CARV/MCPC 2021 Opening Paper Presentation

- A Bibliometric and Sentiment Study of CARV and MCPC Conferences in the 21st Century: Towards Sustainable Customization

Presented by Ann-Louise Andersen

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Introduction

Sustainable Customization

- CARV/MCPC 2021 Conference Theme

"… the continued success of a company is highly dependent on the ability to detect and fulfill idiosyncratic and changing customer needs in a cost-efficient, environmentally friendly, and socially responsible way."

Book of Proceedings

- CARV/MCPC 2021

119 Papers across both conferences

Book of Proceedings

- Divided into 14 Topical Parts

- Smart Automation and Human–Machine Collaboration
- Changeable, Reconfigurable, and Flexible Manufacturing
- Additive Manufacturing
- Machine Learning for Smart Manufacturing
- Smart Factories and Cyber-Physical Production Systems
- Data-driven Approaches for Manufacturing and Variety Management
- Global Production and Supply Chain Networks
- Configuration Management and Choice Navigation
- Insights from Case Studies and Experiments
- Smart Products, Services, and Product-Service Systems
- Learning Factories and Engineering Education
- Digital Transformation and Maturity Assessment
- Sustainable Manufacturing and Circular Economy
- Factory and Shop Floor Planning

Review Process in Brief

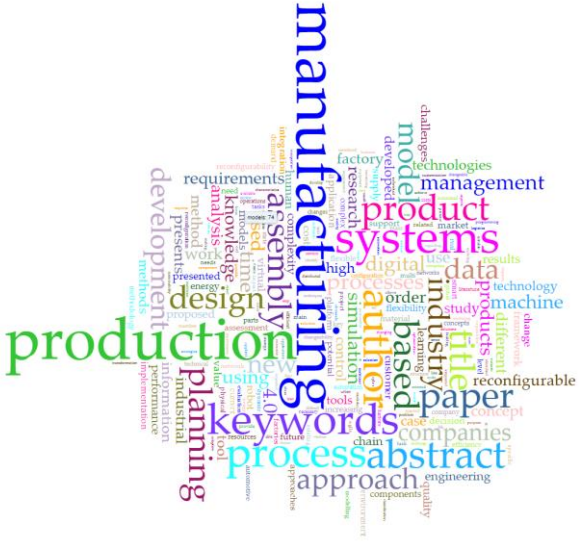
- CARV/MCPC 2021

		1st Review Round	2nd Review Round
CARV2021	**117** Abstracts →		**85** Full papers
MCPC2021	**48** Abstracts →		**34** Full papers
		2-4 review reports per paper on quality, relevance, originality, etc.	*Editor evaluation of revisions, comments, and review reports.*

Traditions of CARV & MCPC

- From 2001/2005 to 2021

Changeable, Agile, Reconfigurable & Virtual Production



Mass Customization, (Product Configuration) Personalization, (Customer co-creation)

Hosting Cities for CARV & MCPC

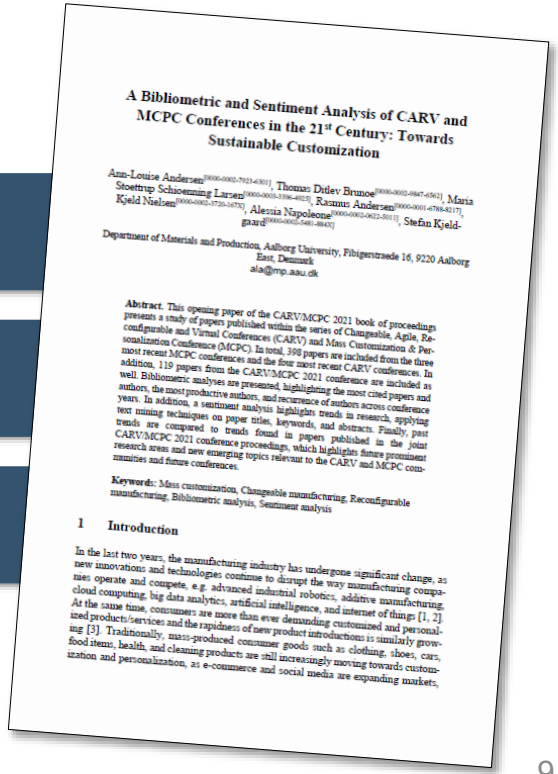
CARV/MCPC 2021 Opening Paper

- 8th CARV and 10th MCPC conference

Experts, Impact, Relevance

Research Trends

Future of CARV & MCPC



A Bibliometric and Sentiment Analysis of CARV and MCPC Conferences in the 21st Century: Towards Sustainable Customization

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Abstract. This opening paper of the CARV/MCPC 2021 book of proceedings presents a study of papers published within the series of Changeable, Agile, Reconfigurable and Virtual Conferences (CARV) and Mass Customization & Personalization Conference (MCPC). In total, 398 papers are included from the three most recent MCPC conferences and the four most recent CARV conferences. In addition, 119 papers from the CARV/MCPC 2021 conference are included as well. Bibliometric analyses are presented, highlighting the most cited papers and authors, the most productive authors, and recurrence of authors across conference years. In addition, a sentiment analysis highlights trends in research, applying text mining techniques on paper titles, keywords, and abstracts. Finally, past trends are compared to trends found in papers published in the joint CARV/MCPC 2021 conference proceedings, which highlights future prominent research areas and new emerging topics relevant to the CARV and MCPC communities and future conferences.

Keywords: Mass customization, Changeable manufacturing, Reconfigurable manufacturing, Bibliometric analysis, Sentiment analysis

1 Introduction

In the last two years, the manufacturing industry has undergone significant change, as new innovations and technologies continue to disrupt the way manufacturing companies operate and compete, e.g. advanced industrial robotics, additive manufacturing, cloud computing, big data analytics, artificial intelligence, and internet of things [1, 2]. At the same time, consumers are more than ever demanding customized and personalized products/services and the rapidness of new product introductions is similarly growing [3]. Traditionally, mass-produced consumer goods such as clothing, shoes, cars, food items, health, and cleaning products are still increasingly moving towards customization and personalization, as e-commerce and social media are expanding markets,

Data & Methods

Data & Methods

Description

Time

- CARV: 2011, 2013, 2016, 2019, 2021 (#5, 11 years)
- MCPC: 2014, 2015, 2017, 2021 *(#4, 8 years)*
- Remaining prior conferences have only internal publications

Data

- Publishers: Springer, Procedia CIRP, Procedia Manufacturing
- Citation Records: Google Scholar via Publish or Perish (except 2021)
- Text: Title, abstract, and keywords for all papers (including 2021)

Papers

- 398 papers are analyzed in total
- 273 CARV papers with citation data, 357 CARV papers in text data
- 125 MCPC papers with citation data, 158 MCPC papers in text data

Data & Methods

CARV: 2011-2019
MCPC: 2014-2017

Citation records (Google Scholar)

398 papers

Bibliometric analysis

Citations per conference, paper, and author
Most productive authors
Recurring and unique authors

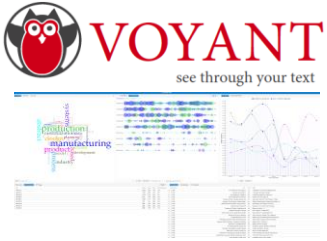
CARV: 2011-2021
MCPC: 2014-2021

Text data (Title, abstract, keyword)

517 papers

Sentiment analysis

Frequent and distinct words
Frequent keywords comparison across conferences
Frequent keywords across time

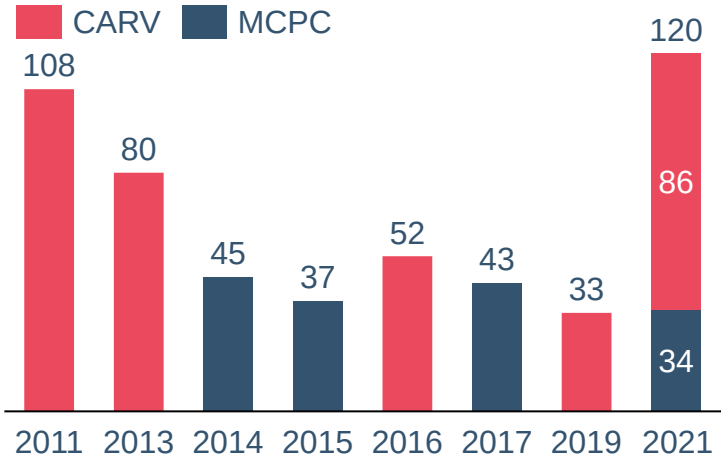


Bibliometric Analysis

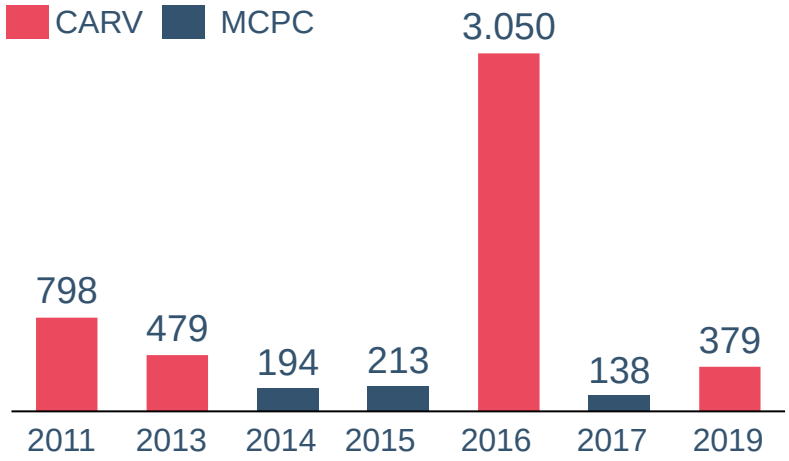
Citations & Papers per Conference

- Comparison of CARV & MCPC

Number of papers for a book of proceedings from a given year



Total citations for a book of proceedings from a given year

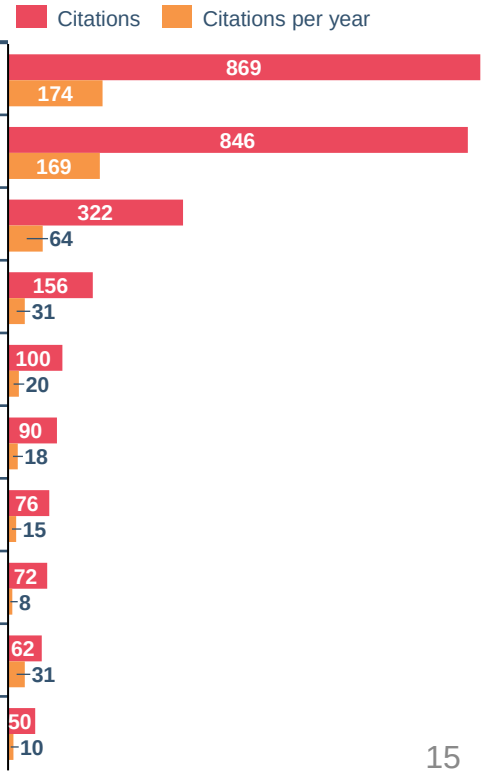


Citations per paper (average)

7,6	6	4,3	5,8	58,7	3,2	11,5

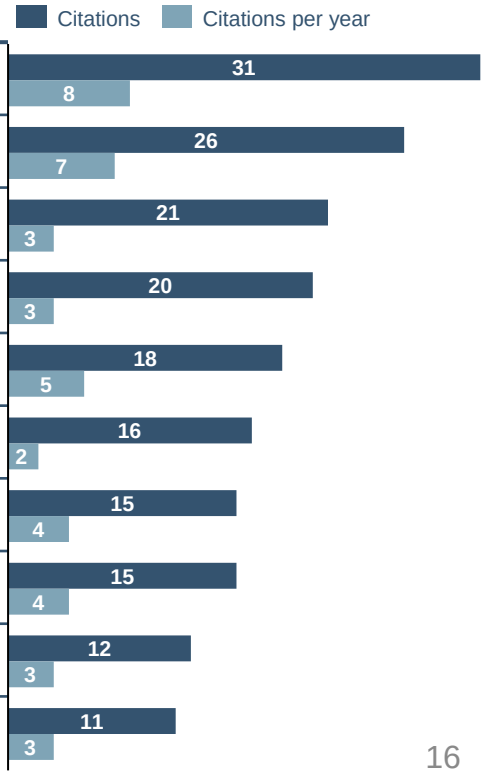
Top Cited Papers of CARV

CARV	Paper title	Author(s)
CARV 2016	A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises	Schumacher, A., Erol, S., & Sihn, W
CARV 2016	A categorical framework of manufacturing for industry 4.0 and beyond	Qin, J., Liu, Y., & Grosvenor, R.
CARV 2016	Software-defined cloud manufacturing for industry 4.0	Thames, L., & Schaefer, D.
CARV 2016	E-commerce logistics in supply chain management: Practice perspective	Yu, Y., Wang, X., Zhong, R.Y. et al.
CARV 2016	Procedure for defining the system of objectives in the initial phase of an industry 4.0 project focusing on intelligent…	Albers, A., Gladysz, B., Pinner, T. et al.
CARV 2016	Digital manufacturing and flexible assembly technologies for reconfigurable aerospace production systems	Jackson, K., Efthymiou, K., Borton, J.
CARV 2016	On Servitization of the Manufacturing Industry in the UK	Huxtable, J., Schaefer, D.
CARV 2011	Change in manufacturing–research and industrial challenges	ElMaraghy, H., AlGeddawy, T., Azab, A. et al.
CARV 2019	Digital twin for adaptation of robots' behavior in flexible robotic assembly lines	Kousi, N., Gkournelos, C., Aivaliotis, S. et al.
CARV 2016	Requirements specification of a computerized maintenance management system–a case study	Lopes, I., Senra, P., et al.



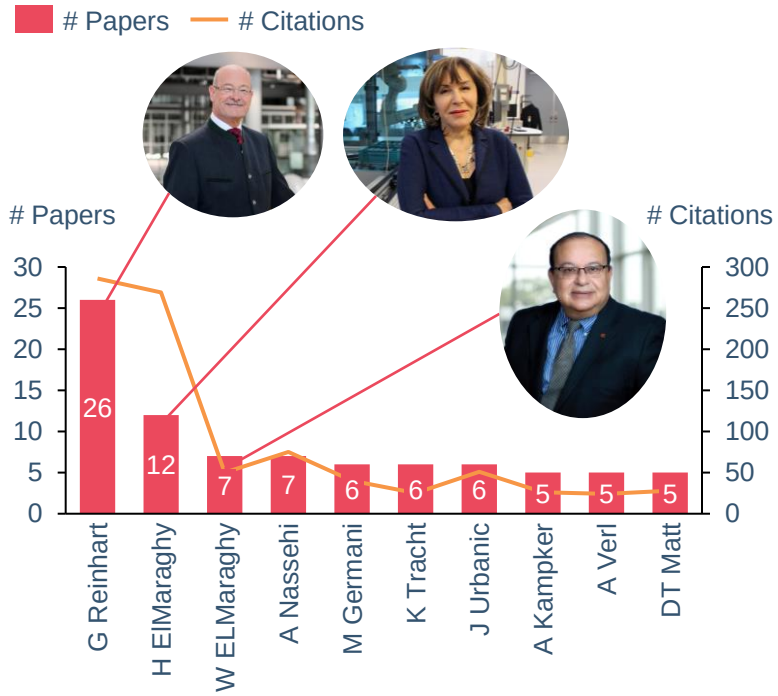
Top Cited Papers of MCPC

CARV	Paper title	Author(s)
MCPC 2015	Proximity marketing as an enabler of mass customization and personalization in a customer service experience	Levesque, N., & Boeck, H.
MCPC 2015	KBE-Modelling Techniques in standard CAD Systems: case-study – Autodesk inventor professional	Gembarski, P.C., Li, H., Lachmayer, R
MCPC 2014	Product, organizational, and performance effects of product modularity	Boer, H.E.
MCPC 2014	Is sustainable mass customization an oxymoron? An empirical study to analyse the environmental impacts…	Pourabdollahian, G., Taisch, M., Piller, F.T.
MCPC 2015	Reconfigurable manufacturing systems in small and medium enterprises	Brunoe, T.D., Andersen, A., Nielsen, K.
MCPC 2014	Open innovation, co-creation and mass customization: What role for 3D printing platforms?	Rayna, T., Striukova, L., Darlington, J
MCPC 2015	A business typological framework for the management of product complexity	Gembarski, P.C., & Lachmayer, R.
MCPC 2015	Mass customization in SMEs: literature review and research directions	Taps, S.B., Ditlev, T., Nielsen, K.
MCPC 2015	The potential of product customization using technologies of additive manufacturing	Lachmayer, R., Gembarski, P. C., Gottwald, P. et al.
MCPC 2014	Food customization: An analysis of product configurators in the food industry	Kolb, M., Blazek, P., Streichsbier, C.

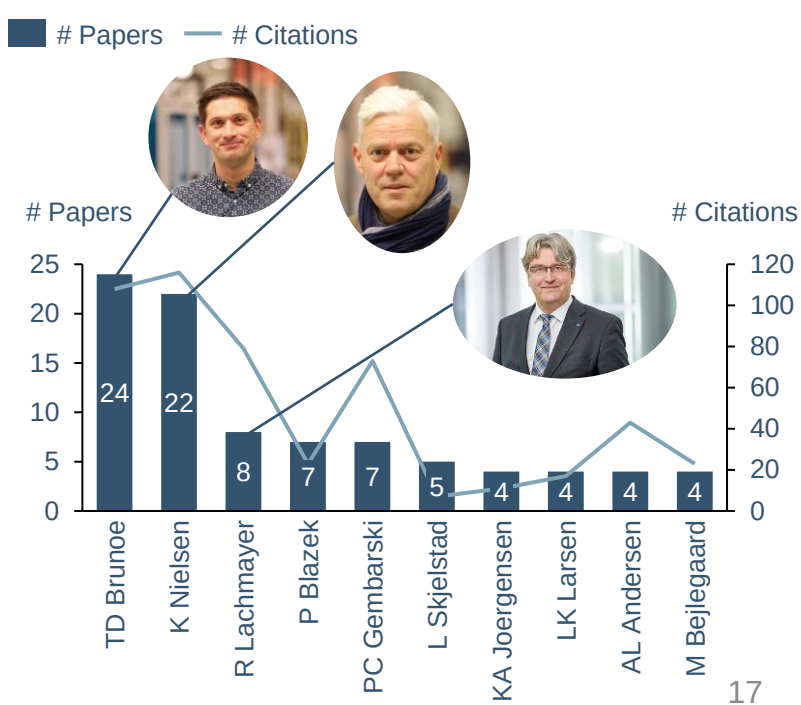


Most Contributing Authors

CARV

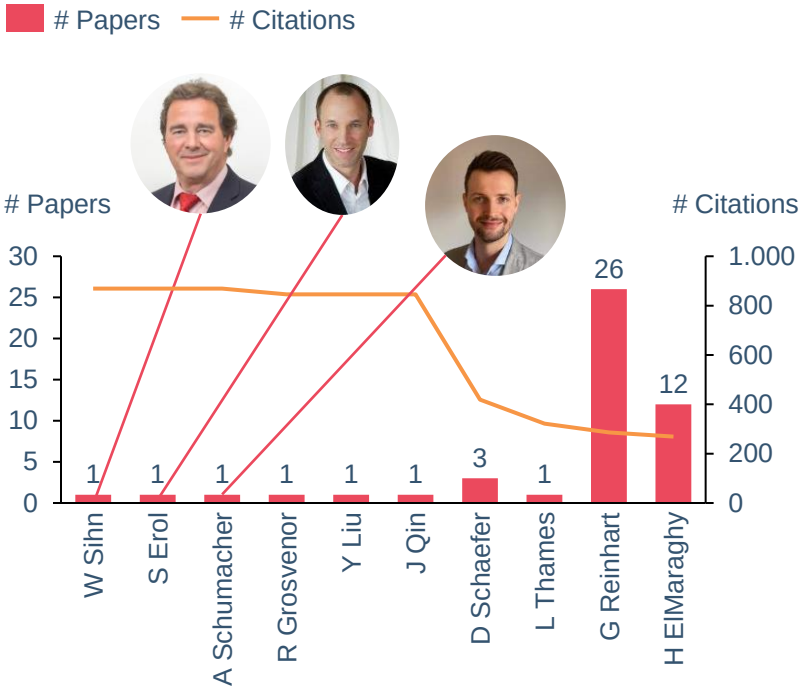


MCPC

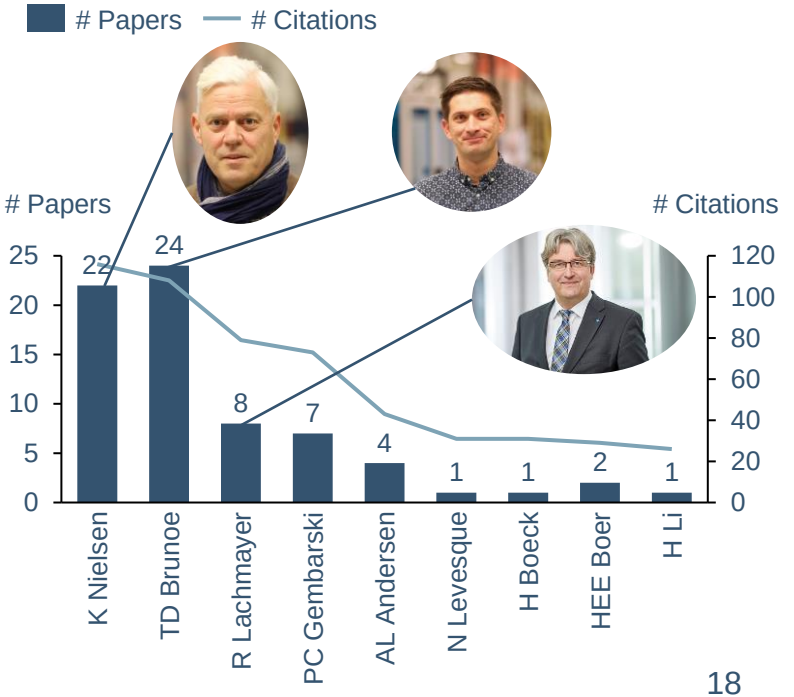


Most Cited Authors

CARV



MCPC



Recurring and Unique Authors

Author entries for all papers*

	CARV	MCPC
Number of author entries	852	363
Unique authors	636	265
Ratio	0,75	0,73
One-time authors	516	223
Ratio to unique authors	0,81	0,84

**Author entries for all papers were generated, giving the number of unique authors and one-time authors.*

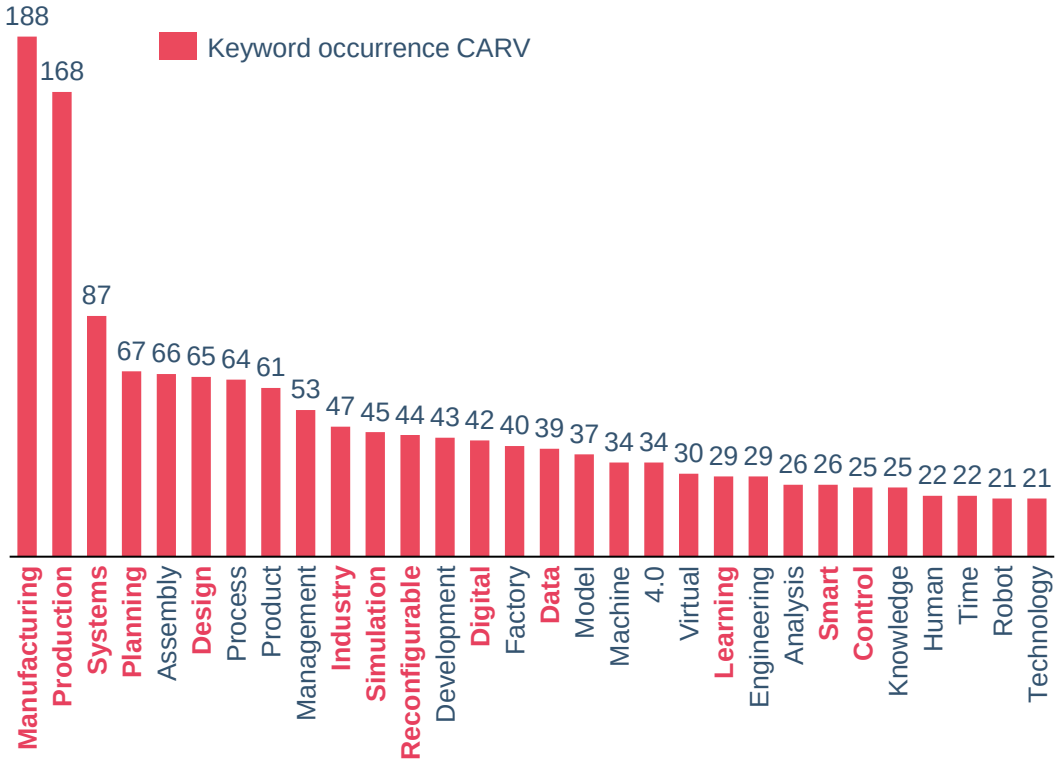
Key points

1. Seemingly high ratio of unique and one-time-authors.
2. Might be due to the relatively short time span covered in analyses and relatively "young" age of both conferences.
3. "Narrow" backbone of both conferences.
4. Both conferences appear to attract many doctoral students.

Sentiment Analysis

Frequent Keywords

- 30 most frequent keywords for CARV

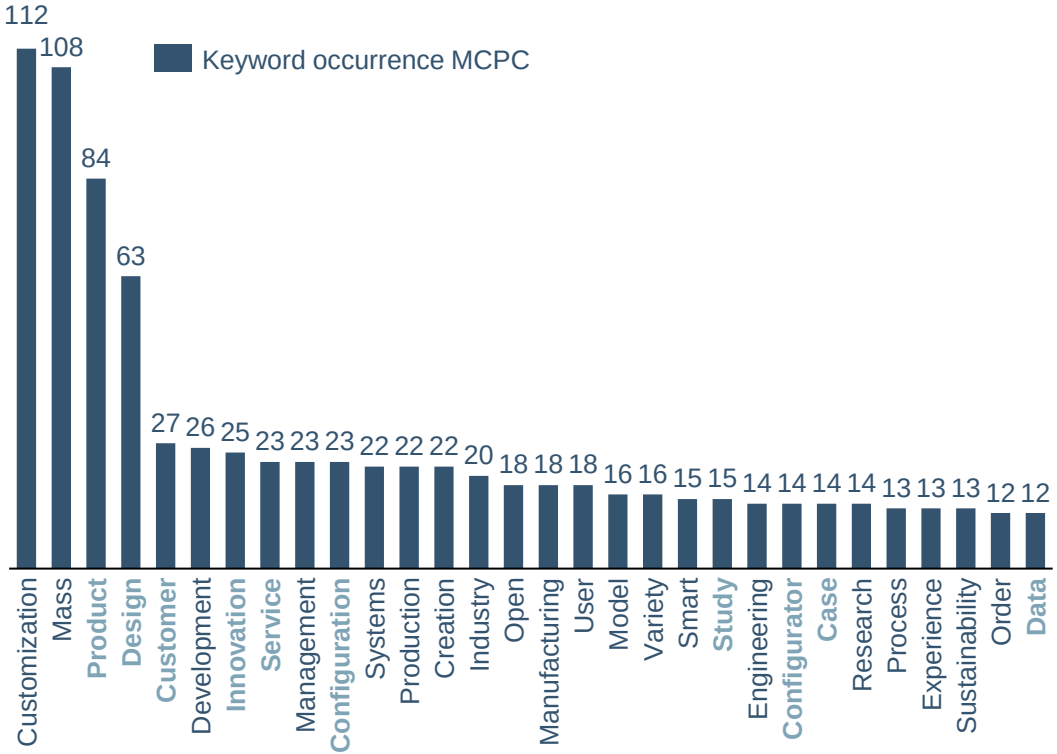


Key points

1. “Manufacturing” and “production” have very high frequency.
2. The entire lifecycle of systems is covered “Design”, “Planning”, Reconfigurable”, Control”.
3. “Industry” (4.0) is frequent, as well as “Digital”, “Smart” and “Data”.
4. “Systems” is more frequent than “Process”, “Product” and “Technology”
5. “Learning” is relatively high in frequency.
6. “Simulation” has high frequency.

Frequent Keywords

- 30 most frequent keywords for MCPC

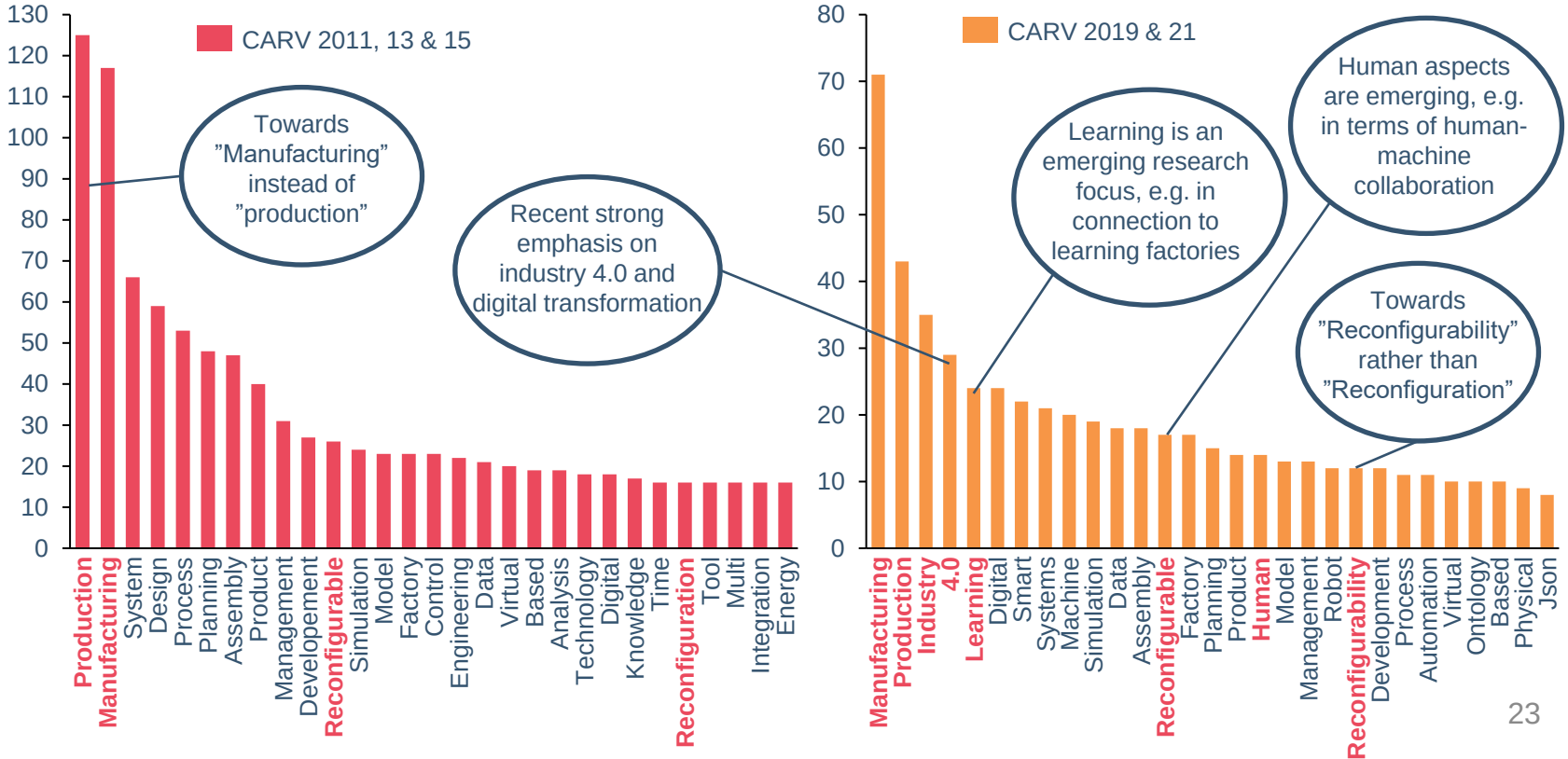


Key points

1. “Product” has high frequency and also much relatively higher frequency than in CARV.
2. “Design”, “Customer”, “Innovation” are dominant keywords.
3. “Service” is high in frequency and different to CARV top 30.
4. Strong focus on “configuration” and “configurator”
5. “Study” and “Case” are frequent.
6. “Data” is relatively less occurring in MCPC than in CARV.

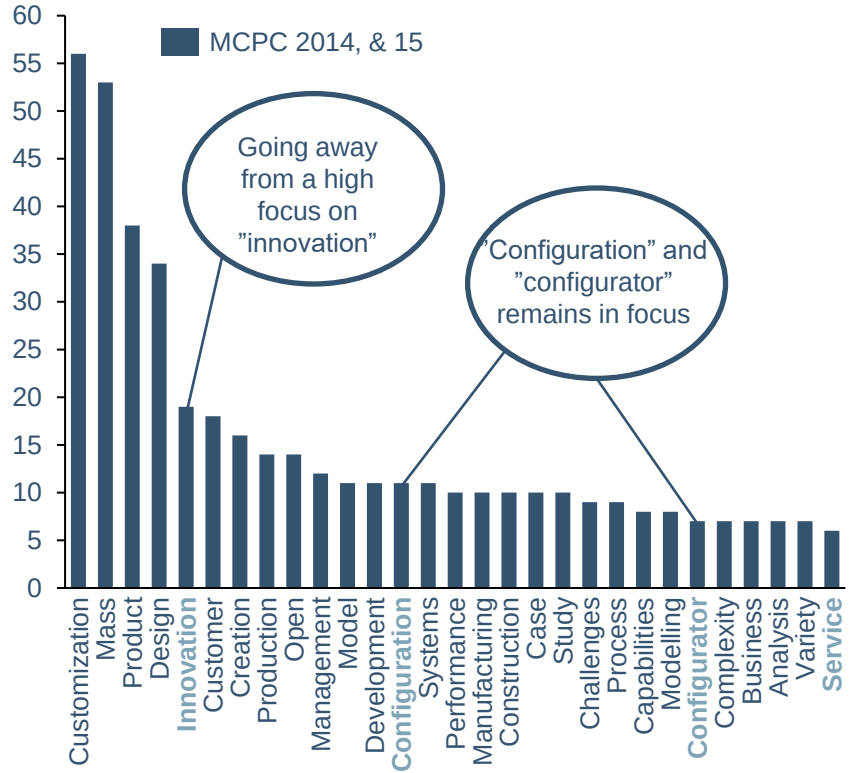
Frequent Keywords

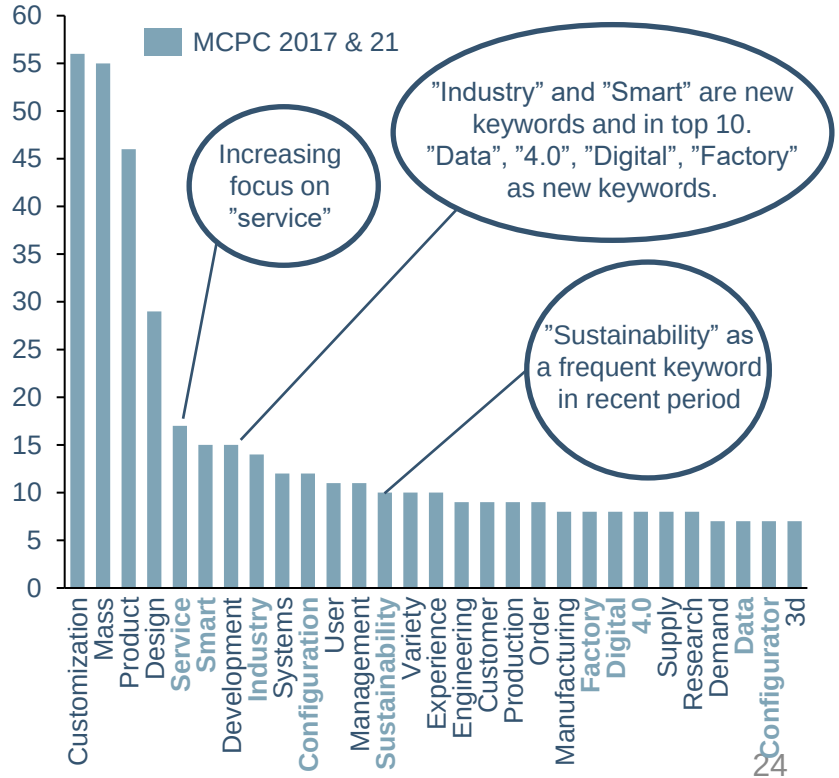
- 30 most frequent keywords with time split



Frequent Keywords

- 30 most frequent keywords with time split





Conclusions

Relevance and Impact of CARV & MCPC

- Influential, “young” and dedicated conferences

- CARV and MCPC have existed for almost two decades
- More than 500 papers published since 2011
- More than 5200 citations to date of papers since 2011
- Mainly European and North American host cities
- Global reach and authorships
- Bringing together academia and industry

Bridging CARV & MCPC

- Towards Sustainable Customization

1 CARV focuses traditionally on manufacturing, production, systems, processes, technology, and is highly simulation, planning, design, oriented with quantitative methods from an engineering perspective.

2 MCPC covers traditionally wide topics, but includes customer perspectives, products, configuration and modelling, business integration, cases, and qualitative approaches.

3 CARV & MCPC have in recent years' proceedings/papers increased similarity in research focus and topics towards industry 4.0 and smart technologies. CARV continues to focus on changeable manufacturing, while MCPC has increased focus on sustainability.

Sustainability has implications on customer behavior, buying behavior, manufacturing processes, distribution, take-back systems, and manufacturing technologies.

CARV 21

MCPC 21

Supporting industry in becoming changeable and delivering customized products in an efficient, environmentally friendly and socially responsible way.

Thank you!

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