

SCIENTOMETRIC ANALYSIS OF PMOS AND THEIR RELATION WITH THE MANAGEMENT OF PROJECTS PROGRAMS AND PORTFOLIOS

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1. INTRODUCTION

Researchers had conducted studies about PMOs, and others had analyzed the effect of this kind of structures in the context of projects, program and portfolios management (PPPM). This research work developed a meticulous state of the art about PMOs and its relation with the PPPM, by performing a detailed scientometric analysis of this matter of study.

The aim of this research is to develop a detailed scientometric analysis of PMOs in the context of project, program and portfolio management by developing a theoretical framework about main concepts related to PMOs and project, program and portfolio management, as well as scientometric; to define a research methodology in order to develop a meticulous scientometric analysis about the PMOs in the context of PPPM; to conduct a comprehensive bibliometric analysis about main authors, topics of study, sources, subgroups, countries and institutions about PMOs and their relation with the PPPM; to document findings

about the scientometric analysis of PMOs in the context of project, program and portfolio management; and to establish conclusions, and to define future lines of research about the PMOs and the PPPM as a topic of study.

2. THEORETICAL FRAMEWORK

On this research work, main concepts related to PMOs and project, program and portfolio management, as well as scientometric were defined. These elements were included on the research methodology of this study.

2.1 PMOs

The term PMO refers to “an office or organization for the management of portfolios, programs or projects” (PMI, 2017 a, p. 4). The concept of PMO is also defined as one of the kinds of organizational structures, with particular characteristics such as: high to almost total authority of the project management with full time assignment, high or total availability of resources to undertake this kind of endeavors, responsibility of project management over budget and other resources needed to face projects (PMI, 2017 a).

For the AIPM, the PMOs “are typically focused on the technical aspects of projects and programs, such as: the development and maintenance of the methodology, report or management of resources; but without the responsibility over the portfolio” (AIPM, 2014, Part F p. 5). The APM states that PMOs are structures designed for the management of project, programs and portfolios PPPM (APM, 2019). Aubry, Hobbs & Thuillier (2009, p. 142) argue that PMOs can be seen as social entities.

For the AMA, a PMO is the place where project managers and the management of projects meet, and is a fundamental element “for organizations that move from doing an adequate job on project management with an individual approach, to create a project management system for the organization that adds value, in a repetitive and reliable way” (Dinsmore & Cabanis-Brewin, 2011, p. 356).

IPMA remarks that PMOs “define the strategies and goals for the development of the activities related with the management of projects (...) and habilitate the development of collective competitive and organizational advantages by conducting joined activities of project and program stakeholders” IPMA (2015, p. 21).

According to Hill, a PMO “involves people (stakeholders), processes (methodologies and practices), and techniques (automated systems and aids for the work) to manage or influence the management of projects” Hill (2013, p. xxi).

ISO 21.500 refers to the PMO concept as “one of the project stakeholders that provides a wide range of activities such as governance, standardization, training on project management, as well as planning and monitoring of projects” ISO 21.500 (2012, p. 9). Kerzner (2013, p. 1097) declares that PMOs “are the guardians of the intellectual property about project management” on an organization. For Lock (2013, p. 171) the PMOs “are a group of centralized project management services”.

According to the P2M, a project office (PO) is a fundamental element for a project oriented organization, and is responsible for the maximization of organizational value based on flexible collaboration (PMAJ, 2017).

The program management offices (PgMO) are “organizational structures that standardize the governance processes related to programs and facilitate sharing of resources, methodologies, tools and techniques” across an organization (PMI, 2017 c, p. 79). A portfolio management office (PfMO) is an “organizational entity that provides a wide range of capacities and support processes for the management of portfolios” (PMI, 2017 b, p. 16).

For Axelos (2013, p. 7) a portfolio, program and project management office (P3O) is “an unique or multiple structures, physical or virtual, temporal or permanent, that provide a combination of centralized and combined services and functions, as well as integration with governance arrangements, the business and other corporate supporting functions”.

2.2 Project management

Project management is defined as “the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements” (PMI, 2017 a, p. 10). Other definition of project management is the application of processes, methods, knowledge, skills and experience to achieve project objectives (APM, 2019). Kerzner (2013, p. 66) defines project management as “the process to reach project objectives throughout a traditional organizational structure and the specialties from the related individuals”.

For the ISO 21.500 this term consists of “the application to a project of methods, tools, techniques and competencies. Project management involves the integration of different phases of the project life cycle” (ISO, 2012, p. 4). From the P2M perspective, project management is the total referential framework of the practical professional capability to deliver a project product, reaching a given mission, by organizing a project team (PMAJ, 2017).

For Lock (2013, p. 1), project management is the “discipline of planning, organizing and controlling people, money and cash, in order to complete projects successfully”. For the AMA, project management is a “group of leanings for the planning, the monitoring and the control of unique endeavors” (Dinsmore & Cabanis-Brewin, 2011, p. 5). For the APM, project management can be defined as the application of processes, methods, knowledge, tools and experiences to reach project goals (APM, 2019).

The IPMA (2015) states that project management is the “application of methods, tools, techniques and competences to a project, with the purpose of reach its goals” (IPMA, 2015, p. 36). For Axelos (2017) project management is the planning, delegation, monitoring and control of the aspects of a project, as well as the motivation of the stakeholders, to reach project objectives within the goals of performance, time, cost, quality, scope, benefits and risks.

2.3 Program management

The PMI defines program management as “the application of knowledge, skills and principles to a program, to reach program objectives and to gain benefits and control, not available, if projects were managed independently” (PMI, 2017 a, p. 14).

For the ISO21.500, program management “consists of on centralized and coordinated activities to reach goals” of the program (ISO, 2012, p. 6). The P2M defines program management as a reference framework of the capacities to adapt, to manage in a flexible way, the performance of the organization, this capacity is showed when incrementing the holistic value and reach a mission, optimizing the relation between the combination of projects (PMAJ, 2017).

For Lock (2013), program management is a step beyond project management, where a wide combination of projects, are managed, in a coordinated way within a structure named program. The AMA defines program management as “the practices that help organizations to group projects and manage them by departments or divisions” (Dinsmore & Cabanis-Brewin, 2011, p. 297).

The APMBOK defines program management as the coordinated management of projects and activities of change management to reach a beneficial change (APM, 2019). The IPMA states program management as “the coordinated management of all components with the purpose of implementing change as well as benefit realization (...) consists of the application of methods, tools, techniques and competencies to a program” (IPMA, 2015, p. 158).

For Axelos (2017), program management is the organization, direction, and coordinated implementation of a group of projects and transformation activities to reach program results and obtain benefits of strategic importance.

2.4 Portfolio management

The PMI defines the term portfolio management as “the centralized administration of one or more portfolios to reach strategic objectives” (PMI, 2017 a, p. 15) and consists of the “application of portfolio mana-

gement principles to align a portfolio and its components, with the organizational strategy” (PMI, 2017 b, p. 5).

For the ISO 21.500, portfolio management “is the centralized management of one or more project portfolios, which includes the identification, priorities setting, authorization, management and control of the projects, programs and other works, to reach strategic goals” (ISO, 2012, p. 6).

For the AIPM, portfolio management “operates at the strategic level of the organization. Different from projects and programs, a portfolio does not have a defined time frame, in contrast, is a continuous process and requires periodical reviews to assure that the portfolios remain balanced and consistent with the organizational strategic objectives” (AIPM, 2014, Part F p. 4).

For Lock (2013), portfolio management is a process that aims the proper definition of priorities that project have formally authorized by top management, to assign the better available resources to mitigate risk exposure, are constantly overlooked to keep them under control.

The AMA defines portfolio management as “manage different projects by departments and divisions” (Dinsmore & Cabanis-Brewin, 2011, 297). The APMBOK says portfolio management is the selection, prioritization and control of projects and programs on an organization aligned with the strategic objectives and it’s delivery capacity (APM, 2019).

IPMA defines portfolio management as “a dynamic decision-making process in which new projects and programs are evaluated, selected, prioritized and balanced in the context of previously approved projects and programs within the portfolio” (IPMA, 2015, p. 282).

Axelos defines portfolio management as a coordinated collection of strategic processes and decisions that together, allows the most effective balance between organizational change and the form in which the organization reaches its objectives (Axelos, 2017).

2.5 Project program and portfolio management (PPPM)

Considering the definitions of project, program and portfolio management mentioned above, it can be said that project program and portfolio management (PPPM) is the management of these kinds of endeavors within a given organization, in a coordinated way.

2.6 Scientometrics

Scientometrics is the “the branch of information science concerned with the application of bibliometrics to the study of the spread of scientific ideas; the bibliometric analysis of science” Oxford (2020 b).

Bibliometric is the “statistical analysis of books, articles, or other publications” Oxford (2020 a).

3. METHODOLOGY

In this section, an exploratory methodology was defined based on the scientometric and bibliometric analysis. The components used on this research work were: (a.) search of the terms PMO, project, program and portfolio management on the main scientific information analysis tools (Scopus and WOS); (b.) identification of 432 scientific publications between 1987 and 2020 (January), related to the matter of study; (c.) depuration of the data from the selected publications; (d.) construction of the loading information files; (e.) exportation of the selected publications information in to the bibliometric analysis tool; (f.) conduct the bibliometric analysis of main topics of investigation about PMOs in the context of PPPM; (g.) definition of key authors; (h.) determination of the principal sources (journals), (i.) main subgroups; (j.) countries; (j.) institutions; and (k.) documentation of the scientometric analysis results about PMOs and their relation with project, program and portfolio management. The methodology of research is shown in the Figure 1.

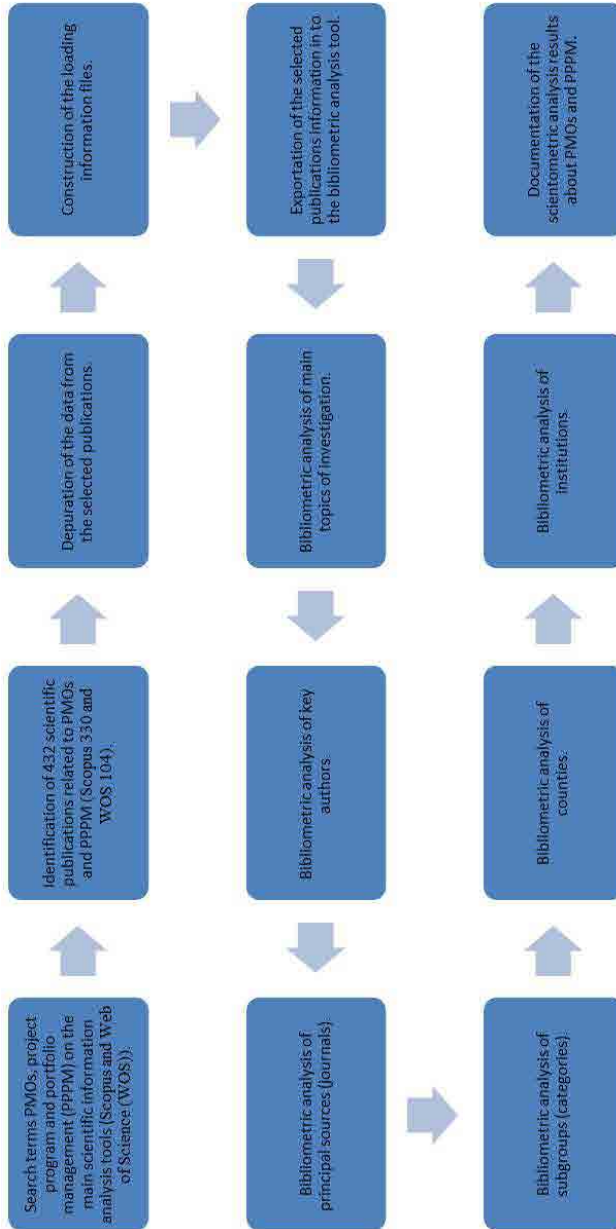


Fig. 1: Methodology of research.

Source: The Author with Rincón-González (2014 a, 2014 b, 2015, 2016, 2017 a, 2017 b, 2018 a, 2018 b, 2018 c, 2019 a, 2019 b, 2020 a, 2020b, 2020c, 2020 d, 2021); Rincón-González & Aragónés-Beltrán (2020); Rincón-González & Díaz-Piraquive (2018, 2019 a, 2019 b, 2019 c, 2019 d, 2020); Rincón-González & Castro-Silva (2019); Rincón-González, Díaz-Piraquive & Diez-Silva (2019); Rincón-González, Nieto, Rodríguez, Romero & Fajardo (2018); Bautista & Rincón-González (2017); Castro-Silva, Rincón-González & Diez-Silva (2020); Cifuentes, Buenaventura, Marroquin, Moya & Rincón-González (2021); Díaz-Piraquive & Rincón-González (2019); Gómez, Rojas, Piedrahita, Cortes, Marín & Rincón-González (2019); Mejía & Rincón-González (2018); Muñoz, Landínez, Ojeda, Quirós, Vera & Rincón-González (2019); Otero & Rincón-González (2020); Peña, and Rincón-González, Sánchez & Gavilán (2018); Rodríguez & Rincón-González (2020); Sarmiento Rojas & Rincón-González (2020); Vargas & Rincón-González (2021).

4. RESULTS

The relations between the PMOs and the PPPM were analyzed by conducting detailed scientometric analysis about how this kind of structures influence the management of projects, programs and portfolios according to the scientific literature illustrated by Scopus and WOS databases. In each case, the following bibliometric analyses were carried out: (a.) publications per year on main scientific information analysis tools; (b.) main topics of research; (c.) key authors, whit more citations and publications; (d.) principal sources, with larger number of scientific articles; (e.) publications by subgroups (categories); (f.) countries of origin; and (g.) research institutions heading the investigation of the matter of study.

4.1 Scientometric analysis of PMOs and their relationship with the management of projects

85.02% of the scientific literature analyzed on this research is about the relation between PMOs and PPPM and is oriented from the project management perspective. This is evidence to prove that the PMOs influence in a strong way the management of this kind of endeavors among organizations.

4.1.1 *Bibliometric analysis of publications about PMOs and their relation with project management*

Since 1987, there had been publications analyzing the way PMOs influence the management of projects, from 2003 an increment on the number of publications related to this phenomenon is observed; illustrating a strong proliferation of studies investigating this aspect of the PPPM as showed on figure 2.

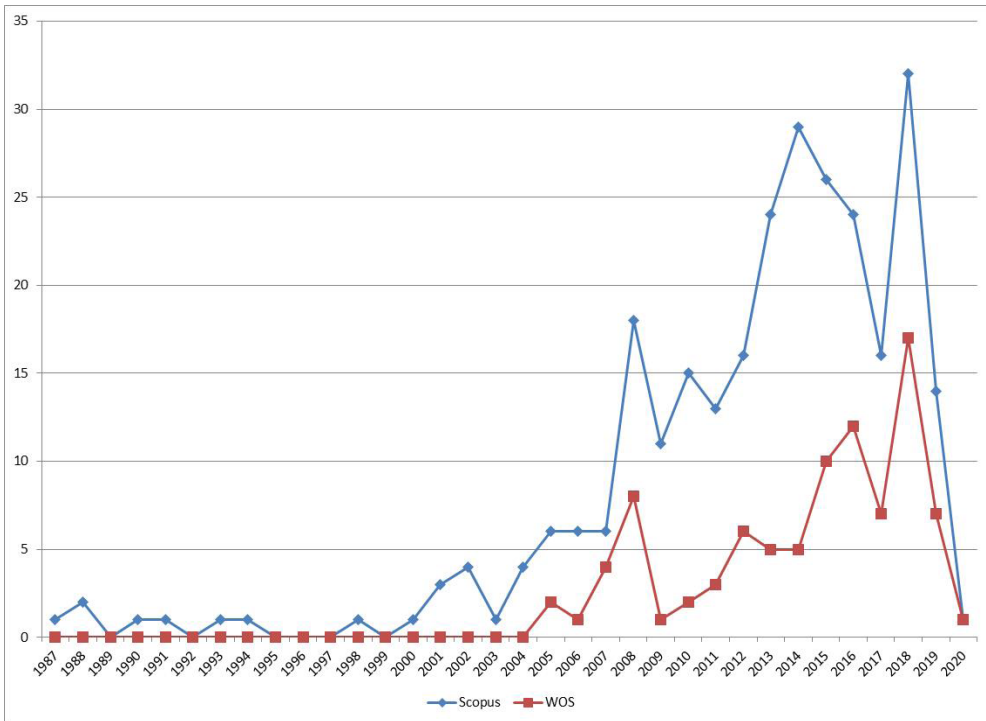


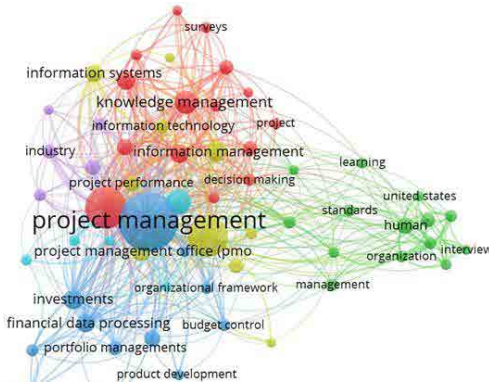
Fig. 2: Scientific publications about the relationship between PMOs and project management – Scopus and WOS (1987 – 2020).

Source: The author with information from Scopus (2020) and WOS (2020).

4.1.2 Bibliometric analysis of main topics of research about the PMOs and their relation with project management

On one hand, the topics with greater link strength about PMOs and project management in Scopus are: (a.) project management, (b.) PMOs, (c.) information management, (d.) investments, and (e.) knowledge management (refer to figure 3).

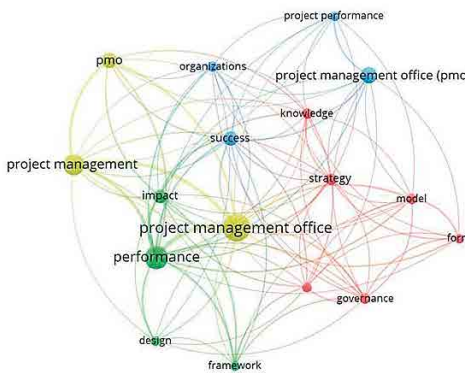
On the other hand, on WOS, the links with mayor impact are: (a.) PMO, (b.) performance, (c.) project management, (d.) impact, and (e.) success, as can be seen on figure 4.



keyword	occurrences	total link strength
project management	168	555
project management offices	82	341
project management office	80	241
information management	22	125
investments	20	121
knowledge management	26	113
financial data processing	17	110
societies and institutions	18	108
management science	18	102
pmo	31	93
information systems	15	79
portfolio managements	10	68
human resource management	11	63
project managers	13	61
human	13	59
research	12	59
information technology	11	55
project management office (pmo)	19	54

Fig. 3: Bibliometric map of main topics of research about the PMOs and their relation with project management – Scopus.

Source: The author with information from Scopus (2020).



keyword	occurrences	total link strength
project management office	36	62
performance	25	60
project management	21	42
impact	9	30
success	10	30
pmo	12	25
strategy	7	23
governance	6	22
model	6	20
framework	5	18
knowledge	6	18
portfolio management	5	17
project management office (pmo)	13	17
organizations	6	16
form	5	14
design	5	13
project performance	5	11

Fig. 4: Bibliometric map of main topics of research about the PMOs and their relation with project management – WOS.

Source: The author with information from WOS (2020).

4.1.3 Bibliometric analysis of key authors on the research about the PMOs and their relation with project management

Regarding to authors with larger numbers of quotes and references, Scopus highlighted the following: (a.) Aubry, M., (b.) Hobbs, B., (c.) Thuller, D., (d.) Lavoie-Tremblay, M., and (e.) Richer, M., as illustrated on figure 5.

Main authors on WOS are: (a.) Aubry, M., (b.) Lavoie-Tremblay, M., (c.) Richer, M., (d.) Cry, G., and (e.) Hobbs, B., as shown on figure 6.

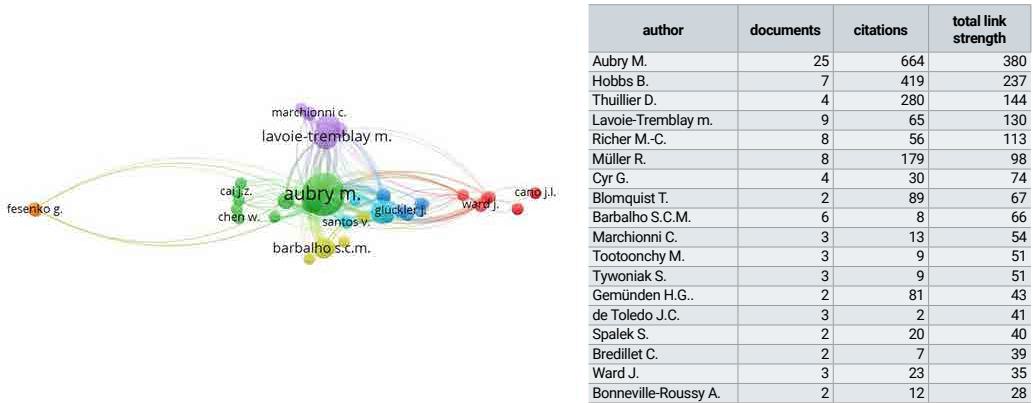


Fig. 5: Bibliometric map of key authors on the research about the PMOs and their relation with project management – Scopus.

Source: *The author with information from Scopus (2020).*

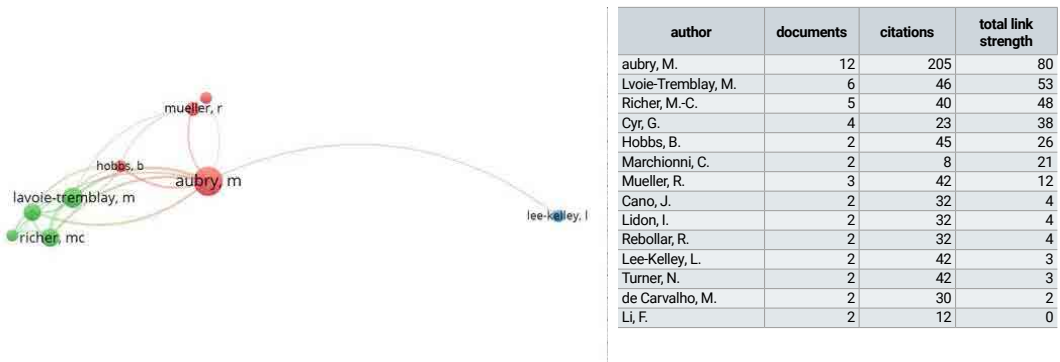


Fig. 6: Bibliometric map of key authors on the research about the PMOs and their relation with project management – WOS.

Source: *The author with information from WOS (2020).*

4.1.4 Bibliometric analysis of most influencing sources on the research about the PMOs and their relation with project management

As most influencing sources about the PMOs and project management are shown on Scopus, the following can be seen: (a.) The International Journal of Project Management, (b.) The Project Management Journal,

(c.) The International Journal of Managing Projects, (d.) Gestao e producao, and (e.) Producao, as can be seen on figure 7.

Regarding to WOS, the sources with higher link strength are: (a.) The Project Management Journal, (b.) The International Journal of Project Management, (c.) The International Journal of Information Technology, (d.) The International Journal of Managing Projects, and (e.) The South African Journal of Industrial Engineering (refer to figure 8).

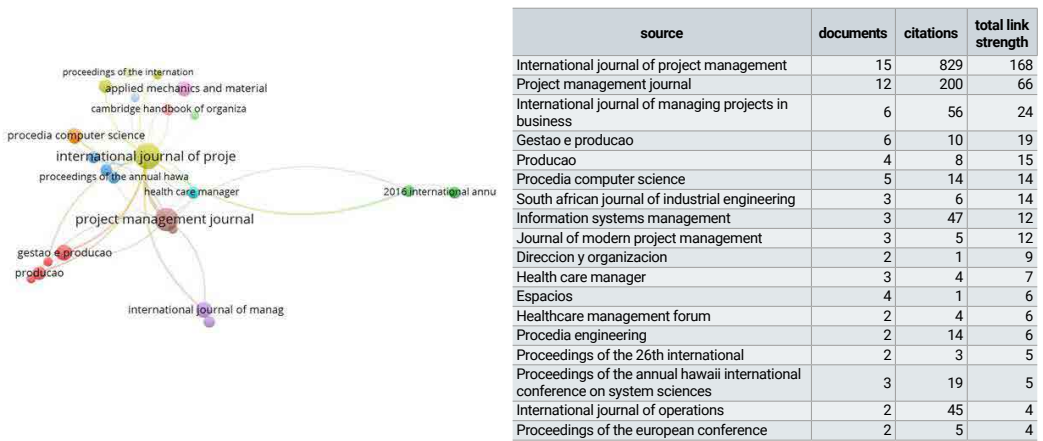


Fig. 7: Bibliometric map of most influencing sources on the research about the PMOs and their relation with project management – Scopus.
 Source: The author with information from Scopus (2020).

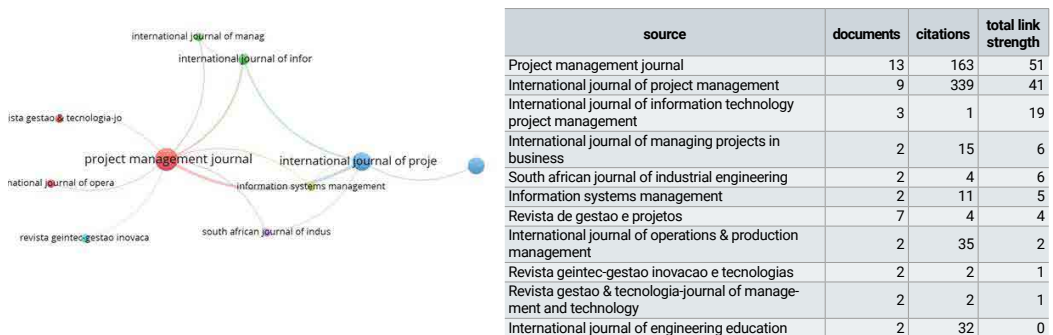


Fig. 8: Bibliometric map of most influencing sources on the research about the PMOs and their relation with project management – WOS.
 Source: The author with information from WOS (2020).

4.1.5. *Bibliometric analysis of publications by subgroup on the research about the PMOs and their relation with project management*

In Scopus, the major subgroups of research about the relation between PMOs and project management are: (a.) business, management and accounting; (b.) engineering; (c.) computer science; (d.) decision science and (e.) social science as shown on figure 9.

According to WOS, the most influencing subgroups about PMOs and the relationship with project management are: (a.) management, (b.) business, (c.) industrial engineering, (d.) computer science information systems, and (e.) economics, as illustrated on figure 10.

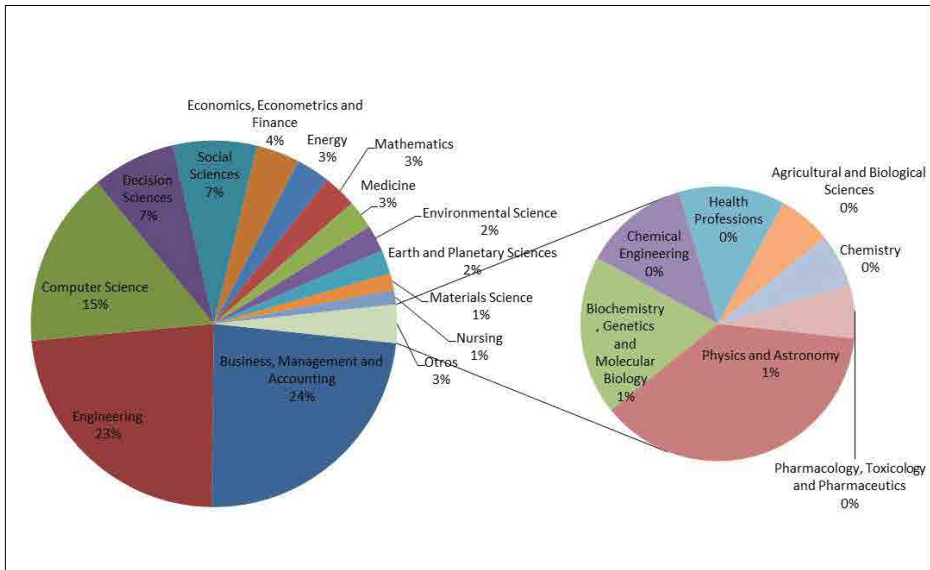


Fig. 9: Publications by subgroup on the research about the PMOs and their relation with project management – Scopus.

Source: *The author with information from Scopus (2020).*

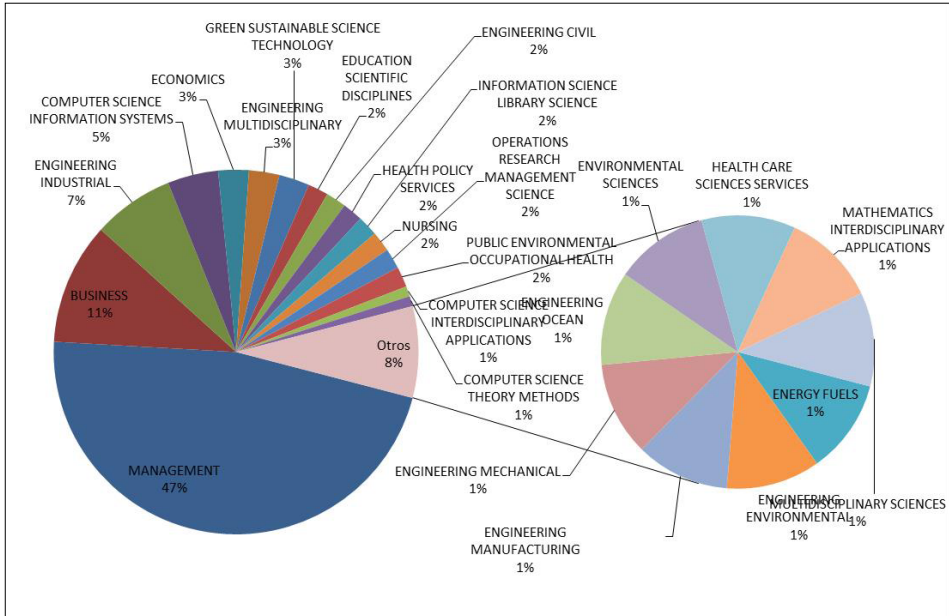


Fig. 10: Publications by subgroup on the research about the PMOs and their relation with project management – WOS.

Source: The author with information from WOS (2020).

4.1.5 Bibliometric analysis of publications by country about the PMOs and their relation with project management

Related to the countries of origin of the researches about the relationship of PMOs and project management, Scopus illustrates the following as those with the larger number of studies: (a.) Canada, (b.) United States of America, (c.) Sweden, (d.) Norway, and (e.) Germany, as shown on figure 11.

In the case of WOS, the countries with stronger links about publications of PMOs and project management are: (a.) Canada, (b.) Australia, (c.) Germany, (d.) Finland, and (e.) Brazil, as illustrated on figure 12.

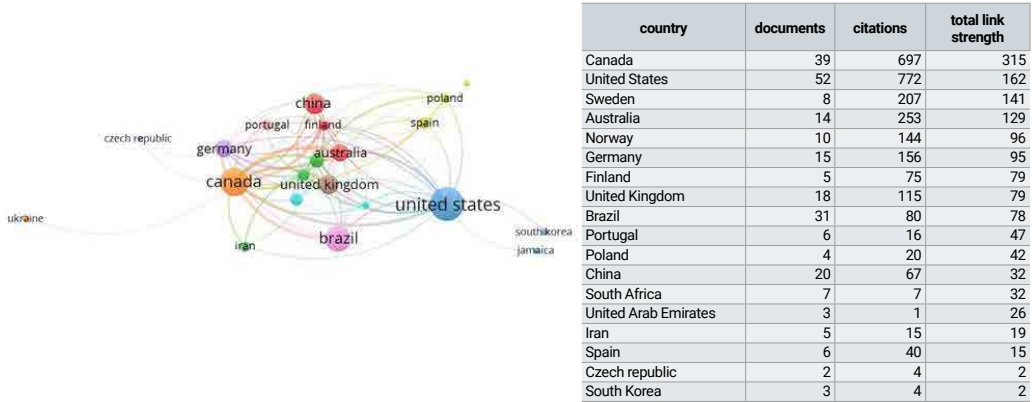


Fig. 11: Bibliometric map of publications by country about the PMOs and their relation with project management – Scopus.

Source: The author with information from Scopus (2020).

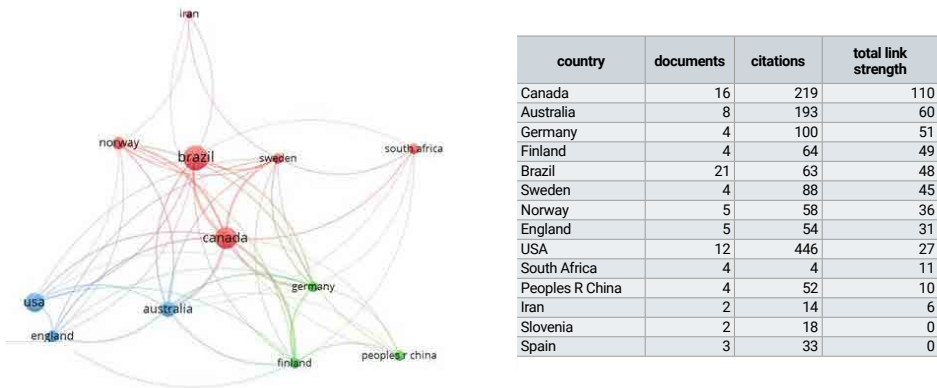


Fig. 12: Bibliometric map of publications by country about the PMOs and their relation with project management – WOS.

Source: The author with information from WOS (2020).

4.1.6 Bibliometric analysis of publications by organization about the PMOs and their relation with project management

About the organizations or institutions leading the research of PMOs and their relationship with project management, Scopus highlighted the following as shown in figure 13: (a.) University of Lisbon, (b.) Queensland University of Technology, (c.) University of Minho, (d.) McGill University, and (e.) University of Ottawa.

Related to this matter, WOS states as main organizations funding this kind of research the following as seen on figure 14: (a.) University of Quebec, (b.) McGill University, (c.) Queensland University of Technology, (d.) University of Sao Paulo, and (e.) Cranfield University.



Fig. 13: Bibliometric map of publications by organization about the PMOs and their relation with project management – Scopus.

Source: The author with information from Scopus (2020).

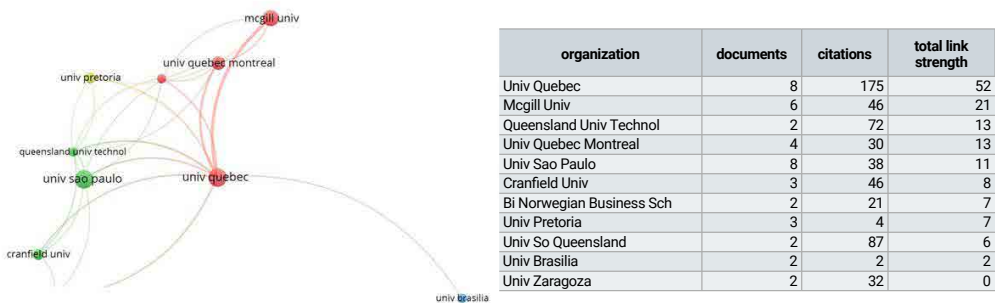


Fig. 14: Bibliometric map of publications by organization about the PMOs and their relation with project management – WOS.

Source: The author with information from WOS (2020).

4.2 Scientometric analysis of PMOs and their relation with the management of programs

Only 4.37% of the literature available on Scopus and WOS about PMOs is related to the program management element of the PPPM. This fact represents a promising line of research to contribute to the development of this scientific field.

4.2.1 Bibliometric analysis of publications about PMOs and their relation with program management

Since 2007, there had been publications contributing to the study of the relationship of PMOs and their relationship with program management. Ups and downs crosswise the years can be seen on this filed of research, with its pick in 2014, as shown on figure 15.

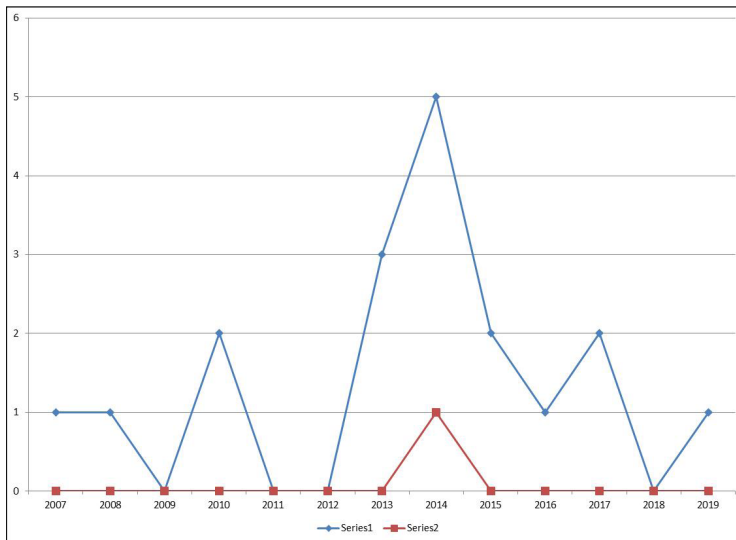


Fig. 15: Scientific publications about the relation between PMOs and program management – Scopus and WOS (2007 – 2019).

Source: The author with information from Scopus (2020) and WOS (2020).

4.2.2 Bibliometric analysis of main topics of research about the PMOs and their relation with program management

About the main topics of research on the relationship between PMOs and program management, Scopus highlighted, as referred

to figure 16, the following: (a.) project management, (b.) PMOs, (c.) program management, (d.) multi-project management, and (e.) financial data processing.

On WOS, this analysis reflected on figure 17 the following topics of research: (a.) business value, (b.) corporate governance, (c.) enterprise project management, (d.) impact, and (e.) knowledge.

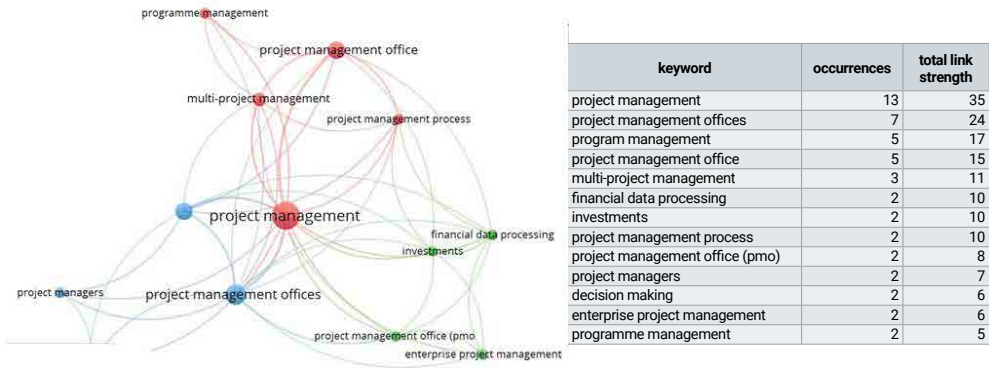


Fig. 16: Bibliometric map of main topics of research about the PMOs and their relation with program management – Scopus.
 Source: The author with information from Scopus (2020).

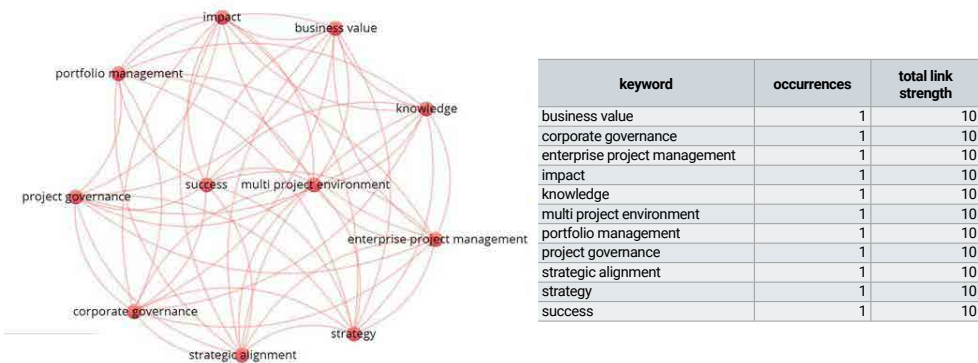


Fig. 17: Bibliometric map of main topics of research about the PMOs and their relation with program management – WOS.
 Source: The author with information from WOS (2020).

4.2.3 Bibliometric analysis of key authors on the research about the PMOs and their relation with program management

Regarding to authors with larger numbers of quotes and references, Scopus highlighted the following: (a.) Aubry, M., (b.) Hobbs, B., (c.) Muller, R., (d.) Turner, J., and (e.) Thullier, D., as illustrated on figure 18.

Main authors on WOS are: (a.) Turner, J., (b.) Miller, R., (c.) Office of Government Commerce, (d.) APM, and (e.) Crawford, L., as shown on figure 19.

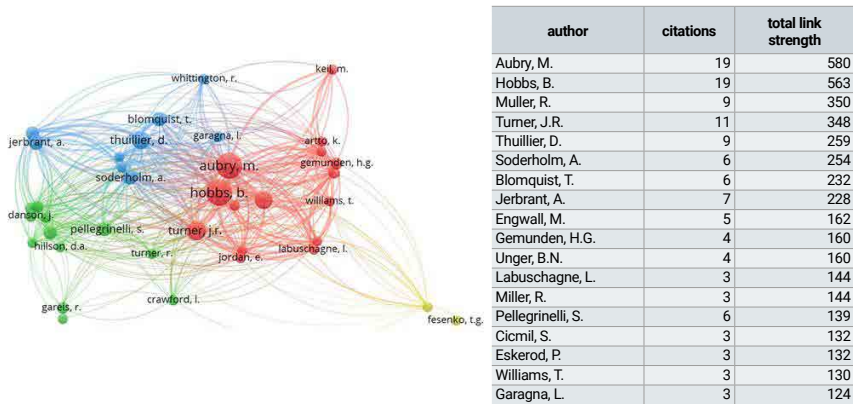


Fig. 18: Bibliometric map of key authors on the research about the PMOs and their relation with program management – Scopus.

Source: The author with information from Scopus (2020).

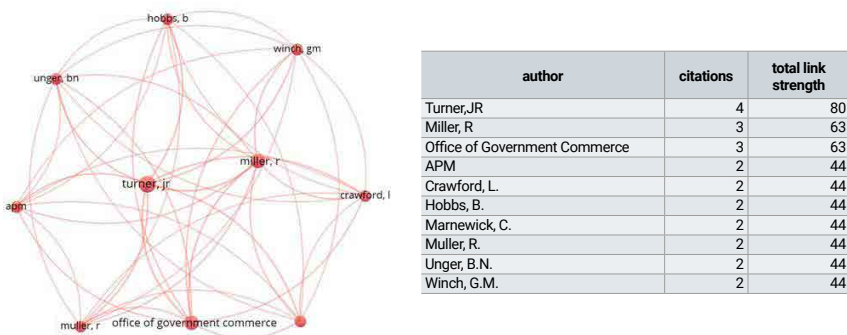


Fig. 19: Bibliometric map of key authors on the research about the PMOs and their relation with program management – WOS.

Source: The author with information from WOS (2020).

4.2.4 Bibliometric analysis of most influencing sources on the research about the PMOs and their relation with program management

On most influencing sources about the PMOs and program management on Scopus, the following can be seen: (a.) 2008 International Conference on Wireless Communications, Networking and Mobile Computing, WiCOM 2008, (b.) 2016 International Annual Conference of the American Society for Engineering Management, ASEM 2016, (c.) 2010 IEEE Andescon Conference, (d.) Applied Mechanics and Material, and (e.) Eastern-European Journal of Enterprise, as can be seen on figure 20.

Regarding to WOS, the sources with higher link strength are: (a.) The International Journal of Project Management, and (b.) The Project Management Journal, (refer to figure 21).

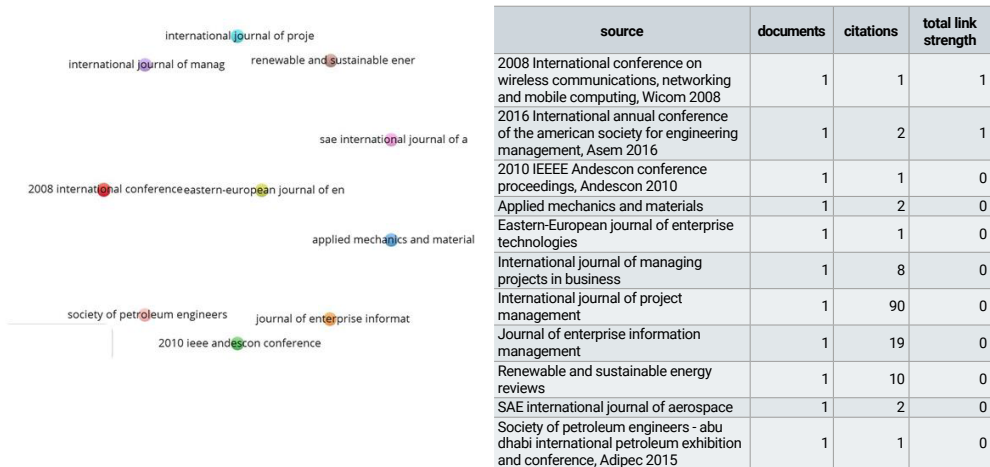


Fig. 20: Bibliometric map of most influencing sources on the research about the PMOs and their relation with program management – Scopus.

Source: The author with information from Scopus (2020).

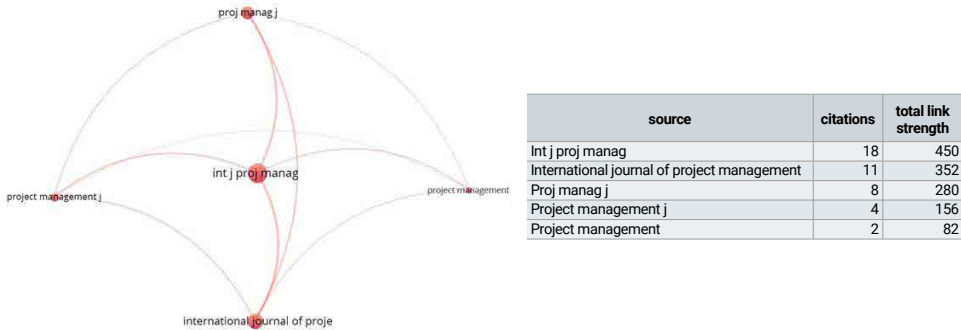


Fig. 21: Bibliometric map of most influencing sources on the research about the PMOs and their relation with program management – WOS.

Source: The author with information from WOS (2020).

4.2.5 Bibliometric analysis of publications by subgroup on the research about the PMOs and their relation with program management

In Scopus, the major subgroups of research about the relationship between PMOs and program management are: (a.) engineering; (b.) business, management and accounting; (c.) computer science; (d.) decision science; and (e.) energy; as shown on figure 22.

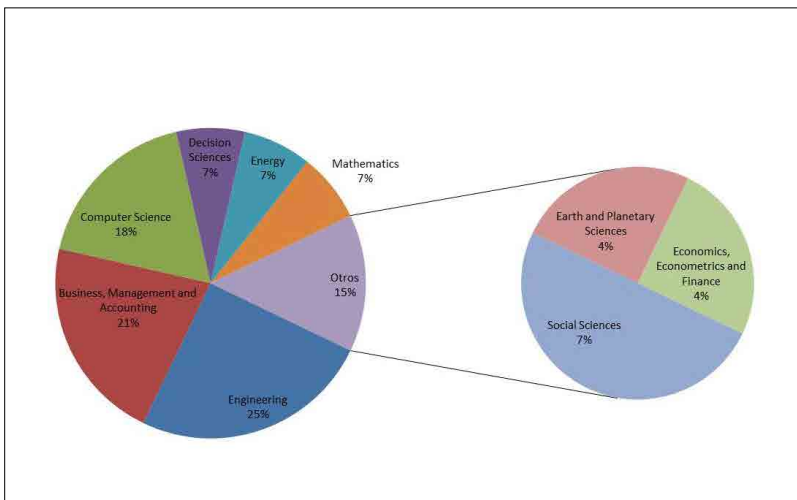


Fig. 22: Publications by subgroup on the research about the PMOs and their relation with program management – Scopus.

Source: The author with information from Scopus (2020).

4.2.6 Bibliometric analysis of publications by country about the PMOs and their relation with program management

Related to the countries of origin of the researches about the relationship of PMOs and program management, Scopus illustrates the following as those with the larger number of studies: (a.) China, (b.) United Kingdom, (c.) Australia, (d.) Ecuador, and (e.) Spain, as shown on figure 23.

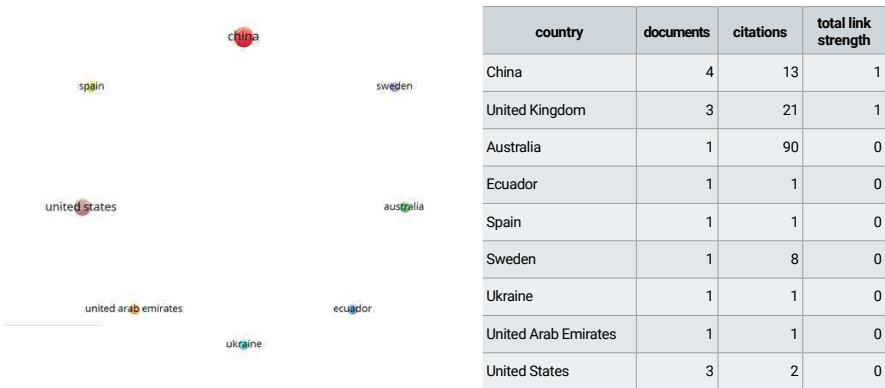


Fig. 23: Bibliometric map of publications by country about the PMOs and their relation with program management – Scopus.

Source: The author with information from Scopus (2020).

4.2.7 Bibliometric analysis of publications by organization about the PMOs and their relation with program management

About the organizations or institutions leading the research of PMOs and their relationship with program management, Scopus highlighted the following as shown in figure 24: (a.) Imperial College of London, (b.) Xiamen University, (c.) College of Civil Engineering and Architecture, (d.) Huaqiao University, and (e.) Cranfield School of Management.



organization	documents	citations	total link strength
Imperial college London, United Kingdom	1	2	2
Department of management, Xiamen University of Technology, Xiamen, China	1	1	1
School of management, Xiamen University, Xiamen, China	1	1	1
College of civil engineering and architecture, Zhejiang University, yuhangtang road 866#, Hangzhou 310058, China	1	10	0
College of civil engineering, Huaqiao University, 361021, Xiamen Fujian, China	1	2	0
Cranfield school of management, Dedford, United Kingdom	1	19	0
Department of engineering and architecture, Luhansk National Agrarian University, alchevskykh str., 44, Kharkiv, 61002, Ukraine	1	1	0
Department of history and cultural studies, o. m. Beketov National University of urban economy in Kharkiv, marshala bazhanova str., 17, Kharkiv, 61002, Ukraine	1	1	0
Dpto. lenguajes y sistemas informáticos e ing. software, Universidad Politécnica de Madrid, Madrid, Spain	1	1	0
Industrial management, The royal institute of technology, Stockholm, Sweden	1	8	0
International institute of education, Zhejiang water conservancy and hydropower college, Hangzhou 310018, China	1	10	0
Mosaic project services pty ltd, Australia	1	90	0
Plex systems inc, United States	1	2	0
Uhe Open University business school, Milton Keynes, United Kingdom	1	19	0
University of Southern Queensland, Australia	1	90	0
Upsi-investigaciones tecnológicas, Universidad técnica particular de Loja, Loja, Ecuador	1	1	0
Zadco petroleum co., United Arab Emirates	1	1	0
Zhejiang provincial hydropower management center, Hangzhou 310009, China	1	10	0

Fig. 24: Bibliometric map of publications by organization about the PMOs and their relation with program management – Scopus.

Source: *The author with information from Scopus (2020).*

4.3 Scientometric analysis of PMOs and their relation with the management of portfolios

10.59% of the scientific literature about PMOs and their relation with PPPM found in Scopus and WOS is related to the portfolio management component. This figure indicates a favorable contribution space related to the development of this scientific field.

4.3.1 Bibliometric analysis of publications about PMOs and their relation with portfolio management

Since 2006, there had been studies about the relation between the PMOs and portfolio management, ups and downs can be seen across the years with peaks in 2015 and 2018 as showed on figure 25.

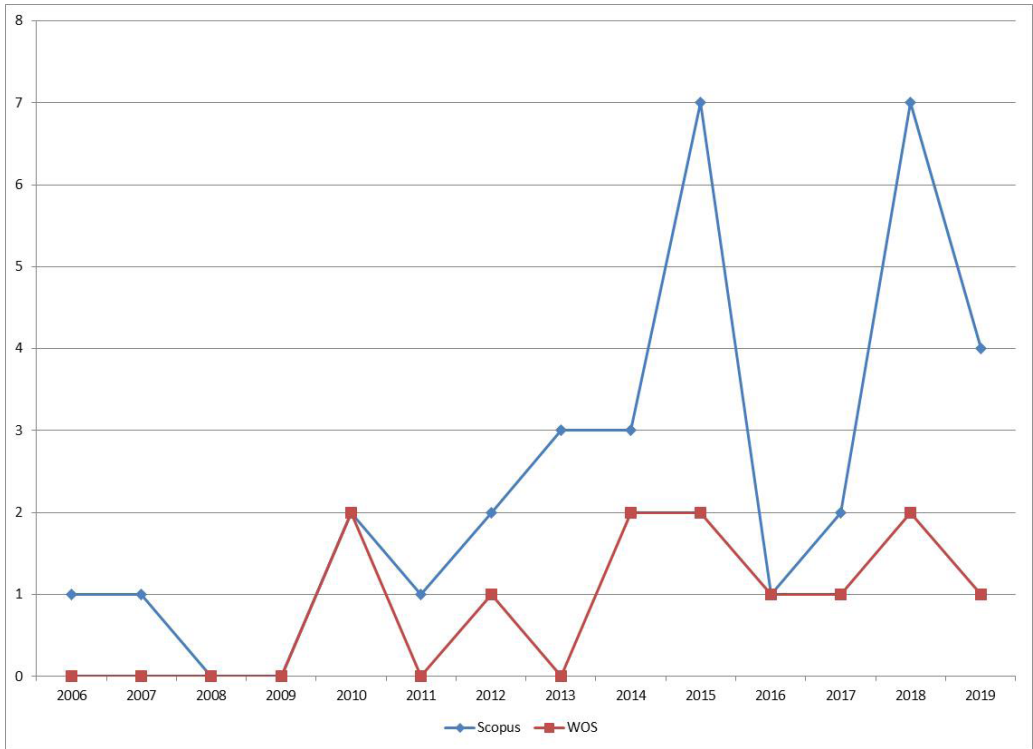


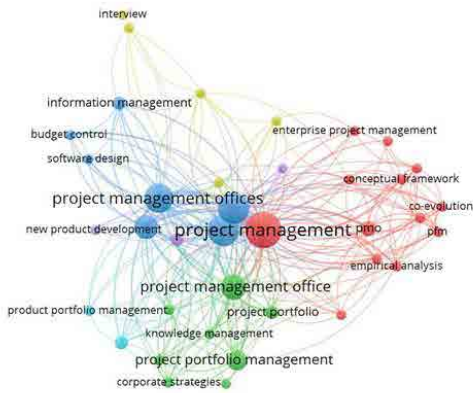
Fig. 25: Scientific publications about the relationship between PMOs and portfolio management – Scopus and WOS (2006 – 2019).

Source: *The author with information from Scopus (2020) and WOS (2020).*

4.3.2 *Bibliometric analysis of main topics of research about the PMOs and their relation with portfolio management*

In accordance with the topics with higher numbers of researches about the relationship between PMOs and portfolio management in Scopus, figure 26 highlights: (a.) project management, (b.) PMOs, (c.) portfolio management, (d.) project portfolio management, and (e.) empirical analysis.

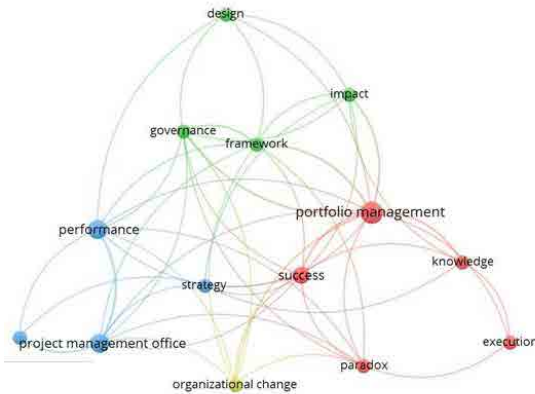
In the same way, WOS highlights the following topics of research (refer to figure 27): (a.) portfolio management, (b.) PMOs, (c.) framework, (d.) governance, and (e.) performance.



keyword	occurrences	total link strength
project management	23	134
financial data processing	17	119
investments	17	119
project management offices	15	90
portfolio managements	10	71
project management office	11	48
project portfolio management	7	38
pmo	4	28
project portfolio	3	27
empirical analysis	2	20
information management	3	20
organizational framework	2	20
sustainable development	3	20
portfolio management	3	19
research	2	18
co-evolution	2	17
corporate strategies	2	17
eigen behavior	2	17

Fig. 26: Bibliometric map of main topics of research about the PMOs and their relation with portfolio management – Scopus.

Source: The author with information from Scopus (2020).



keyword	occurrences	total link strength
portfolio management	5	18
project management office	4	12
framework	2	11
governance	2	11
performance	4	11
success	3	11
impact	2	8
organizational change	2	8
paradox	2	8
knowledge	2	6
strategy	2	6
design	2	5
project management	2	4
execution	2	3

Fig. 27: Bibliometric map of main topics of research about the PMOs and their relation with portfolio management – WOS.

Source: The author with information from WOS (2020).

4.3.3 Bibliometric analysis of key authors on the research about the PMOs and their relation with portfolio management

Regarding to authors with larger numbers of quotes and references, Scopus highlighted the following: (a.) Gemünden, H., (b.) Tootoonchy, M., (c.) Tywoniak, S., (d.) Bredillet, C., and (e.) Jugend, D., as illustrated on figure 28.

Main authors on WOS are: (a.) Aubry, M., (b.) Gemünden, H., (c.) Unger, B., (d.) Bredillet, C., and (e.) Tootoonchy, M., as showed on figure 29.

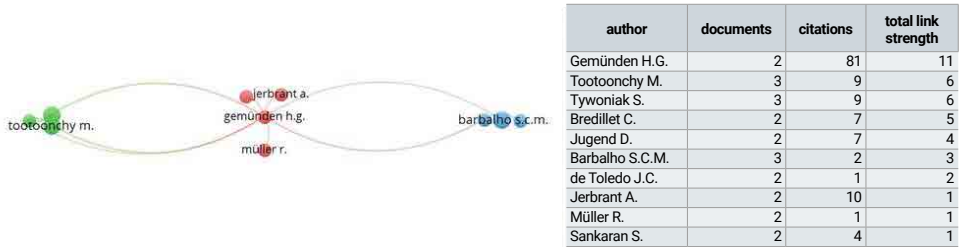


Fig. 28: Bibliometric map of key authors on the research about the PMOs and their relation with portfolio management – Scopus.

Source: The author with information from Scopus (2020).

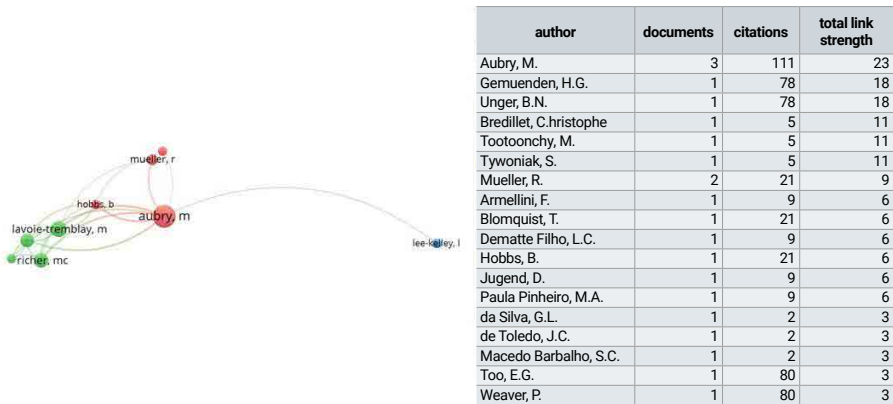


Fig. 29: Bibliometric map of key authors on the research about the PMOs and their relation wi5th portfolio management – WOS.

Source: The author with information from WOS (2020).

4.3.4 Bibliometric analysis of most influencing sources on the research about the PMOs and their relation with portfolio management

On the most influencing sources about the PMOs and portfolio management on Scopus, the following can be seen: (a.) The International Journal of Project Management, (b.) Producao, (c.) South African Journal of Economic, (d.) Dirección y Organización, and (e.) Iamot, as depicted in figure 30.

Regarding to WOS, the sources with higher link strength are: (a.) The International Journal of Project Management, (b.) The Project Management Journal, (c.) Journal of Cleaner Production, (d.) Dirección y Organización, and (e.) Dyna (refer to figure 31).

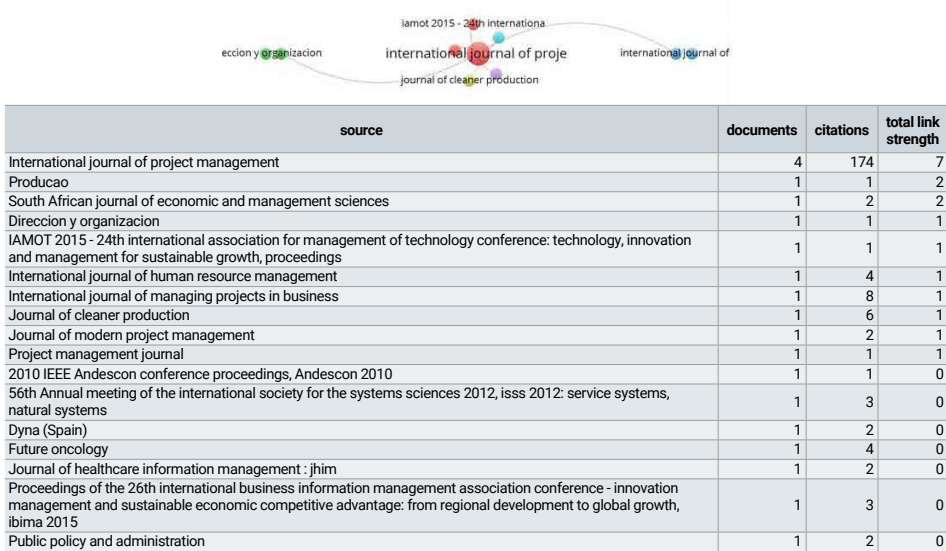


Fig. 30: Bibliometric map of most influencing sources on the research about the PMOs and their relation with portfolio management – Scopus.

Source: The author with information from Scopus (2020).

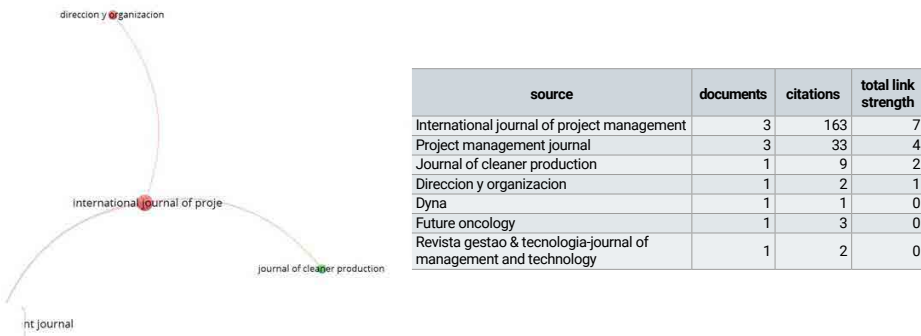


Fig. 31: Bibliometric map of most influencing sources on the research about the PMOs and their relation with portfolio management – WOS.

Source: The author with information from WOS (2020).

4.3.5 Bibliometric analysis of publications by subgroup on the research about the PMOs and their relation with portfolio management

In Scopus, the major subgroups of research about the relation between PMOs and portfolio management are: (a.) business, management and accounting; (b.) engineering; (c.) computer science; (d.) social science; and (e.) decision science; as shown on figure 32.

According to WOS, the most influencing subgroups about PMOs and the relationship with portfolio management are: (a.) management, (b.) economics, (c.) engineering environmental, (d.) engineering multi-disciplinary, and (e.) green sustainable science technology, as illustrated on figure 33.

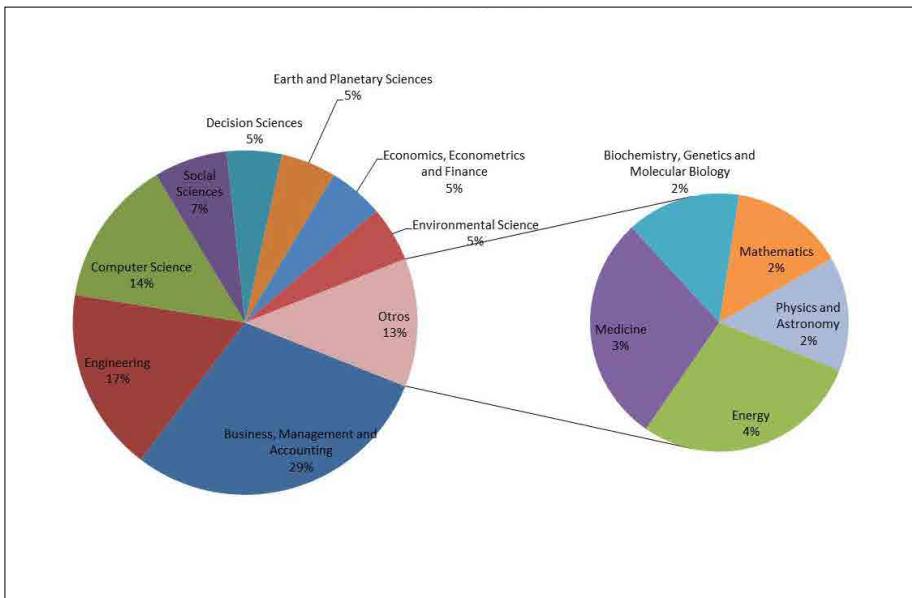


Fig. 32: Publications by subgroup on the research about the PMOs and their relation with portfolio management – Scopus.

Source: *The author with information from Scopus (2020).*

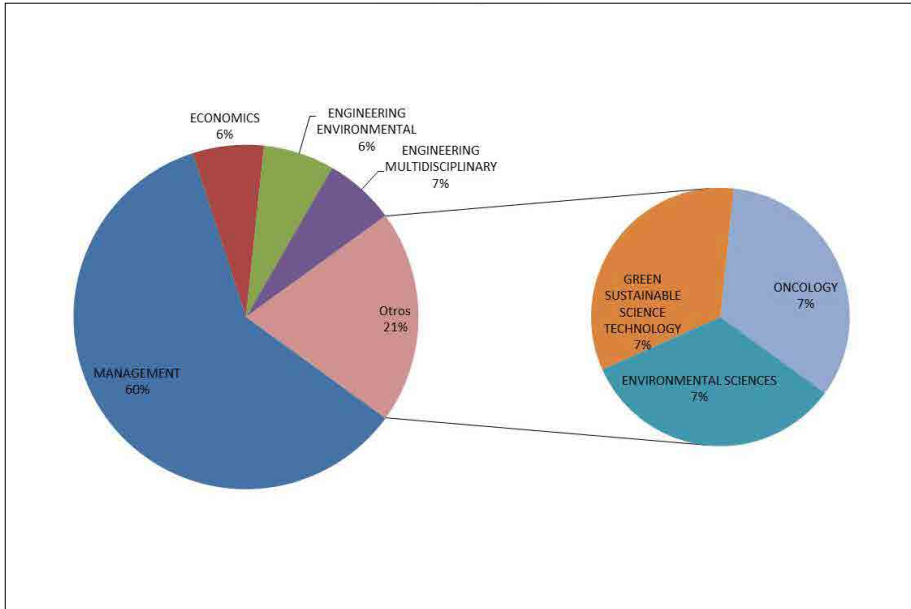


Fig. 33: Publications by subgroup on the research about the PMOs and their relation with portfolio management – WOS.

Source: The author with information from WOS (2020).

4.3.6 Bibliometric analysis of publications by country about the PMOs and their relation with portfolio management

Related to the countries of origin of the researches about the relationship of PMOs and portfolio management, Scopus illustrates the following as those with the larger number of studies: (a.) Canada, (b.) Germany, (c.) Australia, (d.) Brazil, and (e.) Norway, as shown on figure 34.

In the case of WOS, the countries with stronger links about publications of PMOs and portfolio management are: (a.) Canada, (b.) Australia, (c.) Brazil, (d.) Norway, and (e.) Sweden, as illustrated on figure 35.

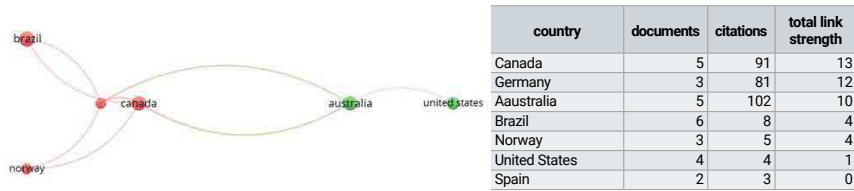


Fig. 34: Bibliometric map of publications by country about the PMOs and their relation with portfolio management – Scopus.

Source: The author with information from Scopus (2020).

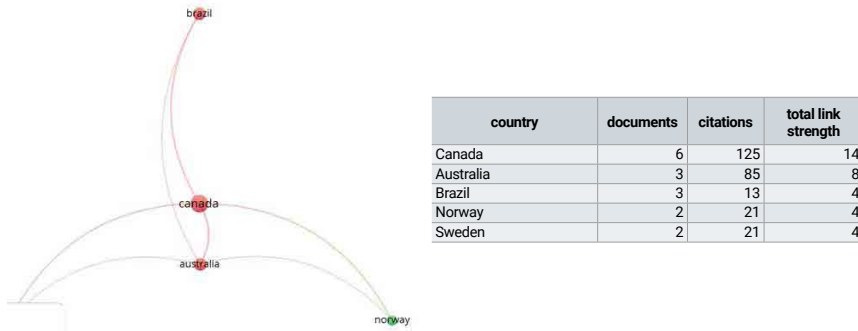


Fig. 35: Bibliometric map of publications by country about the PMOs and their relation with portfolio management – WOS.

Source: The author with information from WOS (2020).

4.3.7 Bibliometric analysis of publications by organization about the PMOs and their relation with portfolio management

About the organizations or institutions leading the research of PMOs and their relation whit portfolio management, Scopus highlighted the following as showed in figure 36: (a.) University of Ottawa, (b.) University of Quebec, (c.) Queensland University of Technology, and (d.) Norwegian Business School.

Related to this matter, WOS states as main organizations funding this kind of research the following as seen on figure 37: (a.) University of Quebec, (b.) Tech University of Berlin, (c.) Queensland University of Technology, (d.) University of Ottawa, and (e.) Norwegian School of Management.

and analysis tools required, same as the bibliometric software to conduct a detailed scientometric analysis about the PMOs in the context of PPPM.

Detailed bibliometric analysis were carried out, identifying the proliferation of publications related to the PMOs and their relation with the PPPM. The most researched topics, key authors, principal sources, main subgroups, countries of origin, and leading organizations about the research of PMOs and their relation with the elements on the PPPM were identified (refer to scientometric analyses on table 1 for project management, table 2 for program management, and table 3 for portfolio management).

Table 1. Summary of the scientometric analysis of PMOs in the context of project management

Main topics of investigation	Key authors	Principal sources
Project management, PMOs, information management, investments, knowledge management, performance, impact and success.	Aubry, M., Hobbs, B., Thuller, D., Lavoie-Tremblay, M. Richer, M., and Cry, G.	The International Journal of Project Management, The Project Management Journal, The International Journal of Managing Projects, Gestao e producao, Producao, The International Journal of Information Technology, and The South African Journal of Industrial Engineering.
Subgroups of investigation	Countries	Institutions
Business, management and accounting; engineering; computer science; decision science; social science; industrial engineering; and economics.	Canada, United States of America, Sweden, Norway, Germany, Australia, Finland, and Brazil.	University of Lisbon, Queensland University of Technology, University of Minho, McGill University, University of Ottawa, University of Quebec, University of Sao Paulo, and Cranfield University.
Main publication		
Aubry (2011 a), Aubry (2011 b), Aubry (2012), Aubry & Brunet (2016), Aubry & Hobbs (2011), Aubry, Hobbs & Thuillier (2007), Aubry, Hobbs & Thuillier (2008), Aubry & Lavoie-Tremblay (2017), Aubry & Lavoie-Tremblay (2018), Aubry, Müller, Hobbs & Blomquist (2010), Aubry, Müller & Glückler (2011), Aubry, Richer & Lavoie-Tremblay (2014), Aubry, Richer, Lavoie-Tremblay & Cyr (2011), Hobbs, Aubry & Thuillier (2008), Lavoie-Tremblay, Aubry, Cyr, Richer, Fortin-Verreault, Fortin & Marchionni (2017), Lavoie-Tremblay, Aubry, Richer & Cyr (2018), Lavoie-Tremblay, Bonneville-Roussy, Richer, Aubry, Vezina & Deme (2012), Lavoie-Tremblay, Richer, Marchionni, Cyr, Biron, Aubry, M., ... Vézina (2012), Müller, Glückler & Aubry (2013), Mueller, Glueckler, Aubry, Shao, Müller, Glückler, J., ... Shao (2013), and Richer, Marchionni, Lavoie-Tremblay & Aubry (2013).		

Source. The author with information from Scopus (2020) and WOS (2020).

Table 2. Summary of the scientometric analysis of PMOs in the context of program management

Main topics of investigation	Key authors	Principal sources
Project management, PMOs, program management, multi-project management, financial data processing, business value, corporate governance, enterprise project management, impact, and knowledge.	Aubry, M., Hobbs, B., Muller, R., Turner, J., Thuller, D., Miller, R., Office of Government Commerce, APM, and Crawford, L.	2008 International Conference on Wireless Communications, Networking and Mobile Computing, WiCOM 2008, 2016 International Annual Conference of the American Society for Engineering Management, ASEM 2016, 2010 IEEE Andescon Conference, Applied Mechanics and Material, Easter-European Journal of Enterprise, The International Journal of Project Management, and The Project Management Journal.
Subgroups of investigation	Countries	Institutions
Engineering; business, management and accounting; computer science; decision science; and energy.	China, United Kingdom, Australia, Ecuador, and Spain.	Imperial College of London, Xiamen University, College of Civil Engineering and Architecture, Huaqiao University, and Cranfield School of Management.
Main publication		
Al Ahmad (2015), Carrillo, Abad, Cabrera & Jaramillo (2010), Celar (2007), Chen, Wang, He & Li (2013), Columbus (2014), Dias De Lucena, Lustosa & Hillson (2015), Fesenko & Fesenko (2017), Janka & Kosieradzka (2019), Jerbrant (2013), Müller (2017), Philbin (2016), Qi, Zhang, Wu, Chen, W & Cai (2014), Qing-Lan & Chang-Wei, (2008), Raisinghani (2014), and Too & Weaver (2014).		

Source. The author with information from Scopus (2020) and WOS (2020).

Table 3. Summary of the scientometric analysis of PMOs in the context of portfolio management

Main topics of investigation	Key authors	Principal sources
Project management, PMOs, portfolio management, project portfolio management, empirical analysis, framework, governance, and performance.	Gemünden, H., Tootoonchy, M., Tywoniak, S., Bredillet, C., Jugend, D., Aubry, M., Unger, B.	The International Journal of Project Management, Producao, South African Journal of Economic, Dirección y Organización, Iamot, The Project Management Journal, Journal of Cleaner Production, and Dyna.

Subgroups of investigation	Countries	Institutions
Business, management and accounting; engineering; computer science; social science; decision science; economics; engineering environmental; engineering multidisciplinary; and green sustainable science technology.	Canada, Germany, Australia, Brazil, Norway, and Sweden.	University of Ottawa, University of Quebec, Queensland University of Technology, Norwegian Business School, Tech University of Berlin, and Norwegian School of Management.
Main publication		
Aubry (2015), Aubry, Hobbs, Mueller & Blomquist (2010), Bredillet, Tywoniak & Tootoonchy (2018 a), Bredillet, Tywoniak & Tootoonchy (2018 b), Ekrot, Rank, Kock & Gemünden (2018), Jugend, Barbalho & da Silva (2015), Paula Pinheiro, Jugend, Demattê Filho & Armellini (2018), Tywoniak, Tootoonchy & Bredillet (2015), and Unger, Gemünden & Aubry (2012).		

Source. The author with information from Scopus (2020) and WOS (2020).

In order to integrate the elements identified on the bibliometric analyses on this research in a coherent model, The Organizational Project Management Maturity Model OPM3 (PMI, 2013 a, p. 23) incorporated the PMOs as a driver to improve PPPM within organizations, by deploying four key elements: (a.) standardization, (b.) measurement, (c.) control, and (d.) improvement. Those elements were latter linked with the processes groups of project (PMI, 2017 a), program (PMI, 2017 c) and portfolio (PMI, 2017 b) management.

Later, the findings of Hill (2013) and Kerzner (2013), highlighted that the PMOs provide services oriented to the continuous improvement of projects, programs and portfolios; standardization by developing methodologies and frameworks; tracking and monitoring of project, program and portfolio performance. All these elements were incorporated into a contribution model of the PMOs to the PPPM (Rincón-González (2018 C), refer to figure 38.

A scientometric summary of the relationship between PMOs, integrating standardization, measurement, control and improvement functions deployed by this kind of structures, and the project, program, and portfolio components of the PPPM, is shown in figure 39.

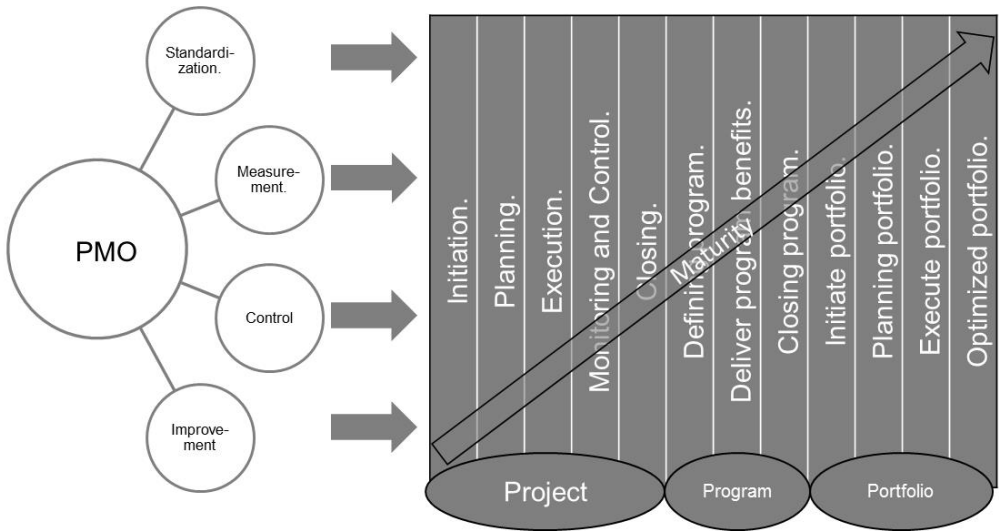


Fig. 38: Contribution of the PMOs to the PPPM.
Source. The author and Rincón-González (2018 c) with PMI (2013, 2017 a, 2017 b, 2017 c).

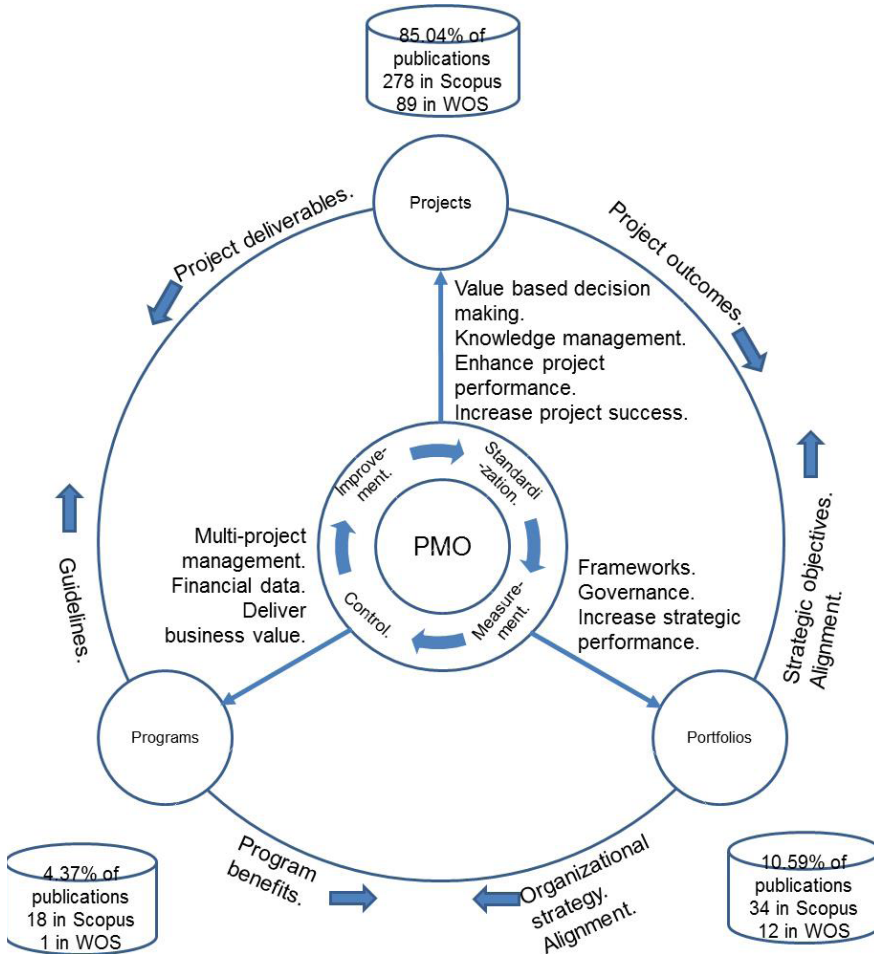


Fig. 39: Summary of the scientometric analysis of PMOs in the context of PPPM.

Source. The author with Rincón-González (2018 c).

6. CONCLUSIONS.

The meticulous bibliometric analysis about the relation between the PMOs as organizational structures within the elements of PPPM; projects, programs and portfolios, as organizational endeavors to generate project outcomes, add value and reach strategic goal, and also established a precise state of the art about a fundamental component of the scientific discipline of project management.

The contribution of PMOs to the PPPM, from a theoretical point of view, was established identifying a positive effect of this kind of structures on the management of projects, adding value oriented decision making capabilities, managing knowledge across the organization, enabling performance improvement, and facilitating project success; programs allowing multi-project management, capturing program financial data, and assuring business value; and portfolios, portfolio management frameworks, governance guidelines, and supporting organizational strategic performance.

As future lines of research, it was proposed to develop applied studies to determinate the impact of PMOs on the elements of PPPM in enterprise contexts.

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