-quality ideas generated across units.	Number of high-quality ideas generated from outside the firm.	Percentage of all ideas generated that end up being selected and funded.	Percentage of funded ideas that lead to revenues; number of months to first sale.	Percentage of penetration in desired markets, channels, customer groups; number of months to full diffusion.

Source: Hansen et al. 2007

Three innovation activities are addressed: accessing knowledge, building innovation, commercializing innovation. This model was developed further (Roper et. al. (2008) so it became easier for different industrial sectors and still provide comparability. Therefore this frame work became the base for NESTA, (National Endowment for Science Technology and the Art) United Kingdom's innovation agency innovation indexing project since 2008. (www.nesta.org.uk/wp14-07)

OSLO Manual Innovation Measurement Modell

This manual is prepared by a joint cooperation of OECD and Eurostat which provides guidelines for collecting and interpreting innovation data in an internationally comparable manner.

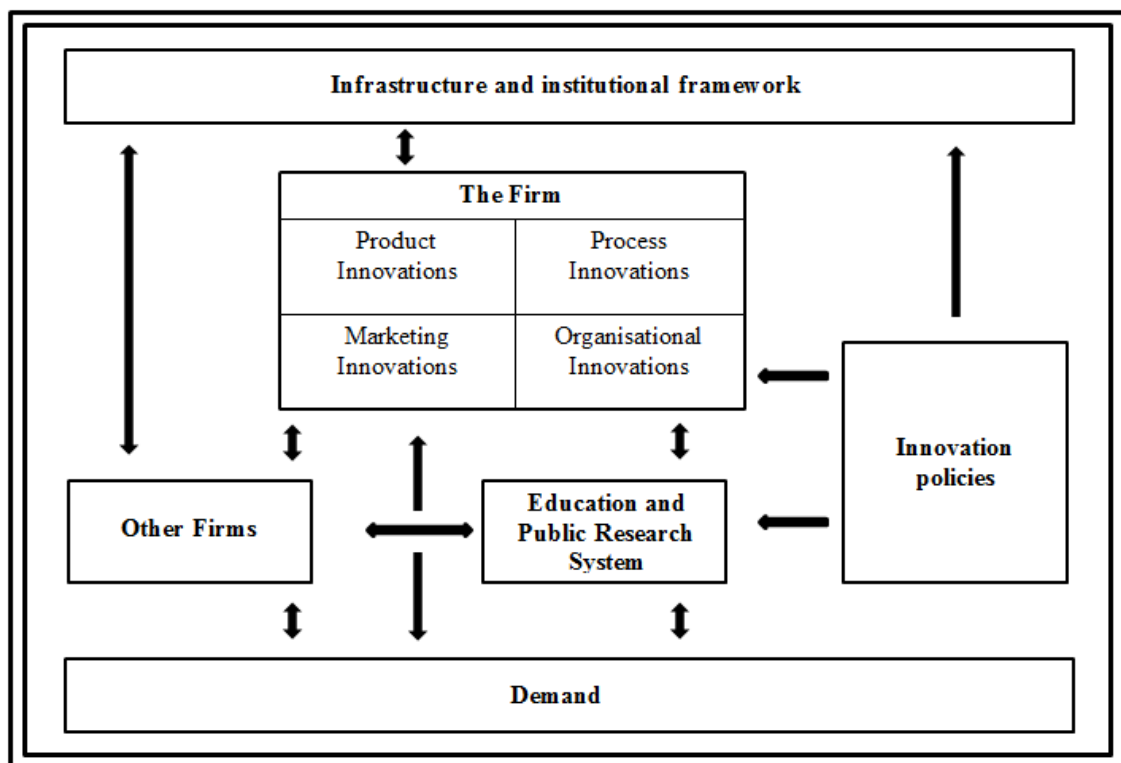


Figure 3. Framework of OSLO Manual about Innovation

Source: Oslo Manual 3rd Edition (2005)

It combines different insights from firm based theories and considers innovation as a system. The main components are innovation at the firm, linkages to other external institutions, policies impacting firm and also what type of demand to be fulfilled (Figure 3). Several models were prepared based on this framework.

Established by European Commission to improve innovation management performance of small- and medium-sized enterprises (SMEs). The assessment is systematically assessing along the dimension of A.T. Kearney House of Innovation model. It measures along the factors shown below (Figure 4). It has already a databank with more than 3000 companies data from different sectors.

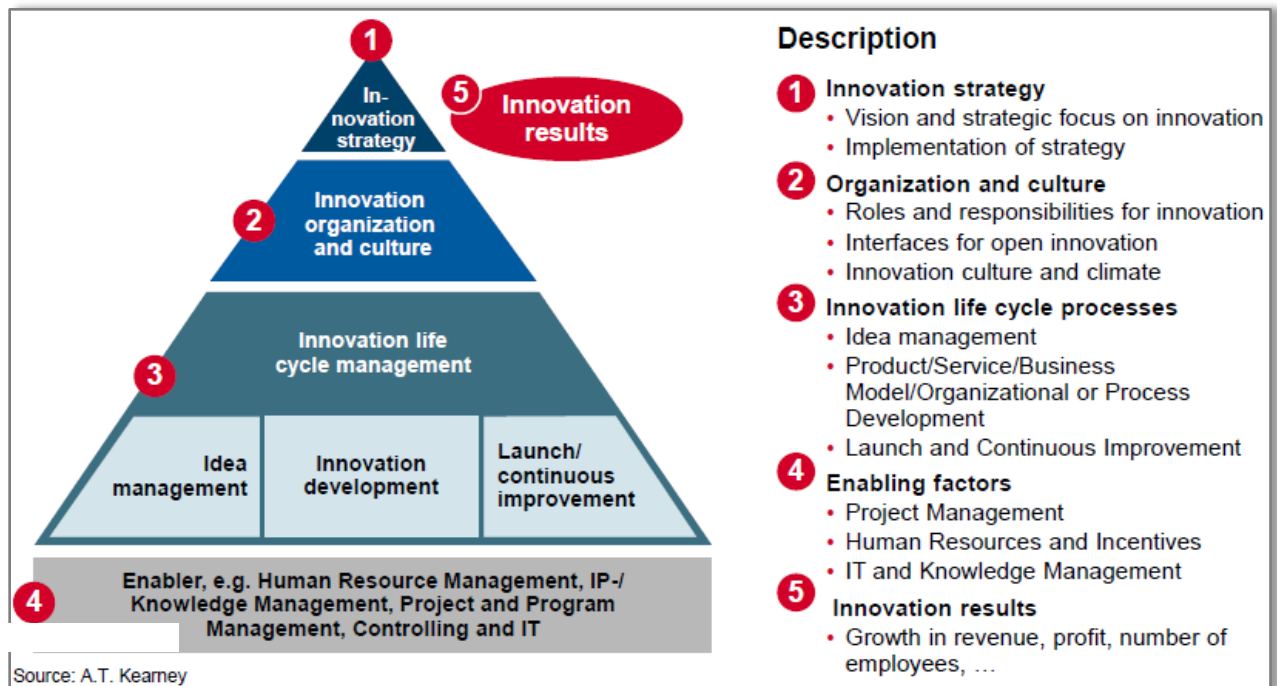


Figure 4. House of Innovation

Source: <https://www.improve-innovation.eu>

Innovation Radar

It was developed by Kellogg School of Management's researchers and was published in 2006. (Sawney et. al, 2006). It explains if companies take a business model innovation approach, compared to a more 'simple' product or process innovation view, are more successful. It addresses four major dimensions:

- **WHAT:** offerings a company creates
- **WHO:** customers it serves
- **HOW:** process it employs
- **WHERE:** points of presence how a company puts their value-proposition to market



Figure 5. Innovation Radar

Source: Sawhney et. al, (2006)

Innovation Maturity (IMMA) Model

The model developed by NC State University, CIMS. (Aiman-Smith et. al, 2005). The assesment is divided into three parts: core competences, management and environmental dimensions. It rates performance on a scale from 1..5 and presents results an easy to understandable heat map (Figure 6).

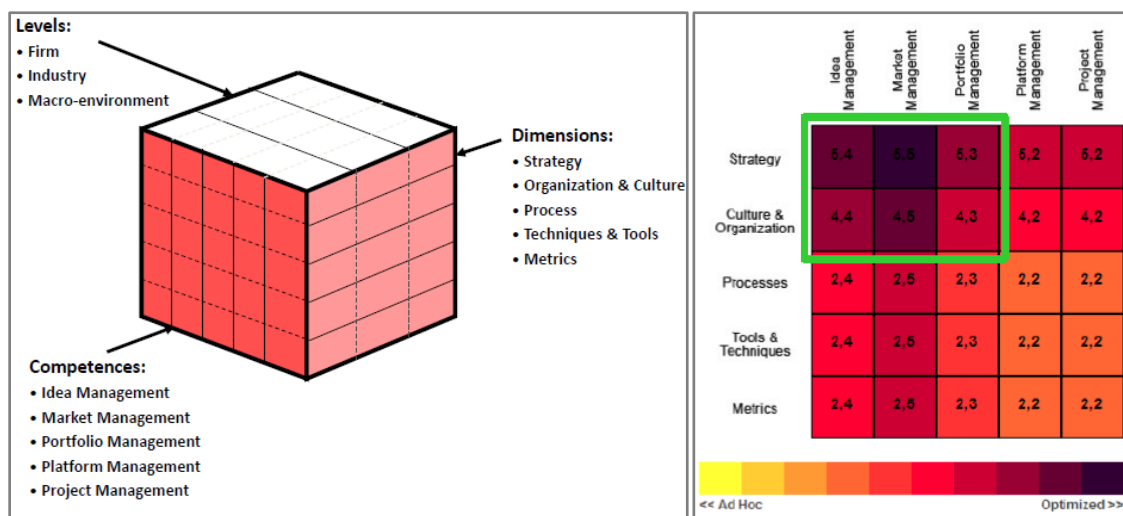


Figure 6. Innovation maturity 3D modell with output heatmap

Source: <http://cims.ncsu.edu/tools-assessments/im-maturity/>

Innolytics Model

Amabile's idea that the generation and development of ideas can be promoted on several levels of an organization (Amabile et al. 1996: 1158) is applied in the formation of the model. The model defines 4 levels: organization, management, staff, environment. 10 categories (strategy, values, management structure, management style, resources, team composition, incentives, communication, risk culture, working climate) and 48 items linked to the different categories. (Meyer, 2014) The received information puts it on a 2 dimensional space depending on impact on pace and level of innovation (Figure 7). Fundamental difference is from all other model that it emphasizes depending which current and future markets certain company is serving all 4 types are equally good. There is no such a thing as an absolute great innovative company which has to be all companies role model. What is important business must match its innovation type with markets are currently served and/or intends to serve in the future. This core message next to easy applicability (investment and maintenance cost, local support) and acceptance was the main criteria to choose the metric system for research.

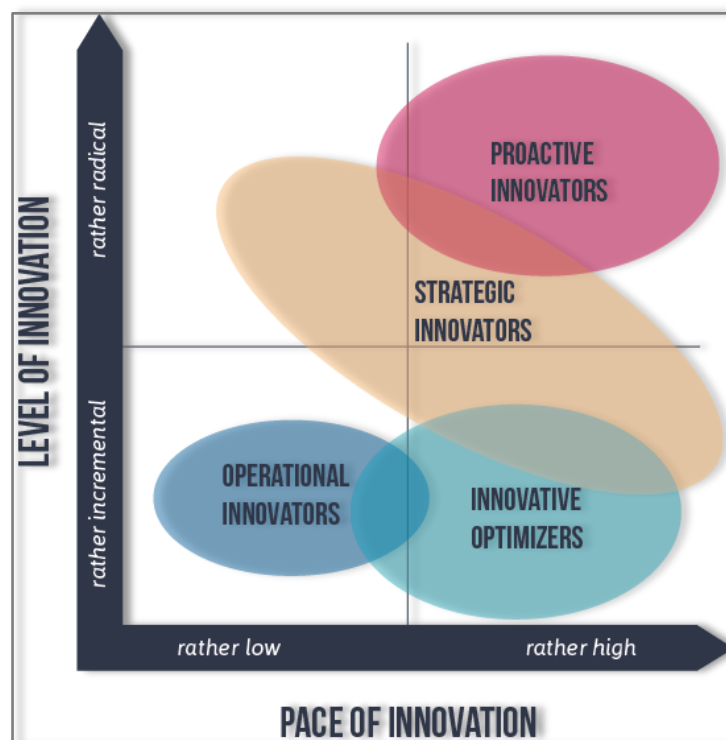


Figure 7. Innolytics model

Source: Meyer, (2014)

Summary of Different Models

The following table shows the overview of some typical innovation model and metric system (Table 3).

Table 3. Overview of some typical innovation model

Measurement Model	Ex. Of tools	Focus	Dimensions	Remarks
Diamond Model	• Improve	• Innovation process • Enabling factors • Linkage	Strategy, process, organization, Linkage and Learning	Adequate when innovation process on its infancy. It highlights key dimensions of innovation process as well as its enabling institutional factor
Funnel Model		• Tech. Innovation or • Product innovation focus • R&D process as the core activity	Strategic Thinking, portfolio Management & Metrics, Research, Ideation; Insight, Targeting; Innovation Development; Market Development; and Selling	Adequate model when there is a due innovation process in the organization
Innovation value chain (IVC)	• NESTA	• Idea Management	Generation, Conversion, Diffusion Knowledge acquisition, Building Innovation, commercializing Innovation	Emphasizes the assessment of the output of innovation process.
Oslo Manual	• IMMA	• 3 dimensional modell	Dimension Levels Competences	20 years of experiment well documented academic based source
	• Innolytics	• Complex Model	4 Level 10 Categories 48 Items	Emphasizes importance of matching innovation style and business, market conditions
	• Innovation radar	• Innovation output performance	Offerings, customers, processes, marketing	Does not ensure the sustainability of innovation process

Source: own research + Gamal,(2011)

RESEARCH DESIGN

Two Strategic Business Fields (SBF) of a leading German global company from the chemical industry were selected to participate in the research. Both SBFs are similar in size, similar in challenge: matured product portfolio, serving saturated markets still there is a necessity to grow beyond organic growth via innovation 5-10 % within next 5 years. For the quantitative questioning all white collar workers, management and employee level were selected at each unit including international sales force and asked in German and English language. Prior conducting official questionnaire a pilot test was carried out on one of the SBFs only to

validate the overall questionnaire design (Figure 9) and the main questionnaire (Table 4) for innovation and the technological background set up. Except some translation related topic the original structure of questionnaire was accepted after conducting pilot on a population n=50.

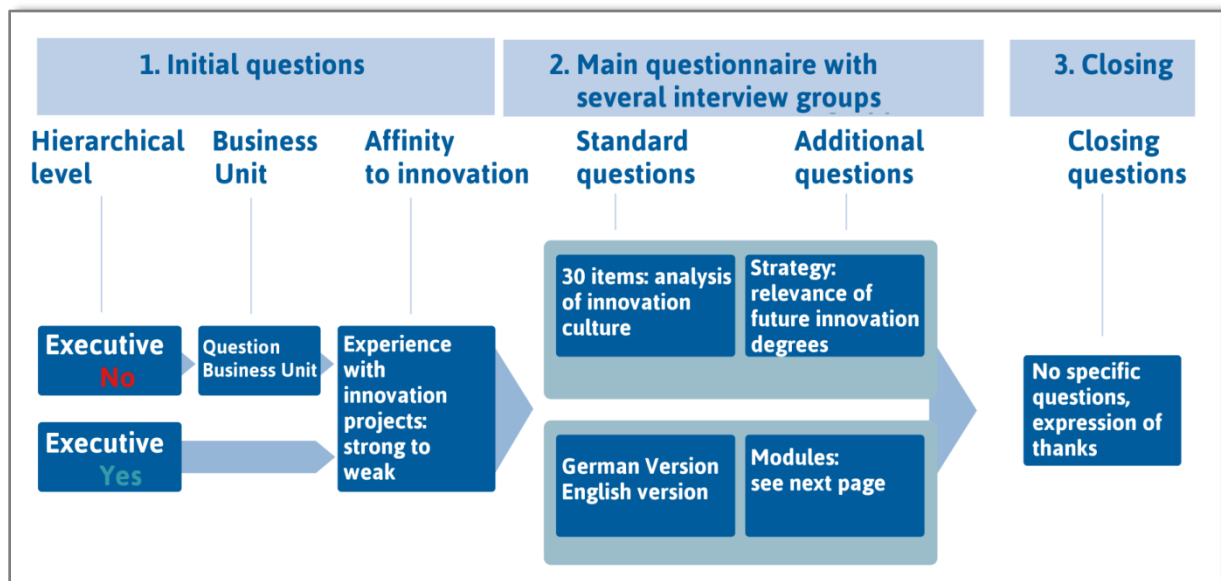


Figure 9. Overall Structure Design

Source: own research

Table 4. Questionare structure

Category	Basis 30 questions	Additional Module	Configuration
Strategy	3 Questions	Importance of various innovation degrees and -categories (10-15 questions)	Evaluation of: Strategic fields of innovation
Values	3 Questions		
Structures	3 Questions	Process quality	Specific processes & structures
Leadership	3 Questions		Innovation-Know-how
Resources	3 Questions		specific resources
Incentives	3 Questions		Influence of incentives
Team	3 Questions	Creative skills and teamroles Experience with innovation (5 questions)	Specific experience with innovation projects
Risk	3 Questions		
Communication	3 Questions		Informal networks Quality of networks Experience with innovation (5 -10 questions)
Climate	3 Questions		

Source: Innolytics GmbH (2015)+own research

RESULTS

The quantitative measurement took place at SBFs (SBF T, SBF N) between 15.06.2015 till 14.07.2015. Addressed population was n=210 at SBF T, n=67 at SBF N. Respond rate was 64% (133) at SBF T, and 80% (66) at SBF N. Management (37)/Employee (97) ratio 0.38 was at SBF T and Management (24)/Employee (30) ratio 0.8 at SBF N.

SBF T and SBF N was found on the same position according to the model: between 'Innovative Optimiser' and 'Strategic Innovator'. For future market challenges due to increased innovation pressure both SBFs suppose change to 'Strategic Innovator' type based on model proposal.

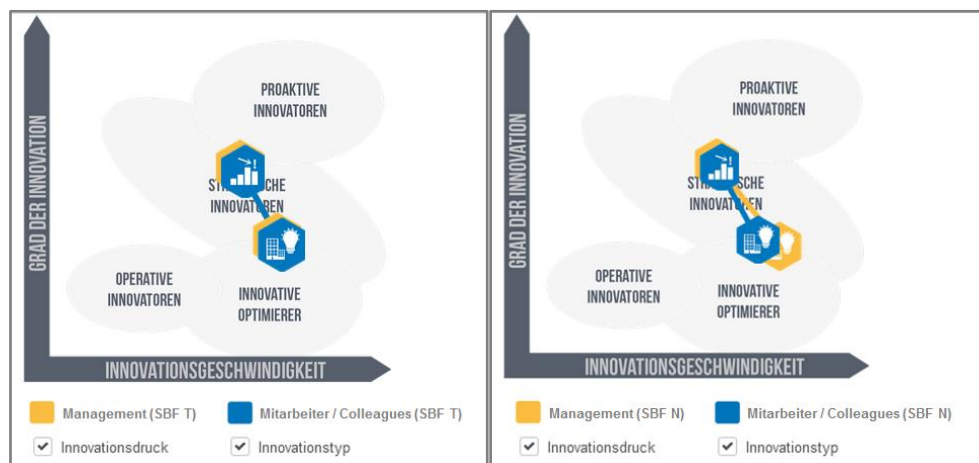


Figure 10-11.SBF T and SBF N Innovation Type

Source: own research

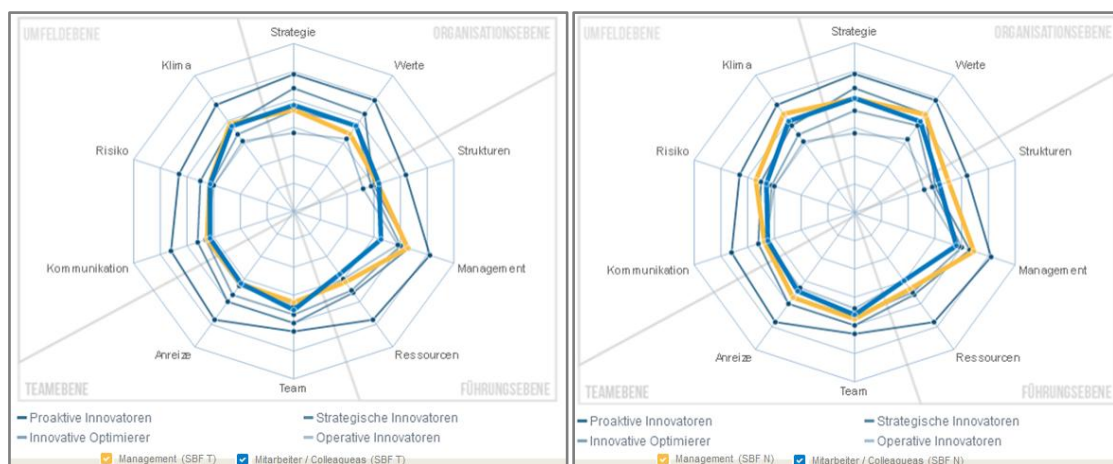


Figure 11-12.SBF T and SBF N Benchmarking Management Summaries

Source: own research

I will introduce all 4 levels (organization, management, team, and environment) of summary results and will present key finding(s) and question(s) which later can be considered at the quantitative interview. Benchmarking management summaries (Figure 11, 12) are showing

management and employee assessment and comparing data to 4 main innovation types provided by the original model.



Figure 13-14. SBF T and SBF N Organization Level Assessment

Source: own research



Figure 15-16. SBF T and SBF N Management Level Assessment

Source: own research

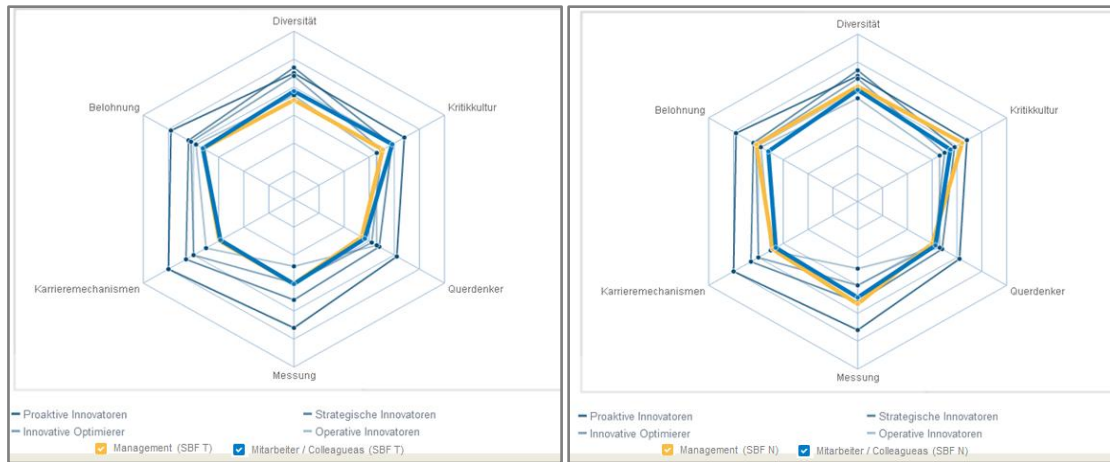


Figure 17-18. SBF T and SBF N Team Level Assessment
source: own research



Figure 19-20. SBF T and SBF N Environment Level Assessment
Source: own research

Organizational level data (Figure 13, 14) are showing management and employee assessment and comparing data to 4 main innovation types provided by the original model. Why there is significant difference between employee and management assessment? What does it mean role model within this organization which looks extremely high? Is it an enabler or a barrier? Does it come from local (German) culture influence and has less to do with company culture? Management level data (Figure 15, 16) are showing management and employee assessment and comparing data to 4 main innovation types provided by the original model. Why there is a huge difference how ideas are push forward from the management and from the employee point of view? Why is there such a large difference between management and employee assessment on authority?

Team level data (Figure 17, 18) are showing management and employee assessment and comparing data to 4 main innovation types provided by the original model. Extremely homogenous teams on both SBFs. Is this not a clear barrier?

Environment level data (Figure 19, 20) are showing management and employee assessment and comparing data to 4 main innovation types provided by the original model. It shows very

low level relating to internal, external partners and meeting culture. What does it mean in reality what are meeting relating to innovation are used for?

DISCUSSION AND CONCLUSIONS

The paper describes and addresses results in a working progress phase therefore drawing main conclusions at this stage are very limited. Innolytics model looks applicable at these two SBFs.

The current innovation type of both SBF seems to be matching with current empirical assumptions. The 4 level of organization, management, staff, environment indication and deviation must be validated through soon to be conducted interviews. These interviews (maximum 6) will be carried with each SBFs employees from sales, R&D, top management, production, supply chain, quality assurance. Full measurements and evaluation is planned to be finished till December 2015.

There are several business relevancies of conducted measurements next to the scientific ones. It points out the barriers of current organization and processes. It helps to identify concrete actions to improve innovation management efficiency. It can provide a common language among all other SBFs as standard tool to access innovation management worldwide within the company.

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