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Unraveling data from an idea management system of 11 radical innovation portfolios: key lessons and avenues for artificial intelligence integration

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Abstract

In strategic and radical innovation, the degree of uncertainty and the amount of complexity is much higher compared to 'business as usual'. Therefore, idea management systems are often used to support such innovation processes. An interesting question is what we can learn from studying data in such idea management systems and what potential implications we can derive from the innovation management literature. In this study, we were allowed to access and analyze data from the same idea management system used in 11 radical innovation projects from the years 2012–2018. Our analysis unravels 8 findings that in different ways nuance or challenge current research on innovation management. Finally, we discuss how the integration of artificial intelligence (AI) in idea management systems can support innovation team members in increasing the innovation potential of the ideas that are elaborated.

Keywords: Idea management, Innovation management, Radical innovation, Action convergence, Pattern recognition, Artificial intelligence, Absorptive capacity, Innovation capacity building

Introduction

The ability to explain and prescribe how established organizations create radical innovation is increasingly getting scholarly attention (Leifer et al., 2000; Lassen et al., 2006; Salerno et al., 2015; O'Connor et al., 2018; Goduscheit & Faullant, 2018). The scientific attention to radical innovation has, for example, been aimed at explaining the need for specific competencies (Utterback, 1994), the different stages an idea must go through from its recognition to its development and commercialization (Leifer et al., 2000; Brix & Jakobsen, 2013), and how measurements can be used to assess ideas in radical innovation portfolios (Kristiansen & Ritala, 2018). In this context, radical innovation is conceptualized as a sequential process, where the strategic direction for new products is specified. However, the output is unclear, and the process of creating new outputs contains different types and degrees of uncertainty (O'Connor & Rice, 2013). Certain activities are considered vital for not leaving radical innovation to chance, such as applying meaningful systematic processes and methods to the innovation processes (Salerno et al., 2015). Applying meaningful systematic processes and methods is considered a cornerstone of today's radical innovation (Salerno et al., 2015). Such systematic processes require, e.g., (1) acknowledging the existence of uncertainty, (2) allowing that uncertainty to be part of the innovation process, and (3) managing the process of reducing uncertainty (O'Connor & Rice, 2013). Creating radical innovation is a complex, context-dependent phenomenon (Funnell & Rogers, 2011) to which a linear cause–effect model cannot guarantee radical innovation outcomes will occur (Brasil et al., 2021). Processes of creating radical innovation require different types of management at different points in time (O'Connor et al., 2018) as well as there is an increasing demand for a management system for identifying and reducing uncertainty as part of a knowledge-creating learning process (Brix and Horsager, 2022). A growing and interesting aspect of the management of radical innovation is how to support the innovation process using technology, such as idea management systems to overcome limitations of human information processing capabilities (e.g., Haefner, 2021). Another theme that is emerging is how artificial intelligence can be used as a value-adding component to idea management systems (Amabile, 2020), e.g., to the ideation and development of ideas in such a way that the search routines of the participants in the innovation project get to frame and define new opportunities (Keding, 2021) as a part of innovation capacity (Mikelsone et al., 2022a, 2022b).

While empirical research on radical innovation is not uncommon (e.g., O'Connor, 1998; Lassen et al., 2006; Brasil et al., 2021), this study reports on longitudinal data that are rarely accessible to researchers and the public: we were allowed access to 11 radical innovation portfolios that were systematically elaborated using the same idea management system and systematic innovation method from 2012 to 2018. By applying an exploratory research strategy, we are interested in understanding the process of elaborating radical innovation ideas from the early stages to the step, where business models are built and ready to be commercialized. The point of interest with this data available is to conduct exploratory research led by the following research question:

What can we learn from analyzing data from 11 radical innovation portfolios, and what are the implications for innovation management research from these findings?

The theoretical lens we apply is absorptive capacity (Cohen & Levinthal, 1990; Lane et al., 2006; Zahra & George, 2002). Absorptive capacity is often described as an ongoing process for an organization and its individuals that want to generate novel ideas for new or highly improved products or technological processes (Fabrizio, 2009). Absorptive capacity is a recognized approach by which an organization identifies new information and translates it into a commercial advantage (Cohen & Levinthal, 1990). The premise for absorptive capacity is that individual and organizational learning processes are connected. A crucial mechanism is that the right individual can identify the potential value of new information (Volberda et al., 2010). Absorptive capacity, therefore, refers to the capacity of an identifier (or recipient) to assimilate new information, both internal and external, to create value, e.g., by improving competitiveness or creating new or improved products. Inspired by Haefner (2021), we also find it interesting with the data available to discuss how artificial intelligence (AI[1]) can support radical innovation processes in combination with the use of idea management systems as a substantial yet only sparsely understood opportunity (Füller et al., 2022; Haefner, 2021). To our knowledge, obstacles related to such a many-faced challenge are yet to be described and, if possible, exemplified. With this study, we open the lid to this black box.

To create new knowledge of the problems identified above, we report on data from an idea management system that was used in 11 radical innovation project portfolios from the years 2012–2018. These 11 radical innovation projects followed the same systematic innovation method to which an idea management system named Rosetta was designed. This systematic method and use of the same idea management system enables us to build an embedded case study as a research strategy (Yin, 2013). Moreover, since our analyzes deal with knowledge and the involvement of inspiration, we explore and discuss how AI may contribute to central functions of idea exploration in the Rosetta idea management system. This reflective exercise to provide theoretical underpinnings and understand its place in the scholarly work of the absorptive capacity literature provides help to innovation professionals in their management and elaboration of ideas for radical innovation.

Theoretical background

For more than 30 years, absorptive capacity (Cohen & Levinthal, 1990) has been subject to scrutiny and acknowledged for its great importance within several research fields, such as learning, innovation, and managerial cognition (Volberda et al., 2010), whereas absorptive capacity has been the bedrock of theories of innovation and the capacity to innovate (Zou et al., 2018). While absorptive capacity can help organizations process information more efficiently towards value creation, the approach also has its limitations. Its usefulness depends on the ability and ingenuity of the employees who use the method and on the organizational context, and the internal workflows and processes (Brix, 2019). Therefore, absorptive capacity is often seen as employee-driven innovation, where the collection, structuring, and elaboration of ideas are put into a system for ensuring assessment, pursuit, and often even remuneration (Knoppen et. al., 2022; Salerno et al., 2015). In the sense of transforming information—or new ideas—into value creation and new products or services (Duan et al., 2020). We view absorptive capacity as the trunk that holds the branch of innovation capacity (Zou et al., 2018).

In relation to the use of idea management systems with an absorptive and innovation capacity perspective, tendencies have gone from proposing suggestion boxes to much more advanced programs and frameworks (Gorski & Heinekamp, 2004). This way, idea management systems can be defined as "*formalized methods of capturing, examining, nurturing and developing ideas created within an organization*" (Nilsson et al., 2002, p. 500). While multiple studies examine different types of idea management systems—especially open-source communities (e.g., Dahlander & Gann, 2010), we do not know much about the role of idea management systems in the context of radical innovation. So far, limited empirical research is available concerning idea management systems at the early stages of innovation (Beretta, 2019). A recent publication by Mikelsone et al. (2022a) distinguishes between idea management systems dependent on whether ideas

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[1] We use the term AI as an abbreviations for Articicial Intelligence. We use the notions AI and machine learning interchangeably.

are submitted with a clear innovation purpose or not—referred to as passive or active—and whether the ideas originate inside the organization's boundary or not—referred to as internal or external. In our work, we expand the notion by Mikelsone et al. (2022a) and discuss the integration of AI in a stepwise idea management process (Mikelsone et al. (2022b). Hence, a sequential idea management system with AI enhances innovation capacity, which may conclusively increase the likelihood of radical innovation. In this scenario, we must first acknowledge that Artificial Intelligence and machine learning models use algorithms (mathematical models) to find patterns in digitally available information (data) and convert them into relevant knowledge (Neirotti et al., 2021). We use the notions AI and machine learning interchangeably. However, implementing an AI model calls for prior consideration of the data presented to a model. For instance, before developing the AI model for our sequential idea management system, we inspect and clean the data, such as considering the format of the information representing an idea (structured vs. unstructured), handling outliers, and missing values, etc. In this context, structured data are stored in predefined formats, such as a date, sender, and read/unread in an email account, whereas unstructured data are the context of the email, such as free text or a picture. Therefore, for a sequential idea management system, such as ours, we need to address how ideas are available to the model, e.g., if presented as free text. Outliers are observations that have an abnormal distance to the remaining samples, such as a date outside the traditional calendar in a mail. Missing values are when we miss an observation from all our features, such as if we do not have a sender for an email. Handling missing values in a sequential idea management system may be handled in one of the three traditional ways: (1) deleting the column to ensure completeness but with the price of losing information, (2) imputation of best-guess value in uni- or multivariate

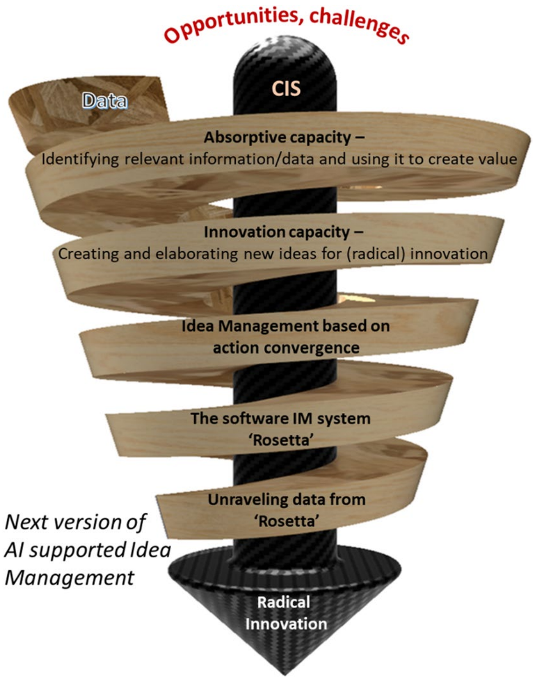


Fig. 1 Funnel for information processing in this article. Source: Own line-up

methods but with the price of simulating observations, or (3) handling the missingness in the AI model class but with the price of being restricted to fewer model choices, e.g., a sequential model or probabilistic graphical model. Therefore, using AI in sequential idea management systems, we first consider the ideas we provide to the model within our sequential idea management system, Rosetta, in the hopes of reaching radical innovation as the findings. Figure 1 illustrates the agile funnel of information from absorptive capacity to findings in our work.

Consideration and examples of the opportunities, benefits, and potential pitfalls of developing and using sequential idea management systems and machine learning are discussed later in this paper.

Methodology

Research strategy

An embedded multi-case study (Yin, 2013) is applied as a research strategy. We report on data from a software idea management system used on 11 cases of radical innovation. All cases were based on the same innovation model, followed the same implementation structure, and had the same external project manager. The details related to these cases are unfolded below. Purposive sampling was used as a sequential design (de Vaus & de Vaus, 2013), where the 11 cases follow each other sequentially, the first starting in 2012 and the last in 2018. The advantage of sequential design and multi-cases is that the experiences from the first case can provide inspiration, new ideas, and methods that can influence the subsequent empirical collection in the subsequent case study (de Vaus & de Vaus, 2013).

Presenting the cases and qualifying the sample

All cases we report on in the study were completed following the same systematic innovation process, the 'Creative Idea Solution model' (CIS). CIS was created in the late 1990'ies, first described by Jakobsen and Rebsdorf (2003) and later published, e.g., by Brix and Jakobsen (2013) and by Jakobsen (2021) in a doctoral dissertation. CIS is a sequential phase model containing four phases, where each phase has four activities or steps, defines with both a process (to follow) and a framework (to do). The data we report on stem from a software system named Rosetta, which was developed as a software Idea Management System following the same phases and activities as the CIS model related to the middle phase called Pre-ject. We start by presenting the phases, activities, and premises of the CIS model, and hereafter we explain the Rosetta idea management system and the data we have available for our study. The purpose of providing an extended explanation of both the CIS model and the Rosetta idea management system is to qualify our sample of how and why the results from the different radical innovation projects are comparable and relevant to report on.

Recognized innovation models such as the 'Discovery, Incubation, and Acceleration (O'Connor et. al., 2008), 'open innovation' (Chesbrough, 2006), 'disruption' (Christensen, 1997), and 'Theory U' (Scharmer, 2007), and the CIS model focuses on describing the need for radical, disruptive, and transformative innovation in a strategic perspective. The CIS model is characterized by the following criteria: first, ideas for radical innovation

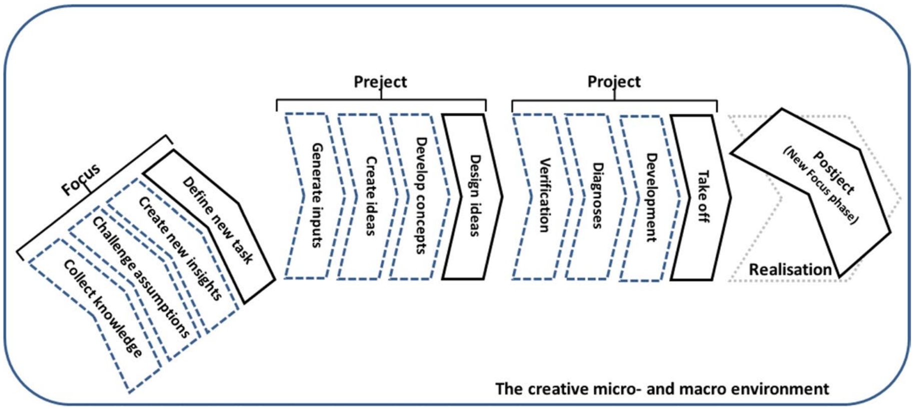


Fig. 2 The Creative Idea Solution model Source: Brix and Jakobsen (2013)

involve knowledge creation from different experts and competence contributors that are both internal and external to the organization (Zobel, 2017). Second, in the CIS model, decisions and judgments are suspended (not limited to postponement), meaning that no active assessment or evaluation process takes place during idea and concept development as this is replaced with actions stimulation, e.g., the blending method (Fauconnier & Turner, 2008), as well as different portfolio models to ensure the overview (Fig. 2).

A third characteristic is that it is not possible to delete ideas, and it is not possible to merge ideas. It is only possible to add new information and knowledge, and if these additions contribute added value, such as new or better understandings, the ideas can be moved to the next step in the process. Therefore, all records are stored in Rosetta for conducting the handling as well as movement. The CIS model has the following phases and activities:

Phase 1: (lateral) focus The first phase in CIS is a lateral focus, where the purpose is to define the (new) innovation task. The first activity in this phase is to collect knowledge regarding what is known related to the challenge, problem or needs (Chilton et al., 2007), e.g., using the Force Field analysis (Lewin, 1943). The second activity is to challenge these assumptions, done by the team members and the knowledge that has been collected. The third activity is to create new insights with the purpose of identifying possible new areas for changing direction and breaking the existing pattern (Brix & Jakobsen, 2013). The fourth activity is to define the main innovation task as well as defining the right creative tools to use and the right experts and inspirations to implement, which leads to the innovation question. Having defined the innovation question, the ideation in phase two can be conducted.

Phase 2: pre-ject In the pre-ject phase, the first activity is to create new inputs based on the innovation question, mainly using creative techniques involving the right people. The inputs that are added enough knowledge and regarded as potential are moved to the next step. An idea is, as a result of this, developed. Developing ideas is based on pattern recognition, association, and blending theory (Fauconnier & Turner, 2008; Oakley et al., 2017) by involving inspiration from other inputs and ideas. Those ideas that appear with clear strengths and often potential challenges are transferred into the next step, the concept level. In this step, the concepts are supplied by new knowledge and inspiration from areas covering the same principle to explore the full potential in a narrow area, and then/if a potential direction opens favorable opportunities, the concept is transferred to a new step, the design level. In the design phase, a vertical innovation process is conducted (Brix & Jakobsen, 2013) to bring the described horizontal processed idea to a holistic concept handling all aspects in the vertical chain (Keeley et al.,; 2013) for pretotyping (Brix & Jakobsen, 2014; Jakobsen & Hansen, 2007). The CIS model has a strict separation of horizontal and vertical innovation, as the process of horizontal innovation (finding originality) is often sabotaged by yet-to-be-touched arguments from the vertical value chain (Jakobsen et al., 2008). The information and data flow in the pre-ject phase are handled in the idea management system Rosetta.

Phase 3: project In the project phase, those established and strongest described designs in relation to the desired outcome based on defined focus are processed individually for potential implementation. The project phase is not a part of Rosetta.

Phase 4: post-ject The post-ject phase is identical to focus but is not postponed until the problem arises with is initiated in parallel with implementation (or whatever else is initiated after the project phase). This is to strive for radical innovation based on challenge, not problem-solving.

The idea management system: Rosetta

The Idea Management system 'Rosetta' works as a systematic portfolio tool tailor-made to the second phase in the CIS model, the pre-ject phase. Rosetta is based on the premise of absorptive capacity, which implies that an inflow of new information must be guided throughout the innovation process by the individual team members taking part in the project. All information, such as notes, photos, links to homepages, etc., are documented right from the start of the pre-ject phase and kept until the final activity has been completed.

Rosetta was originally developed in the late 1990'ies. The first version of Rosetta was made in the relational database Paradox**,** and the second version of Rosetta was built upon Microsoft Access. Based on the learning from working with these two early versions in practice, the current version of Rosetta version III, was updated in Microsoft Access following the four phases described in the pre-ject phase of the CIS framework (Brix & Jakobsen, 2013). Despite a historical perspective with improvements, both the description and the analysis of the data deal only with data from Rosetta version III, and the system is subsequently simply called Rosetta. Table 1 below illustrates the number of radical innovation projects, where Rosetta, in different versions, has been the idea management system supporting the innovation process (Table 2).

Rosetta is a 'Multi to Multi' relation. An input can result in several ideas, and an idea can result in several concepts, etc. At the same time, several inputs can be used as inspiration for an idea, etc. To bring inputs or ideas to the next activity, new

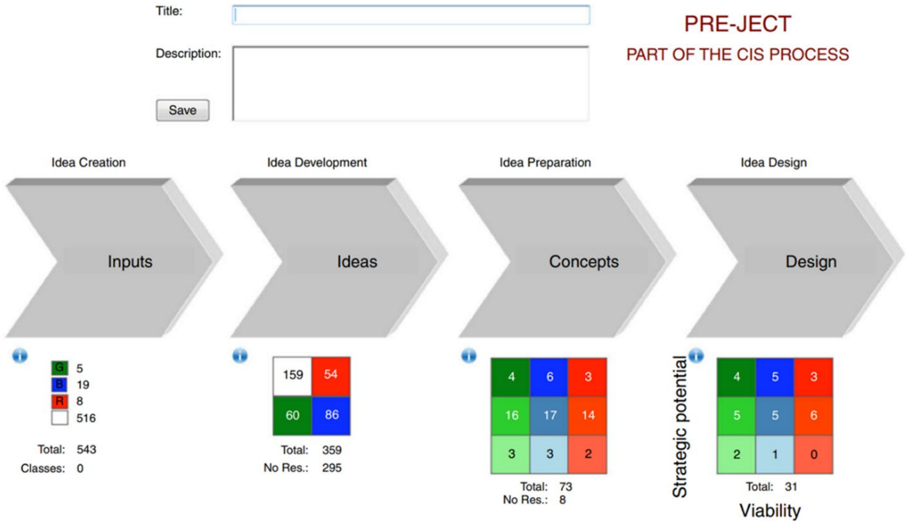
Table 1 Timeline for the development of the Rosetta system with involved major projects

Year	Platform	Country for user	N projects	Sectors/industries
1998 -	Paradox (Borland)	Denmark	2	Television, beverage
2005 -	Microsoft Access	Denmark, Germany	12	Industrial projects
2011 –	Microsoft Access, designed interface, help function, manual look-up functions, English languages	Denmark, Germany, Sweden, Norway, Finland, Netherlands, USA, Lithuania, Russia, Italy	60	37% are industrial projects from Denmark, 20% are municipality and governmental projects from Denmark, and 43% are industrial projects located outside Denmark

Source: Authors' development

Table 2 The 11 cases

Year	Description	Client
2012	Sustainable packaging	Industry
2012	20% more learning in pre-school	Municipality
2013	New purchasing system at a Hospital	Government
2014	Handicap help system	Municipality
2014	Shredder system for waste management support	Industry
2014	Rehabilitation	Municipality
2015	Visitation system to obtain support and assistance	Municipality
2015	Workshop system for handling car during the repair	Industry
2016	Rehabilitation in the healthcare sector	Municipality
2017	Next-generation tumble dryer	Industry
2017	New stimulant as an alternative to tobacco	Industry
2018	Food packaging in the dairy industry	Industry



Inputs:

G 5
B 19
R 8
516

Total: 543
Classes: 0

Ideas:

159	54
60	86

Total: 359
No Res.: 295

Concepts:

4	6	3
16	17	14
3	3	2

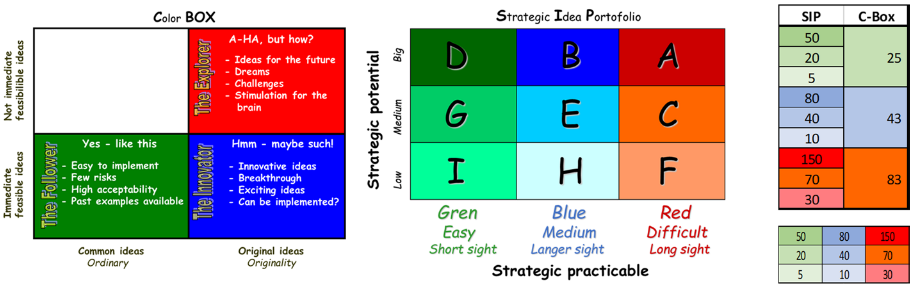
Total: 73
No Res.: 8

Design:

4	5	3
5	5	6
2	1	0

Total: 31

Fig. 3 The overview page in Rosetta following the four steps in the CIS Pre-ject. From Brix and Peters (2015)



SIP	C-Box
50	25
20	
5	
80	43
40	
10	
150	83
70	
30	

50	80	150
20	40	70
5	10	30

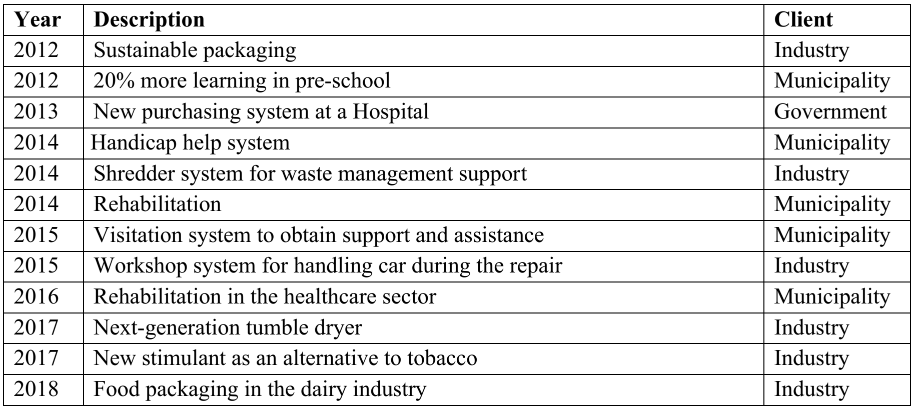
Fig. 4 Description of C-Box (based on Boston matrix) for placement of each individual input in relation to assessed feasibility (left); description of SIP (based on Mckinsey Matrix) with the placement of C-Box in relation to strategic potential and definition of effort area (A- highest) (middle), as well as the layout of character (own construction and line up) with a weighted assessment of originality (to the right) to achieve and to define a calculated level of radicality. The C-Box grade (on the right side of the table to the right) is the average of the three areas in the SIP (own setup as a measurement parameter)

knowledge or insights are required to be included to reduce uncertainty and/or to make clearer descriptions (Fig. 3)..

Although both CIS and Rosetta don't work with evaluation or decision, an overview with transparency and interpretability in Rosetta is created by the team members using colors and placement in the portfolio models. The first step is the use of Color Box, inspired and like the Boston Consulting Group (BCG) Matrix to assist in capitalizing on growth opportunities. The C-box creates a language between the team members regarding practical ideas by eliminating the possibility of sorting, adding, and voting on favorites. Thus, assessments and decision-making processes can be postponed. The second step is an expansion of the C-box with strategic idea portfolio (SIP) is used to inspire and like the GE McKinsey Matrix. SIP is used to compare viability with strategic potential for each concept to establish an overview of the idea position for future efforts. The placement of each record in the portfolio models is done unsupervised by the team members to create a common understanding. According to C-box and SIP, radicality thus relates directly to strategic potential, which is why it stands as a factor for potentially achieved results (Fig. 4).

In this way, the portfolio models are used to calculate the radicality of new ideas based on a set of key variables.

The arguments for why the data related to the 11 CIS projects and Rosetta portfolios qualify our study and, therefore, answer to the study's research question are as follows: first, the 11 cases selected all had an explicit strategic focus on creating radical innovation outcomes; second, they allowed us to use data related to the innovation projects; third they all used the same innovation process and idea management system, which implies that the cases on the project level are comparable and hence a relevant sample to our study. Forth, we report on projects and hence data that has been created and collected prospectively. This implies that the selection of cases was not made ex-post pre-ject finalization, but rather before initiating the innovation projects. We, therefore, argue that we were not biased when selecting cases due to, e.g., the successes or failures of the companies, but rather on where we were allowed to access the engine room of real radical innovation projects.



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2017	Next-generation tumble dryer	Industry
2017	New stimulant as an alternative to tobacco	Industry
2018	Food packaging in the dairy industry	Industry

Fig. 5 The analyzed cases in this study

Data collection

The 11 cases that combined act as the embedded case study are based on data from the Rosetta Idea Management System. In the 11 cases, all steps in the CIS model Preject phase were performed, and all steps in Rosetta were followed, including a final report with a description of the result (design) and, the resulting outputs of the radical innovation process. For other projects, the reported result is not fully completed, and the effect cannot be compared to the data flow. This involves four municipality project, one national project, and six industrial projects of which three is owned by international organizations (Finland, Sweden, and the Netherlands), and one is conducted with a foreign partner (Italy) (Fig. 5).

Data analysis

All data from Rosetta are entered into the database. Associated files are located in independent folders related to the given project. Data can be exported for data processing, e.g., Excel for data analysis and processing. This is also done for this analysis, where the data are processed in Rosetta and is used directly in Excel. Likewise, all cases are reviewed manually with a count of all related inputs for ideas as well as the number of associated experts and areas of knowledge for each individual registration. This is a combination of imported data for statistical processing in Excel.

Results

A fundamental prerequisite when using Rosetta to support radical innovation processes concerns the provision of arguments for deeper insight by providing arguments for action to process each record rather than spending energy and time on creating decision-support measures to create convergence. Despite the framework, where Rosetta works without the ability to merge, evaluate, or judge (the argument for decision convergence), a clear and very significant convergence in the number of records appears. Figure 6shows the amount of input, ideas, concepts, and designs in the four different steps, covering municipality and governmental projects, and industrial projects.

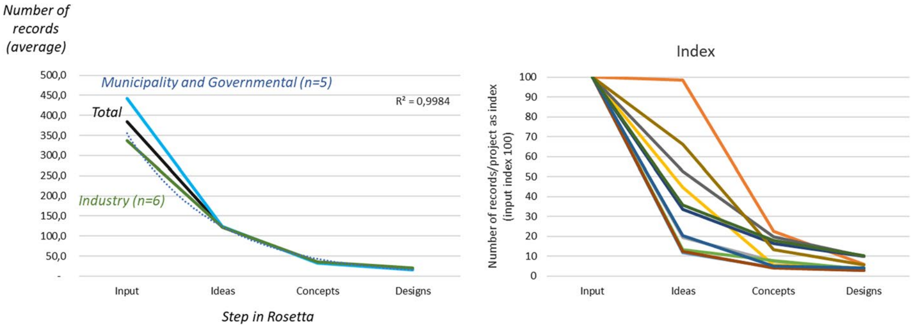


Fig. 6 The number of records concerning input, idea, concept, and design. The figure at the left shows the average of numbers in the four phases both as a summary and respectively for the industrial cases and for the municipality/state cases. The figure on the right shows each case with an indexed view of the development over the four steps

On average, the total curve has an $R^2 = 0{,}9984$ following an exponential curve defined as $= 1016{,}4e^{-1{,}053x}$. The industrial cases also follow an exponential curve ($R^2 = 0{,}9984$) defined as $y = 845{,}23e^{-0{,}979x}$

As well as municipal cases follow an exponential curve defined as $y = 1252{,}2e^{-1{,}14x}$ ($R^2 = 0{,}998$). This shows a clear and significant exponential development mainly following each other, although municipal projects have a slightly larger number of inputs than industrial projects, otherwise following each other for ideas, concepts, and design. Therefore, radical innovation projects are subsequently considered aggregated subsequently without distinguishing between origins in municipal, public, or industrial contexts. At the same time, a significant development can be seen following an exponential curve, but for a few of the cases, a more significant tendency towards a linear development course in the number of registrations. The red case in Fig. 6 (municipality) shows an $R^2 = 0{,}8711$ for linear regression and $R^2 = 0{,}6513$ for exponential regression, just as the green case (industrial) shows an $R^2 = 0{,}9377$ for linear regression and $R^2 = 0{,}8914$ for exponential regression. The rest shows a strong exponential regression than linear regression (in parenthesis) sorted with $R^2 = 0{,}9912$ ($R^2 = 0{,}9284$), $R^2 = 0{,}9706$ ($R^2 = 0{,}8787$), $R^2 = 0{,}9831$ ($R^2 = 0{,}8258$); $R^2 = 0{,}9789$ ($R^2 = 0{,}8099$), $R^2 = 0{,}9829$ ($R^2 = 0{,}9360$), $R^2 = 0{,}9816$ ($R^2 = 0{,}7331$), $R^2 = 0{,}9558$ ($R^2 = 0{,}6856$), $R^2 = 0{,}9668$ ($R^2 = 0{,}6776$) and $R^2 = 0{,}9638$ ($R^2 = 0{,}6741$).

> **Finding 1:** *Unlike the expected tendency of decision support systems in radical innovation management, our unraveling of data demonstrates that activities dealing with the provision of new insights and the creation of new knowledge also act as an effective mechanism for achieving convergence throughout the radical innovation project's stages in the CIS model: inputs, ideas, concepts, and design.*

The logic is cf. Figure 6 shows that the development in numbers follows an exponential curve (in some situations, however, more similar to a linear curve), where final numbers of design with some probability can be defined based on the number of inputs.

The average μ of created input (first step) of the conducted records is 385 (standard deviation σ is 193,56). Input is the result of a workshop using different creativity techniques to stimulate ideation. All input is created based on a workshop performed with a mixture of an established and thorough team, supplemented during the input phase

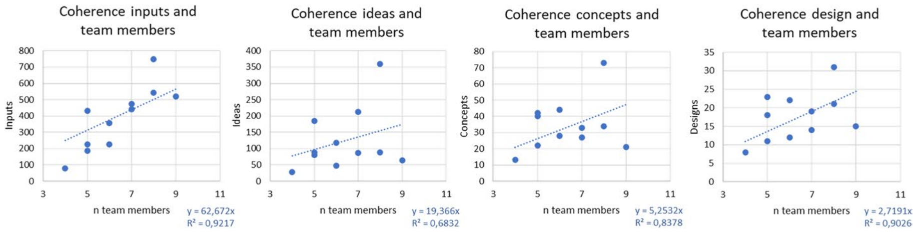


Fig. 7 Number of inputs, ideas, concepts, and designs as a function of the number of team members

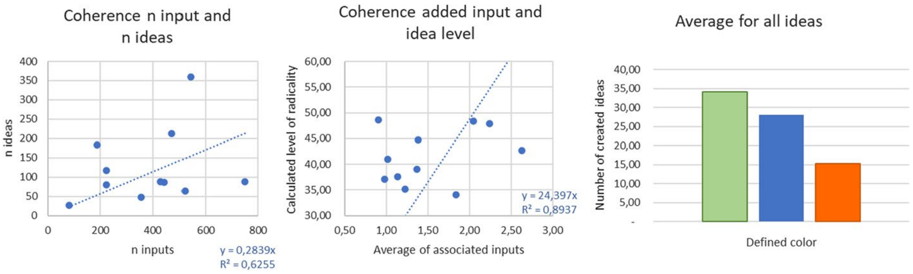


Fig. 8 The coherence between numbers of ideas as a function of created inputs (left), the coherence between the obtained radicality and related input to specific ideas (middle) and the resulting average of the numbers of ideas sorted by color (C-Box), see Fig. 4

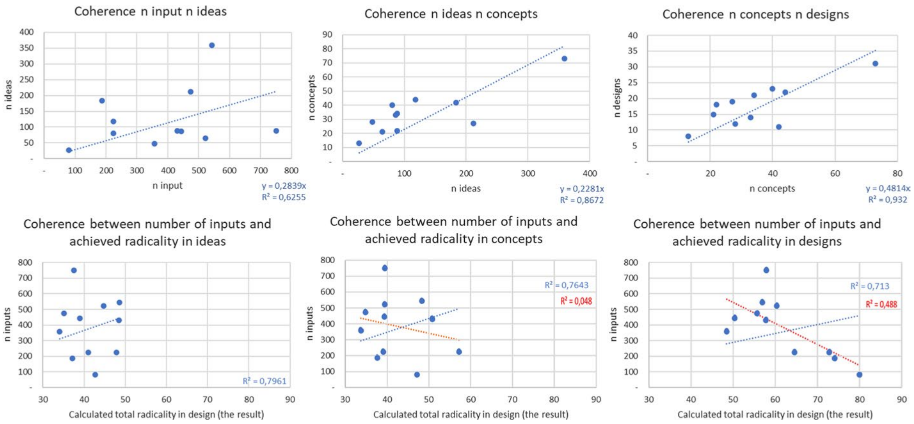


Fig. 9 The coherence between the number of inputs and the number of ideas, concepts, and designs (upper graphs), as well as the number of inputs, compared to the calculated achieved radicality in the finished result by designs (lower graphs)

with a number of other relevant people for creating input for the given challenge. In , Fig. 7 the number of inputs, ideas, concepts, and designs appears as a function of the number of team members. Although the number of workshop participants for input creation is not recorded, a significant correlation is seen between the number of team members and the number of created inputs.

> **Finding 2:** *The team size in the innovation projects influences the number of outputs; more team members, more output measured on numbers.*

It is often argued in the creativity literature that many ideas are needed to get one good, radical idea. Our data from Rosetta (Fig. 9) also shows that a higher number of inputs gives a higher number of ideas, and a higher number of ideas gives a higher number of concepts, leading to a higher number of finished designs.

The average μ of created ideas (second step) of the conducted records is 123 with a standard deviation σ of 95,58. On average, 1.52 inputs are associated with each idea, primarily relating to similar and supplementary input, to a lesser extent as being inspirational, relating to something that describes the same area. This is also connected to the form, where input is created for the time of the relationship, and the addition of knowledge for inspiration is rarely realized.

A weak correlation is seen (Fig. 8) between the number of inputs created and the resulting ideas created. At the same time, Fig. 8 shows a correlation between the number of inputs associated with a given idea and the radicality achieved in the outcome. Despite the number of associated inputs to ideas being relatively limited, a clear connection is seen. The process of associating input to stimulate and inspire ideas during their elaboration matters. Finally, Fig. 8 shows that the main weight of green and incremental ideas emerges despite a basic desire for all projects and radical innovation and disruption. It can thus be said that by working with radical innovation, a large number of ideas for incremental innovation emerges as a beneficial side benefit.

> **Finding 3***: If inspiration from other inputs is used to elaborate on each specific idea the degree of radicality increases significantly.*

This leads to an assumption that an idea management system can significantly improve the degree of radical innovation output, that systematically and automatically presents more and other sources of inspiration in the idea forming and elaboration stage. In addition, this is in line with what is set out in Fig. 9 regarding the more inputs, the more ideas, the more ideas the more concept, and the more concepts the more designs (top figures in Fig. 9). In relation to the process of looking for the average of radicalness of the ideas by looking at the coefficient of determination, it is, on the other hand, not immediately possible to document from our data in Rosetta that many inputs result in a higher degree of ideas for radical innovation, on the contrary, nor is it possible to say the opposite applies.

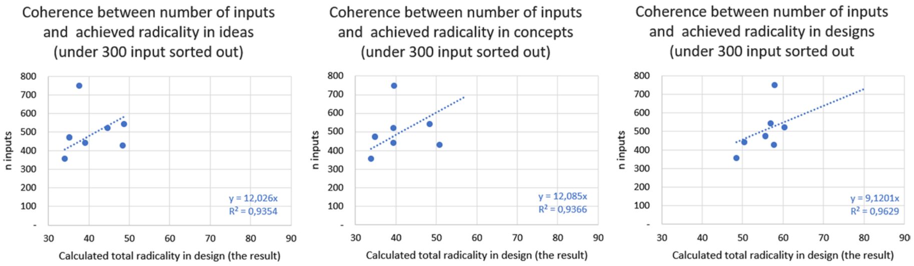


Fig. 10 The coherence between the number of inputs compared to the calculated achieved radicality in the finished result by designs than those with less than 300 created input is sorted from (4 projects)

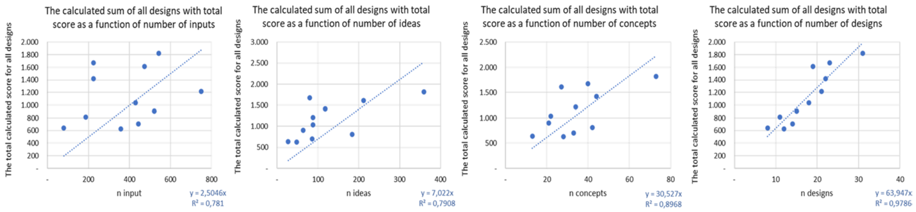


Fig. 11 The coherence between the number of inputs, ideas, concepts, and designs, compared to the total sum of the calculated achieved radicality in the finished result by designs

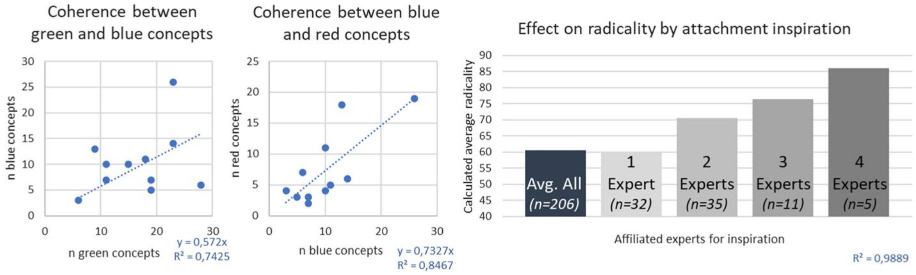


Fig. 12 At the concept level, the correlation between green and blue concepts (no 1) is shown, as well as the correlation between blue and red concepts (no 2) is shown according to C-Box, see Fig. 4. Figure no 3 shows the achieved average radicality only for the concepts where 1, 2, 3, or 4 experts or sources of inspiration have been associated

From Fig. 9, there is no significant correlation between the numbers of created inputs and the obtained score regarding radicalness. In Fig. 10, those projects with less than 300 created inputs are sorted from, and, as a result of this, there is a correlation between created input and obtained degree radicalness.

> **Finding 4***: A high number of ideas does not necessarily contribute to better and more radical innovation, but it contributes to more ideas and concepts (Figure 9). However, the lack of correlation must be seen comparatively with the huge variation in the number of inputs. If the projects with less than 300 input are sorted out (4 of the 11 projects, see Figure 10), the correlations between created input and obtained radical innovation are significant (). However, a project with less than 300 input seems also to perform well, but only related to design (result), which is a challenge as this part is related to the connected inspiration (see Figure 12).*

Creating many ideas should, therefore, not be a goal in itself but the focus should be based on the ideas created as well as the treatment of each idea and concept with added inspiration.

Looking at the total 'Capital' as the sum of the calculated radicalness value in all designs, an increasing coherence between numbers and total radicality is seen over the various steps (Fig. 11).

> **Finding 5***: In unraveling the data, we see some but not a significant correlation between the number of created inputs and finally achieved total radicality—we*

> *cannot unconditionally conclude that more inputs result in a more radical outcome. A stronger correlation is seen between the number of ideas and the finally achieved radicality, and an even stronger correlation between the number of concepts and the final radicality achieved. Finally, there is a significant correlation between the number of designs and the total radicality achieved in the designs. The pattern is reinforced further in the process, where the total radicality of the entire potential (defined as 'Idea Capital') increases when there are more ideas, concepts, and designs.*

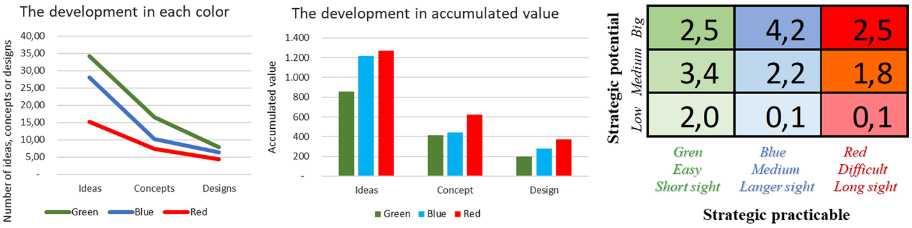
The average μ of created concepts (third step) of the conducted projects is 34 with a standard deviation σ of 16,00. On average, 0,73 external inspirations sources have been connected to each concept as a source for new action.

It can be seen from Fig. 12 that there is a connection between green and blue concepts, just as there is a stronger connection between blue and red defined from the C-box. More gives more. When adding experts as a person of knowledge or a source of inspiration, the measured radicality is increasingly significant.

> **Finding 6***: When experts in the domain or sources for inspiration concerning experts from other domains covering the same principle are related to a concept, the degree of radicality increases significantly. This effect even increases markedly and significantly when the number of associated experts increases*

Our data thus shows that it makes sense (in some contexts) to work with radical innovation (search for red ideas and concepts) as this implicitly results in more blue concepts, and blue results in greener (incremental) concepts. Adding new aspects to the concepts step provides a significantly increased radicality and seems to be extremely effective. Such aspects could be a person with huge knowledge in the new area of the concept or an area, where the fundamental principle in another domain is explored and used with success. This has similarity to described in Triz (Altshuller, 1999).

The average μ of created designs (fourth step) of the conducted projects is 18 with a standard deviation σ of 6,55. The average of ideas, divided by color, falls for all colors from the idea phase to the design phase. Input is not included in this calculation as colors do not appear specifically in this phase. However, the drop is less from concept to design than from idea to concept. There are correspondingly more green results than



Strategic potential	Green Easy Short sight	Blue Medium Langer sight	Red Difficult Long sight
Big	2,5	4,2	2,5
Medium	3,4	2,2	1,8
Low	2,0	0,1	0,1

Strategic practicable

Fig. 13 The evolution of the number of green, blue, and red results over the three of four phases in Rosetta (left), in the middle, added with the SIP and C-Box value, and on the right, the average number of designs for all projects divided by SIP Portfolio

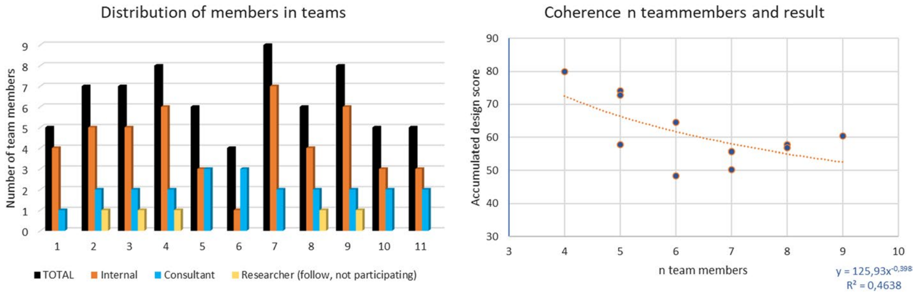


Fig. 14 The teams' composition of employees and consultants (left) and team size as a function of the final result (right)

blue and again red results at all levels, but the number is added with the calculated value set up at SIP (see Fig. 4), as illustrated in the figure in the middle of Fig. 13. This focused on SIP with conscious prioritization thus has the effect that the extent of resulting especially blue and green concepts, consciously or unconsciously, is just greater (the figure on the right in Fig. 13).

> **Finding 7**: *The data unraveling shows a strong tendency toward ideas being processed against the defined expectations as "you get what you measure". A strong indication of radicality in the SIP portfolio provides a markedly influence on the innovation process toward a more radical goal and a tendency to follow those with the highest potential.*

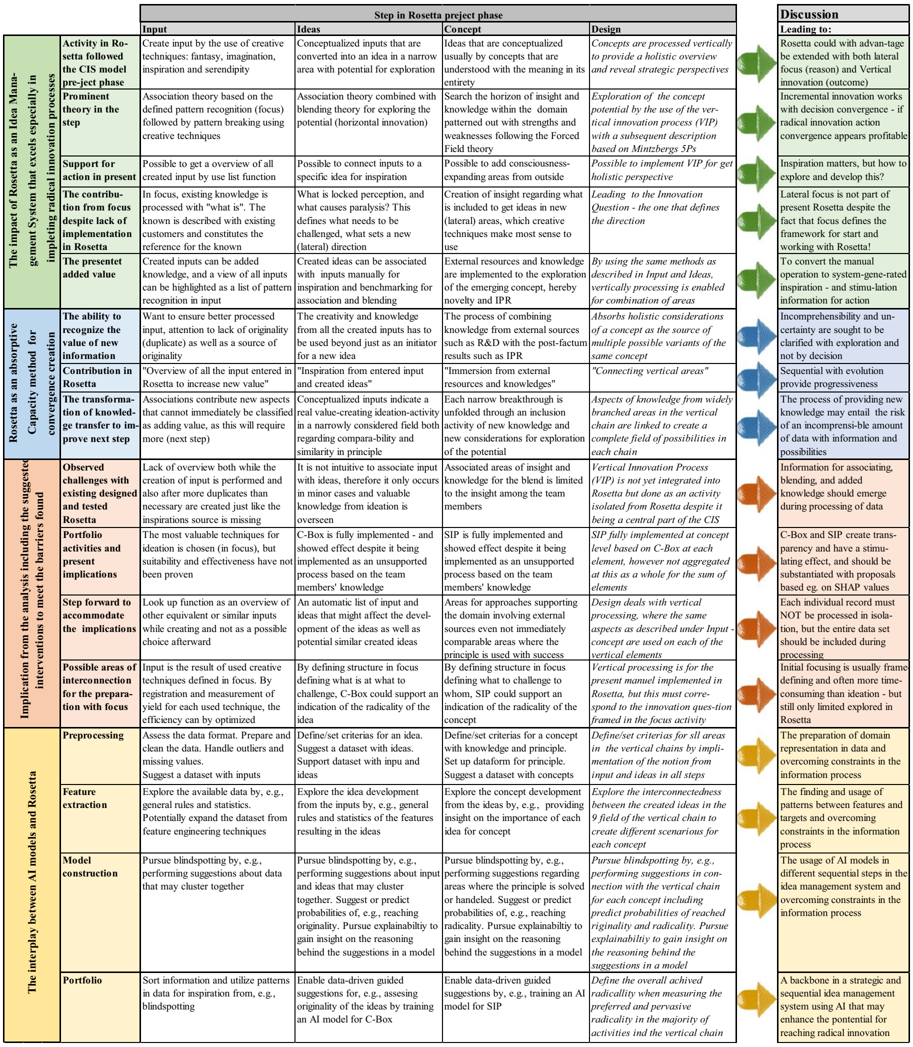
All projects in this analysis are completed following the CIS model (Brix & Jakobsen, 2013) and the phases described in this model's Pre-ject. For all projects in the analysis, the projects have been completed by establishing teams with members from the company or organization in question, respectively, innovation consultants. The distribution can be seen in Fig. 14, just as indicated here were the following (non-participating) consultants. It is not a requirement or prerequisite for the implementation of CIS or the use of Rosetta that it is teamwork, but this has been the situation in the vast majority and all projects in the present analysis. The teams are established before the start of the project and follow the entire process, including the phase before the pre-project phase (lateral focus) regarding the entire task processing. When comparing team size as a function of the resulting score, a smaller decrease in effect is seen as the larger the group becomes. This corresponds to the results, i.e., shown by Laughlin, Silver and Boh (2006).

> **Finding 8**: *Group size seems to be favorable for the number of created ideas but does not seem to have a favorable effect on the creation of ideas for radical innovation—quite the opposite for larger groups. A good group size seems to be 3–5/6 persons.*

Discussion

It is both a strength and a source of overlooking potential errors that all authors of this paper, in their way, are familiar with Rosetta and the comprehensive CIS method. This is as a process consultant/facilitator, an associated researcher, or a participating expert. However, this also provides the ability to characterize Rosetta as an Idea Management

Table 3 Summary of key points



		Step in Rosetta preject phase				Discussion
		Input	**Ideas**	**Concept**	**Design**	**Leading to:**
The impact of Rosetta as an Idea Management System that excels especially in impleting radical innovation processes	**Activity in Rosetta followed the CIS model pre-ject phase**	Create input by the use of creative techniques: fantasy, imagination, inspiration and serendipity	Conceptualized inputs that are converted into an idea in a narrow area with potential for exploration	Ideas that are conceptualized usually by concepts that are understood with the meaning in its entirety	*Concepts are processed vertically to provide a holistic overview and reveal strategic perspectives*	Rosetta could with advan-tage be extended with both lateral focus (reason) and Vertical innovation (outcome)
	Prominent theory in the step	Association theory based on the defined pattern recognition (focus) followed by pattern breaking using creative techniques	Association theory combined with blending theory for exploring the potential (horizontal innovation)	Search the horizon of insight and knowledge within the domain patterned out with strengths and weaknesses following the Forced Field theory	*Exploration of the concept potential by the use of the vertical innovation process (VIP) with a subsequent description based on Mintzbergs 5Ps*	Incremental innovation works with decision convergence - if radical innovation action convergence appears profitable
	Support for action in present	Possible to get a overview of all created input by use list function	Possible to connect inputs to a specific idea for inspiration	Possible to add consciousness-expanding areas from outside	*Possible to implement VIP for get holistic perspective*	Inspiration matters, but how to explore and develop this?
	The contribution from focus despite lack of implementation in Rosetta	In focus, existing knowledge is processed with "what is". The known is described with existing customers and constitutes the reference for the known	What is locked perception, and what causes paralysis? This defines what needs to be challenged, what sets a new (lateral) direction	Creation of insight regarding what is included to get ideas in new (lateral) areas, which creative techniques make most sense to use	*Leading to the Innovation Question - the one that defines the direction*	Lateral focus is not part of present Rosetta despite the fact that focus defines the framework for start and working with Rosetta!
	The presentet added value	Created inputs can be added knowledge, and a view of all inputs can be highlighted as a list of pattern recognition in input	Created ideas can be associated with inputs manually for inspiration and benchmarking for association and blending	External resources and knowledge are implemented to the exploration of the emerging concept, hereby novelty and IPR	*By using the same methods as described in Input and Ideas, vertically processing is enabled for combination of areas*	To convert the manual operation to system-gene-rated inspiration - and stimu-lation information for action
Rosetta as an absorptive Capacity method for convergence creation	**The ability to recognize the value of new information**	Want to ensure better processed input, attention to lack of originality (duplicate) as well as a source of originality	The creativity and knowledge from all the created inputs has to be used beyond just as an initiator for a new idea	The process of combining knowledge from external sources such as R&D with the post-factum results such as IPR	*Absorbs holistic considerations of a concept as the source of multiple possible variants of the same concept*	Incomprehensibility and uncertainty are sought to be clarified with exploration and not by decision
	Contribution in Rosetta	"Overview of all the input entered in Rosetta to increase new value"	"Inspiration from entered input and created ideas"	"Immersion from external resources and knowledges"	*"Connecting vertical areas"*	Sequential with evolution provide progressiveness
	The transformation of knowledge transfer to improve next step	Associations contribute new aspects that cannot immediately be classified as adding value, as this will require more (next step)	Conceptualized inputs indicate a real value-creating ideation-activity in a narrowly considered field both regarding compara-bility and similarity in principle	Each narrow breakthrough is unfolded through an inclusion activity of new knowledge and new considerations for exploration of the potential	*Aspects of knowledge from widely branched areas in the vertical chain are linked to create a complete field of possibilities in each chain*	The process of providing new knowledge may entail the risk of an incomprensi-ble amount of data with information and possibilities
Implication from the analysis including the suggested interventions to meet the barriers found	**Observed challenges with existing designed and tested Rosetta**	Lack of overview both while the creation of input is performed and also after more duplicates than necessary are created just like the inspirations source is missing	It is not intuitive to associate input with ideas, therefore it only occurs in minor cases and valuable knowledge from ideation is overseen	Associated areas of insight and knowledge for the blend is limited to the insight among the team members	*Vertical Innovation Process (VIP) is not yet integrated into Rosetta but done as an activity isolated from Rosetta despite it being a central part of the CIS*	Information for associating, blending, and added knowledge should emerge during processing of data
	Portfolio activities and present implications	The most valuable techniques for ideation is chosen (in focus), but suitability and effectiveness have not been proven	C-Box is fully implemented - and showed effect despite it being implemented as an unsupported process based on the team members' knowledge	SIP is fully implemented and showed effect despite it being implemented as an unsupported process based on the team members' knowledge	*SIP fully implemented at concept level based on C-Box at each element, however not aggregated at this as a whole for the sum of elements*	C-Box and SIP create transparency and have a stimulating effect, and should be substantiated with proposals based eg. on SHAP values
	Step forward to accommodate the implications	Look up function as an overview of other equivalent or similar inputs while creating and not as a possible choice afterward	An automatic list of input and ideas that might affect the development of the ideas as well as potential similar created ideas	Areas for approaches supporting the domain involving external sources even not immediately comparable areas where the principle is used with success	*Design deals with vertical processing, where the same aspects as described under Input - concept are used on each of the vertical elements*	Each individual record must NOT be processed in isolation, but the entire data set should be included during processing
	Possible areas of interconnection for the preparation with focus	Input is the result of used creative techniques defined in focus. By registration and measurement of yield for each used technique, the efficiency can by optimized	By defining structure in focus defining what is at what to challenge, C-Box could support an indication of the radicality of the idea	By defining structure in focus defining what to challenge to whom, SIP could support an indication of the radicality of the concept	*Vertical processing is for the present manuel implemented in Rosetta, but this must correspond to the innovation ques-tion framed in the focus activity*	Initial focusing is usually frame-defining and often more time-consuming than ideation - but still only limited explored in Rosetta
The interplay between AI models and Rosetta	**Preprocessing**	Assess the data format. Prepare and clean the data. Handle outliers and missing values. Suggest a dataset with inputs	Define/set criterias for an idea. Suggest a dataset with ideas. Support dataset with inpu and ideas	Define/set criterias for a concept with knowledge and principle. Set up dataform for principle. Suggest a dataset with concepts	*Define/set criterias for sll areas in the vertical chains by implimentation of the notion from input and ideas in all steps*	The preparation of domain representation in data and overcoming constraints in the information process
	Feature extraction	Explore the available data by, e.g., general rules and statistics. Potentially expand the dataset from feature engineering techniques	Explore the idea development from the inputs by, e.g., general rules and statistics of the features resulting in the ideas	Explore the concept development from the ideas by, e.g., providing insight on the importance of each idea for concept	*Explore the interconnectedness between the created ideas in the 9 field of the vertical chain to create different scenarious for each concept*	The finding and usage of patterns between features and targets and overcoming constraints in the information process
	Model construction	Pursue blindspotting by, e.g., performing suggestions about data that may cluster together	Pursue blindspotting by, e.g., performing suggestions about input and ideas that may cluster together. Suggest or predict probabilities of, e.g., reaching originality. Pursue explainabiltiy to gain insight on the reasoning behind the suggestions in a model	Pursue blindspotting by, e.g., performing suggestions regarding areas where the principle is solved or handeled. Suggest or predict probabilities of, e.g., reaching radicality. Pursue explainabiltiy to gain insight on the reasoning behind the suggestions in a model	*Pursue blindspotting by, e.g., performing suggestions in connection with the vertical chain for each concept including predict probabilities of reached riginality and radicality. Pursue explainabiltiy to gain insight on the reasoning behind the suggestions in a model*	The usage of AI models in different sequential steps in the idea management system and overcoming constraints in the information process
	Portfolio	Sort information and utilize patterns in data for inspiration from, e.g., blindspotting	Enable data-driven guided suggestions for, e.g., assesing originality of the ideas by training an AI model for C-Box	Enable data-driven guided suggestions by, e.g., training an AI model for SIP	*Define the overall achived radicallity when measuring the preferred and pervasive radicality in the majority of activities ind the vertical chain*	A backbone in a strategic and sequential idea management system using AI that may enhance the pontential for reaching radical innovation

Source: Own line-up

system (Nilsson et al., 2002) and recognize the value of Rosetta as an absorptive capacity system related to the 11 radical innovation projects conducted from 2012 to 2018. In this regard, the Rosetta system used in the innovation projects, can be characterized as an active, internal idea management system (Mikelsone et al., 2022a, 2022b). In Table 3 below, we have summarized the study's key findings and implications.

From Finding 1, we see convergence can be achieved, even though decisions are not included, but new aspects and possibilities are added, there narrowing is achievable, thus action convergence. Similarly, Findings 2 and Findings 3 show that there is a correlation between the number of ideas and achieved radicality especially when there are created more than 300 inputs. However, the general correlations between created input and the measured radicality in isolation are not significant and not unambiguous. This is unraveled in the analyses in three areas: (1) findings 3 shows that those ideas inspired by other inputs of the creation present a significantly higher performance regarding radicality;

(2) from Findings 6, it can be seen that adding knowledge and inspiration to the principle in the concept has significant importance for performance. Finally (3) it can be seen from Findings 7 that seeking and substantiating the effect of work concerning radicality is important for the process regarding performing more radicality (Jakobsen et al., 2008). These three elements are currently manually entered based on the existing knowledge (ordinary intelligence) among the team members into Rosetta without the use of systematization and automated functions in the program—or else the analysis shows the effect. It indicates great potential for automation and systematization of such functions.

Table 3 illustrates the exemplification of considerations for each step of previous realizations and the basis of Rosetta unity with opportunities using AI for the four sequences step of the Rosetta Pre-ject phase, being the input-, idea-, concept- and design step—but also with correlation to the lateral focus phase and Pro-ject phase to adapt the entire process (Mikelsone et al., 2022a). The summary described in Table 3 includes the discussion for each area of the presented Rosette software system as an Ide Management system, as an absorptive capacity method with implications related to the special structure, and finally the information stream related to actions both in the presented and as considerations for a future version.

It is well-known that AI advantages are involved in various ways in existing and future versions of absorptive capacity systems to provide better decision support, limit uncertainty, and target its efforts. The unique feature of Rosetta, with the extension of the previous development of the system, is not to limit or minimize uncertainty or create a basis for decision (O'Connor & Rice, 2013)—rather the opposite, where it is proposed to establish more unknown factors and more significant uncertainty to create a basis for the association- and blending theory that is so crucial for seeking and working with radical innovation (Jakobsen & Gertsen, 2022). This is based on the basic assumption of working with a radical innovation that more significant uncertainty in the process being treated results in less uncertainty in the final result, often described based on these proverbs, such as "make mistakes, but do it quickly", "it's not just about doing it right but doing the right thing right", etc.

As a systematic structure, this is arranged through an action-based structure. In that sense, Rosetta presents a new framework for handling progress without decision but by implementing qualified handling (acting) and achieving convergence. Action convergence and decision convergence are related concepts but focusing on different aspects of the process of reaching agreement. Action convergence focuses on the process of aligning actions towards and common goals, while decision convergence focuses on the process of reaching a shared decision or agreement. Theoretically, action convergence is related to play theory, and decision convergence is related to game theory. Overall, both theories contribute to a useful framework for understanding and analyzing social interactions and decision-making processes. Therefore, the information to provide information has another structure and another purpose than often seen in the absorptive capacity as the goal is not, as usual, to converge towards a decision or towards a solution, but rather to contribute with information that can lead to inspiration, association and blending possibilities within areas, where the framework is still often defined quite broadly (Funnell & Rogers, 2011). When structuring your data and information approach, the challenge here is to ensure that there is no overflow of information and opportunities despite the presence of even substantial amounts of data. This is a classic situation that is often solved by providing methods and routines that can bring the amount of data down to a manageable level. With the current system (Rosetta), the opposite is sought, even with supplementation with more data and arguments to better implement actions. The art is not to limit the Rosetta algorithm, but to provide and structure data in such a way that it appears relevant to the individual via the communication they have with the system (von Krogh, 2018).

As an absorptive capacity focusing on the innovation capacity realized in the Idea Management System Rosetta provides two aspects:

1: A system to gathering and process new information, being able to understand, and be able to make use of information and knowledge partly internally (from registered) and partly externally (from other sources).

2: A system assimilating power to ensure that retrieved knowledge both via source (data) and process (additions) contributes in an organized way to make it possible to absorb opportunities specifically appropriated to the individual (learning system) and without an overflow of opportunities.

Implications

In its current form, Rosetta may appear as a relatively simple registration system of entering, adding images and descriptions, relating input to ideas, seeing possibilities of concepts, etc. However, in this study, we demonstrate that Rosetta provides a structure for managing the information and, as a result, provides a strategic tool for increasing the absorptive capacity for an enhanced chance of reaching radical innovation. Moreover, we briefly discuss the prospects of implementing AI in the next version of Rosetta as a way to overcome the challenges the analysis indicates with existing Rosetta as well as explore the manufactured opportunities—and how explainability may be supported to enhance the reasoning from the model, hence explainable AI (XAI). Rosetta treats three central areas inscribed as elements (but not yet unfolded) with the possibilities that lie in the use of AI:

- Explore the digital availability of the information that may enhance absorptive capacity.
- To take action by classifying radicalities from C-box and SIP, utilize available data for each specific input, idea, concept, and design.
- Develop a framework that supports the explainability of the given classification of radicality.

Developing an AI model is traditionally an iterative process between preprocessing, feature selection, and model construction (Duda et al., 2001), which also applies to exploring an AI model for Rosetta (see Table 3). A test of, e.g., performance may follow these steps (Duda et al., 2001). Preprocessing refers to deciding on purpose and preparing the data, e.g., data formats (structured or unstructured), handling outliers, the impact of a missing value, and considering the sample size (to avoid overfitting). Feature selection refers to deciding on relevant information, which can be done manually (as in Rosetta) or with the machine's assistance that relates to classical statistics. Data discretization may also be considered for, e.g., simplifying a model. The data set is then split into a training- and test set (e.g., using 90% of the data for training), each containing the features of interest (Duda et al., 2001). Model construction refers to both model selection and -training for reaching the decision or action based on knowledge about the features, e.g., calculating the probability of being a radical idea if knowing *'Patent?=No', 'Is_addition_to_existing_concept?=Yes'* and *'Seen_elsewhere=No',* etc. The model is only trained on our training data for learning the patterns in data (Duda et al., 2001). When trained, and depending on a given decision threshold, the AI model now allows a classification based on knowledge provided by the features, such as suggesting *'the probability of the idea being radical is 10%. From a decision threshold of 50%, the idea is not classified as radical'.*

While our suggested model uses available information to increase the absorptive capacity from different features to assess radicality, we may need to assess how well this new model can be trusted in terms of classifying correctly. We, therefore, seek to validate the model in, e.g., cross-validation, which provides us with an estimate of the generalized error the model performs (Duda and et al., 2001). If a model performs perfectly, we may need to consider the possibility of having an overfitted model—potentially from a small sample size. On the other hand, if the model performs poorly, we may need to revisit the different steps of developing a model, e.g., re-assessing how we represent the information in the data set, tuning a model differently, or deciding on using another model type. Conclusively, we use the test set to simulate *the real world* and assess how well the model may assist our purpose. In this context, popular methods for XAI, e.g., the SHapley Additive exPlanations (SHAP) (Lundberg & Lee, 2017) waterfall or force plots, share, to our knowledge, overseen fundamental principles with existing strategic management systems, such as forcefields. The SHAP method enables an assessment of feature contribution to the classification of radicality, such as suggesting that *'Seen_elsewhere=No'* increases the probability of being radical, whereto *'Patent?=No'* and *'Is_addition_to_existing_concept?=Yes'* decreases the probability of being radical, given an AI model. In all, SHAP supports explainability by visualizing the feature importance for reaching a 10% chance of being radical in the AI model, which we seek to utilize for Rosetta. Table 3 illustrates sequences of the innovation process using Rosetta and how the iterative steps of developing an AI model may overlap with different phases.

Conclusion

At the beginning of the study, we staged the following research question: *What can we learn from analyzing data from 11 radical innovation portfolios, and what are the implications for innovation management research from these findings?* Our exploration and unraveling of these data have led to following insights and findings:

– In absorptive capacity, the use of an Idea Management System is most often seen as the ability to target and manage internally and externally provided knowledge through transformative learning (Volberta et al., 2010; Brix, 2019). Most often, this deals with learning processes for decision or decision support activities. In contrast, Rosetta presents a model without the possibility of creating a decision, without the possibility of merging ideas, and without the possibility of any reconciliation of ideas' value, suitability, relevance, etc. Despite this approach for creating inspiration and knowledge for the pursuit of an opportunity, the analysis shows that the number of possibilities of the step-by-step process for the creation of radicality, despite the omission of absorptive capacity key areas regarding decision support, converge. This convergence is a surprise and unexpected (Jakobsen, 2021).

- There is a certain correlation between the number of inputs created, and the radicality achieved, but primarily when working with more than 300 inputs. On the other hand, the analysis shows a significant effect on radicality when more input is connected to an idea as inspiration.
- When working on creating more radicality, there is a strong indication in the present analysis that the use of inspiration activity is extremely effective.
- Our analysis indicates that team sizes of 3–5/6 might perform best, while the radicality can decrease with larger group sizes.
- To increase the transparency and interpretability in Rosetta portfolio models is implemented. This use of a portfolio model show that the defined definition markedly influences the work with ideas and concept in the portfolio models. Consciously working towards the creation of radical innovation with the most significant possible potential influences the process of complying with this wish.
- Rosetta contributes to key elements as a more recent contribution to exploiting the potential in the area of adaptive capacity and innovative capacity, where uncertainty is processed with the support of inspiration, new knowledge, or indication of potential opportunities as opposed to removing challenges to reduce uncertainty.

The exploitation of Rosetta shows solid indications for the implementation of inspiration sources related to the created (in the first steps) and external knowledge of sources for inspiration based on mapping the principle of the concept. Here, we see a beneficial use of AI for handling a relatively large amount of data and the many relationships, for categorizing the field of possibilities within association possibilities, blending possibilities, and the supply of new knowledge to stimulate action (Fauconnier et al., 2008; Jakobsen & Gertsen, 2022). This has its justification in the 'law on variety' concerning the sentence that "only variety can destroy variety". Radical innovation contains in its definition a significant degree of uncertainty due to many unknown factors in its form, which is why decisions without knowledge do not make sense (sabotages radical innovation) but only allow realization by removing variety by adding new knowledge, new inspiration, experimenting, and trying to get ahead. This is a completely different discipline that Rosetta primarily aims to deal with in two ways:

- As inspiration activity in each step, continuously processed proposals are provided for similar entries, inspiring entries, challenging entries, and other areas, where this has been solved and where new inspiration or knowledge can be supplemented. Nevertheless, the type and form should be different in the different steps as both the uncertainty and needs are different in the different steps, starting with creating an overview (pattern) of the created followed by more and more implementation of external knowledge, e.g., from patents, similar areas and areas processing the same principle.
- Supported indication of radicality (C-box and SIP) with the indication of likely placement in the portfolio model based on the data described in the individual record

combination data from the initial problem/challenge treatment (in the CIS model called Lateral focus). This has not yet been tested or implemented in Rosetta but will be strong, as the analysis has shown that this is partly favorable for deeper processing of the individual record, and parts can even be of great importance for determining the direction of the naturally occurring convergence.

Abbreviation

AI	Artificial Intelligence

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Author contributions

HSJ is the lead author and is responsible for getting data access. HSJ made the first draft of the methodology, data analysis, and presentation of results. RSJ is responsible for the discussion and AI integration and made the first draft of this. JB is responsible for the first draft of the introduction and the first draft of the theoretical background. All authors have contributed equally to the revision of the manuscript.

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Availability of data and materials

The data set analyzed during the current study is not publicly available due to confidentiality agreements made with the companies we collaborated with.

Declarations

Competing interests

The authors declare that they have no competing interests.

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