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Strategic Problem-Solving: a state of the art

Abstract

Strategic Problem-Solving is a relevant skill in business, widely used to identify problems and find inherent solutions to stop, avoid or mitigate such problems. The literature revolving around problem-solving has been enriched over the years with several theories and approaches. Problem-solving is critical in helping maintain a successful business and look at problems as objectively and modestly as possible. This systematic literature review aims to summarize the current state of the art on the topic of strategic problem-solving. To this end, we performed a bibliometric analysis based on data retrieved from the Web of Science database. The analysis allowed us to identify five different clusters on the theme of problem-solving, namely i) product development and open innovation; ii) organization and firm-customer relationship; iii) creative process and resilience; iv) learning, skills, and work environment; and v) partnership negotiation/cooperation and the role of supply chain and quality management. These clusters are distinct yet complementary to each other, a trait that was possible to observe when common top papers from each cluster were selected for further discussion. Lastly, a shift in the topics of research from past to present was observed which might be related to the emergence of new theories and the turnover of authors. The growing number of recent publications reveals the value of this research and suggests that problem-solving will always have room for improvement.

Keywords: business, economics, learning, management, open innovation, organization, partnership, problem-solving, product development, supply chain, systematic literature review

1. Introduction

Every day, the common citizen faces problems that need to be solved. No matter the social, occupational, or financial status, all of us need, at some point, to decide the course of action to a problem and deal with the decisions and their consequences. Additionally, our lives are often affected by huge global challenges (climate change, war, pandemics, financial instability) that are out of our reach. The solutions and decisions for these challenges are usually taken by superior entities (such as the Government and specific authorities), and their consequences might have direct and indirect impacts on the day-to-day lives of millions of people.

Problem-solving is a process divided into 4 main steps: i) problem definition; ii) cause identification; iii) solution prioritization and selection and iv) solution implementation (1,2). The skill of problem-solving is a trait very much appreciated and recognized at a global level. Specifically, this competence is highly relevant to 21st-century business leaders who are systematically searching for potential employees capable of performing such a request (3). Problem-solving is critical in helping maintain a successful business and look at problems objectively and modestly as possible (4).

This systematic literature review aims to summarize the current state of the art on the topic of strategic problem-solving by performing a bibliometric analysis. The article was divided into different sections, with a first contextualization of the basic concept of the problem and the related problem-solving theories. The methods inherent to the bibliometric analysis are detailed in the

research methodology section, followed by the analysis of the results obtained. Afterward, these findings are discussed, finally allowing us to draw some conclusions from it (5).

2. From the basic concept of problem to the problem-solving-relating theories

Bransford and Stein defined that “a problem exists when there is a discrepancy between an initial state and a goal state, and there is no ready-made solution for the problem solver” (6). Problem-solving is used to identify and describe a problem and find solutions to solve it. For this reason, new inventions are constantly being developed, enabling the evolution of social and cultural dimensions, and supporting market-based economies (1).

The strategic problem-solving process was associated with several theories and components throughout time, supporting different methodologies (1,4,6–16). For instance, in the 1940s, Genrikh Altshuller invented the *Teoriya Resheniya Izobreatatelskikh Zadatch* / Theory of Inventive Problem Solving (TRIZ) (9), an approach based on the assumption that a similar problem has already been solved. Hence, the same principle could be applied to the current problem at hand (10). Later, in 1984, the IDEAL approach was created (13). IDEAL stands for Identify, Define, Explore, Act, and Look and Learn and is one of the most popular problem-solving methods used in business and academic settings to help different learners identify the problem and generate an adequate solution. Recently, Pereira *et al.*, developed the Pereira Problem solving framework to address business and management problems by adopting scientific management practices (4).

Improving the quality of processes is also a critical tool in long-term business success, allied to proper strategic problem-solving can dominate all kinds of competitors. In this context, the Total Quality Management (TQM) theory emerged in the 1980s as a framework for implementing and managing quality improvement activities at a general organizational level (14,17). However, TQM's success was only modest due to the lack of commitment and involvement, inadequate use of statistical methods, and the adoption of general objectives and focus on training rather than technical education (17). On the other hand, another quality-related theory is Six Sigma, mostly applied to identify and solve problems related to a manufacturing or business process (11). This philosophy was also developed in the 80s by Bill Smith, a Motorola engineer, and seems to be far more successful than TQM, mostly because it focuses on projects that positively impact the business's financial performance (17). In addition, the Eight Discipline (8D) is also among the quality improvement popular methodologies and is a cogent theory designed to find out the root causes of a problem, aiming to implement a bullet-proof solution that prevents the recurrence of the identified problem (15,16). Its origins are traced back to the Second World War by the US Government and later by the Ford Company (1987) (18).

3. Research methodology

3.1 Problem Formulation

As a starting point for this project, a literature research question was formulated: *What is the current state of the art of strategic problem-solving in the field of business, management, and economics?*

3.2 Data Collection

For the bibliometric analysis, data collection was performed from the Web of Science (WoS) database. Other databases were not incorporated to minimize duplications of publications. An initial broad search was conducted on the 27th of June 2022, using the search term “problem solving” without further limitations, returning 66,759 results.

Next, the authors defined clearly the most suitable search terms that would fit the topic. The search terms included were a variation of “problem solving” with the keywords “business”, “management” and “strategy”. The search was performed in all fields. The final string was defined as:

*((ALL=(business + "problem solving")) OR ALL=(management + "problem solving"))
OR ALL=(strategy + "problem solving")*

The search was also refined by document type (articles or proceedings papers), category (business, management, or economics), and language (English). The final search returned a total of 2,642 entries.

3.3 Data Evaluation

The evaluation step of the data collection consisted of testing one batch of randomly selected articles (n=5) per category (meaning that a total of 3 batches were tested) to see the relevance of this research. For this, the random function available in Excel was applied to the dataset. A summary of the selected sample is presented in **Table 1**.

Table 1 - Validation of data collected by category.

Category	Reference	Summary
Business	(19)	In the context of team creation, a process of continually solving creative problems, the authors proposed a three-phase idea selection approach: classification, evaluation, and discussion/final decision.
	(20)	The authors introduce recovery as a relevant antecedent of creativity. One of the highlights of this research is that the reflection on how to solve problems outside working hours seems to generate more novel ideas.
	(21)	The authors developed the SFM Method (Solution Finder Model), a procedure meant to be applied during interactions in multidisciplinary groups to collaboratively develop high-quality solutions in a short period.
	(22)	Studying differences in expectation levels of future negotiation interaction showed that buyers and sellers with higher expectations predominantly use a problem-solving bargaining style.
	(23)	This research described the steps to construct a customer’s expectations map and how to use its findings as problem-solving guides.

Management	(24)	The authors tested and validated the hypothesis that having complement knowledge, its proper allocation, and knowing the allocation of resources are critical for problem-solving competency.
	(25)	A round table article discusses what is required to excel in analytics education, a field seeking to develop an interactive problem-solving approach by merging theory and real-life data.
	(26)	In the context of managing complex conflicts between police sergeants and a subordinate or a superior, the authors studied the effectiveness of behavioral components of forcing <i>versus</i> problem-solving.
	(27)	In this case study, the authors analyzed cross-generational knowledge transfer, revealing that it requires co-creation and transformation of knowledge. This approach improves teamwork and problem-solving, coordination, planning, and communication.
	(28)	This study showed that the reform of mechanical professional practice teaching allowed the achievement of several objectives, including developing the student's problem-solving ability.
Economics	(29)	The authors performed a comparative analysis of conflict handling styles between Western managers and Asian managers. The results showed that the first tends to use forcing and problem-solving strategies more than the latter.
	(30)	This research aimed to elaborate a methodological approach to import substitution in industry, mainly to develop a toolkit for problem-solving.
	(31)	The paper elucidated the skills and abilities of crisis managers of microbusinesses. Managerial skills were shown as one of the most relevant, being crucial for resilience, independent problem-solving, flexibility, and financial management.
	(32)	The authors focused on the government's policy problem for detecting illegal logging. This problem was firstly solved for social optimal royalty and auditing levels and, afterward, by examining a revenue-neutral reform toward this benchmark.
	(33)	The first study showing that exposure to economics training improves both analytic skills and problem-solving.

3.4 Analysis and Interpretation

The first step was to analyze and summarize the data from all the 2,642 documents. The analysis included the type of publications, annual track, and geographical and institutional distribution.

Next, the authors evaluated the literature references using the software tool VOSviewer, which grants the construction and visualization of bibliometric networks (34). This tool allows obtaining

different sets of data according to the type of analysis with its corresponding unit and the counting method. **Table 2** shows the analysis performed. Additionally, the most relevant terms were analyzed using text data from the documents, namely the title, and abstract. A VOSviewer thesaurus file was used to perform data cleaning, which allowed merging different variants of an item (i.e., merging keyword synonyms, spelling differences, and abbreviations, an author name, an organization name, a country name, or a cited reference).

Table 2 - Selected analysis on VOSviewer.

Type of Analysis	Unit of Analysis	Counting Method
Citation	Sources	-
Bibliographic coupling	Authors	Fractional Counting
Co-citation	Cited Sources	Fractional Counting

4. Results and Analysis

4.1 Broad analysis

From the universe of 2,642 documents, the majority were published as journal articles (73% versus 27% of conference papers). The temporal distribution of the selected sample depicted in **Figure 1** shows that strategic problem-solving in the fields of business, management, or economics is not a recent subject, as the oldest documents date from 1963. In this particular year, 3 papers were published on this topic, all containing problem-solving in the actual title (35–37). However, the boom of this research started 3 decades ago, in 1992, when 23 documents were published. Since then, the area has been growing, with 2021 being the year with the highest number of available documents (193), a trend that might be overcome in 2022.

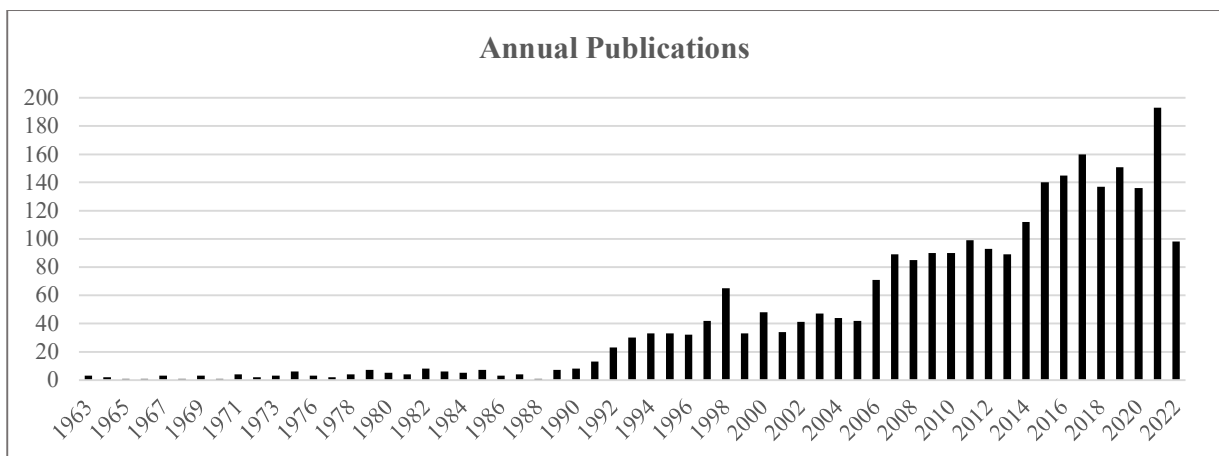


Figure 1 – Temporal distribution of publications.

Regarding geographical distribution, the analysis was performed in VOSviewer and considered all countries from all institutions involved in each document (**Figure 2**). The United States of America (USA) contributed to more than 25% (n=862) of the total publications, a volume far greater than

the second country, England, which authored 261 documents (around 8% of all publications). In terms of institutions, it is not surprising that most of the top 10 publishing institutions are from the USA. American institutions occupy positions 1 (Harvard University), 2 (Massachusetts Institute of Technology), 4 (Texas A&M University), 6 (University of Illinois), 7 (New York University), 9 (The Pennsylvania State University), and 10 (University of Michigan) (**Figure 3**). Other countries represented in this top are the Netherlands (the University of Amsterdam, in 3rd place), Hong Kong (the City University of Hong Kong in 5th place), and Australia (The University of Queensland in 8th place).

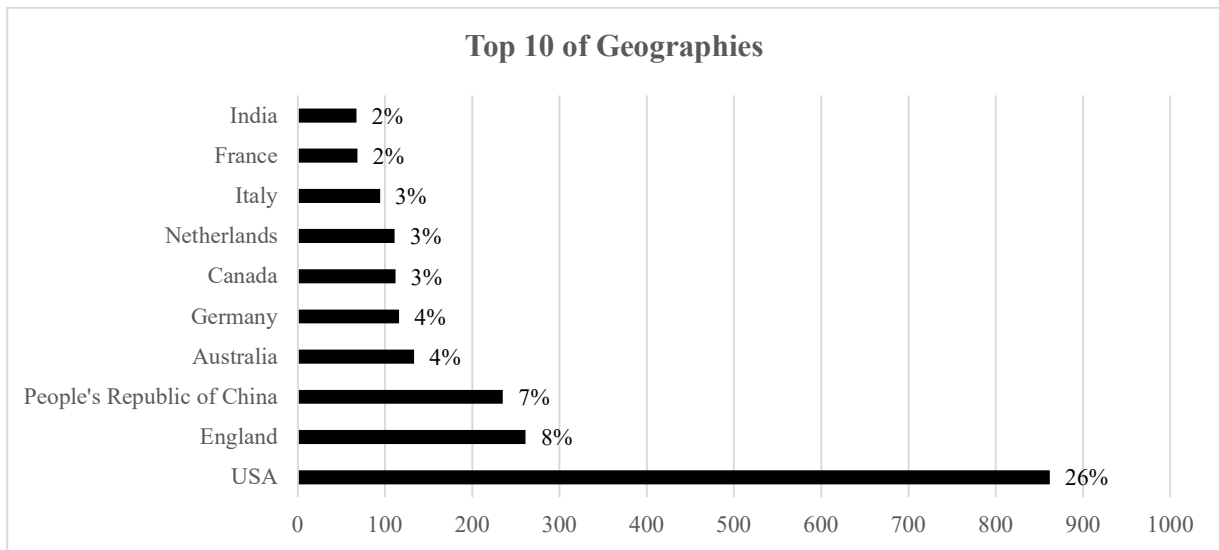


Figure 2 – Geographical distribution of documents.



Figure 3 – Top publishing organizations.

4.2 Bibliographic coupling of authors

A search of the most relevant authors was conducted using VOSviewer software. **Figure 4** represents an overlay visualization of a bibliographic coupling network of authors, allowing not

only the identification of the relatedness of authors based on the number of references they share but also top publishing authors and the ones with more recent publications. This analysis was performed with the fractional counting method, meaning that the weight of each bibliographic coupling link is fractional. A minimum number of 3 documents per author was set.

This approach retrieved a total of 89 authors (of 5893 authors), of which only 87 are connected and represented in **Figure 4**. This bibliographic coupling analysis shows that authors spatially close to each other tend to cite the same publications, which means that both Michael D. Mumford and Guido Conaldi used to cite differently than the remaining researchers. Additionally, larger circles represent authors that have more publications than the ones displayed in smaller circles. Hence, the top identified authors are Carsten K.W. de Dreu, with 9 publications on conflict management; Michael D. Mumford, authoring 8 publications regarding leadership skills and John L. Graham, that published 6 papers on the cultural influence on negotiations.

As an overlay visualization, the map also gives information on scores, in this case, the average publication year of each author. Authors colored in yellow have more recent publications than the ones colored in blue. Additionally, while the top authors have an average publication year before 2006, recent publications are from Hillie Aaldering, with 4 publications on leadership and conflict between 2020 and 2022, and Andrea Furlan and Ambra Galeazzo, that co-authored 4 articles regarding organizational learning between 2017 and 2021.

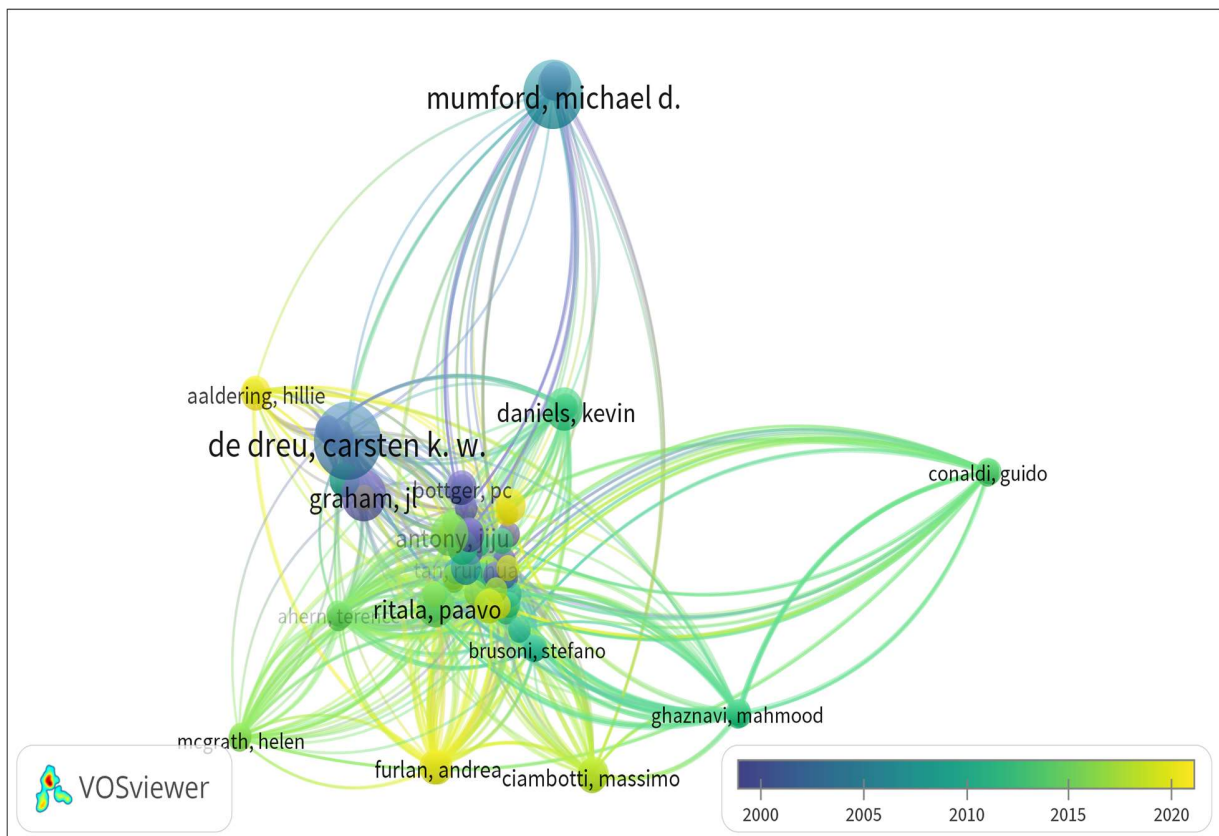


Figure 4 – Overlay visualization map of bibliographic coupling of authors.

4.3 Top publishing sources & co-citation network

Regarding the document's sources, a density visualization map was first generated to identify the top publishing journals. This type of map allows the visual identification of dense areas (represented in yellow) and, in this case, the journals with more published documents. The approach involved selecting journals with at least 15 documents. From a total universe of 920 sources, only 32 journals fit this criterion, 31 of which were linked. **Figure 5** represents this analysis and allows to identify the top 3 publishing journals, namely, European Journal of Operational Research (44 documents), Organization Science (37 documents) and Journal of Business Research (35 documents).



Figure 5 – Density visualization map of publishing sources.

The construction of a co-citation network of sources has a similar methodology to the one previously used for the bibliographic coupling network of authors. A threshold of 20 citations for each source was defined, returning a total of 657 cited sources from a universe of 33490. The network visualization map is shown in **Figure 6**, where each journal is represented by a circle, with different sizes reflecting the number of citations for that specific source. Once again, the degree of relatedness is higher for closer journals in terms of co-citations. The analysis allowed the identification of 6 clusters, each one with a specific area of study: a) Red Cluster, with 171 journals publishing studies on management and social sciences (eg. Journal of Personality and Social Psychology; Journal of Applied Psychology; Cognition & Emotion and Academy of

of 10 occurrences, and only 60% of the most relevant terms are represented. Using this approach, a total of 667 terms was obtained.

In **Figure 7**, each term is a circle whose size is related to the number of publications it appears in their title or abstract (38). Since VOSviewer supports the visualization of bibliometric networks as a form of distance-based maps, a smaller distance between two terms means a higher relatedness between them and that these terms tend to co-occur frequently. The analysis returned 5 clusters, 3 of which are evidenced and unified, namely: the Red Cluster, with 241 terms related to problem-solving in product development and open innovation (business problem, theory of inventive problem, decision maker, strategic decision, scientific method; problem solving; solution; product; open innovation); the Green Cluster, containing 135 terms linked with problem-solving at the organization level and the firm-customer relation (competitive advantage, conflict management, performance; firm; organization; customer; managerial positions; conflict; moderation); and the Yellow Cluster, comprised of 108 terms related problem-solving in learning, skills, and work environment (school, education, communication skills, learning; job; work environment). Although the Blue Cluster, related to problem-solving in the creative process and resilience (team, creative process, facilitator, meeting, crisis, co-creation, resilience), has 1 additional term relative to the Yellow Cluster, it seems to be more scattered around the map than the latter. This fact is also valid for the Purple Cluster, which only has 74 terms included regarding problem-solving in partnership negotiation/cooperation and the role of supply chain and quality management (suppliers, trust, manufacturer, supply chain management, quality management, project management, buyer-supplier relationship, continuous improvement).

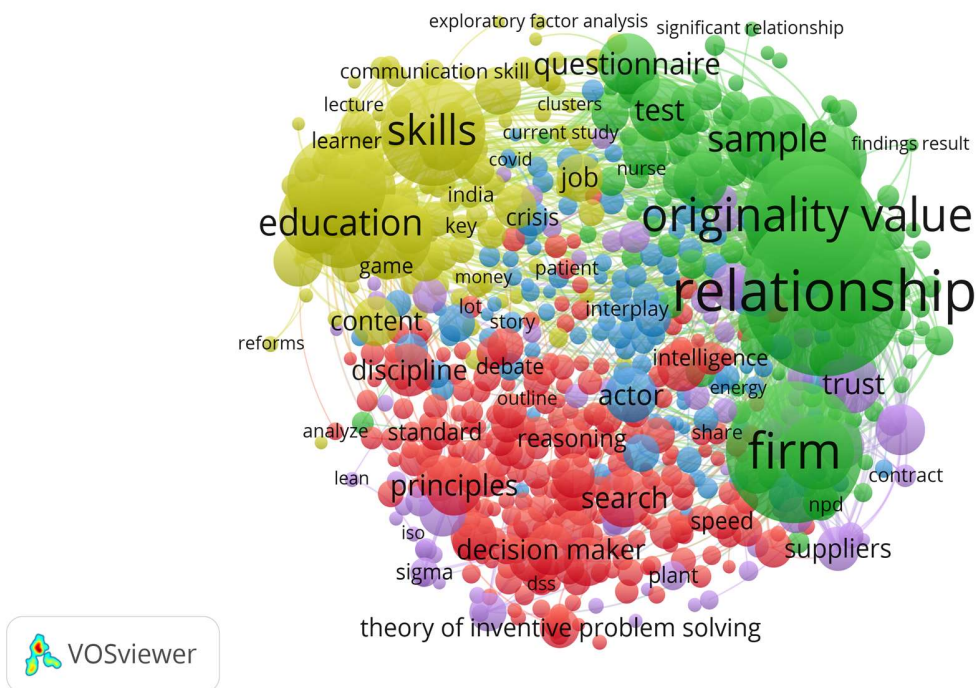


Figure 7 - Network visualization map of co-occurrence of terms.

Within each cluster, the authors selected the top 5 documents based on the highest number of citations and links (**Table 3**) to further analyze regarding main theories and findings. The details of each document are presented in the Discussion section. Due to the complementary nature of the clusters, it is possible that the same document is presented in different clusters.

Table 3 – Top 5 relevant documents from each cluster.

Cluster	Reference	Number of citations*	Links	Related terms in title and abstract
Red – problem-solving in the context of product development and open innovation	“Sticky Information” and the Locus of Problem Solving: Implications for Innovation (von Hippel, 1994) (39)	1725	46	diffusion; location; problem solver; technical problem
	Product Development: Past Research, Present Findings, and Future Directions (Brown and Eisenhardt, 1995) (40)	1855	24	product development
	Understanding dynamic capabilities (Winter, 2003) (41)	2147	20	product development
	Marginality and Problem-Solving Effectiveness in Broadcast Search (Jeppesen and Lakhani, 2010) (42)	568	36	heuristics; search; solver
	Crowdsourcing as a Solution to Distant Search (Afuah and Tucci, 2012) (43)	565	32	crowd; crowdsourcing; search
Green - problem-solving at the organization level and at firm-customer relation	“Sticky Information” and the Locus of Problem Solving: Implications for Innovation (von Hippel, 1994) (39)	1725	46	firm
	Determinants of Innovative Behavior: A Path Model of Individual Innovation in	2494	20	antecedents; individual problem; moderating effect; perceptions;

	the Workplace (Scott and Bruce, 1994) (44)			relationship; workplace
	A knowledge-based theory of the firm - The problem-solving perspective (Nickerson and Zenger, 2004) (45)	694	67	conflict; firm
	Product Development: Past Research, Present Findings, and Future Directions (Brown and Eisenhardt, 1995) (40)	1855	24	customer
	Understanding dynamic capabilities (Winter, 2003) (41)	2147	20	dynamic capabilities; firm
Blue - problem-solving in the context of the creative process and resilience	Product Development: Past Research, Present Findings, and Future Directions (Brown and Eisenhardt, 1995) (40)	1855	24	team member
	Sharing Meaning Across Occupational Communities: The Transformation of Understanding on a Production Floor (Bechky, 2003) (46)	870	18	conceptualization; ground
	Demography and Design: Predictors of New Product Team Performance (Ancona and Caldwell, 1992) (47)	983	13	team member
	When Collections of Creatives Become Creative Collectives: A Field Study of Problem Solving at Work (Hargadon and Beckhy, 2006) (48)	604	21	collection; conversation; creative process; moment
	Value co-creation in knowledge intensive business services: A dyadic perspective on	414	14	co-creation; value creation

	the joint problem-solving process (Aarikka-Stenroos and Jaakkola, 2012) (49)			
Yellow - problem-solving in the context of learning, skills, and work environment	Demography and Design: Predictors of New Product Team Performance (Ancona and Caldwell, 1992) (47)	983	13	pressure; teamwork
	The Situated Nature of Adaptive Learning in Organizations (Tyre and von Hippel, 1997) (50)	315	21	pressure; learning
	Cognitive Fit: An Empirical Study of Information Acquisition (Vessey and Galletta, 1991) (51)	334	12	skills
	When problem solving prevents organizational learning (Tucker, Edmondson and Spear, 2002) (52)	145	12	learning; job
	Computer-Mediated Collaborative Learning: An Empirical Evaluation (Alavi, 1994) (53)	431	3	collaborative learning; college; communication technology; higher education; job; learning process; lecture; pedagogy; status; students; university suppliers
Purple - problem-solving in the context of partnership negotiation/cooperation and the role of supply chain and quality management	Product Development: Past Research, Present Findings, and Future Directions (Brown and Eisenhardt, 1995) (40)	1855	24	
	Characteristics of partnership success: Partnership attributes, communication behavior, and conflict resolution techniques	1576	16	joint problem; manufacturer; partnership; trust

(Mohr and Spekman, 1994) (54)			
Crowdsourcing as a Solution to Distant Search (Afuah and Tucci, 2012) (43)	565	32	suppliers
The Shadow of the Future: Effects of Anticipated Interaction and Frequency of Contact on Buyer-Seller Cooperation (Heide and Miner, 1992) (55)	742	22	ambiguity; information exchange; suppliers
Consumer Trust, Value, and Loyalty in Relational Exchanges (Sirdeshmukh, Singh and Sabol, 2002) (56)	1811	6	trust

*According to the WoS database.

Next, using the overlay visualization map of the same terms allowed the analysis of the trend of topics studied. For this, the authors selected a time frame between 1992 (the boom year) and 2021, allowing a better definition. The map obtained is represented in **Figure 8**. This evaluation tactic revealed a shift relative to the topics studied between the oldest and most recent documents. Specifically, the terms used in 1992 are poorly represented in the overlay visualization map (**Figure 8** displays practically no dark blue circles), indicating the shift in the trend of topics studied. At the early beginning of the 21st century, documents contained terms related to quality, management, and decision support systems (light blue circles). Most of the terms were used averagely after 2010 (the yellow circles representing topics related to organizational management, relationships, learning, and skills), while the recent ones (orange and red circles) concern values, strengths, and limitations, and, as expected, pandemic-related keywords.

observed, since only 89 out of 5893 authors have more than 3 publications, of which only 87 are connected. Surprisingly, the top publishing author is not from an American organization, as expected from the higher number of publications derived from the USA. Carsten De Dreu is a full professor in Social and Organizational Psychology at Leiden University and has 9 publications on the topic of conflict management between 1998 and 2012. Nevertheless, the remaining authors on this top are from American universities, namely The University of Oklahoma (Michael D. Mumford) and The University of California (John L. Graham). However, none of these authors are on the top of the ones with more recent publications. Authors publishing recent publications are shown in yellow, with articles ranging from 2017 to 2022, in contrast to top publishing authors, displayed in blue circles (older publication).

Regarding sources, the European Journal of Operational Research takes the lead on the top of publishing journals, contributing 44 documents for the sample. This European journal is closely followed by an American journal, Organization Science which is not only the most cited journal in the sample (2220 citations) but also the number one source of the most relevant documents (**Table 3**). Moreover, the search for relevant terms in the documents' title and abstract allowed the identification of 5 clusters with concepts revolving around problem-solving, namely i) product development and open innovation; ii) organization and firm-customer relationship; iii) creative process and resilience; iv) learning, skills, and work environment; and v) partnership negotiation/cooperation and the role of supply chain and quality management. The top papers from each cluster will be further discussed in the upcoming sections. Lastly, an analysis on the trend of topics revealed a shift from 1992 to 2021 that could be related to emergent theories and to the turnover of authors. In line with the current world situation, pandemic-related keywords represent the most recent terms.

5.1 Red cluster – problem-solving in the context of product development and open innovation

The first cluster identified, the red cluster, includes terms mostly related to problem-solving in product development and open innovation. Product development is required to generate new products, which consequently comprises the basis of competition for several firms (60). As so, it is not surprising that most of the top published documents of this cluster emphasize the utility of problem-solving in product development. For instance, von Hippel (1994) addresses the fact that the information used by technical problem solvers is often “sticky”, meaning that this information is costly to acquire, transfer and use in a new location (39). The author explored four patterns in the distribution of technical, innovation-related problem-solving that can be affected by information stickiness. The first and simpler pattern is that if the information required is held at one locus, the problem-solving activity will tend to take place at that site. The next level is when more than one locus of sticky information is required. This scenario implies the iteration on the locus of problem-solving activity along the process. However, if the costs of iteration are high, 2 new patterns might emerge: i) either the problem will be divided into subproblems that only require sticky information from one locus or ii) an investment will be done to “unstick” or reduce the stickiness of information. On this pattern, the author further suggests that the investment should be made based on the frequency at that the information is a candidate for transfer (39).

The work developed by Brown and Eisenhardt also focuses on the successful development of products. Based on an empirical literature review, a synthesis of research findings was translated into a model of factors inherent to the success of product development (40). The literature was divided into three main perspectives, namely the rational plan (a sweeping view of product development), the communication web (a narrow field centered on internal and external communication), and the problem-solving perspective. The latter was considered to give a more deeply focused view of the product development process, providing an effective execution of the rational plan perspective (40). Hence, the authors differentiate between process performance and product effectiveness and the effect that the behavior of several functions and roles have on the outcomes (detailed in the associated clusters).

The product development process is also at the essence of Winter's note to understand dynamic capabilities (41). New product development requires capabilities associated with a patterning of activities which typically involves costly investments. Sustaining a pattern approach in new product development implies, for instance, the continuity of technical personnel, facilities, and equipment. The author argues that a choice must be made between the development of dynamic capabilities and the "ad hoc problem solving" which, compared to the first one is not a routine, not highly patterned, and not a repetitious process (41).

Other top documents included in the Red cluster aimed to study the use of external solvers by organizations to solve internal research and development (R&D) problems (42). In this work, Jeppesen and Lakhani addressed the process of "broadcast search" problem-solving, meaning that companies disclose the details of specific problems and invite external participants (the solvers) to create a solution. Results showed that unexpected individuals – those on the margins – tended to find faster a winning solution, showing a positive relation to an increasing distance between the solver's field and the problem's field (42). By showing the value of openness (i.e. disclosing problems) in eliminating basic barriers to entry of marginal individuals, this research contributed to the literature of open and distributed innovation. The finding of technical marginality might suggest that the best way to solve problems is to have experts with complementary yet different backgrounds. The last top document of this cluster follows this topic of open search and is a 2012 paper authored by Afuah and Tucci on the improvement of problem-solving's efficiency and effectiveness through crowdsourcing, the act of outsourcing a task to a crowd rather than an agent in the form of an open call (43). The authors focus on the question of "when" is crowdsourcing a better mechanism for solving problems than the alternatives of internal solving or recruiting specific contractors to solve the problem. Results show that under certain circumstances (characteristics of the problem, the knowledge required for the solution, the crowd, and the solutions to be evaluated), crowdsourcing transforms distant search into local search, enabling firms to take advantage of the many benefits of distant search without the associated costs (43).

5.2 Green cluster – problem-solving at the organization level and the firm-customer relation

As previously stated, the Green cluster includes organizational-related terms as well as the firm-customer relationship. The von Hippel sticky information theory (39) described in the Red cluster is also a relevant document in the Green cluster. In this context, information stickiness might affect several issues including the protection of commercially important secrets and the specialization of

firms. Regarding the first one, the author points out that conducting problem-solving at remote sites does not always mean that trade secrets will be compromised, since that, if necessary, a legal arrangement can be made. However, if the work performed outside the firm is just a small portion not revealing the whole product, these legal precautions might not be required. Additionally, there are some instances when the innovation in work does not need secrecy because it is bound to a protected product/service/process. Regarding patterns of specialization among firms, the author suggests that firms seeking to economize within the transfer of sticky information will seek to align their organizational boundaries and specializations with the segmentations dictated by critical innovation-related problem-solving tasks (39).

Within the innovation theme, Susanne Scott and Reginald Bruce highlighted, also in 1994, the role of innovation in the sustainability of organizations, developing and testing a model of individual innovative behavior in the work context of an R&D facility (44). The study was based on the identification of determinants that could influence innovative behavior through climate perceptions, namely at the level of leadership, individual attributes, and work-group relations. Specifically, the authors found that leadership, support for innovation, managerial role expectations, career stage, and systematic problem-solving style were significantly associated with individual innovative behavior. Furthermore, the proposed model explained almost 37% of the variance in this specific behavior (44). The study represents a substantial finding at the time of the publication, providing a first attempt at modeling the complex phenomenon of individual innovative behavior.

Furthermore, the accumulation and protection of critical knowledge and capability is relevant on the firm's capacity to turnover inputs into valuable outputs (61). In 2004, Nickerson and Zenger developed a knowledge-based theory of the firm focusing on the efficiency of alternative organizational forms to create knowledge or capability, independent of transaction cost logic and its behavioral assumption of opportunism (45). The proposed theory addresses some available literature's shortcomings based on the efficiency of hierarchy in economizing on knowledge exchange. The theory also assists in the selection between the two different knowledge-based explanations for the existence of firms, the one claiming their existence to economize on knowledge transfer (62–64) and the one that argues that firms facilitate knowledge transfer (65–68). In this context, the authors suggest three distinct governance choices for a manager in supporting knowledge formation: markets, authority-based hierarchies, and consensus-based hierarchies (45). This theory is one of the pioneers that simultaneously treat the boundary choice and the choice among alternative internal approaches to organizing, connecting the knowledge-based advantages and disadvantages of both markets and hierarchy to the desired knowledge formation.

On the other hand, the role of customers and customer satisfaction is also evidenced in this cluster. For instance, Brown and Eisenhardt's literature collection suggests that customer involvement in the development of products seems to improve the product's concept effectiveness (40). The last relevant document of this cluster is related to the nonconsensual concept of dynamic capabilities. In this regard, Winter gives a brief note aiming to reduce the mystery around this term, firstly defining it as those capabilities "that operate to extend, modify or create ordinary capabilities"

(41). Dynamic capabilities are often associated with earning competitive advantage over other firms (69) but also with organizational change. For instance, these higher-order capabilities can govern the rate of change of ordinary capabilities (70), defined as those capabilities that only allow the firm to “make a living” (41). However, Winter goes beyond this notion and suggests that it is possible to change without having a dynamic capability, proposing the term “ad hoc problem solving” which, contrary to the dynamic capability, is not a routine, not highly patterned, and not repetitious (41). The author finally suggests that the creation of dynamic capabilities is dependent on costs and benefits associated with the necessary investment relative to the use of an ad hoc problem-solving solution.

5.3 Blue cluster – problem-solving in the context of the creative process and resilience

The value of a team is mainly associated with its power to translate ideas and concepts into actual work that will give benefits. So, this term is critical in the process of problem-solving since the team is the one responsible for executing the process. Having this in mind, it is not surprising that “team member” is the second most common term in the Blue cluster and that the top literature emphasizes its role. For instance, in 1993, Ancona and Caldwell investigated the impact of diversity on team performance (47). Both functional and tenure diversity positively influence team performance at their own pace. The first is linked with an increase in external communication which also increases the managerial ratings of innovation. The latter was associated with an improvement in the clarification of group goals and setting priorities. However, diversity was also found to get in the way of teamwork performance (47), a trait that will be further discussed in the Yellow Cluster.

The work developed by Brown and Eisenhardt centers the project team at the heart of the proposed model of factors inherent to the success of product development (40). Specifically, the authors argue that the project team’s composition, group process, and work organization affect the information, resources, and the team’s problem-solving style will ultimately influence process performance (40).

On a broader aspect of the term “team”, Bechky showed, in 2003, how knowledge is shared in organizations through the transformation of working communities’ situated understandings of their work (46). The author links misunderstandings of different professional category roles (engineers, technicians, and assemblers) to overcome difficulties by cocreating common ground that transforms their understanding of the product and the production process. The final and most valuable outcome of this approach is the generation of a richer understanding of the product, the production process, and the problems that an organization face (46). In 2006, the same author and Hargadon introduced a model to explain the occasional shift in the locus of creative problem-solving, from the individual to the interactions of a collective (48). Based on observations of work, interviews, informal conversations, and archival data, the proposed model allowed the authors to identify four activities that combined appear to contribute to precipitate moments of collective creativity, namely help seeking, help giving, reflective reframing, and reinforcing (48). Later, in 2012, Aarikka-Stenroos and Jaakkola produced a work on the collaborative process of value co-creation in knowledge-intensive business services (KIBS) (49). KIBS are professional organizations such as IT and R&D services and technical, legal, financial, and management

consulting (71) that prioritize knowledge's accumulation, creation, or dissemination to provide a customized service or solution that satisfies the specific needs of a specific client (72). The article provides a framework depicting value co-creation between supplier and customer occurring through a dyadic problem-solving process, with several activities including diagnosis needs, designing and producing solutions, organizing the process and resources, managing value conflicts, and implementing the solution. This framework is intended to function as an auxiliary tool helping with the decision of managerial processes, namely on the selection of critical resources and roles for both suppliers and customers, facilitation of joint activities, and resources' optimization (49).

5.4 Yellow cluster – problem-solving in the context of learning, skills, and work environment

The Yellow cluster refers to problem-solving in learning, skills, and the work environment. On the first subject, Maryam Alavi studied, in 1994, the usefulness of a group decision support system in a computer-mediated collaborative learning (CMCL) process on the enhancement of student learning and evaluation of the classroom experience (53). The study was performed with MBA students, and the main results showed that they had more positive affective reactions to the CMCL process compared to the manual collaborative learning process. Overall, this group perceived higher levels of skill development, learning, and interest in learning and had a more positive evaluation of the classroom experience and the group learning activities relative to other students (53).

At an organization level, Tyre and von Hippel explored, in 1997, the nature of adaptive learning, assessing for this the process of problem-solving involving new production equipment during early factory use (50). In this study, adaptation is a situated process since different organizations contain different kinds of clues about the underlying issues, own different resources for generating and analyzing information, and evoke different assumptions on the part of problem solvers. The authors further suggest improving traditional adaptive learning and collaboration theories having in mind that learning occurs through people interacting in multiple contexts (50). However, the disadvantages of problem-solving in learning are also present in the top documents. For instance, in 2002, Tucker, Edmondson, and Spear proposed that research on problem-solving behavior can provide critical insight into mechanisms through which organizations resist learning and change (52). This work was specifically carried out with nurses, whose job is involved several moments of problem-solving, and showed that overcoming immediate obstacles and ignoring opportunities for change and learning provides an unexplored source of resistance to organizational change. The authors identified implicit heuristics that govern the nurses' problem-solving behaviors and suggest the presence of cognitive, social, and organizational factors inherent to these heuristics, hence preventing organizational change and improvement (52).

Ancona and Caldwell's work on the impact of diversity on team performance do produce internal processes and external communications that further facilitate performance (47), as stated in the Blue cluster. However, a shortcoming of diversity was identified that directly impedes performance, namely the implementation phase because there is less capability for teamwork than there is for homogeneous teams. Strategies to overcome these challenges do not necessarily pass by simply changing the structure of teams. The authors suggest that, at the team level, training and

facilitation in negotiation and conflict resolution may be necessary whereas at the organizational level, there might be the need to protect the team from external political pressures (47).

Notwithstanding the value of the term “learning” and its associated words (learning process, learner, collaborative learning, active learning) in the Yellow cluster, “skills” was, in fact, the term with the highest number of occurrences. Consequently, the term is also represented in the top published documents of this cluster. For instance, when investigating the connection between problem representation and task type in the acquisition of information (51) Vessey and Galletta (1991) observed that MBA students’ performance towards problem-solving improved for symbolic tasks when the problem representation matched the task and when specific problem-solving skills were matched to the problem representation and the task. However, these improvements were small compared with the effects of cognitive fit, meaning that the way a solver represents a problem must be considered in the context of the task at hand. The authors suggest that efforts should be concentrated on determining the characteristics of the tasks to be addressed by the problem solvers, and on the support of those tasks with relevant representations and support tools (51).

5.5 Purple cluster – problem-solving in the context of partnership negotiation/cooperation and the role of supply chain and quality management

The Purple cluster focuses on problem-solving in supply chain and quality management as well as in the negotiation/cooperation process of partnerships among firms. One of the cluster’s top published documents is the previously mentioned work from Brown and Eisenhardt that also involved suppliers in their model of product development (40). The extensive use of supplier networks is one of the top management practices effective for fast, efficient product development (60,73,74). The authors defend that extensive involvement of the supplier network at the early stages of product design might reduce the complexity of the project, consequently creating a faster and more productive process of product development.

The role of suppliers is also highlighted in the work performed by Afuah and Tucci regarding crowdsourcing (43). The authors suggest that some factors favoring crowdsourcing might also favor the contracting of a designated supplier to perform problem-solving tasks when there is a need to conduct a distant search. For instance, within the characteristics of the problem, the increase in the ease of delineation and transmission favors the use of either crowdsourcing or suppliers. Moreover, pervasiveness and low cost in the context of information technology also favor both conditions (43).

Partnership formation among firms is sometimes a required move to maintain a competitive advantage (75,76). Additionally, the term “trust” was found to be the most frequent word in this cluster and is linked with the success of partnerships, highly related to the willingness to collaborate (77) and better management of stress situations displaying greater adaptability (78). Mohr and Spekman address the topic of understanding for the first time the necessary characteristics associated with a successful partnership (54). The study was conducted using vertical partnerships between manufacturers and dealers and the results suggested that the main features inherent to partnership success include i) partnership attributes of commitment,

coordination, and trust; ii) communication quality and participation and iii) the conflict resolution technique of joint problem-solving. This research offered the first insight into proactively managing a successful partnership, reaping the benefits, and avoiding damaging costs related to its failure (54). In 2002, Sirdeshmukh, Singh, and Sabol developed a framework aiming to understand the main behaviors and practices of service providers in building or depleting consumer trust as well as the mechanisms associated with the conversion of consumer trust into value and loyalty in relational exchanges (56). A tripartite view of trustworthiness evaluations along operational competence, operational benevolence, and problem-solving orientation dimensions was supported by the results obtained.

Continuing on relationship grounds, the effect of anticipated interaction and frequency of contact on buyer-supplier potential cooperation domains (flexibility, information exchange, shared problem-solving, and restraint in the use of power) was analyzed in 1992 by Heide and Miner (55), a paper that is also highlighted in the Purple cluster. The authors go beyond the traditional development of trust and commitment between parties as precursors of cooperation. The use of an iterated game framework allowed the authors to find that the chances for cooperative behavior in all domains will increase by the degree of open-endedness of a relationship, the frequency of contact, and, unexpectedly, performance ambiguity (55).

6. Conclusions

Problem-solving is at the heart of different types of organizations and it is a hot topic for top managers and front-line technicians. Herein, an overview of the state of the art in strategic problem-solving is presented through a systematic literature review. Although there is a predominance of American organizations on this topic, Europe institutions are also leaving their footmarks in problem-solving, showed in the number one publishing author and source. The analysis carried out allowed the identification of five different clusters on the theme of problem-solving, which are also complementary to each other, a trait that was possible to observe in the selection of common top articles for different clusters. Lastly, a shift in the topics of research from past to present was observed which might be related to the emergence of new theories and the turnover of authors. The growing number of recent publications reveals the value of this research and suggests that problem-solving will always have room for improvement.

7. References

1. Sharma M, Sharma S, Sahni S. Structured problem solving: combined approach using 8d and six sigma case study. *Engineering Management in Production and Services* [Internet]. 2020;12(1):57–69. Available from: <https://doi.org/10.2478/emj-2020-0005>
2. Riesenberger CA, Sousa SD. The 8D methodology: An effective way to reduce recurrence of customer complaints? In: *WCE 2010 - World Congress on Engineering 2010*. 2010.
3. de Fruyt F, Wille B, John OP. Employability in the 21st century: Complex (interactive) problem solving and other essential skills. Vol. 8, *Industrial and Organizational Psychology*. 2015.

4. Pereira L, Santos R, Sempiterno M, da Costa RL, Dias Á, António N. Pereira problem solving: Business research methodology to explore open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*. 2021;7(1).
5. Cooper HM. Scientific Guidelines for Conducting Integrative Research Reviews. *Rev Educ Res* [Internet]. 1982 Jun 1;52(2):291–302. Available from: <https://doi.org/10.3102/00346543052002291>
6. Bransford JD, Stein BS. *The IDEAL problem solver*. 2nd Edition. Freeman WH, editor. New York; 1993.
7. Hayes JR. *The complete problem solver*. *The Complete Problem Solver*. 2013.
8. Bransford J, Sherwood R, Vye N, Rieser J. Teaching thinking and problem solving: Research foundations. *American Psychologist*. 1986;41:1078–89.
9. Altshuller G. *And Suddenly the Inventor Appeared: TRIZ, the Theory of Inventive Problem Solving*. Technology. 1996.
10. Kaushik SK v. *Innovative Business Management Using TRIZ: TRIZ for Non-Manufacturing Professionals*. Quality Press; 2018.
11. Gardner MM, Forrest III WB. Implementing Six Sigma: Smarter Solutions Using Statistical Methods. *Technometrics*. 2000;42(3).
12. Esaki K. Common Management Process Model of New TQM Based on the Situation Analysis. *Intell Inf Manag*. 2016;08(06).
13. Bransford JD, Stein BS. The ideal problem solver: A guide for improving thinking, learning, and creativity. *Open J Soc Sci*. 1984;2(2).
14. Tobin LM. The New Quality Landscape: Total Quality Management. *Journal of Systems Management*. 1990;41(11).
15. George A, Ranjha S, Kulkarni A. Enhanced problem solving through redefined 8D step completion criteria. *Qual Eng*. 2021;33(4).
16. Rambaud L. *8D structured problem solving: A guide to creating high quality 8D reports*. Phred Solutions; 2006.
17. Montgomery DC, Woodall WH. An overview of six sigma. Vol. 76, *International Statistical Review*. 2008.
18. Elangovan S, Jusoh MS, Muhd Yusuf DH, Ismail MS, Hj Din MS. 8D Problem Solving Methodology: Continuous Improvement in Automation Organization. In: *Journal of Physics: Conference Series*. 2021.
19. Xie L, Zhang P. A Three Phase Idea Selection Approach for Team Creation. In: *2008 International Seminar on Business and Information Management*. 2008. p. 326–9.
20. Weinberger E, Wach D, Stephan U, Wegge J. Having a creative day: Understanding entrepreneurs' daily idea generation through a recovery lens. *J Bus Ventur* [Internet]. 2018;33(1):1–19. Available from: <https://www.sciencedirect.com/science/article/pii/S0883902616301641>
21. Bettoni M, Bernhard W, Bittel N. Collaborative Solutions Quick&Clean: The SFM Method. In: Janiunaite B, Petraite M, Pundziene A, editors. *PROCEEDINGS OF THE 14TH EUROPEAN CONFERENCE ON KNOWLEDGE MANAGEMENT (ECKM 2013), VOLS 1 AND 2*. 2013. p. 44–51. (Proceedings of the European Conference on Knowledge Management).

22. Patton C, Balakrishnan PV (Sundar). The impact of expectation of future negotiation interaction on bargaining processes and outcomes. *J Bus Res* [Internet]. 2010;63(8):809–16. Available from: <https://www.sciencedirect.com/science/article/pii/S0148296309002070>
23. Fonvielle W. How to know what customers really want. *TRAINING & DEVELOPMENT*. 1997 Sep;51(9):40-.
24. Lin TC, Chen CM, Hsu JSC, Fu TW. The impact of team knowledge on problem solving competence in information systems development team. *International Journal of Project Management* [Internet]. 2015;33(8):1692–703. Available from: <https://www.sciencedirect.com/science/article/pii/S0263786315001179>
25. Kumar UD. Analytics education. *IIMB Management Review* [Internet]. 2020;32(1):108–17. Available from: <https://www.sciencedirect.com/science/article/pii/S0970389619301466>
26. van de Vliert E, Euwema MC, Huismans SE. Managing Conflict With a Subordinate or a Superior: Effectiveness of Conglomerated Behavior. *Journal of Applied Psychology*. 1995;80(2).
27. Smuttrasen K, Heo D. From Knowledge Transfer via Co-Creation to Knowledge Transformation: A Case Study of Cross-Generation Knowledge Transfer in a Thai Construction Company [Internet]. *International Conference on Management, Leadership & Governance*. Kidmore End: Academic Conferences International Limited; 2018. p. 431–8, XI–XII. Available from: <https://www.proquest.com/conference-papers-proceedings/knowledge-transfer-via-co-creation-transformation/docview/2088046551/se-2?accountid=38384>
28. Yang D, Shen T, Guo R, Xie X, Li Z. Study on the Reform of Mechanical Professional Practice Teaching under the Background of Engineering Certification. In: *Proceedings of the 2016 International Conference on Advances in Management, Arts and Humanities Science* [Internet]. Atlantis Press; 2016. p. 52–7. Available from: <https://doi.org/10.2991/amahs-16.2016.11>
29. Wang C. Conflict resolution strategies in International Joint Ventures: A case in China. In: Yunshi M, editor. *Multinationals in China: Competition and Cooperation*. 2004. p. 459–66.
30. Volkodavova E, Zhabin A, Yakovlev G. Dichotomy of import substitution and cooperation strategies in industry. *Economic Annals-XXI*. 2017;162(11–12).
31. Mikušová M, Čopíková A. The Identification of Crisis Manager Skills by Using Saaty's Method. In: Bilgin MH, Danis H, Demir E, Can U, editors. *Financial Environment and Business Development*. Cham: Springer International Publishing; 2017. p. 341–67.
32. Amacher GS, Koskela E, Ollikainen M. Royalty reform and illegal reporting of harvest volumes under alternative penalty schemes. *Environ Resour Econ (Dordr)* [Internet]. 2007;38(2):189–211. Available from: <https://doi.org/10.1007/s10640-006-9070-7>
33. Dendir S, Orlov AG, Roufagalas J. Do economics courses improve students' analytical skills? A Difference-in-Difference estimation. *J Econ Behav Organ* [Internet]. 2019;165:1–20. Available from: <https://www.sciencedirect.com/science/article/pii/S0167268119302185>

34. van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* [Internet]. 2010;84(2):523–38. Available from: <https://doi.org/10.1007/s11192-009-0146-3>
35. Porter DE. Information Distribution and Group Size: Some Effects on Group Problem Solving. *IMR-Industrial Management Review* . 1963;4(2):1–17.
36. Cherian EJ. The task group - a group-approach to problem-solving. *IEEE Trans Eng Manag.* 1963;10(2):87–9.
37. Headley JC, Carlson AB. Problem-Solving - the decision-process and management behavior. *Journal of Farm Economics.* 1963;45(5):1219–25.
38. van Eck NJ, Waltman L. Visualizing Bibliometric Networks. In: Ding Y, Rousseau R, Wolfram D, editors. *Measuring Scholarly Impact: Methods and Practice* [Internet]. Cham: Springer International Publishing; 2014. p. 285–320. Available from: https://doi.org/10.1007/978-3-319-10377-8_13
39. von Hippel E. “Sticky Information” and the Locus of Problem Solving: Implications for Innovation. *Manage Sci.* 1994;40(4).
40. Brown SL, Eisenhardt KM. Product Development: Past Research, Present Findings, and Future Directions. *Academy of Management Review.* 1995;20(2).
41. Winter SG. Understanding dynamic capabilities. *Strategic Management Journal.* 2003;24(10 SPEC ISS.).
42. Jeppesen LB, Lakhani KR. Marginality and problem-solving effectiveness in broadcast search. *Organization Science.* 2010;21(5).
43. Afuah A, Tucci CL. Crowdsourcing as a Solution to Distant Search. *Academy of Management Review* [Internet]. 2012 Jul 1;37(3):355–75. Available from: <https://doi.org/10.5465/amr.2010.0146>
44. Scott SG, Bruce RA. Determinants of Innovative Behavior: A Path Model of Individual Innovation in the Workplace. *Academy of Management Journal.* 1994;37(3).
45. Nickerson JA, Zenger TR. A knowledge-based theory of the firm - The problem-solving perspective. Vol. 15, *Organization Science.* 2004.
46. Bechky BA. Sharing Meaning Across Occupational Communities: The Transformation of Understanding on a Production Floor. *Organization Science* [Internet]. 2003 Jun 1;14(3):312–30. Available from: <https://doi.org/10.1287/orsc.14.3.312.15162>
47. Ancona DG, Caldwell DF. Demography and Design: Predictors of New Product Team Performance. *Organization Science.* 1992;3(3).
48. Hargadon AB, Bechky BA. When collections of creatives become creative collectives: A field study of problem solving at work. Vol. 17, *Organization Science.* 2006.
49. Aarikka-Stenroos L, Jaakkola E. Value co-creation in knowledge intensive business services: A dyadic perspective on the joint problem solving process. *Industrial Marketing Management.* 2012;41(1).
50. Tyre MJ, von Hippel E. The Situated Nature of Adaptive Learning in Organizations. *Organization Science.* 1997;8(1).
51. Vessey I, Galletta D. Cognitive fit: An empirical study of information acquisition. *Information Systems Research.* 1991;2(1).

52. Tucker AL, Edmondson AC, Spear S. When problem solving prevents organizational learning. *Journal of Organizational Change Management*. 2002;15(2).
53. Alavi M. Computer-mediated collaborative learning: An empirical evaluation. *MIS Q*. 1994;18(2).
54. Mohr J, Spekman R. Characteristics of partnership success: Partnership attributes, communication behavior, and conflict resolution techniques. *Strategic Management Journal*. 1994;15(2).
55. Heide JB, Miner AS. The Shadow Of The Future: Effects Of Anticipated Interaction And Frequency Of Contact On Buyer-Seller Cooperation. *Academy of Management Journal*. 1992;35(2).
56. Sirdeshmukh D, Singh J, Sabol B. Consumer trust, value, and loyalty in relational exchanges. *J Mark*. 2002;66(1).
57. Dewey J. *How we think*. Boston: D. C. Heath; 1933.
58. Osborn A. *Applied Imagination: Principles and Procedures of Creative Thinking*. New York: Charles Scribner's Sons; 1953.
59. Besant H. The Journey of Brainstorming. *Journal of Transformational Innovation*. 2016;2(1).
60. Clark KB, Fujimoto T. *Product development performance*. Boston: Harvard Business School Press.; 1991.
61. Debreu G. *Theory of Value: An Axiomatic Analysis Of Economic Equilibrium* . New York: Wiley; 1959.
62. Conner KR, Prahalad CK. A Resource-based Theory of the Firm: Knowledge Versus Opportunism. *Organization Science*. 1996;7(5).
63. Conner KR. A Historical Comparison of Resource-Based Theory and Five Schools of Thought Within Industrial Organization Economics: Do We Have a New Theory of the Firm? *J Manage*. 1991;17(1).
64. Demsetz H. The theory of the firm revisited. *J Law Econ Organ*. 1988;4(1).
65. Nahapiet J, Ghoshal S. Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*. 1998;23(2).
66. Kogut B, Zander U. What Firms Do? Coordination, Identity, and Learning. *Organization Science*. 1996;7(5).
67. Kogut B, Zander U. Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science*. 1992;3(3).
68. Arrow KJ. *The limits of organization*. 1st ed. New York: W.W. Norton & Company; 1974.
69. Teece DJ, Pisano G, Shuen A. Dynamic capabilities and strategic management. *Strategic Management Journal*. 1997;18(7).
70. Collis DJ. Research Note: How Valuable Are Organizational Capabilities? David J. Collis *Strategic Management Journal* , Vol. 15, Special Issue: Competitive Organizational Behavior. (Winter, 1994), pp. 143-152. *Strategic Management Journal*. 1994;15.
71. Muller E, Zenker A. Business services as actors of knowledge transformation: The role of KIBS in regional and national innovation systems. *Res Policy*. 2001;30(9).
72. Bettencourt LA, Ostrom AL, Brown SW, Roundtree RI. Client co-production in knowledge-intensive business services. *Calif Manage Rev*. 2002;44(4):100–28.

73. Imai K ichi, Nonaka I, Takeuchi H. Managing the New Product Development Process: How Japanese Companies Learn and Unlearn. In: Hayes R, Clark K, Lorenz C, editors. *The Uneasy Alliance: Managing the Productivity-Technology Dilemma*. Boston: Harvard Business School Press; 1985.
74. Gupta AK, Wilemon DL. Accelerating the Development of Technology-Based New Products. *Calif Manage Rev*. 1990;32(2).
75. Powell WW. Neither market nor hierarchy. *Sociology of organizations: structures and relationships*. 1990;30–40.
76. Bleeke J, Ernst D. The way to win in cross-border alliances. *Harv Bus Rev*. 1991;69(6).
77. Pruitt DG. *Negotiation behavior*. Academic Press; 1981.
78. Williamson O. *The Economic Institutions of Capitalism*. New York: The Free Press; 1985.