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Drilling down the viable system theories in business, management and accounting: A bibliometric review

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Abstract

The aim of this paper is to trace the scientific landscape (authors, scientific papers, topics most frequently dealt with, relationships between them) of the studies concerning the viable system model (VSM) and the viable system approach (vSa), carried out in the period 1990–2018 within the scientific framework of systems thinking by scholars in business, management and accounting (BMA). The methodology adopted herein is based on a scientometric approach, bibliographic mapping and clustering. The analysis was carried out following a three-step procedure: bibliographic coupling of scientific contributions (153 articles recorded in Scopus in the considered period), co-occurrence of the main author keywords and analysis of co-citations. This paper examines for the first time the entire scientific body of knowledge about viable system theories (VSTs) in BMA areas using recent joint mapping and clustering tools.

KEYWORDS

bibliometrics, science mapping, scientometrics, viable system theories

1 | INTRODUCTION

Because of the amplitude, depth and ubiquity of the available data on scientific production and of the increased computing capacity also available at decreased costs at an accelerated pace, bibliometric methods of measurement and analysis of scientific production enable new opportunities to apply, express and verify scientific findings.

In recent years, in fact, it has been possible to analyse the basic categories of entire scientific disciplines (components, relationships and the discipline as a whole) from a systems perspective. The analysed dimensions are, depending on the case, authors, scientific journals, papers, keywords and, more generally, textual contents of any kind (henceforth named 'subjects' or 'objects' of the analysis). Moreover, the relationships consist of the citations in the contributions (*citations*), the bibliographic references in common among them (*bibliographic coupling*), the frequency with which keywords are jointly used (*keyword co-occurrence*) and the frequency with which some publications of previous literature are cited together in the successive publication (*co-citations*).

The analysis can be carried out on a quantitative basis, through software commonly used in the managerial disciplines (Pajek, SciMAT, CiteSpace and HistCite), and others recently made available (VOSViewer, CitNet). The latter are able to manage 'packets' of results for queries addressed to bibliographic databases of common use (Scopus, Web of Science [WoS], PubMed, CrossRef, to cite the best known). The most recent releases of these software packages also provide navigable and publicly accessible synoptic representations (*bibliometric maps*) of the relative importance of the subjects/objects analysed, the reciprocal positioning and the relationships existing between them.

Among the many possible applications, bibliometric methods have been used in this work with the aim of analysing two of the main approaches existing within the scientific field of systems thinking: the viable system model (VSM; Beer, 1972, 1979, 1985; Espejo & Reyes, 2011; Espinosa & Walker, 2011; Rios, 2012) and the viable system approach (vSa; Golinelli, 2000, 2010; Barile, 2009).

Among the different cybernetic models proposed for the design, diagnosis and management of organizations, which are intended as systems aimed at viability (e.g., the capacity for survival as the effect of retaining equilibrium conditions within the environment in which they operate), Beer's VSM is the best known and the inspiration for both approaches. Thus, the VSM explores the conditions that ensure the viability of any system, even as a complex one, an organism, a company, a sector of economic activity or a country. The vSa, recently conceived as a metamodel embracing the various interpretive schemes of systems thinking, analyses in detail the relations that connect a system to its suprasystems and subsystems, in order to identify the consonance and resonance conditions that, once achieved, determine the viability of the system itself. Where VSM focuses mainly on the microenvironment (suppliers, consumers, distributors and financial and institutional systems; Dominici & Palumbo, 2013), which, according to Porter's vision, considers the competitive forces able to influence viability, the vSa instead widens the view, considering the environment as a whole.

Therefore, the VSM, in its diagnostic and planning tasks, has been applied to different types of systems, and at different levels of complexity, for its ability to detect the existence or the lack of adequate communication among the different systems concerned. Currently, various applications at different levels and sectors of economic and social activities confirm its potential: Walker (2017) reports on experiences in various councils in the United Kingdom; Burgess and Wake (2013) discuss its applicability to small- and medium-sized enterprises; Harwood (2009) focuses on its design function by revising its application to the entire Scottish tourism sector; other applications are derived from the consulting environment (Chatzimichailidou & Katsavounis, 2012; Herzog et al., 2016; Hildbrand & Bodhanya, 2014; Maracha, 2016; Melé, Chinchilla, & López-Jurado, 2019; Rezaee, Azar, Erz, & Nayeri, 2019; Rezk & Gamal, 2019). Other scholars (Adham, Kasimin, Mat Isa, Othman, & Ahmad, 2015; Mahamed Ismail, Welch, & Xu, 2015) outline the design contribution of the model to the sustainable quality of university research.

The vSa also has numerous applications in various fields: Saviano, Parida, Caputo, and Datta (2014) focus their attention on the design and sustainability of health systems, Barile and Saviano (2015) use it as an interpretative framework for the management of cultural heritage, and Simone, Barile, and Calabrese (2018) concentrate their attention on the management of territory and its complexity.

The review carried out in this paper can be defined as 'structural' because it examines relationships between research themes, authors, their affiliations, papers produced, etc. This approach allows us to provide 'networks of scientific papers' (de Solla Price, 1965) or 'research profiles' (Porter, Kongthon, & Lu, 2002) or even 'scientific landscapes' (van Eck & Waltman, 2010, 2014) of the examined topic. The approach followed intends to overcome some limitations attributed to traditional narrative, historical and systematic reviews, especially those due to the subjectivity of the scholar (Markoulli, Lee, Byington, & Felps, 2017; Tranfield, Denyer, & Smart, 2003), because those rely on quantitative data and structured procedures. Moreover, the bibliometric approach—thanks to the capability of treating large quantities of data in an overview—is able to obtain results complementary to traditional and systematic literature reviews (LRs).

In particular, the established methods are limited with regard to the following:

- taking into account the proximity or remoteness of existing contributions on the same topics in terms of approaches, methodologies and applications;
- focusing on the existing relationships between the subjects and the objects studied;
- providing a detailed overview that extends to the affiliation of individual scholars, most frequently sought scientific reviews, main 'historical' references on the topic, etc.

The outcomes of the structural reviews, in particular those realized using VOSviewer—the software adopted in this work—are obtained through a formalized, transparent and reproducible procedure and provide publicly available interactive maps that could be useful for successive interpretation or updates.

2 | SOFTWARE AND DATA

2.1 | Software

Among the bibliometric software able to provide the desired scientific landscape (SPSS, Pajek, SciMat), the adopted software for the bibliometric analysis in this study is VOSviewer (visualization of similarities)

developed by van Eck and Waltman (2010, 2014)), with the specific purpose of constructing, displaying and making publicly available bibliometric maps. The software is freely available on the website of the Centre for Science and Technology Studies of the University of Leiden. It provides distance-based bibliometric maps—that is, graphical representations in which the importance of a term is represented by its size and the distance between two terms reflects the strength of the relationship between them: the smaller the distance, the more intense the relationship that binds them.

The potential of the software is expressed in different scales, depending on the amount of the examined data: authors of a VOSviewer exhibit, in one of their papers, published maps representing co-citations among approximately 5,000 scientific journals and the treatment of about a million of bibliographic references (van Eck & Waltman, 2010). The possibility of discussing a scientific map of such dimensions and contents is obviously limited to a general level. This paper analyses a smaller amount of data (153 documents containing 6,189 bibliographic references), thus allowing a more detailed discussion. Accordingly, a narrative LR is possible, with the aim of surveying the state of knowledge on the topic (the third goal of an LR, according to Baumeister & Leary, 1997). Similar results in terms of dimension can be found in the reports on the scientific production of the single disciplinary areas of the University of Helsinki (Forsman, Nane, & Noyons, 2014).

2.2 | Data

Our research query was addressed to the bibliographic databases that ensure the greatest amplitude of results, as well as the necessary treatability of the bibliographic references of each contribution found. The broader but more inconsistent database (Adriaanse & Rensleigh, 2013), Google Scholar, does not allow the analysis of the list of citations of individual articles, thus preventing any citation-based analysis, in favour of Scopus and WoS.

Scopus was interrogated using 'Viable System*' in 'title, keywords and abstract' and WoS in 'topic', in order to ensure, as far as possible, the uniformity of results.

Research in Scopus was limited to the 'business, management and accounting' area; research in WoS was confined to the 'business', 'management' and 'business Finance' areas.

In order to prepare a database that was as qualified as possible and to have the most possible full texts, the query was limited to the articles published (or in press) in scientific reviews, excluding books, book chapters and conference proceedings, for which it is less frequent to find a full text.

Scopus returned 153 references and WoS returned 105. Because of the impossibility of processing different database results in VOSviewer, we chose to use the articles registered in Scopus, because of their greater number.

By limiting the analysis to the database of 153 articles obtained from Scopus (containing a total of 6,189 bibliographic references), the excluded scientific contributions coming from WoS, net of duplications, were 16, or 9.47%, which accounts for the reliability of the sample.

Figure 1 shows how the communities of researchers of VSTs are mainly active in Italy (in particular in the University of Salerno and in Sapienza, University of Rome) and in the United Kingdom (in particular in the University of Liverpool, the University of Hull and Liverpool John Moores University).

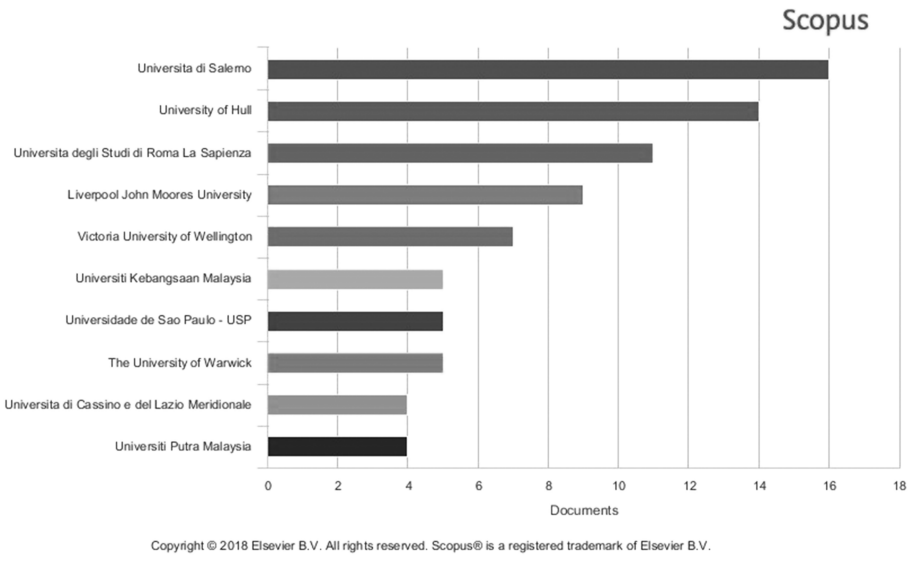

FIGURE 1 Distribution of references by the authors' affiliation

From a chronological point of view, it can be seen (Figure 2) how system studies, the first of which originated in the United Kingdom, are currently in progress in various countries, particularly in Italy. Figure 2, built with the use of VOSviewer and represented here in the 'overlay visualization' mode—which accounts for the average age of the contributions (average publication year)—uses colours, with a relative chromatic scale, to indicate the average time allocation of contributions.

It should be noted that the average publication year only partially reflects the real temporal development of the activity of the scholars; rather, it reflects the progressive access, on their part, to the scientific journals registered in the database questioned.

3 | METHODS

In order to obtain as complete a landscape as possible, we processed data in three subsequent phases, complementary to each other in terms of informative contribution. Using bibliographic coupling (Kessler, 1963), we grouped papers into clusters, defined according to common bibliographic references. The subsequent analysis of the co-occurrence of author keywords made possible tracing the scientific profiles prevailing in each cluster (general disciplinary framework, focus, managerial topic and field of application). Finally, we proceeded with the analysis of co-citations (Small, 1973) to identify the historical (ancestry) references on the basis of which to extrapolate the conceptual roots of each cluster.

'N' ($N > 1$) publications are bibliographically coupled if they mention 'm' ($m \geq 1$) publications of the previous literature. In other words, the bibliographic coupling considers the overlap in the list of bibliographic references of the examined publications: the greater the number of references in common between two publications, the more intense is the link between them.

In a distance-based map, bibliographic coupling only depicts the reciprocal positions and relationships among the examined articles, excluding the references contained in the reference list of each paper. With respect to the method of direct citations, bibliographic coupling includes a larger number of documents because it does not exclude contributions with zero citations, maybe because of their recent publication or their being in press. Finally, the method reveals the existence of documents that deal with topics close to each other and does not make any weighting based on the publication period. For these reasons and because the method of bibliographic coupling provides results strictly consistent with the purposes of this article, we used it as starting point and interpretative key.

The keyword co-occurrence returns the frequency with which a given keyword is used in the group of articles examined and which other keywords are used with it.

The method of co-citations is aimed at establishing the frequency with which 'n' ($n \geq 1$) publications of the previous literature are cited together in 'm' ($m \geq 2$) subsequent contributions. The hypothesis underlying the method is that Documents A and B are similar (they probably share the subject and/or methodology and/or the approach) because they are jointly cited by C and D in the successive literature. The analysis of co-citations extends, with respect to that carried out by means of

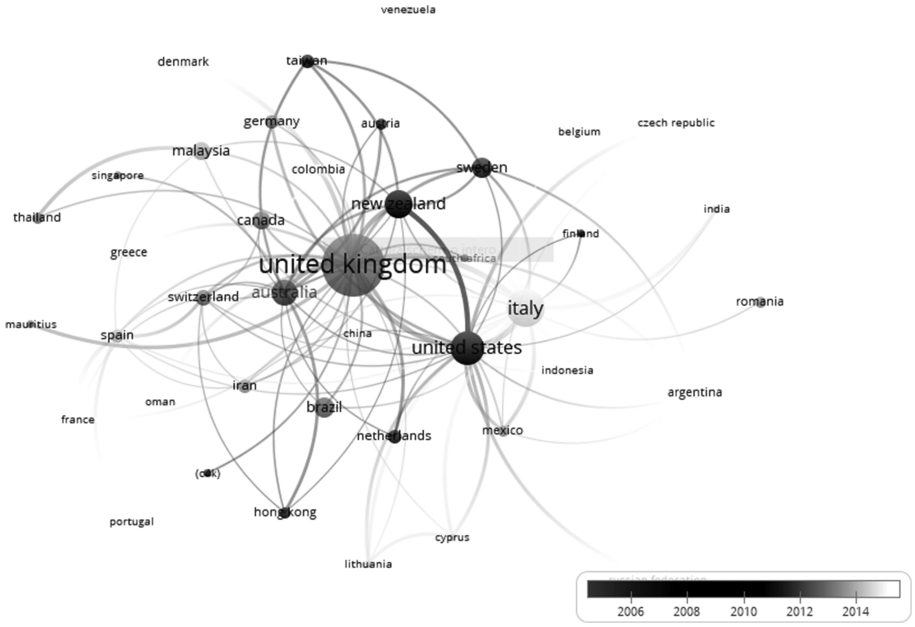

FIGURE 2 Geographical poles of studies on viable system theories (VSTs)

bibliographic coupling or direct citations, to the set of bibliographic references of the considered articles, thus allowing us to take into account the main historical references in the examined topic.

With regard to the counting methods, we adopted, in all applications, the fractional counting method that assigns equal weight to all the co-authors of the same publication, so that the total weight of the single publication is always equal to 1. On the other hand, full counting fully ascribes the publications to each author or assigns a weight of 1 to each of them; this leads to assigning a greater weight to publications with a greater number of authors. For the objectives of this work whose aim is based on the relative importance of the individual publications, the full counting method would have therefore introduced significant distortions. Perianes-Rodriguez, Waltman, and van Eck (2016) and Waltman and van Eck (2015) deeply analyse the differences between full counting and fractional counting.

4 | FINDINGS

4.1 | Bibliographic coupling

Among VOSviewer's advantages, there is a combination of two distinct functionalities: the creation of distance-based maps and clustering. After obtaining the map with the mutual positions of the contributions and their importance in terms of citations or links to other contributions, it is necessary to impose parameters for the detection of clusters and the identification of the individual elements to include in each cluster (essentially 'resolution' and 'minimum cluster size'). Parameters must be chosen that are consistent with the set of purposes of the analysis. The use of VOSviewer in the 'density visualization' mode helps visually identify the clusters to consider through the distance-based map of the considered objects, as shown in Figure 3.

In this preliminary step, we observed the existence of four clusters. This hypothesis has been verified by identifying the publications belonging to each cluster, the most important of which are shown in Table 1. This reveals, at a first glance, how the hypothesis is consistent, based on the most cited papers. For the aims of the present work, we considered that the division into four clusters was sufficient to represent the desired scientific landscape with the desired degree of detail and to pose as foundations for the development of the LR. Therefore, in the subsequent clustering phase, we 'forced' the parameters in order to identify the four clusters represented in Figure 4, which is the same map as Figure 3, but presented in the 'network visualization' mode. According to this representation, the set of parameters determines four groups and the individual elements belonging to each of them.

As represented in Figure 4, the size of the network nodes indicates the relative importance of each document; the thickness of the links indicates the strength of the link between two nodes; and the distance between the nodes indicates the degree of similarity of each document (in terms of bibliographic references cited).

The most cited documents in each cluster are shown in Table 1.

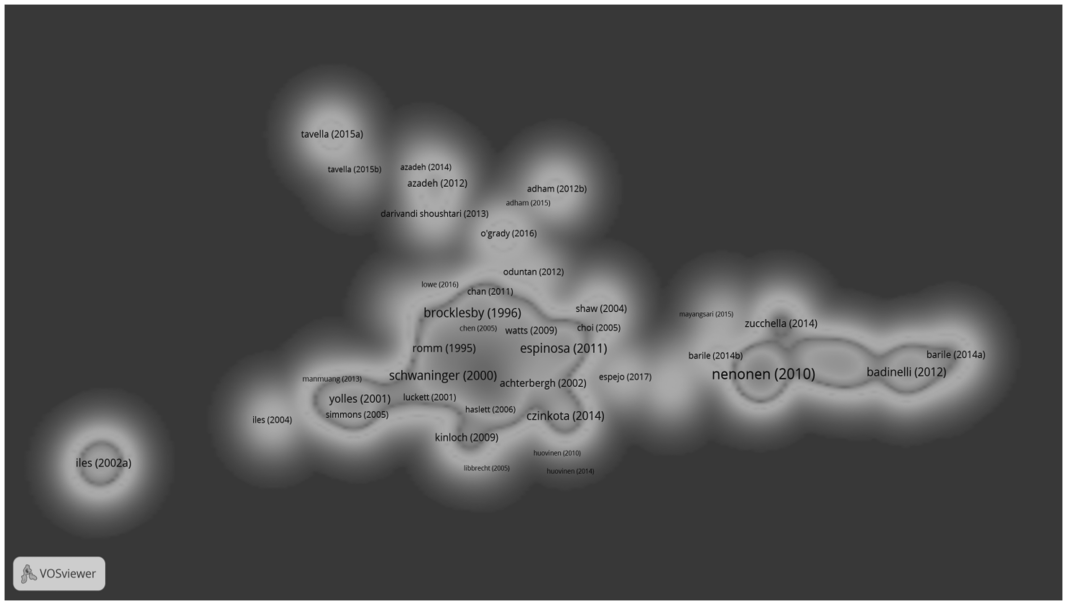

FIGURE 3 Bibliographic coupling map—density visualization

TABLE 1 Most cited documents of each cluster

Cluster 1	
Brocklesby, J., & Cummings, S. (1996). Designing a viable organization structure. *Long Range Planning, 29*(1), 49–57. doi: 10.1016/0024-6,301(95)00065-8	44
Espinosa, A., & Porter, T. (2011). Sustainability, complexity and learning: Insights from complex systems approaches. *Learning Organization, 18*(1), 54–72. doi: 10.1108/09696471111096000	44
Schwaninger, M. (2000). Managing complexity—The path toward intelligent organizations. *Systemic Practice and Action Research, 13*(2), 207–241.	43
Jackson, M. C. (1988). An appreciation of Stafford Beer's 'viable system' viewpoint on managerial practice. *Journal of Management Studies, 25*(6), 557–573.	39
Bititci, U. S., Carrie, A. S., & McDevitt, L. (1997). Integrated performance measurement systems: An audit and development guide. *TQM Magazine, 9*(1), 46–53. doi: 10.1108/09544789710159443	38
Cluster 2	
Nenonen, S., & Storbacka, K. (2010). Business model design: Conceptualizing networked value co-creation. *International Journal of Quality and Service Sciences, 2*(1), 43–59. doi: 10.1108/17566691011026595	91
Barile, S., & Polese, F. (2010). Linking the viable system and many-to-many network approaches to service-dominant logic and service science. *International Journal of Quality and Service Sciences, 2*(1), 23–42. doi: 10.1108/17566691011026586	42
Badinelli, R., Barile, S., Ng, I., Polese, F., Saviano, M., & Di Nauta, P. (2012). Viable service systems and decision making in service management. *Journal of Service Management, 23*(4), 498–526. doi: 10.1108/09564231211260396	37
Czinkota, M., Kaufmann, H. R., & Basile, G. (2014). The relationship between legitimacy, reputation, sustainability and branding for companies and their supply chains. *Industrial Marketing Management, 43*(1), 91–101. doi: 10.1016/j.indmarman.2013.10.005	37
Barile, S., Lusch, R., Reynoso, J., Saviano, M., & Spohrer, J. (2016). Systems, networks, and ecosystems in service research. *Journal of Service Management, 27*(4), 652–674. doi: 10.1108/JOSM-09-2015-0268	36
Cluster 3	
Azadeh, A., Darivandi, K., & Fathi, E. (2012). Diagnosing, simulating and improving business process using cybernetic laws and the viable system model: The case of a purchasing process. *Systems Research and Behavioral Science, 29*(1), 66–86. doi: 10.1002/sres.1102	13
Tavella, E., & Papadopoulos, T. (2015). Expert and novice facilitated modelling: A case of a Viable System Model workshop in a local food network. *Journal of the Operational Research Society, 66*(2), 247–264. doi: 10.1057/jors.2013.187	13
Adham, K. A., Kasimin, H., Said, M. F., & Igel, B. (2012). Functions and inter-relationships of operating agencies in policy implementation from a viable system perspective. *Systemic Practice and Action Research, 25*(2), 149–170. doi: 10.1007/s11213-011-9,215-7	9
Puche, J., Ponte, B., Costas, J., Pino, R., & De La Fuente, D. (2016). Systemic approach to supply chain management through the viable system model and the theory of constraints. *Production Planning and Control, 27*(5), 421–430. doi: 10.1080/09537287.2015.1132349	9
O'Grady, W., Morlidge, S., & Rouse, P. (2016). Evaluating the completeness and effectiveness of management control systems with cybernetic tools. *Management Accounting Research, 33*, 1–15. doi: 10.1016/j.mar.2016.02.003	7
Cluster 4	
Iles, P., & Yolles, M. (2002a). Across the great divide: HRD, technology translation, and knowledge migration in bridging the knowledge gap between SMEs and universities. *Human Resource Development International, 5*(1), 23–53. doi: 10.1080/13678860110007184	30
Yolles, M. (2001). Viable boundary critique. *Journal of the Operational Research Society, 52*(1), 35–47. doi: 10.1057/palgrave.jors.2600069	29
Yolles, M., & Guo, K. (2003). Paradigmatic metamorphosis and organizational development. *Systems Research and Behavioral Science, 20*(2), 177–199. doi: 10.1002/sres.533	28
Iles, P., & Yolles, M. (2002b). International joint ventures, HRM and viable knowledge migration. *International Journal of Human Resource Management, 13*(4), 624–641. doi: 10.1080/09585190210125633	26
Kinloch, P., Francis, H., Francis, M., & Taylor, M. (2009). Supporting crime detection and operational planning with soft systems methodology and viable systems model. *Systems Research and Behavioral Science, 26*(1), 3–14. doi: 10.1002/sres.943	22

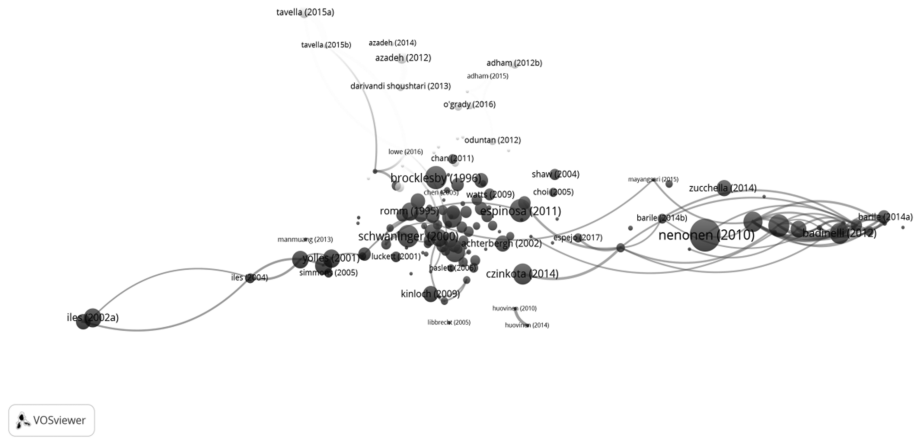

FIGURE 4 Bibliographic coupling map. Downloadable with colours and navigable in detail at https://bit.ly/2QNhoeQ

4.2 | Keyword co-occurrence

In order to define the scientific 'character' of the identified groups in terms of disciplinary belonging, focus, prevailing managerial subjects and fields of application, we identified the most recurring author keywords and the frequency with which they are jointly used.

For the implementation of this method, we prepared and used a thesaurus to exclude more general terms that are inconsistent with the purpose of this work (e.g., research, management and Italy) and to link a series of keywords expressing the same concept, but which are formulated differently (e.g., VSM and corporate social responsibility [CSR]).

This resulted in 425 author keywords, 51 of which were repeated at least twice (49 linked elements).

Subsequently, we formulated the hypothesis that each cluster of keywords corresponds to one of the four clusters identified by means of bibliographic coupling; then, we forced the parameters to obtain four clusters. Results are shown in Figure 5.

The first cluster (red) is characterized by efforts towards the methodological deepening of VSM in a constant search for approaches able to frame the aspects of systemic relationships to plan, control and diagnose the organizations.

The hypothesis appears to be clearly verified for Cluster 2 in which we can observe the disciplinary affinity with marketing and a focus on services and on value co-creation, setting up a methodology that moves away from Beer's VSM towards a more general approach (vSa). The second cluster (green) presents

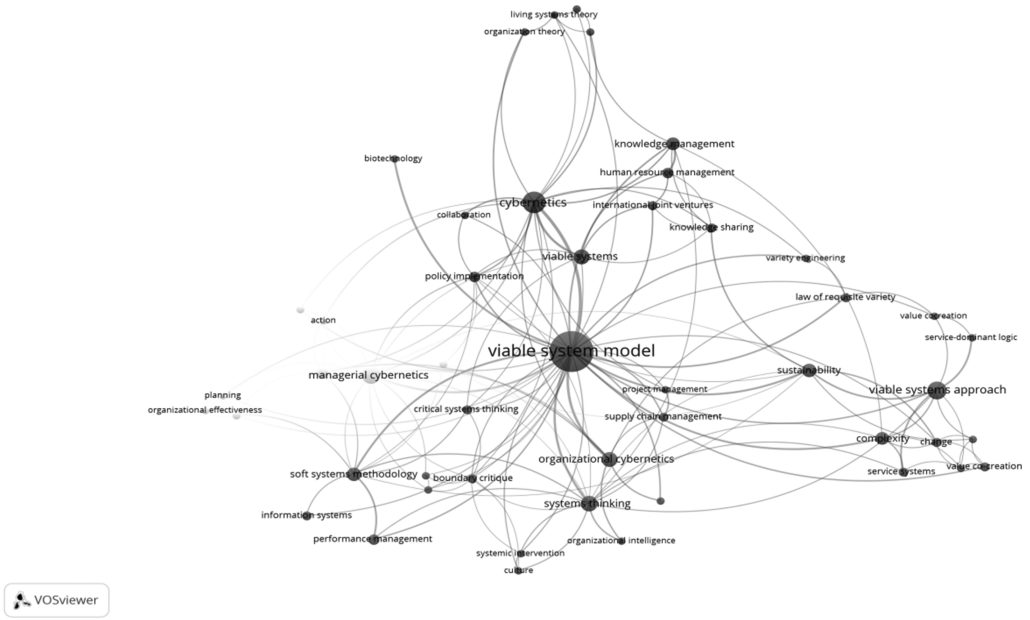

FIGURE 5 Author keywords map. Downloadable with colours and navigable in detail at https://bit.ly/2Rhne7o

distinct characteristics of originality and innovation, because it refers to vSa rather than to VSM.

The third cluster (blue) consists of the studies regarding the evaluation and improvement of business processes and management control systems (MCS) using the VSM and cybernetic tools.

The fourth cluster (yellow) has specific characteristics of disciplinary afference to the business organization and to human resource management, in particular in international relations between companies. For the fourth cluster, the analysis of the co-occurrence of keywords did not identify, at least summarily, the disciplinary placement of studies within the company organization and, in particular, human resource management; this characteristic has, however, been clearly recovered through the consolidated coding and 'distillation' techniques used on the abstracts and available full texts from the systematic LRs. According to the writer, this is due to the modest size of the sample, in addition to the convergence of homogeneous research interests and the widespread reference to VSM.

4.3 | Co-citation

Co-citation analysis was carried out to identify the main historical references of each cluster, as shown in Figure 6 and Table 2.

On the basis of the obtained results, we proceeded with the encoding of titles, abstracts and full text of the documents (where available) included in the analysis, to realize an LR discussing the main characteristics of each cluster, with the aim of surveying the state of knowledge about the topic (third goal of an LR, according to Baumeister & Leary, 1997).

In order to identify the scientific character (core competencies) of each cluster, we carried out a discussion about the main contributions belonging to them, considering four dimensions: the predominant dimension belongs to a cluster of one of the three BMA areas (accounting, management and organization), the prevailing scientific focus, the specific managerial issues dealt with and fields of application.

Because each contribution belongs to more than one of the considered dimensions, we did not focus on determining the exclusive belonging of a contribution to one of the possible intersections of these four dimensions. However, the systematic process allows a satisfactory interpretation of the overall results obtained.

4.4 | Cluster 1 (red): VSM and systems thinking theories

The first cluster is the largest whose centre, in terms of quantity of scientific production, is located at the University of Hull (United Kingdom), and to date, it is also the longest running: the documents found cover the entire time span considered in this contribution.

The high number of publications included in this cluster and the widespread references to Beer's VSM allows an approximate disciplinary classification, which crosses all the scientific areas of BMA, from accounting (Bititci, Carrie, & McDevitt, 1997; Gregory, 2007) to management (Achterbergh & Vriens, 2002; Bassett-Jones, Brown, & Cornelius, 2007; Schwaninger, 2000), and to

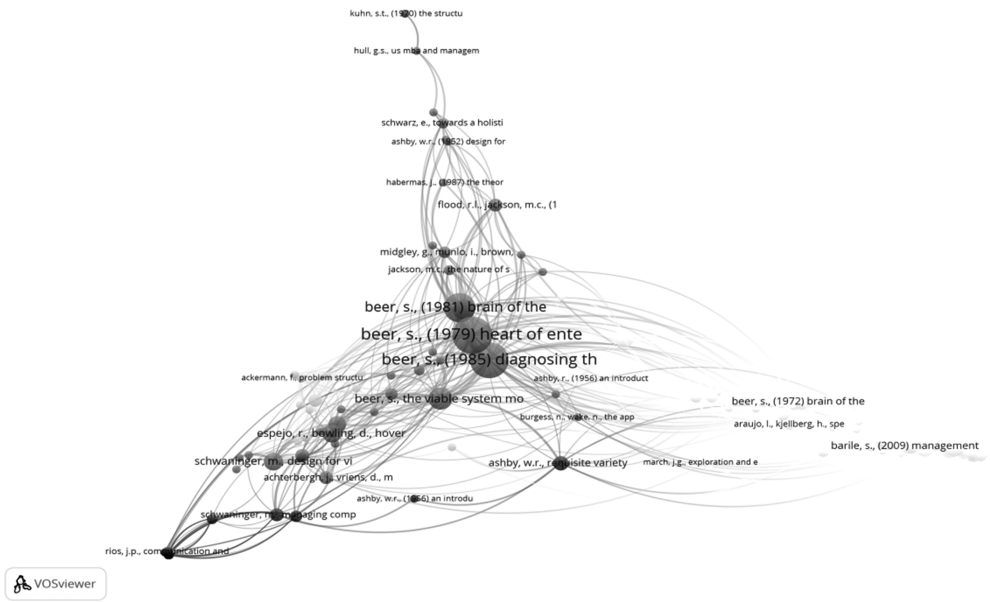

FIGURE 6 Co-citation map. Downloadable with colours and navigable in detail at https://bit.ly/2EKs2MK

TABLE 2 Main contributions in clusters identified through co-citation

Cluster 1
Beer, S. (1972). Brain of the firm. London: Allen Lane.
Beer, S. (1979). The heart of enterprise. Chichester: Wiley.
Beer, S. (1985). Diagnosing the system for organizations. Chichester: Wiley.
Beer, S. (1994). Beyond dispute: The invention of team syntegrity. Chichester: Wiley.
Beer, S. (1984). The viable system model: Its provenance, development, methodology and pathology. *Journal of the Operational Research Society*, 35(1), 7–25.
Checkland, P. B. (1981). Systems thinking, systems practice. Chichester: Wiley.
Flood, R. L. & Jackson, M. C. (1991). Creative problem solving. Chichester: Wiley.
Cluster 2
Barile, S., (2009). Management sistemico vitale. Torino: Giappichelli.
Vargo, S. L. & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68(1), 1–17.
Vargo, S. L. & Lusch, R. F. (2008). Service-dominant logic: Continuing the evolution. *Journal of the Academy of Marketing Science*, 36(1), 1–10.
Barile, S., Pels, J., Polese, F., & Saviano, M. (2012). An introduction to the viable systems approach and its contribution to marketing. *Journal of Business Market Management*, 5(2), 54–78.
Maglio, P. P. & Spohrer, J. (2008). Fundamentals of service science. *Journal of the Academy of Marketing Science*, 36(1), 18–20.
Mele, C., Pels, J., & Polese, F. (2010). A brief review of systems theories and their managerial applications. Service Science, 2(1–2), 126–135.
Badinelli, R., Barile, S., Ng, I., Polese, F., Saviano, M., Di Nauta, P. (2012). Viable service systems and decision making in service management. *Journal of Service Management*, 23(4), pp. 498–526.
Cluster 3
Espejo, R., Bowling, D., & Hoverstadt, P. (1999). The viable system model and the Viplan software. *Kybernetes*, 28(6–7), 661–678.
Schwaninger, M. (2006). Design for viable organizations: The diagnostic power of the viable system model. *Kybernetes*, 35(7–8), 955–966.
Leonard, A. (2000). The viable system model and knowledge management. *Kybernetes*, 29(5–6), 710–715.
Brocklesby, J. & Cummings, S. (1996). Designing a viable organization structure. Long Range Planning, 29(1), 49–57.
Devine, S. (2005). The viable systems model applied to a national system of innovation to inform policy development. Systemic Practice and Action Research, 18(5), 491–517.
Leonard, A. (2008). Integrating sustainability practices using the viable system model. *Systems Research and Behavioral Science*, 25(5), 643–654.
Rios, J. P. (2006) Communication and information technologies to enable viable organizations. *Kybernetes*, 35(7–8), 1,109–1,125.
Cluster 4
Schwarz, E. (1997). Towards a holistic cybernetics: From science through epistemology to being. *Cybernetics and Human Knowing*, 4(1), 17–50.
Beer, S. (1985). Diagnosing the system for organizations. Chichester: Wiley.
Habermas, J. (1987). The theory of communicative action, 2. Cambridge, UK: Polity Press.
Hull, G. S. (2000). US MBA and management training programs in Central and Eastern Europe. *Journal of Technology Transfer*, 25, 319–327.
Kuhn, S. T. (1970). The structure of scientific revolutions. Chicago: University of Chicago Press.
Yolles, M. I. (1999). Management systems: A viable systems approach. London: Financial Times Management.
Yolles, M. I. (2000). The theory of viable joint ventures. *Cybernetics and Systems*, 31(4), 371–396.

organization, in which VSM shows all its planning and diagnostic value (Brocklesby & Cummings, 1996; Leonard, 2009).

It emerges that the main focus of the cluster is the methodological deepening of VSM, derived from the recurrent contributions aimed to combine it with other

methodological approaches of systems theory. In this way, we can highlight a constant search for new approaches, able to better frame the aspects of systems relationships and to improve planning, control and diagnosis of organizations.

Among the authors most focused on the methodological studies, Schwaninger (2000, 2006) and Schwaninger and Pérez Ríos (2008) are worthy of mention. They mainly focused their attention on the connections between VSM and other models in the field of systems theory; among them are Miller's living systems theory (LST), the model of systemic control and system dynamics (SD). By highlighting the principles that unite the different theories, Schwaninger tries to combine models, in order to generate new schemes that better interpret the viability of the organizations: his goal is to trace a general scheme for the planning of a 'smart organization' that considers within it all the structural and interconnected elements necessary for its viability and its development.

Within the cluster, the most frequented managerial issues are MCS, knowledge management and, in a broad sense, (economic, environmental, social) sustainability. The contributions about MCS are all united by a systems perspective that reveals the partiality of the existing schemes both in their planning and diagnostic functions, as well as their ability to consider the whole problem in a holistic and integral vision. In fact, they are not able to assess the completeness of a control system or its effectiveness because they are generally focused on the measurement of short-term performances (Bititci et al., 1997; Gregory, 2007; Morlidge, 2009).

Less numerous are the contributions about other managerial issues, on which a wider community of scholars is currently focused. Among them, we can identify those related to the theme of sustainability, intended in an integral sense as the inclusion of socio-economic issues (CSR), those related to managerial balance with respect to the environment and those closely related to the human environment and knowledge management.

The theme of sustainability is discussed by Paucar-Caceres and Espinosa (2011) in their review of the literature, carried out from 1989 to 2009, on environmental management and sustainability methodologies: the authors find an overall vague situation because of the fact that many scholars use the terms 'environmental management' and 'sustainability' as synonyms or at least as closely related subjects. In this scenario, the authors who are mostly interested in managerial aspects mainly refer to environmental management, while those most involved in theoretical aspects or applications generally speak of sustainability. This nebulosity is confirmed by the contributions of Panagiotakopoulos, Espinosa, and Walker (2016), who, in proposing models based on VSM for designing organizational structures and their interrelationships for innovations related to CSR, talk about both sustainability and environmental management.

The contributions related to the topic of knowledge management (Achterbergh & Vriens, 2002; Ganzert, Martinelli, & Delai, 2012; Paucar-Caceres & Pagano, 2009) focus mainly on the establishment of the knowledge base of an organization, its development, its sharing and its exploitation in order to achieve competitive advantages.

The most cited references of the cluster are shown in Table 2. The prevalent influence of Beer's work is evident both in the neurophysiological aspects (*Brain of the firm*, 1972) and in the logical and graphical representations in the *Heart of enterprise* (1979) and *Diagnosing the system for organizations* (1985).

4.5 | Cluster 2 (green): Marketing and complexity management

This cluster—currently the most active in terms of the amount of scientific production and attention to methodologies and application—is rooted in Italy, with particular reference to the triangular territorial cornered by the University of Salerno, Sapienza University of Rome and the University of Cassino. Although this is the community of scholars, which has most recently accessed the scientific journals registered in Scopus (the contributions found cover the time span 2010–today), remote seminal references (Golinelli, 2000) and their progressive growth imply a dedicated school.

The scholars, according to the well-established basis of systems thinking, introduced significant conceptual changes to Beer's VSM to coin the acronym vSa, proposing the adoption of the interpretive schemes of systems thinking as metamodel capable of understanding any social or economic phenomena. The 'meta' positioning of this approach underlines that it should not be viewed as a set of operative models to apply to a specific problematic context; rather, it stands as an 'an approach to adopt system thinking general interpretation schemes as metamodels for understanding any problematic context (Barile, Pels, Polese, & Saviano, 2012).

From an applicative point of view, the main difference between VSM and vSa consists in the fact that the latter underscores and describes in depth the role of collaborative connections with the suprasystems, as well as with suppliers, consumers, distribution and financial and institutional systems that, according to the Porterian vision, are considered competitive forces that can affect viability, while VSM focuses on understanding organizations inner functioning in order to support external adaptation (Dominici & Palumbo, 2013). A synoptic

summary of the main characteristics of the two approaches is contained in *The viable system perspective of actors in eco-systems* (Polese, Carrubbo, Bruni, & Maione, 2017).

The disciplinary classification of the community is mainly in marketing with a scientific focus—both from a methodological and an applicative point of view—on service networks in which there is value co-creation with a systems perspective (service-dominant logic [SD-l]; Vargo & Lusch, 2004). These two schools of thought influence each other: in SD-l, all social and economic actors are resource integrators that interact through mutual service provision to co-create value (Nenonen & Storbacka, 2010; Vargo & Lusch, 2004); in the vSa approach, every business is considered as a system, immerged in a relational context looking for competitive profiles (viability) through interaction with other actors (Barile, Spohrer, & Polese, 2010; Golinelli, Pastore, Gatti, Massaroni, & Vagnani, 2002; Nenonen & Storbacka, 2010). Also, from a formal point of view, the axioms and postulates of the SD-l (Vargo, 2008; Vargo & Lusch, 2004) and the fundamental propositions and concepts of the vSa (Barile et al., 2012) are determined according to a similar format.

The works dedicated to the exploration of the synergistic convergences between vSa and SD-l are numerous, and each contributes to information enrichment: the main exponents of this cluster, in an attempt to integrate the concepts, compare the conceptual characteristics of SD-l, service science and vSa, finding the conceptual areas shared among them in relation to the aspects of resources, adaptation, competitiveness, interaction and complexity. Nenonen and Storbacka (2010) propose a 12-quadrant matrix that considers the principles on which to base the design, the resources, the capacities of the individual aspects constituted by the market, the offer, the operations and the management. According to the authors, the business model obtained is a useful guide to value co-creation, which must be sought in alignment between all the elements of the business model with those of suppliers and customers.

With regard to marketing, in particular service marketing, the scholars support the thesis that the integration of vSa and SD-l can give rise to significant improvements compared with the prevailing approaches. This integration is based on a quantitative and mechanistic view of the dynamics of service systems, and through metamodels based on systems thinking, which are able to better explain the exchanges that take place (Badinelli et al., 2012). The application-based contributions deal with, among other things, important current issues such as the management of cultural heritage (Baccarani & Golinelli, 2016; Golinelli, 2008), health services and territory (Simone et al., 2018). They show a further characteristic of the cluster, represented by the thesis that the viability can be explained by a harmonization of the resources, skills and abilities existing in the supply system with the expectations and interests of suppliers and users. Barile, Saviano, Iandolo, and Calabrese (2014) summarize this aspect with the introduction of the concepts of consonance and resonance, which respectively represent the potential and the consequent effects of harmonic interactions between two or more systemic entities. The consonance identifies a condition of compatibility and/or complementarity between interacting entities. The resonance is related to pre-existing consonance conditions and is expressed in the results obtained from the interaction between consonant entities.

The most cited references of the cluster are shown in Table 2; particularly evident are the studies in marketing, especially in service systems, and the mutual contamination of SD-l and vSa. This contamination, moreover, goes beyond mere informational phases, recently leading to real collaborations between the founders of the two schools of thought, as evidenced by the contribution *Systems, networks, and ecosystems in service research* (Barile, Lusch, Reynoso, Saviano, & Spohrer, 2016).

4.6 | Cluster 3 (blue): Managerial cybernetics

The localization of this cluster is not only in Malaysia, particularly in the University of Kebangsaan Malaysia and the University of Putra Malaysia but also in Iran (Teheran) and in New Zealand (Auckland).

It is a cluster with a strong focus on the application of systems thinking at a country level.

In this cluster we find the most relevant applications of viable system theory (VST), from the implementation of country system policies of development into key sectors of economic and social life (university, biotechnology, mobile and fixed technologies; Adham et al., 2015; Adham, Sarkam, Said, Nasir, & Kasimin, 2017).

Other policy applications at a country level include the national talent recruitment program in China (Fang, Zhu, & Zheng, 2015), the redesign of managerial structure and the redefinition of managerial processes in a large national supply chain network (Darivandi Shoushtari, 2013), the Swedish cultural heritage system for digital preservation (Runardotter, 2011) and the complex economic system of chicken stocking in Iran (Azadeh, Darivandi Shoushtari, Saberi, & Teimoury, 2014).

With regard to managerial issues, they deal with the redesign of MCS (O'Grady, Morlidge, & Rouse, 2016; O'Grady, Rouse, & Gunn, 2010), the purchasing business

processes and supply chain management (Puche, Ponte, Costas, Pino, & De La Fuente, 2016).

O'Grady et al. (2010), in their discussion about the consolidated and widespread schemes of Ferreira and Otley (2009) on performance management and control, and those of Simons, Dávila, and Kaplan (2000) on the levers of control, argue that the VSM provides a comprehensive scheme for the design and diagnosis of an MCS for the explicit consideration of multiple levels of control, communication channels, interaction with the environment and mechanisms for achieving equilibrium between stability and change. Subsequently, the authors confirm this conclusion on the empirical basis of the application of VSM to the case of a logistics company (O'Grady et al., 2016).

4.7 | Cluster 4 (yellow): Human resource management and knowledge migration

This cluster is the smallest, with its main poles at the Liverpool John Moores University and Teesside University in Middlesbrough (UK). The first references found in the database date back to 2001, the latest one to 2015, although scientific activity on the viable systems is still continuing. The main disciplinary background seems to be in the field of human resources management, considered to be a fundamental managerial activity for the firms' viability.

From these, studies emerge the problem of transferring the knowledge of human resources via a firm's internationalization process, despite the presence of the diagnostic applications of Beer's VSM.

In this scenario (Iles & Yolles, 2002a, 2002b, 2003), various contributions discussed the theme of the criticality of human resource management in international business alliances. In particular, the chances of possible success or failure of international joint ventures (IJVs) are enclosed, from the VSM perspective, in a reference framework for the effective 'migration' of knowledge (Iles & Yolles, 2002a). The authors attribute the main obstacle to the success of the initiatives in the phases of design and implementation of IJVs to the scant attention paid to human resources. IJVs are systems of activities composed of subsystems characterized by three domains: cognitive, transformational and behavioural. Each subsystem has its own characteristics of cognitive properties of influence, purpose and interest, which, in the event of misalignment (lack of consonance and consequent resonance), can determine the failure of the agreement.

The topic of modelling knowledge migration processes is taken up by the authors (Iles & Yolles, 2002b) in the exploration of cognitive asymmetries between universities and small and medium enterprises (SMEs), with the elaboration of a model of knowledge transfer based on an experimental case through the presence of so-called technology translators who are types of 'knowledge brokers'. The theme is resumed with the elaboration of a model (Iles, Ramgutty-Wong, & Yolles, 2004), based on the VST, about the transfer of human resources and of the related wealth of knowledge between different cultures through the case of the civil service in the Mauritius Islands. All the models belonging to this cluster explore the interests, goals and cognitive influences of the parties involved and their impact on the success of knowledge transfer, appreciation and conscious action.

In the context of the international processes of firms, Huovinen (2010) hypothesizes that it is possible to design a business unit as a viable system capable of sustaining a separate existence at only three levels of hierarchy. Then, Huovinen (2014) asserts that even an international business can be successfully managed in the short and long term in its focal contexts as a set of three recursive systems, based on skills and based on processes. Libbrecht and Vandevyvere (2005) consider the elements of a system (component, relationships and the whole) as respectively represented by the relative abilities, competences and mutual interdependences. The most cited references of the cluster are shown in Table 2. The cluster seems to be less influenced by the thoughts of Beer than Cluster 1, taking as main references the basic texts of the methodology and epistemology of science.

5 | LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The limitations of this study result from the level of the analysis carried out, which depended on the database used and was confined to references found in Scopus in the BMA area, using the query viable system*. These limitations identify, from another point of view, promising future lines of research that could be based on the tools and results of this contribution by virtue of the maps made available.

The limited size of the database (153 articles in scientific reviews) determines the boundaries and the depth of the analysis. In fact, by not considering the references in Scopus in scientific areas other than BMA, we chose to not identify studies on the same topics/theories surveyed in other areas; on the other hand, this allowed us to take advantage of examining their respective scientific profiles in depth. Moreover, among the limitations common to all LRs based on the results of the queries of an existing bibliographic

database, only the contributions in English are considered and, among them, only journal articles because of the ease of finding full-text documents. This resulted in an exclusion of books, chapters and conference proceedings, potentially leaving behind more influential contributions, although in some part captured by the analysis through the co-citation approach (Table 2), which presents the works most frequently cited together in the database used, including books. Further research will address this issue.

Another limitation consists of not capturing the positioning of the studies on VSTs in the general panorama of systems thinking, including other areas close to BMA (e.g., social sciences, decision sciences and economics). This allows us to identify future lines of research, consisting of an extension of the database with consolidated criteria of the systematic LRs. Furthermore, this highlights the modularity and the systemic character of the application of bibliometric methods.

Another limitation derives from not exploring the scientific characteristics of the single groups from a historical perspective. The chosen level of analysis means that it only partially takes into account the evolution within the individual groups, although it highlights the system level with the birth and development of new clusters, particularly the Italian one. The historical evolution of thought in the context of individual clusters (e.g., Cluster 1, the most extensive in terms of both the reference time frame and the number of contributions) can be easily reconstructed based on the maps made available: a cluster can be explained, subdivided into further clusters on a chronological basis and studied in depth in this diachronic scenario.

6 | MANAGERIAL IMPLICATIONS

From a managerial perspective, we decided to separately discuss the implications related to the specific topic (VSM and vSa) and those related to bibliometric methods of measurement and analysis of the scientific production of scholarly communities.

With regard to the first aspect, its potential impact on management can be developed through appropriate divulgation to managers about the diagnostic capabilities of VSM and vSa in identifying any deficiencies in the intrasystem and intersystem relationships (respectively, those existing in the organization and between the organization and the environment), and in relating these aspects to its viability.

A field of application of both models could be represented by universities—which are well suited to being interpreted from a VSM point of view—with regard to internal relations and the systems closest to them and in terms of vSa with regard to environment.

In the academic field, bibliometric tools also show their usefulness for the management of research activities. For instance, it is appropriate to mention the University of Helsinki, which, in achieving its goal of ranking among the top 50 universities in the world and becoming a responsible social force, bases its research management strategies on bibliometric information.

Finally, both the bibliometric methods of scientific information acquisition and systematization, and the potentials of VSM and vSa, should be transferred to future managers, while questioning the current university approach in management training.

In particular, the VSM can validly combine traditional knowledge transfer methods; the vSa focuses on the wide disciplinary field and is necessary to face economic-social environments that will become increasingly complex for future managers.

7 | CONCLUSIONS

Our conclusions regard two distinct but complementary issues: the contribution of bibliometric methods to knowledge management and the overall landscape of the specific topic considered.

Generally, the tools of scientometry seem able to modify the traditional channels of finding, systematizing and transmitting knowledge, thanks to new means of scientific reporting. Scholars can overcome the boundaries of their library and scientific communities, reaching a synoptic view of interesting happenings in the scientific world, and take advantage of immediate access to scientific contents at multiple levels of detail.

Moreover, the capability of bibliometric methods to direct the scholar can provide indications about the most promising lines of research. The identification of the territorial localization of schools, their application destinations (disciplinary, thematic and methodological approaches and specific topics) and the possibility of tracing documents and the authors of the subjects of interest allows us to define the position of the scholar with respect to the most up-to-date level of scientific knowledge.

As far as the reviews of the literature are concerned, the present paper shows that bibliometric methods are able to identify aspects that cannot be perceived through traditional methods:

- They take into account the proximity (similarity) or the distance (diversity) of the examined contributions.

- They focus on the relationships existing between the subjects and/or objects studied.
- They allow the definition of detailed frameworks that, from the bibliographic references in common between the different contributions, can be traced back to even the affiliation of the individual scholars.

Moreover, they present the systemic characteristics of recursion; in fact, they examine the objects/subjects of the study in multiple degrees of detail. This brings out a fundamental property of the bibliometric approach in the joint clustering–mapping set-up (e.g., the chance of conducting the analysis according to the aims, pursued in a similar way to successive enlargement aerial photogrammetry techniques).From the point of view of the specific topic, the present paper shows how managerial studies in the systems thinking field represent an approach in constant evolution. This is also true from a methodological point of view, from the specific managerial issues dealt with and from the fields of application, which are growing exponentially and require the models to be able to interpret social and business realities that are very different from one another.

However, the methodologies based on systems thinking remain an inadequately explored field in BMA if we consider the few communities of scholars that study them constantly and systematically. In this regard, the considerations of Brocklesby and Cummings (1996) still seem valid: the authors, proving the validity of Beer's VSM as an instrument of organizational analysis, complained about the limited diffusion in managerial literature, attributing the main cause of this to the excessively theoretical way in which the model was generally presented.

The four clusters identified through bibliographic coupling are clearly distinct from the territorial point of view, from that of the scholar affiliations and from the temporal one; the scientific characterization (disciplinary affiliation, methodological approaches and prevailing managerial themes) of each cluster is also relatively clear. This is evident in the case of the Italian School, John Moores University of Liverpool and the University of Teesside in Middlesbrough. In addition to the reference to the conceptual advancement of the vSa with respect to the VSM, the Italian school has given rise to a disciplinary framework prevalent in marketing, a conjugation with SD-l optics and interpretative models of the value co-creation in service networks. The characterization of the third cluster of human resources management with a view to VSM, which has not clearly emerged through bibliometric analysis, has however been clearly recovered through LRSi methods.

The distance between the clusters of identified scholars and schools suggests an opportunity for greater interaction in order to generate synergies and increase the level of internationalization of research on the topic.

In addition, the 'voids' in the keywords map suggest directions for future research and collaboration. The same is valid, a fortiori, for the topics covered and the methodologies used, testified to by the same map: it suggests, also from a strictly mechanical point of view, other combinations of keywords previously undetected and therefore original research interests.

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REFERENCES

Achterbergh, J., & Vriens, D. (2002). Managing viable knowledge. *Systems Research and Behavioral Science*, *19*(3), 223–241. https://doi.org/10.1002/sres.440

Adham, K. A., Kasimin, H., Mat Isa, R., Othman, F., & Ahmad, F. (2015). Developing a framework for a viable research university. *Systemic Practice and Action Research*, *28*(5), 503–525. https://doi.org/10.1007/s11213-015-9341-8

Adham, K. A., Kasimin, H., Said, M. F., & Igel, B. (2012). Functions and inter-relationships of operating agencies in policy implementation from a viable system perspective. *Systemic Practice and Action Research*, *25*(2), 149–170. https://doi.org/10.1007/s11213-011-9215-7

Adham, K. A., Sarkam, S. F., Said, M. F., Nasir, N. M., & Kasimin, H. (2017). Monitoring of policy implementation: convergent mobile and fixed technologies as emergent enablers. *Systemic Practice and Action Research*, *30*(5), 535–551. https://doi.org/10.1007/s11213-016-9406-3

Adriaanse, L. S., & Rensleigh, C. (2013). Web of Science, Scopus and Google Scholar: A content comprehensiveness comparison. *The Electronic Library*, *31*(6), 727–744. https://doi.org/10.1108/EL-12-2011-0174

Azadeh, A., Darivandi, K., & Fathi, E. (2012). Diagnosing, simulating and improving business process using cybernetic laws and the viable system model: The case of a purchasing process. *Systems Research and Behavioral Science*, *29*(1), 66–86. https://doi.org/10.1002/sres.1102

Azadeh, A., Darivandi Shoushtari, K., Saberi, M., & Teimoury, E. (2014). An integrated artificial neural network and system dynamics approach in support of the viable system model to enhance industrial intelligence: The case of a large broiler industry. *Systems Research and Behavioral Science*, *31*(2), 236–257. https://doi.org/10.1002/sres.2199

Baccarani, C., & Golinelli, G. M. (2016). L'Heritage merita un Progetto Strategico Nazionale (heritage deserves a National

Strategic Project). *Sinergie Italian Journal of Management*, *34*(Jan-Apr), 15–18. https://doi.org/10.7433/s99.2016.02

Badinelli, R., Barile, S., Ng, I., Polese, F., Saviano, M., & Di Nauta, P. (2012). Viable service systems and decision making in service management. *Journal of Service Management*, *23*(4), 498–526. https://doi.org/10.1108/09564231211260396

Barile, S. (2009). Management sistemico vitale, Giappichelli.

Barile, S., Lusch, R., Reynoso, J., Saviano, M., & Spohrer, J. (2016). Systems, networks, and ecosystems in service research. *Journal of Service Management*, *27*(4), 652–674. https://doi.org/10.1108/JOSM-09-2015-0268

Barile, S., Pels, J., Polese, F., & Saviano, M. (2012). An introduction to the viable systems approach and its contribution to marketing. *Journal of Business Market Management*, *5*(2), 54–78.

Barile, S., & Polese, F. (2010). Linking the viable system and many-to-many network approaches to service-dominant logic and service science. *International Journal of Quality and Service Sciences*, *2*(1), 23–42. https://doi.org/10.1108/17566691011026586

Barile, S., & Saviano, M. (2015). From the management of cultural heritage to the governance of the cultural heritage system. In *Cultural heritage and value creation: Towards new pathways* (pp. 71–103). Springer International Publishing. https://doi.org/10.1007/978-3-319-08527-2_3

Barile, S., Saviano, M., Iandolo, F., & Calabrese, M. (2014). The viable systems approach and its contribution to the analysis of sustainable business behaviors. *Systems Research and Behavioral Science*, *31*(6), 683–695. https://doi.org/10.1002/sres.2318

Barile, S., Spohrer, J., & Polese, F. (2010). Editorial column—System thinking for service research advances. *Service Science*, *2*(1–2), 1–3. https://doi.org/10.1287/serv.2.1_2.i i,iii

Bassett-Jones, N., Brown, R. B., & Cornelius, N. (2007). Delivering effective diversity management through effective structures. *Systems Research and Behavioral Science*, *24*(1), 59–67. https://doi.org/10.1002/sres.762

Baumeister, R. F., & Leary, M. R. (1997). Writing narrative literature reviews. *Review of General Psychology*, *1*(3), 311–320. https://doi.org/10.1037/1089-2680.1.3.311

Beer, S. (1972). *Brain of the firm: The managerial cybernetics of organization*. London: Allen Lane the Penguin Press.

Beer, S. (1979). *The heart of enterprise*. Wiley.

Beer, S. (1984). The viable system model: Its provenance, development, methodology and pathology. *Journal of the Operational Research Society*, *35*(1), 7–25. https://doi.org/10.1057/jors.1984.2

Beer, S. (1985). *Diagnosing the system for organizations*. New York, Wiley: Chichester West Sussex.

Beer, S. (1994). *Beyond dispute: The invention of team syntegrity*. Chichester: Wiley.

Bititci, U. S., Carrie, A. S., & McDevitt, L. (1997). Integrated performance measurement systems: A development guide. *International Journal of Operations & Production Management*, *17*(5), 522–534. https://doi.org/10.1108/01443579710167230

Brocklesby, J., & Cummings, S. (1996). Designing a viable organization structure. *Long Range Planning*, *29*(1), 49–57. https://doi.org/10.1016/0024-6301(95)00065-8

Burgess, N., & Wake, N. (2013). The applicability of the viable systems model as a diagnostic for small to medium sized enterprises. *International Journal of Productivity and Performance Management*, *62*(1), 29–46. https://doi.org/10.1108/17410401311285282

Chatzimichailidou, M. M., & Katsavounis, S. (2012). S. Beer's viable system model application in furniture industry—A case study, Entrepreneurship, Innovation and Regional Development, Sofia, Bulgaria, 1-2 June.

Checkland, P. B. (1981). *Systems thinking, systems practice*. Chichester: Wiley.

Czinkota, M., Kaufmann, H. R., & Basile, G. (2014). The relationship between legitimacy, reputation, sustainability and branding for companies and their supply chains. *Industrial Marketing Management*, *43*(1), 91–101. https://doi.org/10.1016/j.indmarman.2013.10.005

Darivandi Shoushtari, K. (2013). Redesigning a large supply chain management system to reduce the government administration: A socio-functional systems approach. *Systemic Practice and Action Research*, *26*(2), 195–216. https://doi.org/10.1007/s11213-012-9244-x

de Solla Price, D. J. (1965). Networks of scientific papers. *Science*, *149*(3683), 510–515. https://doi.org/10.1126/science.149.3683.510

Devine, S. (2005). The viable systems model applied to a national system of innovation to inform policy development. *Systemic Practice and Action Research*, *18*(5), 491–517. https://doi.org/10.1007/s10979-005-8485-y

Dominici, G., & Palumbo, F. (2013). Decoding the Japanese lean production system according to a viable systems perspective. *Systemic Practice and Action Research*, *26*(2), 153–171. https://doi.org/10.1007/s11213-012-9242-z

Espejo, R., Bowling, D., & Hoverstadt, P. (1999). The viable system model and the Viplan software. *Kybernetes*, *28*(6–7), 661–678. https://doi.org/10.1108/03684929910282944

Espejo, R., & Reyes, A. (2011). *Organizational systems: Managing complexity with the viable system model*. Berlin Heidelberg: Springer. https://doi.org/10.1007/978-3-642-19109-1

Espinosa, A., & Porter, T. (2011). Sustainability, complexity and learning: Insights from complex systems approaches. *The Learning Organization*, *18*(1), 54–72. https://doi.org/10.1108/09696471111096000

Espinosa, A., & Walker, J. (2011). *A complexity approach to sustainability: Theory and application*. Imperial College Press. https://doi.org/10.1142/p699.

Fang, Y., Zhu, D., & Zheng, Y. (2015). The current status and systematic framework of talent programmes in basic research in China: A system theory perspective. *Technology Analysis & Strategic Management*, *27*(6), 722–738. https://doi.org/10.1080/09537325.2014.957665

Ferreira, A., & Otley, D. (2009). The design and use of performance management systems: An extended framework for analysis. *Management Accounting Research*, *20*(4), 263–282. https://doi.org/10.1016/j.mar.2009.07.003

Flood, R. L., & Jackson, M. C. (1991). *Creative problem solving*. Chichester: Wiley.

Forsman, M., Nane, T., & Noyons, E. (2014). Research performance analysis for the University of Helsinki 2005-2012/13, CWTS Bibliometric Report, Leiden University.

Ganzert, C., Martinelli, D. P., & Delai, I. (2012). Intelligence systems methodology: A systemic approach to the organizational intelligence function. *Knowledge Management Research and Practice*, *10*(2), 141–152. https://doi.org/10.1057/kmrp.2011.44

Golinelli, C. M. (2008). La valorizzazione del patrimonio culturale. Verso la definizione di un modello di governance, Giuffrè, Italia.

Golinelli, G. M. (2000). *L'approccio sistemico al governo dell'impresa* (Vol. 1), Cedam, Padova, Italy.

Golinelli, G. M. (2010). Viable systems approach (VSA): Governing business dynamics, CEDAM.

Golinelli, G. M., Pastore, A., Gatti, M., Massaroni, E., & Vagnani, G. (2002). The firm as a viable system: Managing inter-organisational relationships. *Sinergie Italian Journal of Management*, *58*, 65–98.

Gregory, A. J. (2007). Target setting, lean systems and viable systems: A systems perspective on control and performance measurement. *Journal of the Operational Research Society*, *58*(11), 1503–1517. https://doi.org/10.1057/palgrave.jors.2602319

Habermas, J. (1987). *The theory of communicative action* (Vol. 2). Cambridge, UK: Polity Press.

Harwood, S. A. (2009). The changing structural dynamics of the scottish tourism industry examined using stafford beer's VSM. *Systemic Practice and Action Research*, *22*(4), 313–343. https://doi.org/10.1007/s11213-009-9129-9

Herzog, M., Ebentheuer, A. W., Winter, M., Taube, J., Froeschl J., & Herzog, H. (2016). Applications of the viable system model in automotive and battery storage systems, IEEE International Conference on Systems, Man, and Cybernetics (SMC), Budapest, 2016, pp. 001747–001752, https://doi.org/10.1109/SMC.2016.7844490

Hildbrand, S., & Bodhanya, S. (2014). Application of the viable system model in a complex sugarcane supply chain. *British Food Journal*, *116*(12), 2048–2068. https://doi.org/10.1108/BFJ-06-2013-0158

Hull, G. S. (2000). US MBA and management training programs in Central and Eastern Europe. *Journal of Technology Transfer*, *25*, 319–327. https://doi.org/10.1023/A:1007830806873

Huovinen, P. (2010). Recursive advancement of competence-based business management and its conceptual modeling. *Research in Competence-Based Management*, *5*, 175–202. https://doi.org/10.1108/S1744-2117(2010)0000005010

Huovinen, P. (2014). Advancement of international business ideation as three recursive, multi-competence-enabled systems. In *Research in Competence-Based Management* (Vol. 7, pp. 337–377). Emerald Group Publishing Ltd. https://doi.org/10.1108/S1744-211720140000007011

Iles, P., Ramgutty-Wong, A., & Yolles, M. (2004). HRM and knowledge migration across cultures: Issues, limitations, and Mauritian specificities. *Employee Relations*, *26*(6), 643–662. https://doi.org/10.1108/01425450410562227

Iles, P., & Yolles, M. (2002a). Across the great divide: HRD, technology translation, and knowledge migration in bridging the knowledge gap between SMEs and Universities. *Human Resource Development International*, *5*(1), 23–53. https://doi.org/10.1080/13678860110007184

Iles, P., & Yolles, M. (2002b). International joint ventures, HRM and viable knowledge migration. *International Journal of Human Resource Management*, *13*(4), 624–641. https://doi.org/10.1080/09585190210125633

Iles, P., & Yolles, M. (2003). International HRD alliances in viable knowledge migration and development: The Czech Academic Link Project. *Human Resource Development International*, *6*(3), 301–324. https://doi.org/10.1080/13678860210122652

Jackson, M. C. (1988). An appreciation of Stafford Beer's 'viable system' viewpoint on managerial practice. *Journal of Management Studies*, *25*(6), 557–573. https://doi.org/10.1111/j.1467-6486.1988.tb00047.x

Kessler, M. M. (1963). Bibliographic coupling between scientific papers. *Journal of the Association for Information Science and Technology*, *14*(1), 10–25. https://doi.org/10.1002/asi.5090140103

Kinloch, P., Francis, H., Francis, M., & Taylor, M. (2009). Supporting crime detection and operational planning with soft systems methodology and viable systems model. *Systems Research and Behavioral Science*, *26*(1), 3–14. https://doi.org/10.1002/sres.943

Kuhn, S. T. (1970). *The structure of scientific revolutions*. Chicago: University of Chicago Press.

Leonard, A. (2000). The viable system model and knowledge management. *Kybernetes*, *29*(5–6), 710–715. https://doi.org/10.1108/03684920010333143

Leonard, A. (2008). Integrating sustainability practices using the viable system model. *Systems Research and Behavioral Science*, *25*(5), 643–654. https://doi.org/10.1002/sres.937

Leonard, A. (2009). The viable system model and its application to complex organizations. *Systemic Practice and Action Research*, *22*(4), 223–233. https://doi.org/10.1007/s11213-009-9126-z

Libbrecht, S., & Vandevyvere, P. (2005). Systemic competence management in support of the viability of organisations. In *Advances in applied business strategy* (Vol. 9) (pp. 147–168). Emerald Group Publishing Ltd. https://doi.org/10.1016/S0749-6826(05)09008-6

Maglio, P. P., & Spohrer, J. (2008). Fundamentals of service science. *Journal of the Academy of Marketing Science*, *36*(1), 18–20. https://doi.org/10.1007/s11747-007-0058-9

Mahamed Ismail, N. A., Welch, C., & Xu, M. (2015). Towards a sustainable quality of university research: Knowledge sharing. *Knowledge Management Research and Practice*, *13*(2), 168–177. https://doi.org/10.1057/kmrp.2013.39

Maracha, V. (2016). Feedback mechanisms in public administration system: VSM application and institutional factors, Governing Business Systems. Theories and Challenges for Systems Thinking in Practice, 25.

Markoulli, M., Lee, C. I. S. G., Byington, E., & Felps, W. A. (2017). Mapping human resource management: Reviewing the field and charting future directions. *Human Resource Management Review*, *27*(3), 367–396. https://doi.org/10.1016/j.hrmr.2016.10.001

Mele, C., Pels, J., & Polese, F. (2010). A brief review of systems theories and their managerial applications. *Service Science*, *2*(1–2), 126–135. https://doi.org/10.1287/serv.2.1_2.126

Melé, D., Chinchilla, M. N., & López-Jurado, M. (2019). The "Freely Adaptive System". Application of this cybernetic model to an organization formed by two dynamic human systems. *Philosophy of Management*, *18*(1), 89–106. https://doi.org/10.1007/s40926-018-0098-x

Morlidge, S. P. (2009). Money, time and variety engineering: The application of cybernetics to the diagnosis and design of financial performance management systems. *Systemic Practice and Action Research*, *22*(4), 235–247. https://doi.org/10.1007/s11213-009-9124-1

Nenonen, S., & Storbacka, K. (2010). Business model design: Conceptualizing networked value co-creation. *International Journal of Quality and Service Sciences*, *2*(1), 43–59. https://doi.org/10.1108/17566691011026595

O'Grady, W., Morlidge, S., & Rouse, P. (2016). Evaluating the completeness and effectiveness of management control systems with cybernetic tools. *Management Accounting Research*, *33*, 1–15. https://doi.org/10.1016/j.mar.2016.02.003

O'Grady, W., Rouse, P., & Gunn, C. (2010). Synthesizing management control frameworks. *Measuring Business Excellence*, *14*(1), 96–108. https://doi.org/10.1108/13683041011027481

Panagiotakopoulos, P. D., Espinosa, A., & Walker, J. (2016). Sustainability management: Insights from the viable system model. *Journal of Cleaner Production*, *113*, 792–806. https://doi.org/10.1016/j.jclepro.2015.11.035

Paucar-Caceres, A., & Espinosa, A. (2011). Management science methodologies in environmental management and sustainability: Discourses and applications. *Journal of the Operational Research Society*, *62*(9), 1601–1620. https://doi.org/10.1057/jors.2010.110

Paucar-Caceres, A., & Pagano, R. (2009). Systems thinking and the use of systemic methodologies in knowledge management. *Systems Research and Behavioral Science*, *26*(3), 343–355. https://doi.org/10.1002/sres.931

Perianes-Rodriguez, A., Waltman, L., & van Eck, N. J. (2016). Constructing bibliometric networks: A comparison between full and fractional counting. *Journal of Informetrics*, *10*(4), 1178–1195. https://doi.org/10.1016/j.joi.2016.10.006

Polese, F., Carrubbo, L., Bruni, R., & Maione, G. (2017). The viable system perspective of actors in eco-systems. *TQM Journal*, *29*(6), 783–799. https://doi.org/10.1108/TQM-05-2017-0055

Porter, A. L., Kongthon, A., & Lu, J. C. (2002). Research profiling: Improving the literature review. *Scientometrics*, *53*(3), 351–370. https://doi.org/10.1023/A:1014873029258

Puche, J., Ponte, B., Costas, J., Pino, R., & De La Fuente, D. (2016). Systemic approach to supply chain management through the viable system model and the theory of constraints. *Production Planning and Control*, *27*(5), 421–430. https://doi.org/10.1080/09537287.2015.1132349

Rezaee, Z., Azar, A., Erz, A. M. B., & Nayeri, M. D. (2019). Application of viable system model in diagnosis of organizational structure. *Systemic Practice and Action Research*, *32*(3), 273–295. https://doi.org/10.1007/s11213-018-9454-y

Rezk, S. S., & Gamal, S. (2019). The viable system model and its applications in higher education: An overview. *Kybernetes*, *48*(3), 438–450. https://doi.org/10.1108/K-04-2018-0185

Rios, J. P. (2006). Communication and information technologies to enable viable organizations. *Kybernetes*, *35*(7–8), 1109–1125. https://doi.org/10.1108/03684920610675111

Rios, J. P. (2012). *Design and diagnosis for sustainable organizations: The viable system method*. Springer Science & Business Media. https://doi.org/10.1007/978-3-642-22318-1

Runardotter, M. (2011). Organizational cooperation for cultural heritage—A viable systems approach. *Systems Research and Behavioral Science*, *28*(1), 77–90. https://doi.org/10.1002/sres.1047

Saviano, M., Parida, R., Caputo, F., & Datta, S. K. (2014). Health care as a worldwide concern. insights on the Italian and Indian health care systems and PPPs from a VSA perspective. *EuroMed Journal of Business*, *9*(2), 198–220. https://doi.org/10.1108/EMJB-10-2013-0050

Schwaninger, M. (2000). Managing complexity—The path toward intelligent organizations. *Systemic Practice and Action Research*, *13*(2), 207–241. https://doi.org/10.1023/A:1009546721353

Schwaninger, M. (2006). Theories of viability: A comparison. *Systems Research and Behavioral Science*, *23*(3), 337–347. https://doi.org/10.1002/sres.731

Schwaninger, M., & Pérez Ríos, J. (2008). System dynamics and cybernetics: A synergetic pair. *System Dynamics Review*, *24*(2), 145–174. https://doi.org/10.1002/sdr.400

Schwarz, E. (1997). Towards a holistic cybernetics: From science through epistemology to being. *Cybernetics and Human Knowing*, *4*(1), 17–50.

Simone, C., Barile, S., & Calabrese, M. (2018). Managing territory and its complexity: A decision-making model based on the viable system approach, VsA. *Land Use Policy*, *72*, 493–502. https://doi.org/10.1016/j.landusepol.2017.12.070

Simons, R., Dávila, A., & Kaplan, R. S. (2000). *Performance measurement & control systems for implementing strategy* (p. 203). Upper Saddle River, NJ: Prentice Hall.

Small, H. (1973). Co-citation in the scientific literature: A new measure of the relationship between two documents. *Journal of the Association for Information Science and Technology*, *24*(4), 265–269. https://doi.org/10.1002/asi.4630240406

Tavella, E., & Papadopoulos, T. (2015). Expert and novice facilitated modelling: A case of a viable system model workshop in a local food network. *Journal of the Operational Research Society*, *66*(2), 247–264. https://doi.org/10.1057/jors.2013.187

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, *14*(3), 207–222. https://doi.org/10.1111/1467-8551.00375

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

van Eck, N. J., & Waltman, L. (2014). Visualizing bibliometric networks. In *Measuring scholarly impact* (pp. 285–320). Springer. doi: https://doi.org/10.1007/978-3-319-10377-8_13

Vargo, S. L. (2008). Customer integration and value creation: paradigmatic traps and perspectives. *Journal of Service Research*, *11*(2), 211–215. https://doi.org/10.1177/1094670508324260

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, *68*(1), 1–17. https://doi.org/10.2307/30161971

Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: Continuing the evolution. *Journal of the Academy of Marketing Science*, *36*(1), 1–10. https://doi.org/10.1007/s11747-007-0069-6

Walker, M. (2017). The search for viability: A practitioner's view of how the viable systems model is helping transform English local government, and why it has passed unrecognised. *Systems Research and Behavioral Science*, *34*(3), 313–334. https://doi.org/10.1002/sres.2455

Waltman, L., & van Eck, N. J. (2015). Field-normalized citation impact indicators and the choice of an appropriate counting method. *Journal of Informetrics*, *9*(4), 872–894. https://doi.org/10.1016/j.joi.2015.08.001

Yolles, M. (2001). Viable boundary critique. *Journal of the Operational Research Society*, *52*(1), 35–47. https://doi.org/10.1057/palgrave.jors.2600069

Yolles, M., & Guo, K. (2003). Paradigmatic metamorphosis and organizational development. *Systems Research and Behavioral Science*, *20*(2), 177–199. https://doi.org/10.1002/sres.533

Yolles, M. I. (1999). Management systems: A viable systems approach, London, Financial Times Management.

Yolles, M. I. (2000). The theory of viable joint ventures. *Cybernetics and Systems*, *31*(4), 371–396. https://doi.org/10.1080/019697200124757

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