The APMS Conference & IFIP WG5.7 in the 21st Century: A Bibliometric Study

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Abstract. The APMS conference and IFIP WG 5.7 community can proudly look back at a rich history of research and practical impact in the field of production and production management. However, in the light of the recent disruptions of the field, often summarized under the terms Industry 4.0 or Smart Manufacturing, it is critical to assess recent research trends and changing key topics within the community to enable informed decisions about the future directions of the conference. This paper takes a critical look at 1,428 published papers from the APMS proceedings that are available on Scopus and derives key insights through a bibliometric study. A special focus is put on the last five years to reflect the recent effects of digital transformation on the driving topics of the conference. The results show the emergence and dominance of Industry 4.0 among the recent topics, but also provides evidence of established topics, such as sustainability, remaining relevant. Overall, the study provides a wealth of information that provides the foundation for forward looking discussion among the community members.

Keywords: Key Topics, APMS, Production Management, Smart Factory, Smart Manufacturing, Industry 4.0, IFIP, Bibliometric Analysis.

1 Introduction

The field of production and production management is currently experiencing an interesting phase with paradigms like Smart Manufacturing and Industry 4.0, disrupting whole industries on a global scale [1]. Exciting technologies such as the Industrial Internet of Things (IIoT), Additive Manufacturing, Cyber-Physical Systems, AI and machine learning are being introduced to the shop-floor and beyond [2]. This digital transformation has a strong influence on industry and academia alike, and also effects policies related to the domain. With regard to these disruptive and rapid changes, it is necessary to critically reflect on the topics that i) have been covered by the contributions of the APMS community, as well as ii) observable changes in preferences regarding the dominant topics and research areas, especially for an established community with a long history such as IFIP WG5.7 and APMS. It is then crucial to provide transparent and insightful data to enable an informed discussion around the future directions of the

community and the APMS conference, thus ensuring and solidifying the stance at the pinnacle of production management research and industrial relevance.

The flagship conference of the International Federation for Information Processing (IFIP) Working Group 5.7[1] was originally established in 1978, and with it the '*International Conference on Advances in Production Management Systems (APMS)*'[2] as a working conference. Starting out as a tri-yearly event, it has emerged as a premier yearly international conference held every year since 2005. From 2005 to 2012, the conference venues where mainly located in Europe. However, paying tribute to its global ambition, today the APMS conference location rotates in a three-year rhythm through Asia (incl. Australia/New Zealand), Europe/Africa, and the Americas. This regular global rotation started in 2013 with the conference being held in State College, Pennsylvania, USA. The APMS conferences in the 21st Century, their years, and locations are illustrated in Table 1 and Fig. 1 (locations only).

This paper pays tribute to the history of this conference series with a focus on the 21st Century. With a history of 23 events (by 2018), and over 40 years, the objective of this research is to investigate the international collaborations, topics covered over time, and, most importantly, provide insights in emerging topics of relevance to the APMS community. The objective is to build i) a solid understanding of the roots of this international conference series, and the community built around it, and ii) provide insights on relevant topics, including historic trends and forward-looking trends based on solid, bibliometrics data.

Fig. 1. World map with APMS locations from 2000-2018.

The remainder of this paper is structured as follows: First, we will briefly elaborate on our methodology for this paper before providing in-depth insights in the data used for our analysis in Section 2. Following we present the main results in Section 3 and discuss selected topics of relevance in more detail in Section 4. Section 5 concludes the paper and provides an outlook on future work and next steps.

[1] https://www.ifipwg57.org

[2] https://www.apms-conference.org

2 Methodology & data

We chose a bibliometric study as the methodology to develop this paper. Furthermore, we decided to concentrate on two main timeframes, 2000-2018 (a.k.a. the 21st century) and 2014-2018 (a.k.a. the last five years). The main data source of this bibliometric analysis were the published proceedings of the APMS conference from 2000 until 2018. It has to be noted that the available data for our analysis was not complete for the first timeframe (see Table 1) as some of the earlier editions are not available as part of the Springer series and thus the Scopus database. The second timeframe provided a complete dataset for analysis, including all relevant meta-data.

For our analysis, we focused on the Scopus database, as the most established provider of high-quality conference proceedings data, where we identified the proceedings and pre-processed the data. Table 1 depicts the year, locations, conference topic, and number of papers included in this analysis. Hyperlinks are included in the table to provide direct links to proceedings when available. Several editions are published in up to three books – please click on the Roman number (I-III) to activate the hyperlinks in such cases, otherwise, click on the topic of the specific conference. Cleaning refers to adjusting for the correct date as conference year and year of publication of the proceedings varied in selected cases. Furthermore, we had to remove other papers from conferences with similar titles and/or published in Springer's AICT series.

We then exported the identified papers from Scopus, and again pre-processed the .csv files to ensure consistency and compliance with our analytical tools. We mainly relied on MS-Excel and VOSviewer for our analysis and data visualizations. VOSviewer is a bibliometric analysis tool focused on visualization of similarities. The tool works by first developing a similarity matrix based on association strength, then uses the similarity values to determine location and proximity of labels.

To augment the data derived from the Scopus files, we went through the minutes of the IFIP WG 5.7 meetings for the years 2000-2018, mainly to identify the Special Interest Groups (SIGs) formed, active, merged, and resolved (see Fig. 6).

Table 1. APMS Conference Proceedings 2000-2018 (based on Scopus data)

Year	No	Location	Conference Topic*	Papers
2002	8	Eindhoven, Netherlands	Collaborative Systems for Production Mgmt.	-
2003	9	Karlsruhe, Germany	Integrating Human Aspects in Prod. Mgmt.	-
2005	10	Washington D.C., USA	-	-
2006	11	Wroclaw, Poland	Lean Business Systems and Beyond	-
2007	12	Linköping, Sweden	Advances in Production Management Systems	-
2008	13	Espoo, Finland	Innovation in Networks	59
2009	14	Bordeaux, France	New Challenges, New Approaches	82
2010	15	Cernobbio, Italy	Competitive and Sustainable Manufacturing, Products and Services	142
2011	16	Stavanger, Norway	Value Networks: Innovation, Technologies, and Management	66

2012	17	Rhodes Island, Greece	Competitive Manufacturing for Innovative Products & Services (Part I / II)	184
2013	18	State College, USA	Sustainable Production and Service Supply Chains (Part I / II)	134
2014	19	Ajaccio, France	Innovative & Knowledge-Based Prod. Mgmt. in a Global-Local World (Part I/ II/ III)	233
2015	20	Tokyo, Japan	Innovative Production Management Towards Sustainable Growth (Part I / II)	164
2016	21	Iguassu Falls, Brazil	Initiatives for a Sustainable World	112
2017	22	Hamburg, Germany	The Path to Intelligent, Collaborative and Sustainable Manufacturing (Part I / II)	122
2018	23	Seoul, South Korea	Production Mgmt. for Data-Driven, Intelligent, Collaborative, & Sustainable Manuf. / Smart Manuf. for Industry 4.0 (Part I / II)	129
			total number of papers included in analysis	*1,428*

* Hyperlink of proceedings and/or further information provided if available.

3 Results

We structured the results from our analysis in four main sub-sections: *co-authorships and country networks*, *most productive and highly-cited authors and countries*, *most relevant keywords of the APMS proceedings*, and *Special Interest Groups* (SIGs). Following, we present the analysis results as a basis for our discussion in the next section.

3.1 Co-authorship and Country Networks

The IFIP WG 5.7 and APMS conference has global ambitions and continuously provides a forum for international exchange. We analyzed the number of different countries represented as authors of respective APMS proceedings for each year from 2014 to 2018, as well as an accumulated count for the timeframe 2000-2018 (see Table 2).

Table 2. Summary of APMS Collaborations (based on Scopus data)

Year	# of papers	# of countries	# of authors
2014	233	34	601
2015	164	28	418
2016	112	22	281
2017	122	32	351
2018	129	29	348
2000 - 2018	*1,428*	*57*	*2,531*

Furthermore, we analyzed the authorship networks and visualized the clusters using VOSviewer based on i) individual authors (see Fig. 2 & Fig. 4), as well as ii) on the basis of their respective countries (see Fig. 3 & Fig. 5) for the two timeframes 2000-2018 (see Fig. 2 & Fig. 3) and 2014-2018 (see Fig. 4 & Fig. 5).

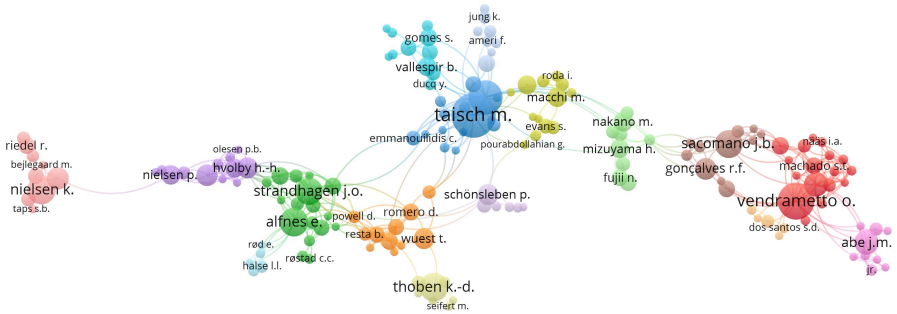

Fig. 2. Co-authorship Network Diagram between 2000-2018 (Authors with at least 4 papers)

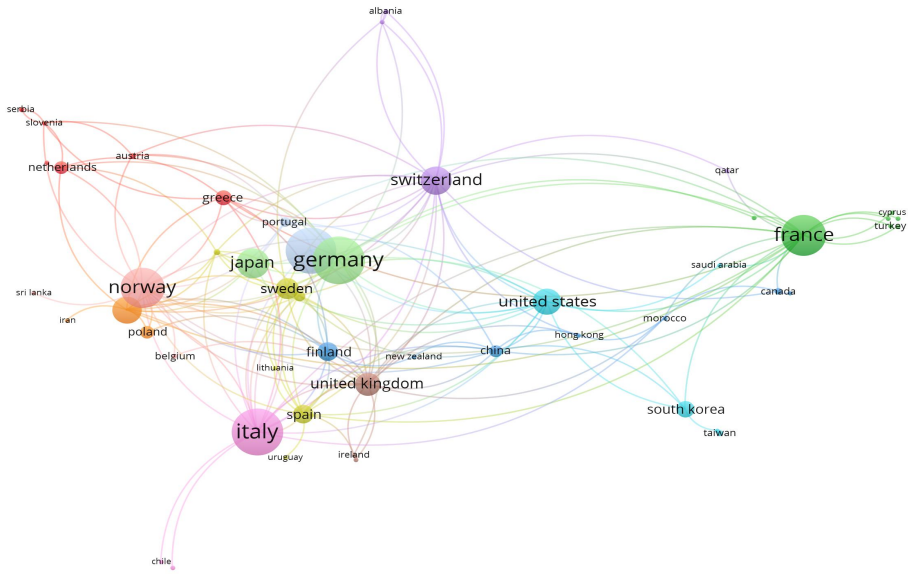

Fig. 3. Network Diagram of Countries between 2000-2018 (Countries with at least 1 paper)

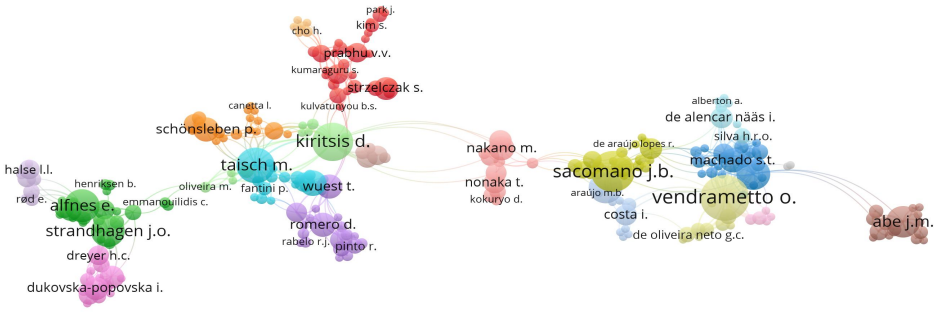

Fig. 4. Co-authorship Network Diagram between 2014-2018 (Authors with at least 2 papers)

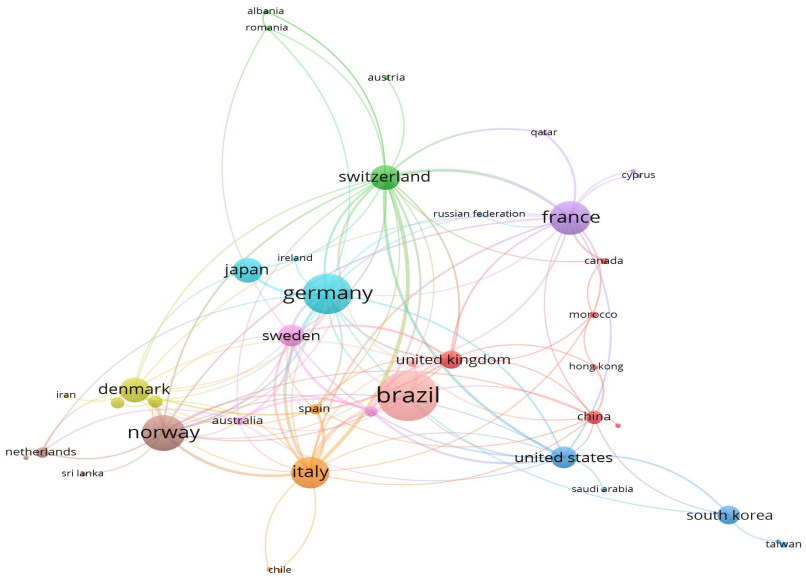

Fig. 5. Network Diagram of Countries between 2014-2018 (Countries with at least 1 paper)

3.2 Most Productive and Highly-Cited Authors and Countries

We analyzed the most productive (measured by *no. of published papers*) and highly-cited (measured by *no. of citations*) authors and countries for our two chosen timeframes: 2000-2018 (see Table 3) and 2014-2018 (see Table 4). Furthermore, we analyzed the 10 most cited papers from 2000-2018 (see Table 5) and 2014-2018 (see Table 6).

Table 3. Most Productive and Highly-Cited Authors & Countries (2000-2018)

Highly-Cited Author		**Most Productive Author**		**Most Productive Country**	
author	*no.*	*author*	*no.*	*country*	*no.*
Taisch, M.	155	Taisch, M.	49	Germany	191
Thoben, K.-D.	67	Vendrametto, O.	36	Italy	189
Stahre, J.	64	Kiritsis, D.	32	Brazil	181
Romero, D.	62	Alfnes, E.	25	France	150
May, G.	57	Nielsen, K.	25	Norway	147
Nielsen, K.	56	Thoben, K.-D.	25	Japan	94
Bernus, P.	47	Sacomano, J.	24	Switzerland	88
Noran, O.	47	Strandhagen, J.	23	Denmark	81
Alfnes, E.	44	Stich, V.	22	United States	78
Dolgui, A.	44	Dos Reis, J..	19	United Kingdom	63
Garetti, M.	44	Abe, J.	19		
		Schuh, G.	19		

Table 4. Most Productive and Highly-Cited Authors & Countries (2014-2018)

Highly-Cited Author		**Most Productive Author**		**Most Productive Country**	
author	*no.*	*author*	*no.*	*country*	*No.*
Romero, D.	61	Vendrametto, O.	26	Brazil	141
Stahre, J.	59	Sacomano, J.	22	Germany	101
Bernus, P.	47	Nielsen, K.	21	Norway	84
Noran, O.	47	Kiritsis, D.	20	France	78
Taisch, M.	47	Taisch, M.	18	Italy	69
Negri, E.	41	Brunoe, T.D.	16	Switzerland	49
Nielsen, K.	36	Alfnes, E.	16	Japan	49
Thoben, K.-D.	36	Dos Reis, J.	15	Denmark	47
Brunoe, T.	35	Strandhagen, J.	15	United States	40
Fumagalli, L.	34	Goncalves, R.	15	Sweden	40
		Abe, J.	15		

Table 5. Top 10 Highest Cited Papers (2000-2018)

authors	year	title (adapted/shortened)	ref.	no.
Romero, D.	2016	The operator 4.0: Human CPS & adaptive automation	[3]	27
Bogdanski, G.	2013	Ext. energy value stream appr. applied on electronics ind.	[4]	22
Romero, D.	2015	Towards a human-centered ref. architecture	[5]	20
Mourtzis, D.	2015	Perf. indicators for eval. of PSS design: A review	[6]	19
Andersen, A.	2015	Reconf. manuf. on multi. levels: Lit. rev.& res. directions	[7]	19
Fumagalli, L.	2014	Ontology-based modeling of manuf. & log. systems	[8]	19
Bentaha, M.	2013	Stoch. formulation of disassembly line balancing probl.	[9]	18
Bentaha, M.	2013	Chance constrained programming model …	[10]	16
Trentesaux, D.	2014	Sustainability in manuf. operations scheduling.	[11]	16
Bocewicz, G.	2012	Cyclic steady state refinement: Multimodal proc. persp.	[12]	16

Table 6. Top 10 Highest Cited Papers (2014-2018)

authors	year	title (adapted/shortened)	ref.	no.
Romero, D.	2016	The operator 4.0: Human CPS & adaptive automation	[3]	27
Romero, D.	2015	Towards a human-centered ref. architecture	[5]	20
Mourtzis, D.	2015	Perf. indicators for eval. of PSS design: A review	[6]	19
Andersen, A.	2015	Reconf. manuf. on multi. levels: Lit. rev.& res. directions	[7]	19
Fumagalli, L.	2014	Ontology-based modeling of manuf. & log. systems	[8]	19
Trentesaux, D.	2014	Sustainability in manuf. operations scheduling	[11]	16
De Carolis, A.	2017	Maturity model for digital readiness of manuf. companies	[13]	14

Nielsen, P.	2014	An empirical investigation of lead time distributions	[14]	13
Bruno, G.	2014	Expl. of semantic platform to store & reuse PLM knowl.	[15]	13
Garza-Reyes, J.	2014	Lean & green – syn., diff., lim., & need for six sigma	[16]	13

3.3 Most Relevant Keywords of APMS Proceedings

We decided to analyze the keywords instead of title and/or abstract to identify trends regarding the key topics and research domains covered by the APMS conference over the last five year. Our rationale behind this decision is that keywords introduce less bias, e.g., through multiple usage of one word in the abstract of an individual paper, and also are supposedly more standardized to enable topical searches. While this is partly true, there is still a large variability among the keywords within the data.

Table 7 illustrates the most used keywords from each of the 2014-2018 APMS proceedings, as well as the accumulated count for the five-year period. The number of displayed keywords varies from 6 to 9 following the methodology to include the keywords that have a higher count than the group that would expand the list above ten. The total keyword count (of different keywords) that was analyzed was 955 (2014); 670 (2015); 452 (2016); 518 (2017); 540 (2018); and 3,135 (total).

Table 7. Top 6-9 Most used Keywords of APMS Proceedings 2014 - 2018.

2014		**2015**		**2016**		**2017**	
keyword	*no.*	*keyword*	*no.*	*keyword*	*#*	*keyword*	*no.*
sustainability	15	cloud manuf.	10	paraconsistent logic	8	industry 4.0	23
SMEs	9	engineer-to-order	9	sustainability	7	manufacturing	6
scheduling	7	lean manuf.	9	emergy	5	smart manuf.	6
simulation	7	sustainability	8	supply chain	4	lean manuf.	5
case study	7	paraconsistent logic	8	simulation	4	sustainability	4
lean manuf.	7	case study	7	CPPS	4	education	4
				innovation	4	supply chain	4
				lean manuf.	4	digitization	4
						logistics	4

2018		**2014-2018**	
keyword	*no.*	*keyword*	*no.*
industry 4.0	24	industry 4.0.	50
CPPS	8	sustainability	36
mass customization	7	lean manuf.	30
smart factory	7	engineer-to-order	24
lean manuf.	5	simulation	22
engineer-to- order	5	CPPS	22

3.4 Special Interest Groups (SIGs)

The data of the Special Interest Groups (SIGs) within IFIP WG 5.7 is rather limited ad there are only a few SIGs active at a given time. Fig. 6 highlights the formed, active, merged, and resolved SIGs in the 21st Century.

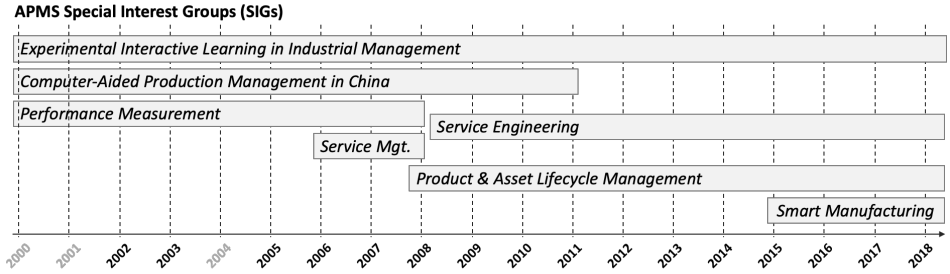

Fig. 6. Timeframe of Active Special Interest Groups (SIGs) between 2000-2018

4 Discussion

The previous results section reported the 'hard facts' directly derived from the data. The analyses and visualization chosen are following common standards in bibliometric analysis, e.g., authorship networks that illustrate the strength of the relationship. We chose to provide more visualizations in lieu of detailed explanation given the page limit. In this section, we will now discuss and expand on these results and put them into context to provide additional context that we were not able to represent in the results above.

The results of our authorship analysis show a consistent representation of 22 to 34 different countries each year over the last five years and 57 different countries in the 21st Century, the APMS stands true to its claim to be a true international conference with global impact.

The authors' keywords are a main focus of our discussion as there is a wide variability of terms used that describe similar domains. However, the clustering is inherently subjective as the interpretation and definition of the cluster boundaries is subjective in itself. Therefore, the following discussion is not comprehensive, but a snapshot of the data the authors deemed most interesting given the context and objectives of this paper.

The popularity of the keyword '*case study*' (see Table 7) is an indication that the objective of the APMS of practice-oriented research that provides value to industry is taken seriously. The keyword, while not always top-ranked, is consistently among the higher ranked keywords every year.

The keyword *'industry 4.0'* is not only the most dominant key word in the last two years and over the timeframe of 2014-2018, but when seen as a cluster, and thus combined with 'smart manufacturing, 'CPS', 'smart factory', and 'intelligent manufacturing', just to name a few, it becomes even more dominant. When we interpret the cluster even broader, and include 'product service systems', 'servitization', 'digital transformation', and 'internet of things' as part of the 'industry 4.0' cluster as well, this trend

is reinforced even more. Overall, it can be safely concluded that Industry 4.0 is, unsurprisingly, a core topic of the APMS community and is here to stay for the near future.

The *'smart factory'* keyword that emerges in 2018 can be traced back to the host country South Korea, where smart factory is the term used for their federal Industry 4.0/Smart Manufacturing program. The simultaneous emergence of *'maturity model'* and *'industry 4.0'* and *'smart manufacturing'* may indicate the struggle of companies to adapt and cope with these new paradigms.

There are many other clusters that emerge from the data and that reflect the key topical domains covered. Of those, we would like to mention three specifically: i) '*supply chain*' is represented in top keywords, however, not in a position that does the topic justice when we look at the cluster that might include 'logistics', 'production logistics', 'SCM' and so forth. Supply chain and logistics have been (and seem to continue to be) an essential area of interest to the APMS community. When analyzing the keywords, a cluster around ii) *'data analytics'* emerges that includes 'machine learning', 'modeling', and 'simulation', as well as various specific algorithms. This is a very diverse cluster, yet of key interest to the community. Another cluster that we feel is worthy of discussion is iv) *'business model'*, which highlights the economic viability and management perspective a lot of the keywords reflect. This is another key aspect of the APMS community that brings together different disciplines and thus different domains.

In the following, we created a visual representation of all keywords used in the APMS papers from 2014-2018 as a word cloud (see Fig. 7) that allows a quick overview of key topics, but also shows the diversity of topics covered by this conference.

Fig. 7. Word Cloud of all Keywords from APMS Proceedings 2014-2018

5 Conclusion & Outlook

This paper intended to reflect on the rich history and topical development of the IFIP WG 5.7 and associated APMS conference over the term of the 21st Century. With the radical disruption of the Fourth Industrial Revolution already at full pace, this is a perfect time to critically reflect whether the topical focus of the APMS conference is still up-to-date and a good representation of the reported work, or if adjustments are necessary to be fit for the future.

Summarizing our findings, our analysis shows that the APMS conference is a truly international community with strong collaborations among the members. The keywords show that new topical areas emerge and become more dominant – especially the cluster around Industry 4.0, which is already reflected in the thriving 'smart manufacturing' SIG as well. The outlook is promising when we look at the most cited papers from 2000-2018 with 6 out of 10 being published within the last five years. However, increasing the number of citations of APMS proceedings should be a focus of the community to increase the impact and reputations of the conference.

There are several limitations that we need to keep in mind when reading our study. First, the early years of the 21st Century are not represented in the data as the proceedings are not available on Scopus. Therefore, the total numbers of papers reported for the timeframe 2000-2018 as well as other derived results such as author networks and such are not 100% accurate. However, the objective of this paper was to reflect the recent changes in scope and focus of the community and in that sense, the recent five years, for which all data was available and is included in the analysis can be considered more important. A second limitation that needs to be reported is the subjectivity that revolves around the clusters of keywords briefly discussed in Section 5. While the results of the keywords analysis is objective and accurate, the discussion is influenced by the authors interpretation, and as such, is subjective to some extent.

Acknowledgment

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References

1. Thoben, K.-D., Wiesner, S. & Wuest, T.: "*Industrie 4.0" and Smart Manufacturing – A Review of Research Issues and Application Examples*. International Journal of Automation Technology, 11(1), 4-19 (2017).
2. Mittal, S., Kahn, M., Romero, D. & Wuest, T.: Smart Manufacturing: Characteristics, Technologies and Enabling Factors. *Part B: Journal of Engineering Manufacture, Online first*, 1-20 (2017).
3. Romero, D., Bernus, P., Noran, O., Stahre, J., & Berglund, Å. F.: *The operator 4.0: Human cyber-physical systems & adaptive automation towards human-automation symbiosis work systems*. In: Nääs et al. (eds) APMS. Initiatives for a Sustainable World. APMS 2016. AICT, vol 488., pp. 677-686. Springer, Cham (2016).
4. Bogdanski, G., Schönemann, M., Thiede, S., Andrew, S., & Herrmann, C.: *An extended energy value stream approach applied on the electronics industry.* In: Emmanouilidis et al. (eds) APMS. Competitive Manufacturing for Innovative Products and Services. APMS 2012. ACIT, vol 397, pp. 65-72. Springer, Heidelberg (2013).

5. Romero, D., Noran, O., Stahre, J., Bernus, P., & Fast-Berglund, Å.: *Towards a human-centred reference architecture for next generation balanced automation systems: Human-automation symbiosis*. In: Umeda et al. (eds) Advances in Production Management Systems: Innovative Production Management Towards Sustainable Growth. APMS 2015. AICT, vol 460, pp. 556-566. Springer, Cham (2015).
6. Mourtzis, D., Fotia, S., & Doukas, M.: Performance indicators for the evaluation of product-service systems design: A review. In: Umeda et al. (eds) APMS: Innovative Production Management Towards Sustainable Growth. APMS 2015. AICT, vol 460, pp. 592-601. Springer, Cham (2015).
7. Andersen, A., Brunoe, T. D., & Nielsen, K.: *Reconfigurable manufacturing on multiple levels: Literature review and research directions.* In: Umeda et al. (eds) APMS: Innovative Production Management Towards Sustainable Growth. APMS 2015. AICT, vol 460, pp. 274-282. Springer, Cham (2015).
8. Fumagalli, L., Pala, S., Garetti, M., & Negri, E. (2014). *Ontology-based modeling of manufacturing and logistics systems for a new MES architecture.* In: Grabot et al. (eds) APMS. Innovative and Knowledge-Based Production Management in a Global-Local World. APMS 2014. ACIT, vol 438, pp. 192-200. Springer, Heidelberg (2014).
9. Bentaha, M. L., Battaïa, O., & Dolgui, A.: *A stochastic formulation of the disassembly line balancing problem*. In: Emmanouilidis et al. (eds) APMS. Competitive Manufacturing for Innovative Products and Services. APMS 2012. ACIT, vol 397, pp. 397-404. Springer, Heidelberg (2013).
10. Bentaha, M. L., Battäıa, O., & Dolgui, A.: *Chance constrained programming model for stochastic profit-oriented disassembly line balancing in the presence of hazardous parts.* In: Emmanouilidis et al. (eds) APMS. Competitive Manufacturing for Innovative Products and Services. APMS 2012. ACIT, vol 414, pp. 103-110. Springer, Heidelberg (2013).
11. Trentesaux, D., & Prabhu, V.: *Sustainability in manufacturing operations scheduling: Stakes, approaches and trends.* In: Grabot et al. (eds) APMS. Innovative and Knowledge-Based Production Management in a Global-Local World. APMS 2014. ACIT, vol 439, pp. 106-113. Springer, Heidelberg (2014).
12. Bocewicz, G., Nielsen, P., Banaszak, Z. A., & Dang, V. Q.: *Cyclic steady state refinement: Multimodal processes perspective*. In: Frick et al. (eds) APMS. Value Networks: Innovation, Technologies, and Management. APMS 2011. AICT, vol 384, pp. 18-26. Springer, Heidelberg (2012).
13. De Carolis, A., Macchi, M., Negri, E., & Terzi, S. (2017). *A maturity model for assessing the digital readiness of manufacturing companies.* In: Lödding et al. (eds) APMS. The Path to Intelligent, Collaborative and Sustainable Manufacturing. APMS 2017. AICT, vol 513, pp. 13-20. Springer Cham (2017).
14. Nielsen, P., Michna, Z., & Do, N. A. D.: *An empirical investigation of lead time distributions*. In: Grabot et al. (eds) APMS. Innovative and Knowledge-Based Production Management in a Global-Local World. APMS 2014. ACIT, vol 438, pp. 435-442. Springer, Heidelberg (2014).
15. Bruno, G., Antonelli, D., Korf, R., Lentes, J., & Zimmermann, N.: *Exploitation of a semantic platform to store and reuse PLM knowledge*. In: Grabot et al. (eds) APMS. Innovative and Knowledge-Based Production Management in a Global-Local World. APMS 2014. ACIT, vol 438, pp. 59-66. Springer, Heidelberg (2014).
16. Garza-Reyes, J. A., Winck Jacques, G., Lim, M. K., Kumar, V., & Rocha-Lona, L.: *Lean and green - synergies, differences, limitations, and the need for six sigma*. In: Grabot et al. (eds) APMS. Innovative and Knowledge-Based Production Management in a Global-Local World. APMS 2014. ACIT, vol 438, pp. 71-81. Springer, Heidelberg (2014).