

Gaming for Healthcare: A Bibliometric Analysis in Business and Management

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Received: October 21, 2020

Accepted: November 17, 2020

Online Published: November 24, 2020

doi:10.5539/ibr.v13n12p27

URL: <https://doi.org/10.5539/ibr.v13n12p27>

Abstract

The purpose of this paper is to scrutinize and classify the literature linking gaming for healthcare and management phenomena.

An objective bibliometric analysis is conducted, supported by subjective assessments based on studies focused on the linking of gaming for healthcare and management fields.

From the analysis and its evaluation, three clusters depicting literature linking gaming for healthcare and management phenomena are showed: management and governance public/private healthcare system; gaming and knowledge/strategic management; management health/medical insurance system using game theory. Moreover, the study shows the limits of existing literature on this topic and proposes future research topics.

This is one of the first attempts to comprehend the research stream which, over time, has paved the way to the intersection between gaming for healthcare and management fields.

Keywords: bibliometric analysis, gaming, game, healthcare, digital therapies, business and management

1. Introduction

In the healthcare field, digital therapies are the new frontier. These are apps and videogames, using for example Nintendo Wii or Microsoft Kinect, that not only support the patient in physical and psychological rehabilitation but treat him. The goal of digital therapies is to cure some diseases by playing.

Gamification refers to a process of enhancing a service with affordances for gameful experiences to support users' overall value creation (Huotari, Hamari, 2017). The application of gamification logic (puzzle-solving, the passage of levels, competition, and its reward) in the production of services by the non-play is used for years in many different fields, from management training to school education (Vervoort, 2019). The driver of digital therapy is patient innovation. Patient innovation is product-service solution designed by patients and their caregivers (Maffei *et al.*, 2017; Olivera *et al.* 2015; Zejnilovic *et al.* 2016).

Gaming has the potential to revolutionize healthcare service. The game is a *service system* (Huotari, Hamari, 2017). According to Vargo *et al.* (2008, p. 145), a *service system* refers to “an arrangement of resources (including people, technology, information, etc.) connected to other systems by value propositions”.

Some examples of game applications in the healthcare sector are the following. SuperPoteri videogame, used in dentistry for children, was designed to prevent fear from affecting a correct operation and to ensure that the prescribed therapy is put into practice carefully at home. Tommi videogame helps small oncology patients to positively face their path of care. Akili videogame aimed at treating attention deficit hyperactivity disorder, depressive disorder, autism spectrum disorders, and even multiple sclerosis. Ms-Fit videogame allows multiple sclerosis patients to perform movements to improve posture, balance, and breathing. Vitamin videogame is useful for physical rehabilitation. MirrorAble videogame is utilized for rehabilitation for children with stroke.

The pharmaceutical sector has just been touched by the digital transformation until a few years ago it was a closed system, difficult to be attacked by start-ups due to the strict regulations and the length of development

projects (10-15 years for the approval of a drug).

Referring to gamification for the healthcare sector, a recent study, by Research Reports, shows that by 2022 the gamification business in health care will grow by as much as 55%, get to USD 3,780 million. It is the beginning of a new era, with fewer drugs and more high-tech but more "natural" methods.

It is evident that gaming for healthcare is a new and interesting market, but there are no academic studies in business and management fields which analyze the phenomenon as a whole. To this, an objective bibliometric analysis is conducted and supported by subjective assessments, based on the previous and current studies on the intertwining of gaming for healthcare in business and management fields.

The paper proceeds as follows. The next section presents the methodology. Then, the results of the bibliometric analysis are showed. Finally, discussion, conclusions, and future research directions are provided.

2. Methodology

The research consists of five stages: study design; data collection; data analysis; data visualization and interpretation.

In the study design, we define the main objective of this research that is to analyse and systematize the various aspects of extant literature that lies at the intersection between gaming for healthcare and business and management realms. We adopt an objective and a subjective approach to examine how the topic of gaming and healthcare has been integrated into the business and management field.

For data collection, we select the Web of Science (WoS) database. Data analysis is performed by a bibliometric analysis which represents the objective approach. Bibliometrics refers to "the collection, the handling and the analysis of quantitative bibliographic data, derived from scientific publications" (Verbeek *et al.*, 2002: 181). It consists of general descriptive statistics (e.g. identifying the main authors, publishing journals, etc) (Wu and Wu, 2017) and more sophisticated methods like the document co-citation, collaboration, and co-occurrence analyses (Briner and Denyer, 2012; Rosseau, 2012).

The bibliometric analysis is carried out by using the R package bibliometrix version 2.2.1 (Aria & Cuccurullo, 2017) which also allows for extracting bibliometric networks using different units of analysis, i.e. citations, authors, countries, keywords, etc. It performs co-word analysis (Callon *et al.*, 1983) by multiple correspondence analysis (Lebart *et al.*, 1984) and hierarchical agglomerative clustering (Rousseeuw, 1987).

Bibliometrics can make a systematic, transparent, and reproducible review process based on the statistical measurement of science, scientists, or scientific activity (Broadus, 1987; Diodato, 1994; Pritchard, 1969; Crane, 1972).

Data visualization is used to represent a science map and the result of data analysis.

The last stage is interpretation, where the objective approach is integrated by a

subjective approach (qualitative analysis), which is based on scholars' interpretation of a given field of research. In fact, a qualitative assessment completes the bibliometric analysis, in particular, the literature linking gaming for healthcare in business and management phenomena is scrutinized and classified.

3. Results of the Bibliometric Analysis

We began by querying the Web of Science (WoS) database with the search term *gaming* in the topic - i.e. title, abstract and keywords - associated with, at least, one of the following terms: *healthcare*, *health-care* or *health care* in the topic. We selected the WoS Categories: business and management. This procedure yielded 69 documents extracted by 47 sources (Table 1.). Then we carried out the bibliometric analysis, by using the R package bibliometrix version 2.2.1 (Aria & Cuccurullo, 2017). Such analysis opens by presenting the main information about data (Table 1.).

Leaving out the rows whose meaning is obvious, in the third row of Table 1 we find the number of keywords associated with the documents by WoS database (ID=263), then the number of keywords associated with the documents by the authors (DE=249).

Table 1. Main Information about data

Documents	69
Sources (Journals, Books, etc.)	47
Keywords Plus (ID)	263
Author's Keywords (DE)	249
Period	1991 – 17/10/2019
Average citations per documents	9.812
Authors	173
Author Appearances	177
Authors of single-authored documents	13
Authors of multi-authored documents	160
Single-authored documents	13
Documents per Author	0.399
Authors per Document	2.51
Co-Authors per Documents	2.57
Collaboration Index	2.86

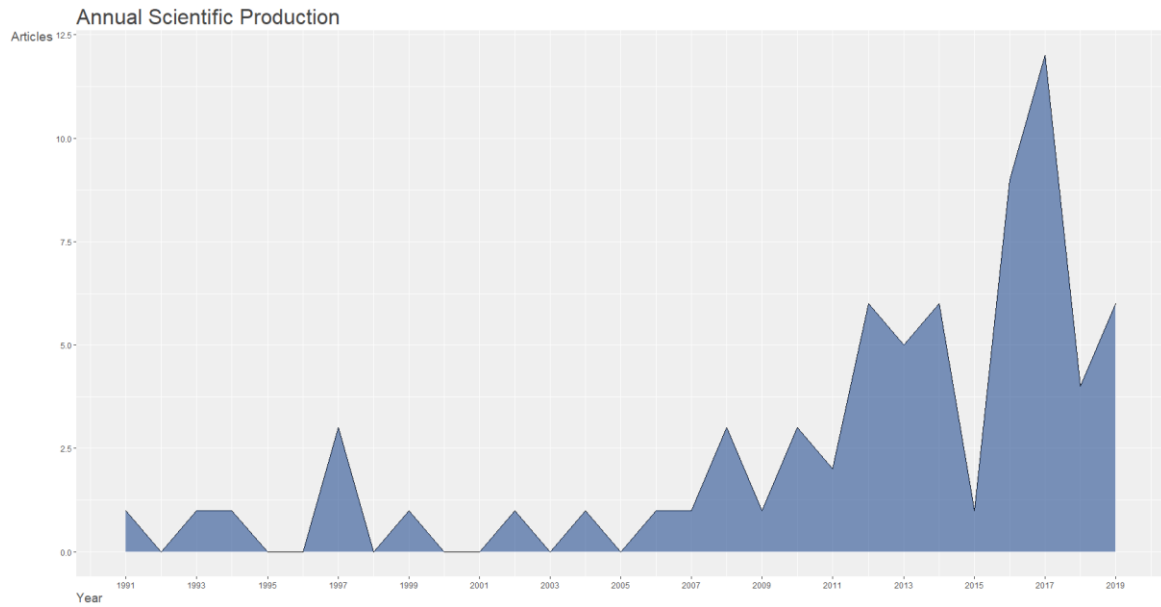
In the sixth row of Table 1., there are the average citations per documents (9.812) calculated by the ratio between the total citations and the number of documents. In the twelfth row, the number of documents per author (0.399) is calculated by dividing the number of documents and the number of authors, contrary the number of authors per document (2.51) is the ratio between the number of authors and the number of documents. The last two data denote a few documents e many authors. Finally, the number of Co-Authors per documents (2.57) is equal to the ratio between the Author Appearances and the documents and the collaboration index (2.86) is obtained by dividing the number of authors of multi-authored documents and the multi-authored documents. These two indices indicate a strong collaboration among the authors

Table 2. describes the document types: articles are the most part of the documents, revealing high-quality publications.

Table 2. Document types

Article	48
Article, Proceedings Paper	2
Book Review	1
Editorial Material	1
Proceedings Paper	16
Review	1

The scientific production, started in 1991, increased in the last years, except for 2015, highlighting the recent interest in the topic (Figure 1.). The number of articles for 2019 is incomplete due to the fact that the data collection ended on 17/10/2019. The annual percentage growth rate is equal to 9.372, so it is in rapid growth.



Year	1991	1993	1994	1997	1999	2002	2004	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Articles	1	1	1	3	1	1	1	1	1	3	1	3	2	6	5	6	1	9	12	4	6

Figure 1. Annual Scientific Production

Table 3. and Figure 2. report and represent the absolute (Articles) and relative (Freq) frequency distribution of affiliation countries, the Intra-country (SCP) and intercountry (MCP) collaboration number and intercountry collaboration index (MCP_Ratio).

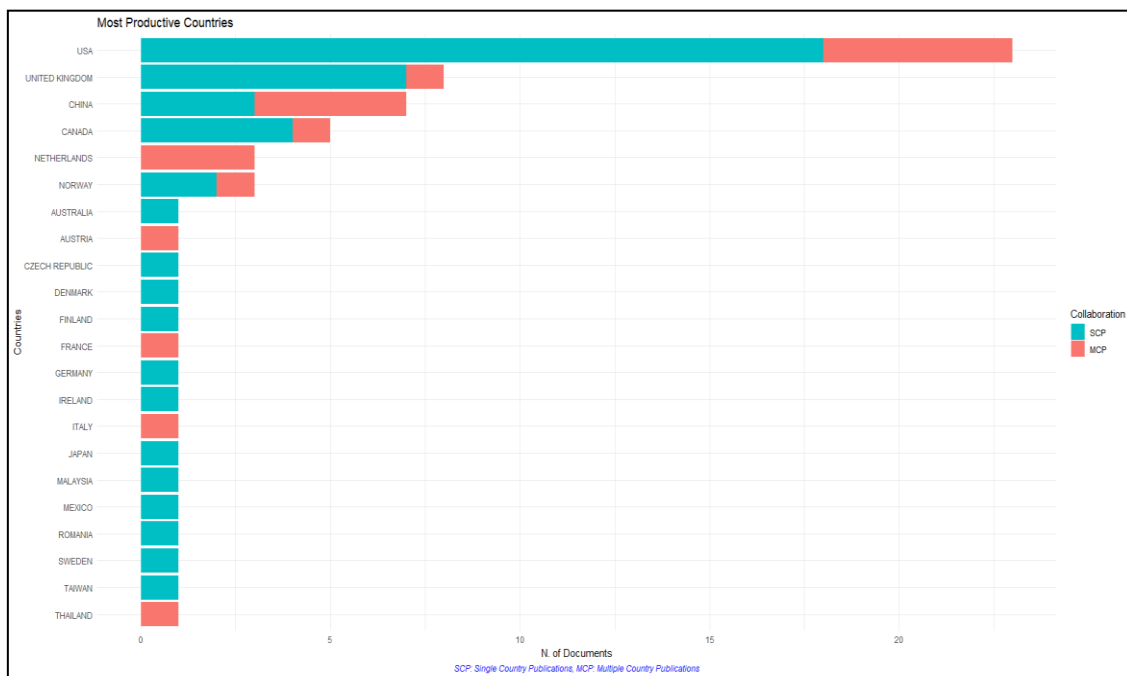


Figure 2. Corresponding Author's Countries

Table 3. Corresponding Author's Countries

	Country	Articles	Freq	SCP	MCP	MCP Ratio
1	Usa	23	0.3538	18	5	0.217
2	United Kingdom	8	0.1231	7	1	0.125
3	China	7	0.1077	3	4	0.571
4	Canada	5	0.0769	4	1	0.2
5	Netherlands	3	0.0462	0	3	1
6	Norway	3	0.0462	2	1	0.333
7	Australia	1	0.0154	1	0	0
8	Austria	1	0.0154	0	1	1
9	Czech Republic	1	0.0154	1	0	0
10	Denmark	1	0.0154	1	0	0
11	Finland	1	0.0154	1	0	0
12	France	1	0.0154	0	1	1
13	Germany	1	0.0154	1	0	0
14	Ireland	1	0.0154	1	0	0
15	Italy	1	0.0154	0	1	1
16	Japan	1	0.0154	1	0	0
17	Malaysia	1	0.0154	1	0	0
18	Mexico	1	0.0154	1	0	0
19	Romania	1	0.0154	1	0	0
20	Sweden	1	0.0154	1	0	0
21	Taiwan	1	0.0154	1	0	0
22	Thailand	1	0.0154	0	1	1

The USA claims the biggest number of documents and Intra-country (SCP) and intercountry (MCP) collaboration. USA, United Kingdom, China, Canada and Norway produce Intra-country (SCP) and intercountry (MCP) collaborations. Netherlands, Austria, France, Italy and Thailand present only intercountry collaborations. The remaining countries show only Intra-country collaborations.

The collaboration links between countries are displayed in Figure 3. The most productive countries - such as the USA, United Kingdom, China, Canada, Netherlands and Norway - are the most collaborative ones.

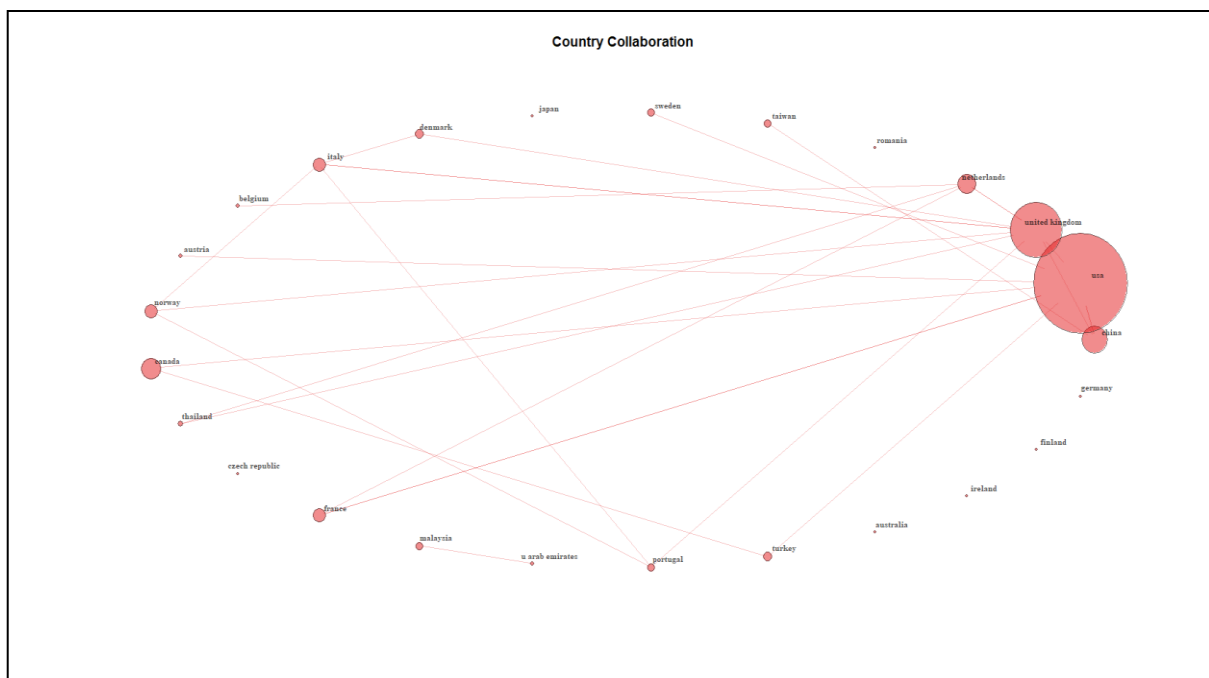


Figure 3. Country Collaboration

Table 4. illustrates the total citations and the average article citations obtained by the ratio between the total citations and the number of articles. It is interesting to note that the USA shows the biggest number of total citations whereas Germany presents the highest average article citations. This is due to the fact that the USA is the most productive country, while Germany produced one of the most cited papers.

For sake of simplicity, we summarize the main results of the bibliometric analysis in several tables, such as most productive authors (Table 5.), top manuscripts per number of citations (Table 6.), most relevant sources (Table 7.) and most relevant keywords (Table 8.).

Table 5. shows the three authors who produced more than one publication and the number of articles they authored or co-authored. All the authors, but three, published only one article, thus reflecting that very few business and management scholars focused on the importance of gaming for healthcare.

Table 6. illustrates the top ten manuscripts per citations, the number of times each manuscript has been cited (TC) and the yearly average number of times each manuscript has been cited (TCperYear). These are highly cited papers given that their citations far exceed the average citations per documents which is equal to 9.812

The topic gaming in healthcare has been published by 47 sources, of which only 9 present more than one document, relieving that very few sources are specialized at dealing with the topic (Table 7.).

Table 8. presents the Authors' Keywords (DE) and the Keywords associated with the document by WoS database (ID) which occur more than once. The results tell us that the most frequent author Keywords (DE) in the data are "game theory," "healthcare" and "healthcare management"; whereas the most frequent keyword-plus (ID) is "model" closely followed by "quality", "care" and "health care".

After descriptive analysis, we can try to extract bibliometric networks using different units of analysis, i.e. citations, authors, countries, keywords, etc. All networks can be graphically visualized or modelled like as in Figure 3. which represents the country scientific collaboration.

Figure 4. displays the keyword plus co-occurrence network composed of nodes (keywords), connected by ties (co-occurrences). In the plot, nodes with higher degrees have larger balls. Looking at this graph, it seems clear that the main thematic nexus in the network is composed of "quality and model" combined with "healthcare and demand." These findings will be confirmed by cluster analysis.

Table 4. Citations per Country

	Country	Total Citations	Average Article Citations
1	USA	318	13.83
2	Canada	77	15.40
3	United Kingdom	73	9.12
4	China	46	6.57
5	Germany	27	27.00
6	Norway	20	6.67
7	Ireland	19	19.00
8	Denmark	14	14.00
9	France	12	12.00
10	Netherlands	10	3.33
11	Italy	4	4.00
12	Mexico	4	4.00
13	Austria	2	2.00
14	Taiwan	2	2.00
15	Australia	1	1.00
16	Finland	1	1.00
17	Sweden	1	1.00
18	Thailand	1	1.00
19	Czech Republic	0	0.00
20	Japan	0	0.00
21	Malaysia	0	0.00
22	Romania	0	0.00

Table 5. Most Productive Authors

	Authors	Articles
1	Tang Cs	3
2	Nagurney A	2
3	Tayur S	2

Table 6. Top manuscripts per citations

	Paper	TC	TCperYear
1	Anand Ks, 2011, Manage Sci	72	9.00
2	Morrell K, 2008, J Manage Stud	52	4.73
3	Nichols Na, 1994, Harv Bus Rev	45	1.80
4	Cho Sh, 2013, M\&Som-Manuf Serv Oper Manag	38	6.33
5	Galor E, 1997, J Econ Manage Strategy	35	1.59
6	Bradshaw-Camball P, 1991, Organ Sci	31	1.11
7	Xu F, 2017, Tourism Manage	28	14.00
8	Hu Qj, 2012, M\&Som-Manuf Serv Oper Manag	27	3.86
9	Bode I, 2006, Public Manag Rev	27	2.08
10	Grennan M, 2014, Manage Sci	26	5.20

Table 7. Most Relevant Sources

	Sources	Articles
1	Management Science	7
2	Journal Of Economics \& Management Strategy	5
3	European Journal Of Operational Research	4
4	M\&Som-Manufacturing \& Service Operations Management	4
5	Public Management Review	3
6	Information Systems Research	2
7	Organization Studies	2
8	Proceeding Of Knowledge Management International Conference (Kmic) 2014 Vols 1 and 2	2
9	Tourism Management	2

Table 8. Most Relevant Keywords

Author Keywords (DE)	Articles	Keywords-Plus (ID)	Articles
Game Theory	13	Model, Quality	7
Healthcare	11	Care, Health Care	6
Healthcare Management	5	Competition	5
Gamification, Queueing Theory	3	Contracts, Demand, Health, Information, Market	4
Asymmetric Information, Boundary Spanning, Competition, Continuous Improvement, Engagement, Investment Opportunities, Knowledge Translation, Health Services, Organizational Alignment, Performance Indicators, Performance Software, Performance Tracking, Public Policy, Queueing Games, Regulation, Service Operations, Supply Chain Management, Variational Inequalities	2	Behavior, Cost, Decisions, Games, Health Insurance, Management, Performance, Price, Reimbursement	3
		Accreditation, Allocation, Choice, Collaboration, Design, Efficiency, Government, Hospitals, Impact, Industry, Information Technology, Innovation, Internet, Knowledge, Medicine, Models, Optimization, Perspective, Primary Care, Risks, Service, Stability, Strategies, Welfare	2

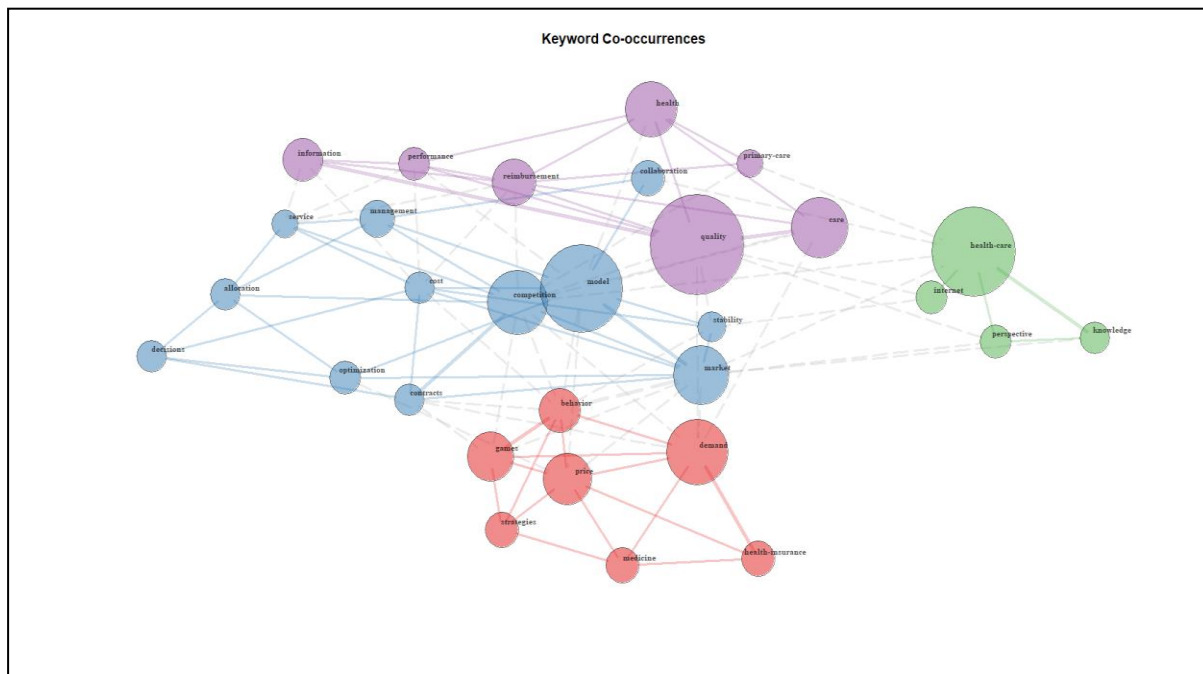


Figure 4. Keyword co-occurrence plot

Finally, we perform co-word analysis (Callon *et al.*, 1983) by multiple correspondence analysis (MCA) and hierarchical agglomerative clustering (HAC). The statistic units are the documents and the variables are the terms extracted from titles. The MCA allows us to produce a semantic map of the research field. The HAC seeks to build a hierarchy of clusters.

The HAC leads to the dendrogram of Figure 5, which suggests of yielding three clusters. To validate this suggestion we execute silhouette analysis which provides a graphical representation of how well each object has been classified. Three clusters present: higher average silhouette width than 4 and 5 clusters; none observation assigned to the wrong cluster and very few borderline observations. Therefore three clusters are the optimal choice. The silhouette plot (Figure 6) shows the cluster size.

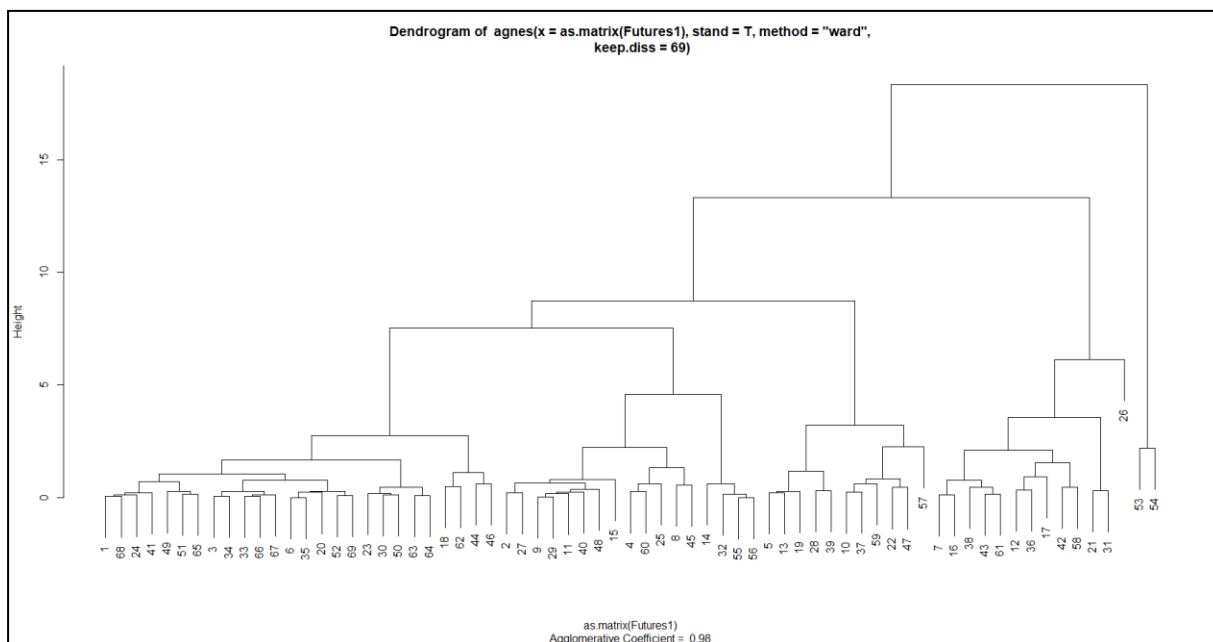


Figure 5. Dendrogram of the documents

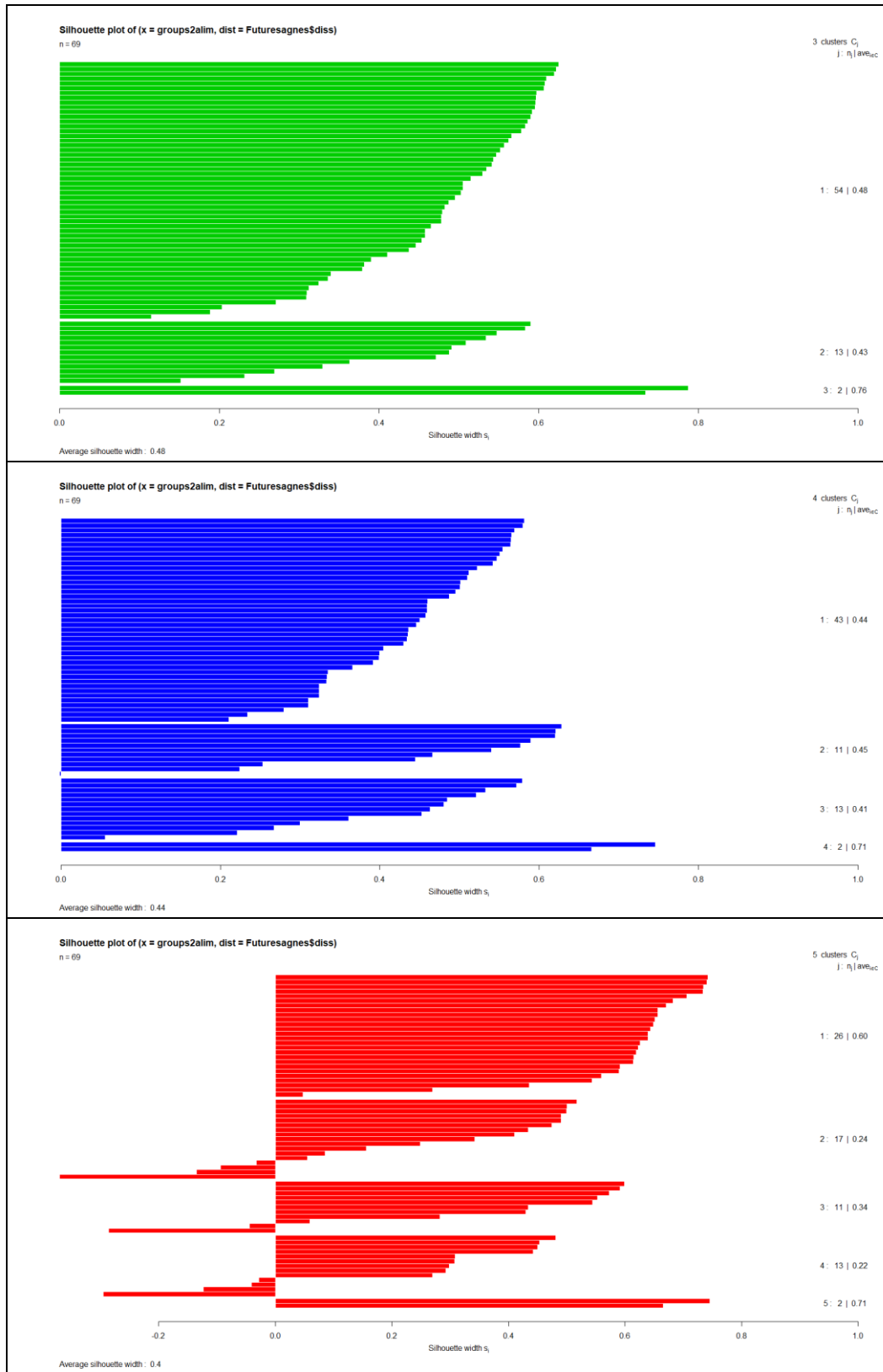


Figure 6. Silhouette plot

Table 10 illustrates the cluster results. In the second column of table 10 there are the documents, then we have the total citations (TC), the cluster to which each document belongs (cluster) as well as its neighbour cluster (fourth column) and the silhouette width (sil_width) of the observation. Green rows indicate the observations which well matched to the assigned cluster, contrary, red rows specify the very few borderline observations.

Table 10. Cluster results

N	Paper	TC	Cluster	cluster neighbord	sil_width
1	anand ks, 2011, manage sci	72	1	2	0.4580531
2	morrell k, 2008, j manage stud	52	1	2	0.6251249
3	nichols na, 1994, harv bus rev	45	1	2	0.5919003
4	cho sh, 2013, m\&som-manuf serv oper manag	38	1	2	0.6098455
5	galor e, 1997, j econ manage strategy	35	1	2	0.5025678
6	bradshaw-camball p, 1991, organ sci	31	1	2	0.5049784
7	xu f, 2017, tourism manage	28	2	1	0.4713434
8	hu qj, 2012, m\&som-manuf serv oper manag	27	1	2	0.5146393
9	bode i, 2006, public manag rev	27	1	2	0.6077247
10	grennan m, 2014, manage sci	26	1	2	0.3789382
11	tian k, 2014, j consum res	21	1	2	0.5957468
12	coyle d, 2009, chi2009: proceedings of the 27th annual chi conference on human factors in computing systems, vols 1-4	19	2	1	0.4876606
13	lu ms, 1999, j econ manage strategy	17	1	2	0.5294229
14	nagurney a, 2013, int trans oper res	16	1	2	0.4652841
15	hu qj, 2014, mark sci	15	1	2	0.5568527
16	baril c, 2016, eur j oper res	15	2	1	0.4911737
17	wu j, 2016, inf manage	14	2	1	0.1515707
18	knudsen m, 2011, organ stud	14	1	2	0.3091836
19	brekke kr, 2012, j econ manage strategy	14	1	2	0.5415809
20	mamani h, 2013, manage sci	13	1	2	0.5433639
21	andritsos da, 2014, eur j oper res	12	2	1	0.5474981
22	zhang dj, 2016, manage sci	11	1	2	0.4458215
23	lander b, 2016, res policy	11	1	2	0.3357857
24	knight va, 2013, eur j oper res	11	1	2	0.4536934
25	lu sf, 2013, manage sci	9	1	2	0.5833323
26	hammedi w, 2017, j serv manage	7	2	1	0.3631486
27	ata b, 2017, manage sci	7	1	2	0.6220851
28	skountridaki l, 2017, tourism manage	7	1	2	0.3816189
29	sahinoglu m, 2012, international conference on asia pacific business innovation and technology management	6	1	2	0.6065113
30	demirezen em, 2016, inf syst res	6	1	2	0.3398193
31	simeone l, 2017, j knowl manag	4	2	1	0.5339975
32	stith ss, 2016, j econ manage strategy	4	1	2	0.4874284
33	karanfil o, 2008, oper res	4	1	2	0.5969615
34	dai t, 2017, m\&som-manuf serv oper manag	4	1	2	0.5972559
35	trinkaus j, 2002, j bus ethics	4	1	2	0.5049784
36	d'silva j, 2012, technol anal strateg manage	3	2	1	0.5090647
37	zhou w, 2017, eur j oper res	3	1	2	0.4107217
38	merschbrock c, 2016, facilities	3	2	1	0.3292313
39	gauteplass aa, 2017, prop manag	3	1	2	0.3123196
40	ma ca, 1993, j econ manage strategy	3	1	2	0.6195781
41	froelich ka, 2012, nonprofit manag leadersh	3	1	2	0.4955205
42	kislov r, 2017, organ stud	2	2	1	0.5831716

43	lin mh, 2012, picmet `12: proceedings - technology management for emerging technologies	2	2	1	0.2317147
44	koinig i, 2017, int j advert	2	1	2	0.4794688
45	knight v, 2017, j oper res soc	1	1	2	0.5516326
46	guo p, 2019, m\&som-manuf serv oper manag	1	1	2	0.3901045
47	zhang h, 2018, serv sci	1	1	2	0.4576514
48	lawrence e, 2010, 23rd bled econference etrust: implications for the individual, enterprises and society	1	1	2	0.5861733
49	bjorkman a, 2018, internet res	1	1	2	0.4825709
50	buske k, 2016, adm sci	1	1	2	0.2708560
51	laikari a, 2008, vtt symposium on service science, technology and business	1	1	2	0.5620074
52	nagurney a, 2019, omega-int j manage sci	1	1	2	0.5656700
53	chen zhichu cz, 2015, proceedings of 2014 china international conference on insurance and risk management	0	3	1	0.7873572
54	sugawara s, 2017, comput econ	0	3	1	0.7336235
55	fink t, 1997, aqp's 19th annual spring conference and resource mart, 1997 proceedings - ``the spirit of working together	0	1	2	0.4778288
56	korfhage de, 1997, asqc's 51st annual quality congress proceedings	0	1	2	0.4778288
57	cernik o, 2016, contributions to game theory and management, vol ix	0	1	2	0.2030554
58	feng w, 2018, proceedings of 2018 china marketing international conference: smart marketing: human, technology and innovation	0	2	1	0.5898715
59	cheng yu cy, 2007, proceedings of the 2007 international conference on management science and engineering, finance analysis section	0	1	2	0.3241610
60	douglas s, 2019, public manag rev	0	1	2	0.5961867
61	zahari nm, 2014, proceeding of knowledge management international conference (kmice) 2014, vols 1 and 2	0	2	1	0.2689221
62	enakimio i, 2010, proceedings of the 11th european conference on knowledge management, vols 1 and 2	0	1	2	0.3098046
63	alkadi i, 2004, service systems and service management - proceedings of icsssm `04, vols 1 and 2	0	1	2	0.1145598
64	hammond j, 2019, public manag rev	0	1	2	0.1886580
65	savva n, 2019, manage sci	0	1	2	0.5345560
66	dollinger m, 2010, bus horiz	0	1	2	0.5901593
67	bouayad l, 2019, inf syst res	0	1	2	0.5784810
68	chohan fm, 2014, proceeding of knowledge management international conference (kmice) 2014, vols 1 and 2	0	1	2	0.4374536
69	khatib m, 2018, performance management or management performance?	0	1	2	0.5470630

The results of MCA and HCA are plotted on the two-dimensional map of Figure 7. Looking at Figure 7., we observe that:

1. the first cluster is mainly characterised by the following terms: excellence, organization, measurement, performance, supplier, chain, provider, kidney, price, pharmaceutical, network, impact, unit, cost, dynamic, system, social, narrative, online, elderly, health, management, care, risk, communities, policies, time, improve.
2. The second cluster is mainly characterised by the following terms: mechanism, increase, user, healthcare, gamification, case, role, design, innovation, activities, service, patient, serious, knowledge, effect, development.
3. The third cluster is mainly characterised by the following terms: analysis, approach, barrier, cooperative, economics, empirical, facility, game, hazard, hospital, insurance, market, medical, model, separate, studies, theories, tourism.

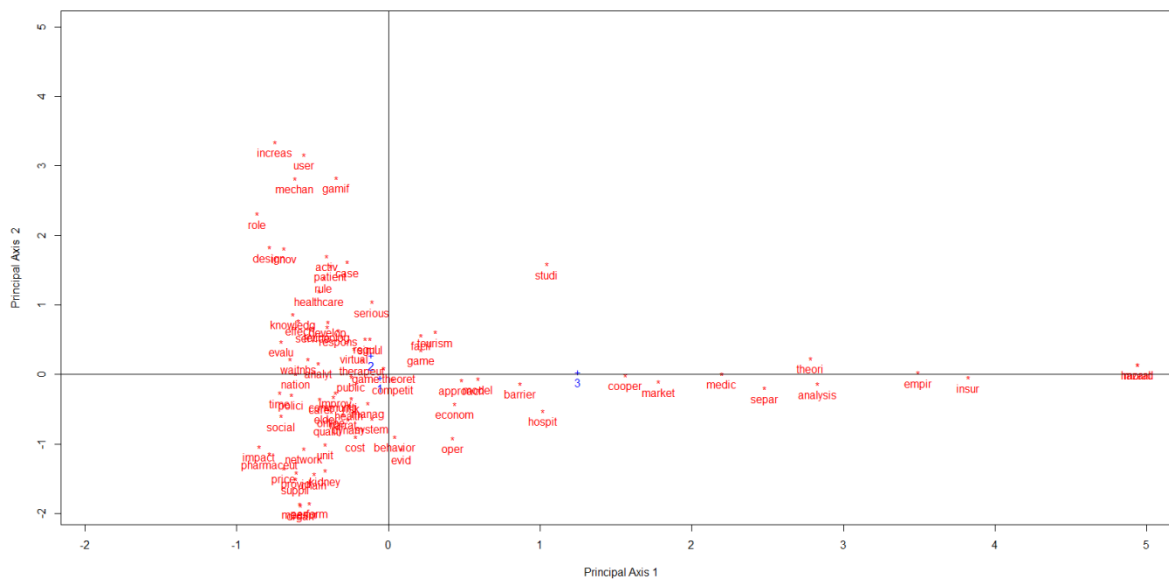


Figure 7. Two-dimensional map

We proceed with a qualitative analysis of the clusters, in particular, we proceed with the study of the titles, abstracts and keywords of the papers that fit better.

The first cluster is composed of 54 papers, whose 28 fit well. The qualitative analysis of these 28 papers shows that 23 focus on “management and governance public/private healthcare system with application of game theory” and 5 papers on “game technology for healthcare”: Tian *et al.* (2014), Karanfil and Barlas (2008), Lawrence *et al.* (2010), Laikari (2008), Khatib (2018).

Tian *et al.* (2014) focus on the power of game technology-enhanced narratives to build collaborative therapeutic communities and to provide the impetus for affecting social change and action in health care systems.

Karanfil and Barlas (2008) concentrate on the power of game technology to develop alternative therapies for body water disorders.

Lawrence *et al.* (2010) present an analytic framework for investigating interactive gaming technologies in order to: improve the physical and mental health outcomes; help improve the quality of life of the elderly and the chronically unwell and inform whether they are living in their own homes or in aged care facilities.

Laikari (2008) shows gaming has a lot of potentials to provide various new service business opportunities for entertainment and recreation as well as for the healthcare sectors.

Khatib (2018) analyses the relation between computer games and risk behaviours.

The second cluster is made up of 13 articles, of which 5 fit good, these 5 papers focus on the topic “gaming and knowledge/strategic management”; belong in this group: Simeone *et al.* (2017), D’Silva *et al.* (2012), Kislov *et al.* (2017).

Simeone *et al.* (2017) analyse the intersection of three different fields: open innovation, knowledge management and design (based on gaming principle) for innovation.

D’Silva *et al.* (2012) describe how an innovation impasse in nanomedicine could have ensued if the traditional wait and watch strategies of legislators and regulators had been followed. They explain how waiting games were avoided through the opening up and distribution of regulatory approaches.

Kislov *et al.* (2017), drawing on a qualitative longitudinal case study of a collaborative partnership between a university and healthcare organizations, describe changes in the structure, sources and mutual convertibility of capital assets over time.

The third cluster is composed of 2 articles that fit very well: Chen and Ma (2015), Sugawara and Omori (2017).

They are focused on the study of management health/medical insurance systems using game theory.

4. Discussion

The study points out the most part of the documents are papers, revealing high-quality publications. Moreover, the most productive countries are the USA with the biggest number of documents and Intra-country and inter-country collaboration.

All the authors, but three, published only one article, thus reflecting that there are few scholars (in business and management) focused on the study of gaming for healthcare. This data is also confirmed by the analysis of the number of sources; in fact, the topic “gaming for healthcare” has been published by 47 sources, of which only 9 present more than one document, relieving that very few sources are specialized at dealing with the topic.

Scientific production does not present a regular trend, but it is in rapid growth in the last years, highlighting the recent interest in the topic.

The analysis of the main keywords shows that the key topic of scientific production has been the “game theory”. This data is confirmed by the cluster analysis which highlights the thematic “game theory” applied to the healthcare sector is the prevailing one. In fact, we only found 5 papers on “game technology for healthcare”: Tian *et al.* (2014), Karanfil and Barlas (2008), Lawrence *et al.* (2010), Laikari (2008), Khatib (2018).

Among the top 10, there are 3 papers that do not fit well with the related clusters, they are: Anand *et al.* (2011), Xu *et al.* (2017), Grennan (2014).

Anand *et al.* (2011) analyse trade-offs quality-speed conundrum in customer-intensive services (healthcare sector) adopting queuing games theory.

Xu *et al.* (2017) studied gamification of tourism can contribute to more rewarding interactions, such as engaging tourists in experiential co-creation and training service providers for innovative processes and functions. Gamification can be used to enhance tourists on site experiences; in fact, location based games encourage on site engagement with the destination, augmented reality games interact the player with the real surrounding tourism attractions; gaming as an entertainment tool to kill time. As well, gamification increases brand awareness and loyalty to the destination; in fact, online games recall memories, encourage sharing experiences, inviting friends, advocate the destination, rewards/coupons in the game and gamified loyalty programs encourage repeat visits.

Grennan (2014) presents bargaining ability and competitive advantage in the medical devices market applying game theory.

In summary, the cluster analysis and the qualitative study show that the studies on the topic “gaming for healthcare” are recent and very few, in fact, only 5 articles out of 69 were found: Tian *et al.* (2014), Karanfil and Barlas (2008), Lawrence *et al.* (2010), Laikari (2008), Khatib (2018).

5. Conclusion and Future Research

In the healthcare industry, the new frontier is gaming therapy. In fact, recently there are more gaming technology applications in the healthcare market, but there are no academic studies in business and management fields which analyze the phenomenon as a whole. Starting from this gap in the literature, the present study is inserted. To this, the purpose of this paper was to scrutinize and classify the literature linking gaming for healthcare and management phenomena.

The paper offers a bibliometric analysis, supported by a qualitative approach, of the concept of gaming for healthcare, showing the different aspects of this concept mainly referring to the managerial literature.

From the analysis, three clusters emerged: the first one is on management and governance of public/private healthcare system; the second one is on gaming and knowledge/strategic management; the third is on the management of health/medical insurance system by using game theory.

The results highlight that there are very few articles on fundamental aspects for the success of digital therapies: the patient/player engagement; so that, future studies could contribute to the debate on this topic. Moreover, another not analyzed aspects in the literature are what characterizes patient innovation in healthcare concerning other forms of user innovation and the contemporary involvement of different communities: the *scientific community* (doctors and specialists), the *patient community*, the *community of those who design and produce* and finally the *institutional system* that rules all these subjects. What are the critical success factors of gaming for digital therapies? What are the strategies adopted by companies and/or healthcare communities to promote patient/player engagement for digital therapies? Will these new technologies contribute to making the co-creation of health services easier and more effective? There are no studies on these topics, future studies could contribute to the

debate on these matters.

As with most studies, this research offers interesting insights, but it is also affected by some limitations. For instance, a multidisciplinary approach would request a different bunch of keywords such as multidisciplinary. Therefore, future research can be deeper and examine this scenario and enlarge the pool of papers. Alongside, there are other chances for a content analysis which could show other key aspects of the current research topic on gaming for healthcare.

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