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COMPETITIVE CAPABILITY ASSESSMENT OF INDUSTRIAL COMPANIES WITHIN THE FRAMEWORK OF ADVANCED INNOVATION DESIGN APPROACH

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Abstract

The comprehensive assessment method includes 80 innovation performance parameters and 10 key indicators of innovation capability, such as innovation process performance, innovating system performance, market and customer orientation, technology orientation, creativity, leadership, communication and knowledge management, risk and cost management, innovative climate, and innovation competences. The cross-industry study identifies parameters critical for innovation success and reveals different innovation performance patterns in companies.

Keywords: innovation management, empirical studies, product development

1. Introduction

The Advanced Innovation Design Approach (AIDA) has been conceptualised as a holistic methodology for enhancing the innovative and competitive capability of industrial companies in the cross-industry research project "Innovation Process 4.0" in Germany from 2015 to 2017 (Livotov, 2016). Its further development for application in the field of process engineering has been continued in the context of the EU research project "Intensified by Design - Platform for the intensification of processes involving solids handling" within the international consortium of 22 universities, research institutes and industrial companies under the H2020 SPIRE programme (Casner and Livotov, 2017). AIDA can now be considered as a new mindset with an individually adaptable range of the strongest innovation design techniques. These include comprehensive front-end innovation process, advanced innovation methods, best tools and methods of the theory of inventive problem solving TRIZ (Altshuller, 1984; VDI, 2016), systematic approaches to design (Pahl and Beitz, 1996), organisational measures for accelerating innovation, and IT-solutions for Computer-Aided Innovation, among other innovation design methods, elaborated over the last decade in the industry and academia (de Bont et al., 2013; Celi, 2014).
As a holistic and systemic approach AIDA supports innovative design process, combining a new product development with optimisation or disruption of the user's working process. The innovation process with self-configuration, self-optimization, self-diagnostics and intelligent information processing and communication, is understood as a holistic system comprising the following typical phases with feedback loops and simultaneous auxiliary or follow-up processes: the uncovering of solution-neutral customer needs, technology and market trends, the identification of the needs and problems with high market potential and formulation of innovation tasks and strategies, systematic idea generation and problem solving, the evaluation and enhancement of solution ideas, the creation of innovation concepts based on solution ideas, the evaluation of these innovation concepts as well as implementation, validation and the market launch of chosen innovation concepts. AIDA postulates the principle of

completeness in all major process phases, such as innovation strategy formulation, problem analysis and definition, comprehensive idea generation, problem solving and new concept development.

AIDA implementation in companies helps to improve their innovation processes, enhancing their competitive capability and contributing generally to an innovation-friendly climate. The competitive capability of companies is understood as their long-term sustainable ability to maintain the competitive advantages, through both incremental and radical product, process, service or business model innovations with repeatable market success.

However, industrial companies have different needs regarding the optimization of their innovation ability, which may depend on companies' industrial or business sectors, business models, business trends including the financial results, company size and structure, complexity of products, innovation outcomes (product, process, service) and other factors. Thus, an attempt to systematically identify, structure, and evaluate these needs was undertaken, and specific opportunities for further enhancement of innovation and thus of the competitive capabilities of industrial companies were revealed in the presented research study. As a result of these efforts, a method for the comprehensive assessment of the competitive capability of industrial companies, based on evaluation of 80 innovation performance parameters and 10 key indicators has been developed by the interdisciplinary AIDA research consortium and added to the AIDA toolbox.

This work considers a literature review about the critical role of the innovation capability (Noordin and Mohtar, 2013) and is based on the thorough analysis of innovation process management in the industry, and especially in the small and medium enterprises given in (Livotov, 2016). It builds on results of the following research studies and works, mentioned in chronological order: the set of metrics needed for assessing a company's innovativeness, combining three views on innovation - resource, capability, and leadership (Müller et al., 2005), success factors and guidelines in the early stages of the innovation process (Kohn and Wischmann, 2006), the synthesis of successful innovation process models linked to innovation capability factors such as competencies, knowledge exploitation, and organisational support (Du Preez et al., 2006), the controlling model for analysis and optimisation of the company's innovation system (Bürgin, 2007), the definition and empirical study of 28 critical success factors of SME's innovation capability (Kirner et al., 2007), nine general key success factors in new product development (Cooper and Kleinschmidt, 2007), 20 efficiency metrics for innovation and new product development process in industrial companies (Livotov, 2010), innovation indicators proposal for four application areas within the MINT - Measuring Innovation in Teams framework (Nilsson et al., 2010), seven categories with 40 items, characterizing the relationship between innovation capability and performance (Saunila et al., 2014), the principles of holistic enterprise innovation performance measurement system (Dewangan and Godse, 2014), and a definition of innovation metrics, indicators and empowering factors in an industrial case study (Benaim et al., 2015).

2. Research method

Systematic mapping of the innovation processes within the research consortium of 10 German industrial companies was done over a period of 12 months. This was achieved in a series of workshops and interviews with CEOs, R&D leaders and engineers, and by literature analysis in the field of research. The industrial research partners were companies of different sizes and industrial sectors: automation and control systems, automotive engineering, automotive OEM, furniture technology, material application systems, power tools manufacturer, power-train technology, sealing technology, surface technology, and vacuum technology. Half of the partners were medium-sized enterprises.

The comprehensive processing of information allowed for the identification of more than 100 separate problems, tasks, needs or factors for achieving successful innovation, which are subsequently summarised by the 80 innovation performance parameters (IPP). As illustrated in Table 1 and fully presented in the Appendix, the 80 IPPs belong to two general categories, defined as

I. InnoSystem: 50 IPPs, No.1 to No.50, characterizing companies as innovating systems.
II. InnoProcess: 30 IPPs, No. 51 to No. 80, characterizing innovation process established in the companies.

In order to select IPPs with higher priorities, two parameters - the importance of each IPP and the current satisfaction with its existing performance within the companies - were evaluated by staff members on scale of 0% (lowest value) to 100% (highest value), with intervals of 25%: 100% - very high, 75% - high, 50% -medium, 25% - low, 0% - very low. 168 completely anonymously questionnaires from 19 companies with 80 importance and 80 satisfaction questions were retrieved and processed. The importance and satisfaction mean values across a company allowed one to calculate with formula (1) the ranking value p_i of each IPP, and two complimentary general metrics:

- total innovating system performance V_S, based on the corresponding 50 IPPs No. 1 to No. 50
- total innovation process performance V_P, based on the corresponding 30 IPPs No. 51 to No. 80

Table 1. Innovation performance parameters IPP (example)

No.	Description	Category	Assigned indicator
1	Senior executives understand innovation process	InnoSystem	4. Leadership
2	System of metrics for accountable innovation	InnoSystem	4. Leadership
17	Innovation competences of staff members	InnoSystem	8. Innov. Competences
24	Contacts with external research institutes	InnoSystem	2. Technol. orientation
…			
51	Prediction of new technologies and technical features	InnoProcess	2. Technol. orientation
53	Identification of existing and future customer needs	InnoProcess	1. Market orientation
80	Fast and efficient organisational problem-solving	InnoProcess	4. Leadership

The innovation performance parameters with higher importance and lower satisfaction have reasonably higher ranking values p_i , and thus higher need for action in terms of enhancing innovation and competitive capability. In the formula (1) the ranking p_i of each IPP is calculated as a maximal contribution of the IPP to the growth of current total innovation system performance V_S , or of the total innovation process performance V_P in accordance to the universal approach for the importance-satisfaction analysis, presented in (Livotov, 2008):

$$\begin{cases} p_i = \frac{(W_i + aW_i(W_i - Z_i))(1 - Z_i)}{\sum_{i=1}^{i=n}(W_i + aW_i(W_i - Z_i))} \\ V = \sum_{i=1}^{i=n} \frac{Z_i(W_i + aW_i(W_i - Z_i))}{\sum_{i=1}^{i=n}(W_i + aW_i(W_i - Z_i))} \end{cases} \tag{1}$$

where:
p_i – ranking of the IPP, %
V - total innovating system performance V_S or innovation process performance V_P, %
W_i - mean importance of IPP, 0…100%
Z_i - mean satisfaction with current IPP performance, 0…100%
n - total number of IPP (here n=50 for innovating system or n=30 for innovation process)
a - adjustment coefficient, a = 1 in case of the equal weighting of importance W_i and satisfaction Z_i

Moreover, each IPP can be assigned to one of the following 8 innovation indicators: Market and customer orientation, Technology orientation, Creativity, Leadership, Communication and knowledge management, Risk and cost management, Innovative climate, and Innovation competences, as presented in Table 2 and the Appendix. The value of the innovation indicators I_1 to I_8 is defined as a mean satisfaction value of the assigned IPPs. For example, the value of the innovation indicator *1. Market and customer orientation* is calculated with the formula (2) in accordance to its definition in the Table 2 and with the satisfaction values Z_i of the assigned IPPs presented in Table 3:

$$I_1 = (Z_{26} + Z_{27} + Z_{28} + Z_{42} + Z_{49} + Z_{50} + Z_{53} + Z_{54} + Z_{55})/k \tag{2}$$

where:
Zi - mean satisfaction with performance of the IPPs No. 26, 27, 28, 29, 42, 49, 50, 53, 54, 55, in %
k - amount of IPPs assigned to the innovation indicator; here k = 10

Table 2. Innovation indicators with the assigned IPPs

No	Innovation Indicator	No. of assigned innovation performance parameters IPP
1	Market and customer orientation	26, 27, 28, 29, 42, 49, 50, 53, 54, 55
2	Technology orientation	24, 25, 34, 40, 48, 51, 52, 56
3	Creativity	15, 37, 38, 39, 43, 44, 45, 46, 58, 59
4	Leadership	1, 2, 3, 4, 11, 23, 47, 80
5	Communication & knowledge management	30, 31, 32, 33, 41, 57, 60, 62, 64, 69, 70, 72, 74
6	Risk and cost management	63, 65, 66, 67, 68, 71, 73, 75, 76, 77, 78, 79
7	Innovative climate	7, 8, 9, 10, 12, 13, 14, 16
8	Innovation competences	5, 6, 17, 18, 19, 20, 21, 22, 35, 36

Table 3. Innovation indicator 1. Market and customer orientation

IPP No	Assigned innovation performance parameter (IPP)	Satisfaction with IPP performance Zi *
26	Customers involvement in entire innovation process, from capturing customer needs to the market launch of new products.	63,0%
27	Systematic collection, evaluation and implementation of customer feedback, in the form of complaints, suggestions and ideas.	62,2%
28	Systematic review of customer acceptance of new technologies, products or services before market launch.	60,1%
29	Convincing market communication, with the explanation of all customer benefits in new product launches.	66,7%
42	Preferred tracking and implementation of ideas with particularly high customer value.	73,2%
49	Our company understands the customers' innovation process well: we know how our customers innovate and what challenges they face.	60,5%
50	Our customers understand the innovation process in our company well.	49,5%
53	Complete identification of existing and new customer requirements and needs.	55,4%
54	Identification of the strongest product or service characteristics with highest market potential or market acceptance.	59,9%
55	Monitoring competitive activities in the market and identification of the main competitive features.	63,3%
1. Market and customer orientation - estimation example with formula (2)		**60,7%**

*) cross-industry mean values based on n=168 questionnaires received from 19 companies

Additionally, for each innovation performance parameter a segment analysis of the importance and satisfaction opinions from staff members in the companies can be performed in accordance with following procedure, described in (Livotov, 2008):

- segment 1: percentage of opinions with high importance (≥75%) and high satisfaction (≥75%),
- segment 2: percentage of opinions with high importance (≥75%) and low satisfaction (≤50%),
- segment 3: percentage of opinions with low importance (≤50%) and high satisfaction (≥75%),
- segment 4: percentage of opinions with low importance (≤50%) and low satisfaction (≤50%).

It is a simple and transparent evaluation mechanism, which complements the actual evaluation based on mean values of importance W_i and satisfaction Z_i. It enables the identification of groups of staff members (group size, department) with similar priorities in the innovation process, and to anticipate potential conflicts of interest. For example, the IPPs in segment 1 are well-served and don't require urgent improvement efforts. The IPPs in segment 3 are currently over-served, and in segment 4 they are irrelevant, i.e. without significant need for action. The IPPs in the critical segment 2 are characterised by high importance and low performance, and therefore should be put into the focus of improvement actions. In addition to the statistically estimated ranking p_i, the highest size values S_i of the segment 2 help to pick critical IPPs directly, as shown in Table 4 and Table 5.

3. Discussion of results

Analysis of the in-depth interviews and workshops with 10 consortium partners and the outcomes of the cross-industry survey with 168 participants from 19 companies in 2016-17 allow us to assume that the competitive capability and innovation success of the companies depend up to 65% on organisational factors (50 IPPs in category InnoSystem) and up to 35% on technological or methodological competences (30 IPP in category InnoProcess). Table 4 and Table 5 illustrate the results of the importance-satisfaction analysis for the corresponding innovating system and innovation process. They show the mean values for the top 5 innovation performance factors for the InnoSystem and InnoProcess categories respectively. These 10 IPPs from a total of 80 can be considered critical for enhancement of competitive and innovation capability, on average, across all companies. The individual analysis of companies shows that each company has its specific priorities and set of innovation performance parameters critical for the improvement of innovation capability.

Table 4. Top 5 innovation performance parameters (IPP) of the innovating system

No.	Innovation performance parameter (IPP)	Ranking pi [%]	Importance Wi	Satisfaction Zi	Critical segment Si
13	Strong non-commercial motivation of engineers and employees for innovative ideas, e.g. through awards.	1,09	70%	44%	47%
46	Continuous development and implementation of measures that enhance creativity and innovation.	1,03	75%	51%	63%
8	Employees can devote some of their time to their own innovative projects that have not yet officially started.	1,03	78%	53%	55%
38	Regular meetings of cross-departmental expert teams to generate novel ideas and inventively solve problems.	1,02	74%	50%	51%
6	Many employees in various departments actively promote innovation and drive it forward.	1,00	83%	57%	55%

cross-industry mean values based on n=168 questionnaires received from 19 companies

The mean values of the total innovating system performance V_S and total innovation process performance V_P amounts to V_S = 62,8% and V_P =58,8% correspondingly. No assessed industrial company could reach a maturity level of 75% (lower bound of high performance) for both metrics. A moderate statistically significant positive correlation with Pearson r=0,62 (p<0,01) between both performance values V_S and V_P was observed for 19 companies.
The average values of the innovation indicators across the participants of the study are presented in Table 6. Also, no industrial company can reach a maturity level of 75% for any metric. For the entire data (n=168), a strong positive correlation can be observed between the Leadership and the Innovation Competences (r=0,80, p<0,01), the Leadership and Creativity (r=0,82, p<0,01) and between the Innovation Competences and the Creativity (r=0,87, p<0,01). The correlation between the Innovating climate and the Creativity with Pearson r=0,60 (p<0,01) is somewhat moderate.
Similar to the outcomes of the earlier empirical innovation study (Kirner et al., 2007), no statistically significant difference in IPP importance and satisfaction values of SMEs with less than 500 employees and of large enterprises can be extracted from the results.

Table 5. Top 5 innovation performance parameters (IPP) of the innovation process

No.	Innovation performance parameter (IPP)	Ranking pi [%]	Importance Wi	Satisfaction Zi	Critical segment Si
53	Complete identification of existing and new customer requirements and needs.	1,90	86%	55%	56%
72	Seamless information exchange and transparent communication in innovation process.	1,86	84%	55%	60%
80	Quick and efficient solving of organizational problems in the innovation process.	1,78	83%	55%	58%
52	Cross-industry tracking of new technological trends and technologies transfer.	1,58	82%	59%	52%
65	Anticipatory early identification of technical problems and risks in new ideas or concepts.	1,56	83%	59%	52%

cross-industry mean values based on n=168 questionnaires received from 19 companies

Table 6. Innovation indicators and their mean values across the industry

No	Innovation indicator	Mean value
1	Market and customer orientation	60,7%
2	Technology orientation	62,4%
3	Creativity	58,7%
4	Leadership	62,5%
5	Communication and knowledge management	59,6%
6	Risk and cost management	59,2%
7	Innovative climate	63,3%
8	Innovation competences	63,7%

The results of the study reveal different innovation performance patterns and correlation of innovation indicators in companies as illustrated in Figure 1 and Figure 2. The below-average numbers of innovation indicators are often observed in cases of low leadership value.

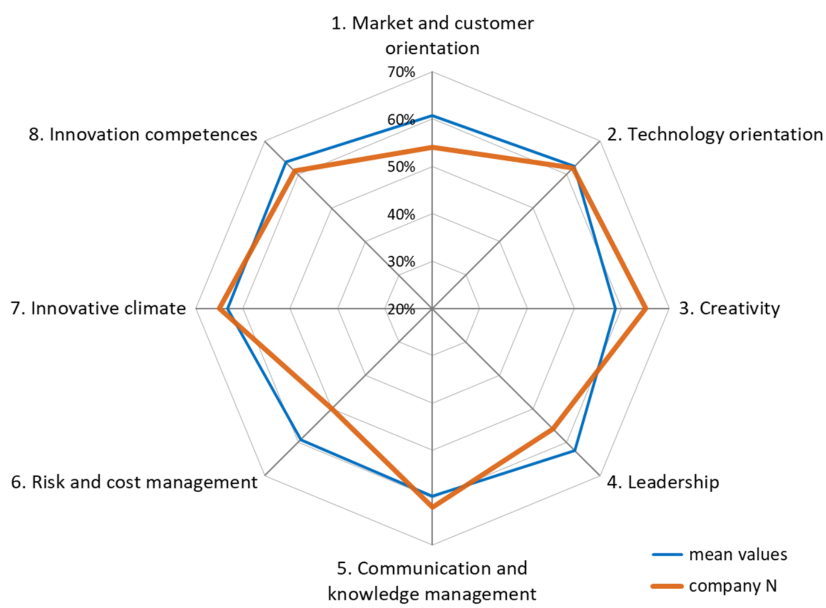

Figure 1. Example of innovation indicators of one company (orange polygon) in comparison with average values in the industry (blue polygon)

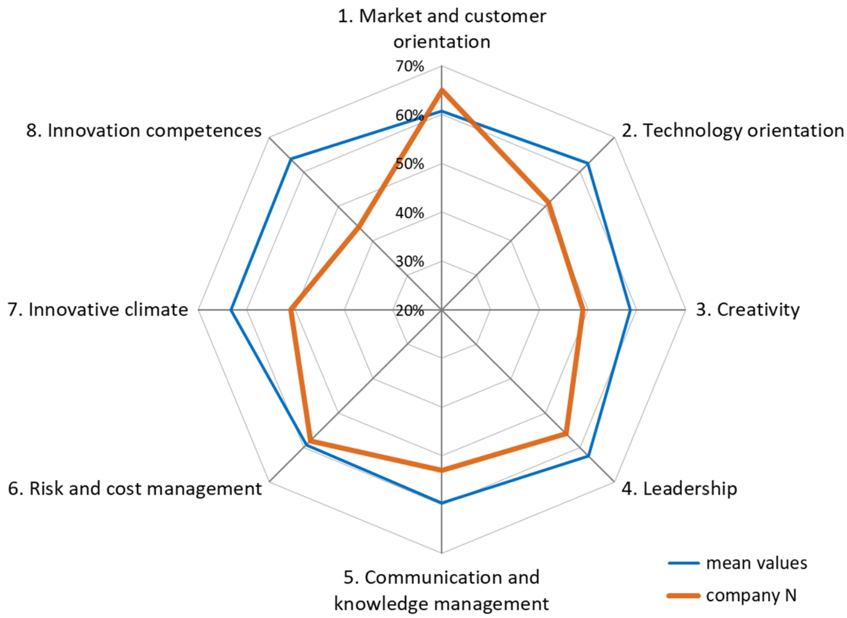

Figure 2. Example of innovation indicators of one company (orange polygon) in comparison with average values in the industry (blue polygon)

The innovation performance of companies in terms of innovation indicators values is often unbalanced, and typically only shows one or two strong features, as shown in the Figure 2. Another statistical observation confirms that established risks and cost management in the companies can moderately correlate with lower value of the innovative climate.

4. Conclusion and outlook

The evaluation of the company self-assessments has shown that each company has a unique scope of urgent measures to enhance its innovation capability. Due to the results obtained, company's executives and engineers can see that they often overestimate their actual innovation performance and perhaps do not even know or monitor the relevant performance parameters or indicators. The application of the proposed method for the practice allows the targeted enhancement of innovative capability and helps to establish a well-structured and comprehensive approach in managing innovation.

The objective of the presented research work is to develop a holistic assessment method for revealing opportunities for the fast and systematic enhancement of innovation and competitive capabilities of industrial companies, making this process more systematic, measurable, and controllable.

Additionally, the list of innovation performance parameters and indicators can be extended in the future with new aspects, such as parameters relevant for process innovation and business model innovation or for issues regarding the innovation impact of suppliers and service innovation.

Finally, a developed database of standard measures, best practices and tools for realisation of the identified opportunities for enhancement of innovation capability can be supplemented and evaluated through practical application in the context of the Advanced Innovation Design Approach.

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Appendix: 80 innovation performance parameters, categories and assigned innovation indicators with estimated importance W_i, satisfaction Z_i and ranking values p_i

(cross-industry mean values based on n=168 questionnaires from 19 companies).

No.	Innovation Performance Parameters - IPP	Category	Innovation Indicator	Imp. Wi	Sat. Zi	Rank. pi [%]
1	Executives understand the innovation process, its individual phases and subtasks in detail.	InnoSystem	4. Leadership	77%	67%	0,63
2	The success of innovation projects is measurable and belongs to the most important corporate indicators.	InnoSystem	4. Leadership	69%	52%	0,85
3	Executives support and personally promote innovation in the company.	InnoSystem	4. Leadership	89%	71%	0,69
4	The executives have a very high willingness for theapplication of new technologies, development of new markets, etc.	InnoSystem	4. Leadership	91%	73%	0,65
5	Many employees in various departments understand the innovation process, its individual phases, and subtasks.	InnoSystem	8. Innovation competences	78%	54%	0,99
6	Many employees in various departments actively promote innovation and drive it forward.	InnoSystem	8. Innovation competences	83%	57%	1,00
7	Flexible individual working conditions and results-oriented performance evaluation of employees and staff members.	InnoSystem	7. Innovating climate	73%	60%	0,75
8	Employees can devote some of their time to their own innovative ideas or projects that have not yet officially started.	InnoSystem	7. Innovating climate	78%	53%	1,03
9	Employees are always welcome to contribute ideas and suggestions to the innovation projects.	InnoSystem	7. Innovating climate	92%	79%	0,48
10	Employees are always welcome to include critical suggestions or concerns in innovation projects.	InnoSystem	7. Innovating climate	88%	75%	0,56
11	Short and fast decision-making in innovation projects.	InnoSystem	4. Leadership	82%	63%	0,80
12	Promotion of innovative ideas of employees through financial incentives.	InnoSystem	7. Innovating climate	70%	57%	0,77
13	Strong non-commercial motivation of engineers and employees for innovative ideas, e.g. through awards.	InnoSystem	7. Innovating climate	70%	44%	1,09
14	Innovation is part of the mission statement of a company and its corporate strategy.	InnoSystem	7. Innovating climate	87%	75%	0,54
15	A high degree of commitment and proactive thinking among employees.	InnoSystem	3. Creativity	84%	69%	0,68
16	Available budget for pre-development and research projects that are not funded by customer orders.	InnoSystem	7. Innovating climate	84%	63%	0,85
17	Technical competences of the employees required in innovation projects.	InnoSystem	8. Innovation competences	86%	75%	0,54
18	Social competences of the employees required in innovation projects, like communicative or team-working skills.	InnoSystem	8. Innovation competences	80%	71%	0,56
19	Methodological competences of the employees required in innovation projects, such as innovation methods or techniques.	InnoSystem	8. Innovation competences	76%	64%	0,69
20	Targeted and systematic personnel development in the field of innovation.	InnoSystem	8. Innovation competences	79%	59%	0,88
21	Many employees in different divisions are ready to acquire new competencies and skills related to the innovation process.	InnoSystem	8. Innovation competences	72%	66%	0,58

No.	Innovation Performance Parameters - IPP	Category	Innovation Indicator	Imp. Wi	Sat. Zi	Rank. pi [%]
22	Innovation project teams are constituted by the employees with required qualifications.	InnoSystem	8. Innovation competences	80%	67%	0,66
23	Executives support and promote teamwork throughout the duration of innovation projects.	InnoSystem	4. Leadership	84%	66%	0,76
24	Regular dialogue with external research and development organisations.	InnoSystem	2. Technology orientation	74%	65%	0,62
25	Regular contacts in the field of innovation with other companies in other industrial sectors or with suppliers.	InnoSystem	2. Technology orientation	68%	61%	0,63
26	Customers involvement in entire innovation process, from capturing customer needs to the market launch of new products.	InnoSystem	1. Market and customer orientation	76%	63%	0,72
27	Systematic collection, evaluation, and implementation of customer feedback, in the form of complaints, suggestions or ideas.	InnoSystem	1. Market and customer orientation	80%	62%	0,79
28	Systematic review of customer acceptance of new technologies, products or services before market launch.	InnoSystem	1. Market and customer orientation	80%	60%	0,86
29	Convincing market communication with the explanation of all customer benefits in new product launches.	InnoSystem	1. Market and customer orientation	85%	67%	0,75
30	Open communication of the goals and tasks of innovation projects between all those involved in a company.	InnoSystem	5. Communication and knowledge management	85%	64%	0,84
31	Open information exchange for problems; failures in innovation projects are not penalized.	InnoSystem	5. Communication and knowledge management	88%	70%	0,71
32	Learning from mistakes in innovation projects, to avoid the repetition of past mistakes.	InnoSystem	5. Communication and knowledge management	87%	65%	0,84
33	Taking the interests of various divisions, such as marketing, R&D, production, sales, service, etc. into account at an early stage of the innovation projects	InnoSystem	5. Communication and knowledge management	72%	58%	0,78
34	External experts confirm the future sustainability of technologies used in the company.	InnoSystem	2. Technology orientation	60%	66%	0,42
35	Clearly defined criteria for evaluating and selecting concrete ideas or proposals for implementation.	InnoSystem	8. Innovation competences	76%	59%	0,80
36	Consistent pursuit of innovation goals and implementation of selected ideas, even if there are initial difficulties or problems.	InnoSystem	8. Innovation competences	84%	64%	0,81
37	Regular use of brainstorming or other creativity techniques in the search for new ideas and solutions.	InnoSystem	3. Creativity	75%	61%	0,74
38	Regular meetings of cross-departmental expert teams to generate novel ideas and creatively solve problems.	InnoSystem	3. Creativity	74%	50%	1,02
39	Continuous generation and implementation of new ideas regarding new products or new services in the company	InnoSystem	3. Creativity	81%	63%	0,79
40	Continuous generation and implementation of ideas regarding new available production methods or technologies.	InnoSystem	2. Technology orientation	76%	61%	0,76
41	Continuous generation and implementation of ideas regarding better communication, knowledge, and information systems in the company.	InnoSystem	5. Communication and knowledge management	73%	55%	0,86
42	Preferred tracking and implementation of ideas with particularly high customer value.	InnoSystem	1. Market and customer orientation	83%	73%	0,55

No.	Innovation Performance Parameters - IPP	Category	Innovation Indicator	Imp. Wi	Sat. Zi	Rank. pi [%]
43	One or only a few particularly creative colleagues or inventors propose the most novel ideas.	InnoSystem	3. Creativity	54%	66%	0,36
44	Regular creativity workshops with customers, external partners, suppliers.	InnoSystem	3. Creativity	59%	45%	0,83
45	Search for new creative ideas without restrictions or limits: everything is conceivable.	InnoSystem	3. Creativity	77%	63%	0,72
46	Continuous development and implementation of measures that enhance or promote creativity and innovation.	InnoSystem	3. Creativity	75%	51%	1,03
47	Coordination and support of the innovation process and innovation projects by innovation manager or innovation management department.	InnoSystem	4. Leadership	66%	53%	0,80
48	Continuous and systematic research activities, basic developments, new product or process developments.	InnoSystem	2. Technology orientation	81%	64%	0,77
49	Our company understands the customers innovation process well: we know how our customers innovate and what challenges they face.	InnoSystem	1. Market and customer orientation	72%	61%	0,71
50	Our customers understand the innovation process in our company well.	InnoSystem	1. Market and customer orientation	51%	50%	0,59
51	Precise technology forecasts future technical or technological product characteristics in own business field.	InnoProcess	2. Technology orientation	83%	60%	1,54
52	Cross-industry tracking of new technological trends and solutions to transfer and lever new technologies from other industries and from research.	InnoProcess	2. Technology orientation	82%	59%	1,58
53	Complete identification of existing and new customer requirements and needs.	InnoProcess	1. Market and customer orientation	86%	55%	1,90
54	Identification of the strongest product or service characteristics with highest market potential or market acceptance, to be able to set priorities correctly.	InnoProcess	1. Market and customer orientation	82%	60%	1,52
55	Monitoring competitive activities in the market and identification of the main competitive features.	InnoProcess	1. Market and customer orientation	79%	63%	1,25
56	Identification of new customer groups or new markets for own know-how, technologies, products.	InnoProcess	2. Technology orientation	84%	62%	1,46
57	Reasoned and detailed formulation of innovation tasks or innovation strategies.	InnoProcess	5. Communication and knowledge management	72%	54%	1,48
58	Comprehensive problem solving and idea generation: no valuable idea or solution is overlooked.	InnoProcess	3. Creativity	77%	58%	1,43
59	Fast solving of particularly difficult technical problems.	InnoProcess	3. Creativity	73%	60%	1,22
60	Complete capturing of all employee ideas in every step of product development	InnoProcess	5. Communication and knowledge management	74%	59%	1,34
61	Comprehensive collection and documentation of ideas from customers, suppliers etc., following the Open Innovation approach.	InnoProcess	1. Market and customer orientation	71%	54%	1,44
62	Error-free evaluation and objective selection of ideas for implementation in new product concepts.	InnoProcess	5. Communication and knowledge management	75%	57%	1,44
63	Fast access to relevant new patent information such as patent applications or patents worldwide.	InnoProcess	6. Risk and cost management	77%	71%	0,90

No.	Innovation Performance Parameters - IPP	Category	Innovation Indicator	Imp. Wi	Sat. Zi	Rank. pi [%]
64	Well-structured and quickly accessible storage of existing relevant patent information.	InnoProcess	5. Communication and knowledge management	72%	65%	0,99
65	Early identification of technical problems and risks in new ideas or innovation concepts.	InnoProcess	6. Risk and cost management	83%	59%	1,56
66	Avoidance of possible organizational risks in the execution of an innovation project or market launch, such as financial misjudgements etc.	InnoProcess	6. Risk and cost management	77%	58%	1,44
67	Early consideration of costs in the innovation process, for example, during the idea or concept assessment.	InnoProcess	6. Risk and cost management	69%	65%	0,96
68	Systematic cost reduction in all steps of the innovation process and new product development.	InnoProcess	6. Risk and cost management	65%	62%	0,97
69	Rapid acquisition of information on a specific topic, such as feasibility checks, search for suppliers or know-how carriers, etc.	InnoProcess	5. Communication and knowledge management	78%	65%	1,18
70	Well-structured and easily accessible information on all phases of the innovation process, from customer needs analysis to ideation, design and market launch.	InnoProcess	5. Communication and knowledge management	72%	54%	1,49
71	Repeatability of innovation projects at a high-quality level, e.g. according to a defined procedure, milestone system, etc.	InnoProcess	6. Risk and cost management	70%	58%	1,21
72	Seamless information exchange and honest, transparent communication in the innovation process across departments, such as Marketing, R&D, Service etc.	InnoProcess	5. Communication and knowledge management	84%	55%	1,86
73	Low overall duration of innovation project, from the definition of the goals and requirements to the implementation of the product concept and market launch.	InnoProcess	6. Risk and cost management	71%	53%	1,47
74	Relevant information, e.g. about market situation, technology or competitors is always up to date in any phase of the innovation project.	InnoProcess	5. Communication and knowledge management	75%	57%	1,46
75	Innovation projects are always completed in the planned time, without interruptions or delays.	InnoProcess	6. Risk and cost management	58%	47%	1,29
76	IP protection: the know-how developed in the innovation projects cannot be copied by the competition or indirectly used in a modified form.	InnoProcess	6. Risk and cost management	80%	63%	1,31
77	The expected innovation outcomes and progress in achieving set targets is monitored at all stages of the innovation process.	InnoProcess	6. Risk and cost management	70%	59%	1,19
78	Quick verification or feasibility check of new ideas and innovation concepts, e.g. by prototyping.	InnoProcess	6. Risk and cost management	83%	68%	1,16
79	Monitoring and management of the innovation process with performance indicators, e.g. number of patents, number of project interruptions, delays etc.	InnoProcess	6. Risk and cost management	61%	48%	1,37
80	Quick and efficient solving of organizational problems in the innovation process, e.g., resources planning, personnel issues etc.	InnoProcess	4. Leadership	83%	55%	1,78

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