

From Goods to Services Consumption: A Social Network Analysis on Sharing Economy and Servitization Research

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The transition from consuming goods to consuming services is a topic of great interest for service researchers and has been examined from various perspectives. We provide an overview of how this field of research has been approached by systematically analyzing the current state of the academic literature. We report the results of a social network analysis of the sharing economy and servitization literature, which reveals the structure of the knowledge networks that have been formed as a result of the collaborative works of researchers, institutions, and journals that shape, generate, distribute, and preserve the domains' intellectual knowledge. We shed light on the cohesion and fragmentation of knowledge and highlight the emerging and fading topics within the field. The results present a detailed analysis of the research field and suggest a research agenda on the transition of goods to services consumption.

1. Introduction

The vast majority of management research traditionally applies a manufacturing perspective and, hence, a goods-based view (Rust and Huang 2014). However, economies around the world have long reached the age of service-driven economic growth. Services now have undisputable

significance for economies, determine corporate and personal wellbeing, and increasingly edge forward to traditional goods consumption domains (Rifkin 2000). Consumption increasingly shifts from mere goods-related transactions towards service-related transactions. This development has recently been amplified by the technological advancements and innovative business models that allow consumers to use material products through services without the need for ownership (Perren and Kozinets 2018).

In this regard, research on the sharing economy has made significant contributions to the recent understanding of services. The umbrella term sharing economy connotes consumption without ownership through service-mediated processes of exchange (Lessig 2008). A variety of activities and actors constitute specific settings of exchange processes and depict the rich diversity and, in consequence, the fragmented understanding of the sharing economy (Frenken and Schor 2017). For instance, sharing activities either happen in B2C (business-to-consumer) settings or in P2P (peer-to-peer) settings (Schor et al. 2015). Moreover, the exchange processes induced by sharing services range from the shared usage of tangible products (e.g., Bardhi and Eckhardt 2012) or intangible assets (e.g., Milanova and Maas 2017) to redistribution and collaboration (Botsman and Rogers 2011). Sharing service models are thought to change the way in which consumers form relations with material products (Belk 2014). Consequently,



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much research on the sharing economy has focused on consumer acceptance of sharing services (e.g., Bardhi and Eckhardt 2012; Piscicelli et al. 2015; Tussyadiah 2016) and the consequences of adopting sharing services (e.g., Tussyadiah and Pesonen 2016; Roos and Hahn 2017; Fritze 2017).

The exchange processes related to the sharing economy are mediated by commercial platforms, and in most cases, businesses provide the necessary assets for the shared use of material products (e.g., carsharing; McAfee and Brynjolfsson 2017). Relatedly, industrial manufacturers have put increasing effort in developing and selling service solutions rather than just material products. A prominent example for this trend is Rolls-Royce's 'power-by-the-hour' approach (Baines et al. 2007; Neely 2007), which translates their material product sales into performance-based service contracts (i.e., pay-as-you-use principle for aircraft engines). This business transition, which is known as servitization, has gained scholarly interest in recent years (Baines et al. 2009a; Lightfoot et al. 2013; Vandermerwe and Rada 1988). Since most researchers in this field agree that manufactures should servitize their offerings to generate growth beyond their goods base, the circumstances under which such a transition is most profitable for companies has been the focus of several studies (e.g., Benedettini et al. 2017; Kastalli and Van Looy 2013; Quinn 1992; Valtakoski 2017; Wise and Baumgartner 1999).

While the literature related to the sharing economy often focuses on the demand side (i.e., the customer perspective), the servitization literature is mostly devoted to the supply side (i.e., the business perspective). Some studies have reflected on prior research in both fields separately by using systematic literature reviews for the sharing economy (e.g., Frenken and Schor 2017) and servitization (e.g., Annarelli et al. 2016). While such reviews are helpful to illuminate the research landscape, both areas of scholarly inquiry – the sharing economy and servitization – constitute fields of research that are jointly devoted to the economic transition of goods to services consumption. However, prior research has not combined these two fields in order to map the extant state of the knowledge on the goods to services transition. By addressing this gap in the research, this article presents a joint analysis of the sharing economy and servitization literature.

Moreover, by further extending prior research that univocally relied on systematic literature reviews (e.g., Annarelli et al. 2016; Frenken and Schor 2017), our study considers the knowledge network structures in the field. Through this, we address a shortcoming of literature reviews in that they do not reveal interrelated research structures within a domain. However, analyzing and synthesizing such structures is crucial in order to detect the connectivi-

ty patterns of key publications and scientific collaborations that dominate and influence a research domain (Bourdieu 1993; Khan and Park 2013). To this aim, researchers have started applying social network analysis (SNA; Wasserman and Faust 1994) in many areas, such as information technology management (Khan and Wood 2016; Swar and Khan 2013), social media systems (Khan 2013), and methodological issues in management research (Khan et al. 2018).

SNA is a method for modelling and visualizing social networks in order to detect social structures (Otte and Rousseau 2002) that define the nature of knowledge exchange between actors in the network (Serrat 2009). The relationships in a social network are characterized by a set of nodes, which are connected by ties. Nodes are actors such as authors, institutions, or publication outlets. The relations, or ties, connect the actors and indicate the dynamics of the network (Gartffon, et al. 1999). The method allows for a systematic enquiry of the relationships among authors, author teams, and organizations that have shaped a field through academic publications (Cross et al. 2001). In essence, SNA utilizes big data to document the network complexities of the research domain, influential researchers, journals, and institutions. By employing SNA it is possible to measure, monitor, and evaluate the knowledge flows and relationships in a research domain network, identify key players within the network, and understand the way in which actors interact and share knowledge. Moreover, SNA can be employed to identify which words or word pairs experience an increase or decrease in usage frequency in abstracts or titles of academic publications. This way, the analysis reveals the temporal evolution of emerging and fading topics within a specific research domain. To achieve these goals, the SNA visualizes the relationships in network graphs and offers a range of metrics that help assessing the actors' role in the network (Krystallis, et al. 2011).

In this research, we apply SNA in the context of research on the transition of consumption from goods to services [1]. Based on 649 studies that were published in 275 journals by 1,349 authors from 613 institutions, our results illustrate how the relevance of certain research topics has developed over time, how the community collaborates, to what extent the knowledge network is fragmented or well-formed, and, finally, how certain authors are positioned within the domain. Our results not only offer unique insights into the domain's intellectual structure, but also allow for deriving emerging and fading trends in the field.

With our analysis we shed light on the structure of the emerging research field that is devoted to the transition processes that facilitate, guide, and accelerate the overall shift of consumption from goods to services (i.e., the shift

of ownership-oriented business models to access-based services). That is, by using SNA we map the research field from a bibliographic analytical perspective and build bridges among seemingly disjoint sources of knowledge. Our analyses allow deriving future research directions to advance understanding of consumers' shift from goods to services.

2. Elements of the social network analysis

2.1. Data

We developed a comprehensive keyword list based on the extant terminology on the sharing economy and servitization literature (e.g., Annarelli et al. 2016; Cheng 2016; Frenken and Schor 2017), which we used as an input to obtain the relevant papers from the Web of Science (WoS) database. Specifically, we used the following list of terms to identify the relevant articles published between 1965 and 2017 by searching each article's title, keywords, and abstract: [2]

"Sharing economy" OR "shareconomy" OR "sharing services" OR "collaborative consumption" OR "collaborative economy" OR "consumer sharing" OR "peersharing" OR "peer-to-peer sharing" OR "p2p-sharing" OR "access-based consumption" OR "access economy" OR "access-based services" OR "nonownership consumption" OR "non-ownership consumption" OR "non-ownership services" OR "open access consumption" OR "product-service systems" OR "servitization" OR "flat-sharing" OR "accommodation-sharing" OR "car-sharing" OR "carsharing" OR "clothes-sharing" OR "ride-sharing" OR "file-sharing" OR "streaming services" OR "music streaming" OR "music-streaming" OR "movie streaming" OR "movie-streaming"

This search produced an initial number of 2,404 papers that were published in 342 journals. We coded all articles to identify the research articles that relate to the emergence and dissemination of sharing and servitization business models. We excluded research papers that (1) focus on the technological underpinnings of such business models (e.g., optimizing algorithms for enhancing online p2p sharing network capabilities; Jeon and Nahrstedt 2003; Sasabe et al. 2003), (2) are devoted to operations research topics (e.g., the allocation of material assets in sharing networks; Fan et al. 2008; Kek et al. 2009), and (3) focus on non-commercial contexts (e.g., illegal file sharing; Buxmann et al. 2005; McKenzie 2009). Although these papers provide valuable contributions to improving operational efficiency in commercial sharing consumption contexts, their contribution to understanding the transition of goods to services consumption is limited. Moreover, the literature screening suggested that sustainability research and research on the sharing economy and servitization are related streams. We only included sustainability research that directly relates to the sharing economy and servitization (e.g., its impact on sustainability), which means that we excluded papers that refer to business model innovations but do not have a clear reference

to the sharing economy or servitization business models (e.g., Barber et al. 2012; Halme et al. 2004).

A total of 649 articles that were published in 275 journals remained for the SNA. The landscape of academic publication outlets in the field is diverse and covers multiple disciplines. However, some journals such as the *Journal of Cleaner Production* (51 articles, 7.86 %), *Transportation Research Record* (26 articles, 4.01 %), *International Journal of Operations & Production Management* (18 articles, 2.77 %), and *Industrial Marketing Management* (17 article, 2.62 %) are heading the list of number of publications related to the goods to services transition.

2.2. Burst detection

We first examine the temporal evolution of emerging topics in the domain of research on the transition from goods to services consumption. To do so, we apply Kleinberg's (2003) burst detection algorithm that allows for identifying emerging trends in a research domain (e.g., Chen 2006, 2009; Mane and Borner 2004). The algorithm employs a probabilistic automaton, which refers to the frequencies of individual words and corresponds to the points in time when the frequencies of the words change significantly. The algorithm uses the articles' titles and abstracts as inputs to identify words or word pairs that experience a sudden increase in usage frequency. The change in usage frequency is indicated by the *burst weight* (Guo et al. 2011). To run the burst detection, we apply Sci2Team's (2009) Science of Science tool.

2.3. Network types

We used the SNA to construct network types related to (1) author, (2) institution, and (3) source co-citation networks in order to analyze the connectivity patterns of key publications in the field based on the 649 articles.

Author networks are established when authors (referred to as *nodes* in SNA terms) publish in journals and establish co-authorship relationships (referred to as *links* in network terms). Hence, an author network reveals scientific collaborations among individual researchers (Liu et al. 2005). We examine and describe (1) the entire network structure on the network level and (2) the specific characteristics on the network's node level (Khan and Wood 2016; Trier and Molka-Danielsen 2013; Vidgen et al. 2007; Xu and Chau 2006). *Institution networks* are similar to author networks but use their affiliations as nodes and thus capture the knowledge flow among institutions whose authors collaborate (Swar and Khan 2013). *Source co-citation networks* are formed when different papers cite the same sources (e.g., journals and conference proceedings) in their reference sections. These networks portray similarities between different papers regarding the foundations of the scientific work and disclose schools of thought in the area of study (Ding et al. 2000; Tsay et al. 2003). We used NodeXL (Smith et al. 2010) and Pajek (Nooy et al. 2005) to

analyze and visualize the author and institution networks and VOSviewer (van Eck and Waltman 2010) to construct the source co-citation network.

2.4. Network properties

Networks consist of subnetworks, which represent the network components (Hanneman and Riddle 2005). The network's core component has the most nodes to other components. Notably, a component may not be overall connected to other components, although some connections exist between the nodes of the different components (Wasserman and Faust 1994). The connections between the nodes are visualized in a specific length. The longer a connection, the longer that knowledge dissemination takes through the network from one node to another.

The longest connection in a network is called the network's *diameter* and describes the network's size (Wasserman and Faust 1994). In turn, the network's *density* is defined by the number of established links relative to all possible links in the network. In a fully connected network, each node connects to every other node, which would depict a density of one. The *clustering coefficient* describes the density of connections in the network and, as such, the degree of interrelatedness of the components within the network (Barabási et al. 2002). The average number of links among the nodes in a network defines the network's *average degree*.

Node-level properties (i.e., those of authors and institutions) can be characterized by the degree, betweenness centrality, and eigenvector centrality. A node's *degree* is a quantitative description of its relations to other nodes, which is the number of links to other nodes in the network. The *betweenness centrality* relates to a node's positioning within the network and characterizes its influence or control on collaborations and the flow of information (Liu et al. 2005). Nodes with a high degree and betweenness centrality take a focal position because they exhibit many connections in the network. Those nodes are called *hubs*. Finally, the node's networking ability is quantified by the *eigenvector centrality*, which considers the node's connections with other nodes in relation to its importance within these connections (Marsden 2008).

While strong relationships within a network indicate an active flow of knowledge exchange, they can also constrain it. That is, the specification of connections within a network may lead to *structural holes*. Structural holes emerge when, for example, an author has an advantageous position that allows him or her to more easily form co-authorships than other nodes that are more constrained in this regard (Hanneman and Riddle 2005). We capture structural holes by computing each node's *aggregate constraint*, which is a node's sum of constraints. Nodes with high aggregate constraints have fewer oppor-

tunities to form new collaborative ties and, in turn, have fewer opportunities to exploit structural holes (Nooy et al. 2005).

3. Results

3.1. Burst detection – emerging and fading topics

Tab. 1 shows the results from the burst detection by listing the ten latest emerging and disappearing topics with the start and end dates of their presence in article titles and abstracts, sorted by the start date and burst weight. When no end date is noted, the terms are considered to still be active. The weight represents the relevance of a burst term over its active period. A higher weight could result from a term's long active period, higher frequency, or both.

The term *product-service systems* has the highest weight of 5.12, meaning that it has appeared very frequently in the titles and abstracts of articles between 2006 and 2013. Product-service systems are defined as systems of integrated goods and services that provide alternative usage scenarios, intended to (1) create additional value for customers and (2) reduce the environmental impacts compared to individual material product consumption through ownership (Beuren et al. 2013). Hence, they form the functional basis for the shift from goods to services consumption through servitization and sharing business models. One of the most prominent current cases of product-service systems on the market is carsharing, which can be considered as an access-based consumption (i.e., free-floating, short-term car rental) alternative to individual car ownership or a general mobility extension that is predominantly available in larger cities (Bardhi and Eckhardt 2012). However, different fields of research now employ distinct theoretical bases and terminologies about product-service systems. These span different articles that either investigate the successful implementation and management of product-service systems (e.g., Morelli 2006;

Rank	Word	Weight	Start	End
1	Product-service systems	5.12	2006	2013
2	Regulation	4.78	2016	
3	Insights	4.72	2017	
4	Disruption	4.22	2016	
5	Digital	2.46	2017	
6	Growth	2.19	2003	2012
7	Value	2.11	2016	
8	Motivation	2.00	2016	
9	Platform	0.79	2017	
10	Experience	0.02	2017	

Tab. 1: The top 10 latest bursting and disappearing topics in article abstracts and titles

Neely 2008), their influences on established business models (e.g., Schäfers et al. 2016a; Zervas et al. 2017), or consumer behaviors related to the adoption and evaluation of related business offers (e.g., Bardhi and Eckhardt 2012; Hamari et al. 2016; Fritze 2017). For instance, early contributions on the sharing economy predominantly focused on social interactions, especially by critically discussing the nature of the occurring sharing processes (Bardhi and Eckhardt 2012; Belk 2010; Lamberton and Rose 2012). However, more recently (i.e., starting in 2017), the discussion on the sharing economy has increasingly shifted towards investigating *platforms* (weight = 0.79). In this regard, researchers have attempted to improve the conceptualization of the phenomenon of the sharing economy in order to illuminate the economic status of the markets (Cheng 2016). Sharing business models have been conceptualized as “lateral exchange markets,” which are formed through intermediating technology platforms that facilitate “exchange activities among a network of equivalently positioned economic actors” (Perren and Kozients 2018, p. 21). As such, research on product-service systems paved the way for follow-up research within the overall research field devoted to the transition from goods consumption to services consumption. That is, while the concept of product-service systems served as a crucial vehicle for stimulating academic inquiry for understanding how the transformation of business models and consumer behavior happens from goods-based consumption to service-based consumption, researchers now more frequently relate to other concepts in a specific domain of inquiry. This tendency of specialization indicates the increasing maturity of the field.

The term *regulation* (weight = 4.78) has started to appear more frequently since 2016, which may be connected to the widely reported *growth* (weight = 2.19) of service transitions. In addition, the burst detection also underlines the increasingly discussed disruptive power (*disruption*, weight = 4.22) of prominent sharing businesses such as Uber or Airbnb in established markets and the resulting resistance of affected stakeholders (e.g., cities, hotels, and taxi associations), calling for legal interventions of regulations (Cannon and Summers 2014; Edelman 2017). That is, while the growth of sharing and servitization business models is sufficiently evidenced (Cheng 2016; Kastalli and Van Looy 2013), there is an increasing interest concerning the disruptive power and regulation necessity of sharing business models.

Overall, assessing the *motivation* (weight = 2.00) and perceived *value* (weight = 2.11) of consumers and businesses concerning their participation in the shift from goods-based to service-based consumption is an upcoming theme, aiming for a better understanding of the overall potential of sharing businesses to sustainably transform markets and economies. Besides the rather descriptive investigations concerning consumers’ acceptance and adoption of

sharing businesses (e.g., Möhlmann 2015) and normative suggestions that manufacturers should servitize their offerings to generate growth beyond their goods base (e.g., Kamp and Parry 2017), there has recently been an increase in articles that fulfill the demand for deeper *insights* (weight = 4.72) into consumer behavior and management in a sharing business context. For example, recent articles started to investigate the mediating processes that make consumers choose between ownership and sharing consumption (Bardhi and Eckhardt 2017; Lawson et al. 2016) as well as the “dark sides” of shared consumption on material assets, such as the well-known “tragedy of the commons” (Schäfers et al. 2016b). Moreover, there is a call for insights related to the potential strategic threats for corporate success by business model shifts in light of servitization (Benedettini et al. 2017; Valtakoski 2017).

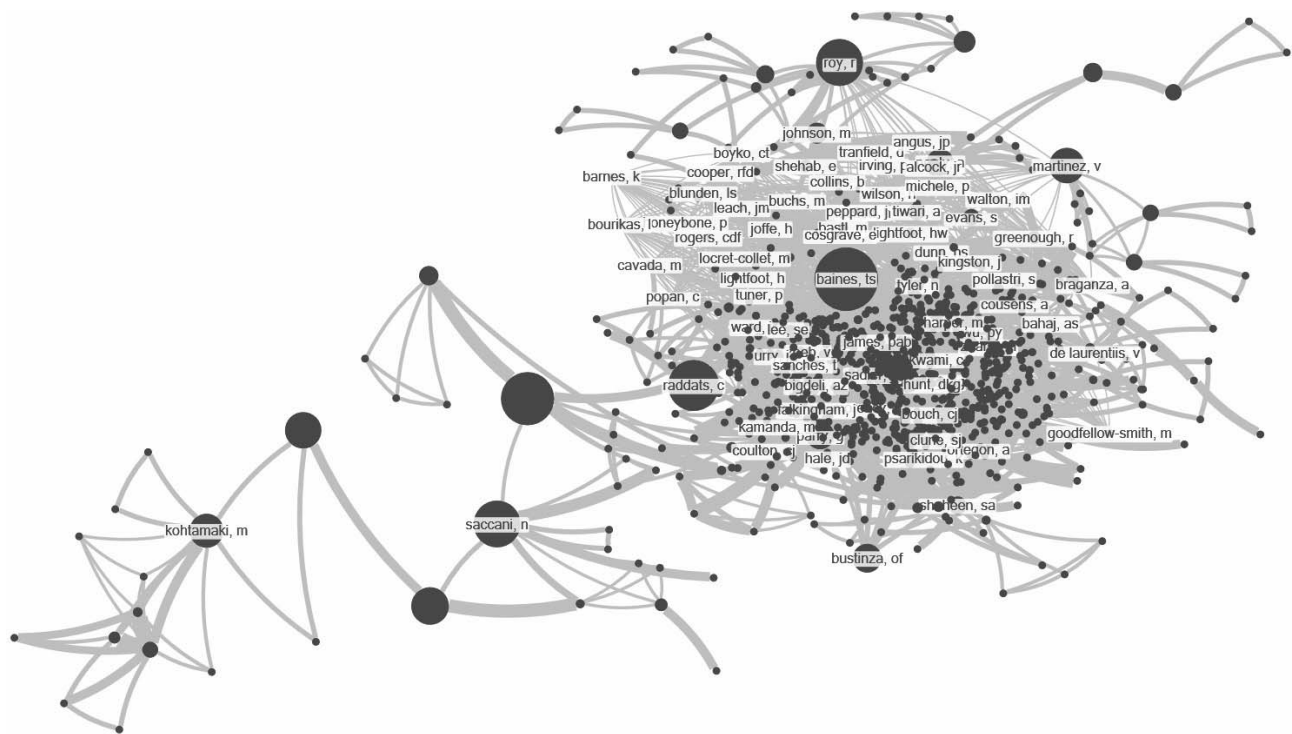
Finally, the burst detection analysis indicates an emerging interest in service management and marketing within the research field, as indicated through the term *experience* (weight = 0.02), which started in 2017 and is still active. In fact, literature reviews considering the different perspectives on the field also highlight the relevance of insights to be derived from a stronger connection of the servitization, sharing economy, and service management research (Baines et al. 2017; Benkenstein et al. 2017; Cheng 2016).

3.2. Author network

3.2.1. Network-level analysis

In total, 1,349 authors participated in the network to form 2,749 co-authorship ties. Fig. 1 illustrates the author network structure where nodes represent the authors and the links among the nodes represent the co-authorship ties. The network’s average degree is 4.08 (the average number of co-authors that a person has published with). The network comprises 403 subnetworks (connected components) with two or more authors and seven isolates (solo authors). The largest connected component comprises 144 authors (10.67 % of all authors).

The network appears to be dominated by few researchers who have established dense connections around them. However, only 0.30 % of all possible network ties have been realized, which indicates that the network is rather fragmented. This density is low in absolute terms and evidences the high number of components relative to the number of co-authors and the network’s density. Moreover, the clustering coefficient is 0.70, thus indicating that authors are embedded in dense clusters with limited ties outside these clusters. Finally, the network’s small diameter of 12 also suggests that the authors in the domain have a high tendency to form groups. Overall, this structure is very similar to the authorship networks encountered in the information systems field (Khan and Wood 2016; Trier and Molka-Danielsen 2013; Xu and Chau 2006).



Created with NodeXL Pro (<http://nodexl.codeplex.com/>) from the Social Media Research Foundation (<http://www.smrfoundation.org>)

Notes: The node sizes indicate centrality, and link widths indicate the collaboration intensity. Only authors with ten or more ties are shown.

Fig. 1: Author collaboration network-largest component (1965–2017)

In essence, the author network analysis indicates that only a few researchers dominate the field and collaborate within an established circle. The results further highlight the fragmentation of knowledge flows within the network meaning that those authors and research groups that currently dominate the field rarely collaborate with each other.

3.2.2. Node-level analysis

Tab. 2 lists the top 20 authors in terms of their degree, betweenness centrality, eigenvector centrality, and aggregate constraints. The authors *Christian Kowalkowski*, *Chris Raddats*, and *Tim Baines* are hubs in the network. That is, they have many connections in the network and influence the network through their various collaborations, as evidenced by their high betweenness centrality. Referring to the degree, *Tim Baines*, *Nick Tyler*, and *Phil Y. Wu* take focal positions in the author network. *Nick Tyler*, *Phil Y. Wu*, and *Victoria Zebb* rank high in terms of eigenvector centrality, which means they take on important positions within their connections.

Most authors have an aggregate constraint of around 1.0 (mean = 0.9531; standard deviation = 0.262), thus indicating that only a few authors have a position that allowed them to profit from the overall network. Most authors could not considerably benefit from the overall network as they had difficulties in forming ties based on previous co-authorships (Burt 1992). Finding such a network struc-

ture is not entirely surprising, considering that the transition of goods to services is a relatively new field of inquiry that has just gained significant traction during the last decade.

Interestingly, while some of the highly ranked authors are mainly considered as individual authorities in the field, others have, as indicated in the network-level analysis, formed larger groups of collaborations or institutional labs. For instance, *Tim Baines* constantly publishes on servitization, mainly regarding its dissemination, and investigates its operational practices and technologies (e.g. Baines and Shi 2015; Baines and Lightfoot 2013). Moreover, *Christian Kowalkowski* takes a prominent position in the network based on his research on deservitization (i.e., a company's shift from a once servitized, service-centric business model back to a product-centric logic) and service innovation (Kowalkowski et al. 2017; Kindström and Kowalkowski 2014). In turn, *Andy Neely* has founded the Cambridge Service Alliance [4], which brings together a large group of academics (e.g., *Veronica Martinez*) and industrial partners interested in servitization in order to gain insights and explore tools for complex service systems.

Notably, single publications and temporal collaborations may influence an author's ranking in the network analysis. For instance, the Liveable Cities Project [5] is a five-year programme of research on sustainable cities. A recent publication from this project by Boyko et al. (2017) on how

Rank	Degree	Betweenness centrality	Eigenvector centrality	Aggregate constraint
1	Baines, Tim	Kowalkowski, Christian	Tyler, Nick	Budd, Leslie
2	Tyler, Nick	Raddats, Chris	Wu, Phil Y.	Waddell, Paul
3	Wu, Phil Y.	Baines, Tim	Zeeb, Victoria	Sheate, William
4	Zeeb, Victoria	Saccani, Nicola	Ward, Jonathan	Matschewsky, Johannes
5	Ward, Jonathan	Roy, Rajkumar	Urry, John	Brax, Saara A.
6	Urry, John	Baines, Tim	Tuner, Philip	Abramovici, Michael
7	Tuner, Philip	Brax, Saara A.	Sanches, Tatiana	Borja, Karla
8	Sanches, Tatiana	Martinez, Veronica	Sadler, Jonathan P.	Schmidt, Chester W.
9	Sadler, Jonathan P.	Kohtamaki, Marko	Rogers, Christopher D. F.	Schiederig, Tim
10	Rogers, Christopher D. F.	Parry, Glenn	Psarikidou, Katerina	Hong, Yong-Pyo
11	Psarikidou, Katerina	Bustinza, Oscar F.	Popan, Cosmin	Scherer, Anne
12	Popan, Cosmin	Neely, Andy	Pollastri, Serena	Sattler, Henrik
13	Pollastri, Serena	Johnson, Mark	Ortegon-Sanchez, Adriana	Sato, Keita
14	Ortegon-Sanchez, Adriana	Tiwari, Ashutosh	Locret-Collet, Martin	Sanna, Venere S.
15	Locret-Collet, Martin	Shen, Jin	Lee, Susan E.	Sandin, Gustav
16	Lee, Susan E.	Kindström, Daniel	Leach, Joanne M.	Hofmann, Eva
17	Leach, Joanne M.	Durugbo, Christopher	Kwami, Corina	Samuel, Hany A.
18	Kwami, Corina	Shehab, Essam	Kamanda, Mamusu	Coreynen, Wim
19	Kamanda, Mamusu	Lelah, Alan	Joffe, Helene	Salonen, Anna
20	Joffe, Helene	Shaheen, Susan	James, Patrick A. B.	Saglam, Onur

Tab. 2: Top 20 authors

sharing can contribute to more sustainable cities features several authors with diverse research backgrounds other than management of manufacturing. As such, some authors appear in the network that traditionally would not have published in management journals.

Besides that, the node-level analysis shows that the overall research field devoted to the goods to services transition is currently dominated by servitization researchers with an industrial management or manufacturing research background. However, while some authors may not take a prominent position in the network, their contributions have stimulated ongoing debates and consequent research, for example, regarding social exchange processes within sharing service settings (e.g. Belk 2010; Bardhi and Eckhardt 2012; Schäfers et al. 2016b).

3.3. Institutions network

3.3.1. Network-level analysis

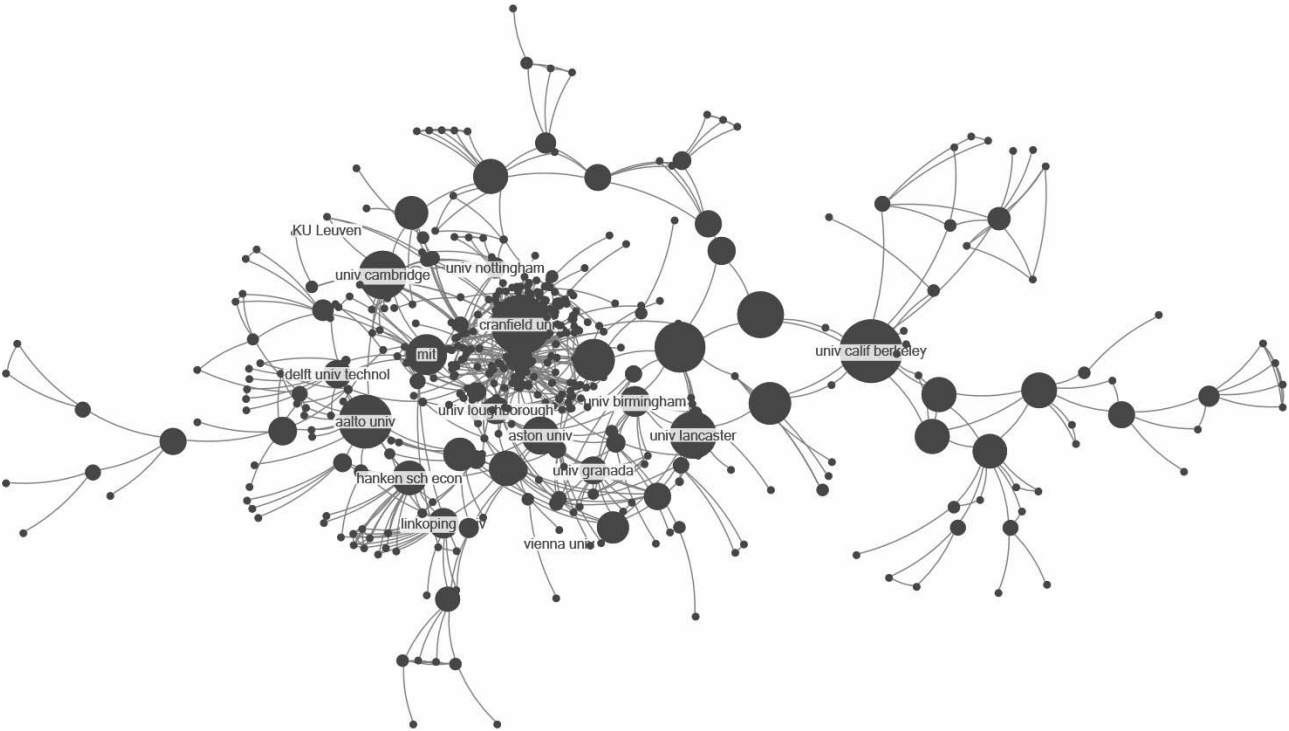
In total, 613 institutions participated in the network to form 713 co-authorship ties. The network consists of 202 components (with two or more nodes) and 121 institutions that do not form co-authorship ties with other institutions. The largest component comprises 250 institutions (40.78 % of all institutions) and forms 491 ties in total. The average number of institutions that an institution has published with is 2.33 (i.e., the average degree). With a density of 4 %, a diameter of 14, and an average clustering coefficient of 0.39, the institution network has a similar structure as the author network but with a broader base of institutions in the central component.

Fig. 2 illustrates the institution network. The nodes represent institutions with the node sizes indicating each node's betweenness centrality. The links connecting the nodes represent the co-authorship ties, whereby thicker links indicate a stronger collaboration.

3.3.2. Node-level analysis

Tab. 3 shows the top 20 institutions by degree, betweenness centrality, eigenvector centrality, and aggregate constraints. Specifically, *Cranfield University*, the *University of Cambridge*, and *Aalto University* have high importance for the network. These institutions exhibit low aggregate constraints, which indicates that affiliated researchers have good opportunities to exploit the structural holes in the network.

Furthermore, 25 institutions (4.08 % of all institutions) have low aggregate constraint values between 0.09 and 0.28, indicating that they are in a good position to exploit structural holes. 142 institutions (23.16 % of all institutions) have medium aggregate constraint values ranging from 0.28 to 0.65, most of them (446 institutions; 72.76 % of all institutions) have very high constraint values up to 1.76. This implies that only a few institutions (4.08 %) were positioned well to exploit the network and the majority (72.76 %) could not use their position to benefit from the network.



Created with NodeXL Pro (<http://nodexl.codeplex.com>) from the Social Media Research Foundation (<http://www.smrifoundation.org>)

Note: Only nodes with a degree centrality of more than 10 are labeled. Node widths represent the betweenness centrality

Fig. 2: Institutional collaboration network

Rank	Degree	Betweenness centrality	Eigenvector centrality	Aggregate constraint
1	Cranfield University	University of California, Berkeley	Cranfield University	Cranfield University
2	University of Cambridge	Cranfield University	University of Cambridge	University of Cambridge
3	Linköping University	Aalto University	ESADE Business School	Aalto University
4	Aalto University	University of Leeds	University of Nottingham	University of Granada
5	Hanken School of Economics	University of Cambridge	University College Dublin	MIT
6	MIT	University of Lancaster	London Business School	University of California, Berkeley
7	University of California, Berkeley	EADA Business School	MIT	Delft University of Technology
8	University of Granada	École Polytechnique Fédérale de Lausanne	Aston University	Stanford University
9	University of Birmingham	Open University	Hannken School of Economics	University of Birmingham
10	Aston University	MIT	Loughborough University	University of Lancaster
11	Loughborough University	Aston University	University of Twente	University of Leeds
12	Delft University of Technology	Georgia Institute of Technology	Aalto University	University of Manchester
13	University of Lancaster	University of Liverpool	Linköping University	Shanghai Jiao Tong University
14	University of Nottingham	Dublin City University	KU Leuven	Aston University
15	University of Leeds	University of California, Davis	University of Liverpool	Loughborough University
16	Stanford University	University of California, Riverside	Trinity College Dublin	Linköping University
17	University of Manchester	University of Twente	Queens University	ETH Zurich
18	Dublin City University	Stanford University	University of Manchester	University of Nottingham
19	ESADE Business School	Hannken School of Economics	Polytechnic University of Bari	Dublin City University
20	University of Liverpool	Copenhagen Business School	University of Granada	Georgia Institute of Technology

Tab. 3: Top 20 institutions

3.4. Source co-citation networks

Finally, we analyzed the relationships and similarities among journals publishing research on the transition from goods to services consumption. To this aim, we examined

source co-citation networks, which form when papers co-cite sources (e.g., journals and conference proceedings) in their reference lists. For this analysis, out of the total sources cited ($n = 10,451$ articles), we considered only sources that were cited at least 10 times ($n = 341$) (e.g.,

Transportation Research Record forms a separate cluster of research, which is not connected to the most prominent marketing and management journals. This is surprising, considering that most articles in this journal investigate carsharing (e.g., Balac et al. 2015; Shaheen et al. 2016; Weikl and Bogenberger 2015), which is a prominent unit of analysis in marketing and management.

Moreover, while the *Journal of Consumer Research* – the most renowned outlet for scholarly research on consumer behavior – is well connected to other business research outlets, such as the *Journal of Business Ethics* and *Journal of Business Research*, it does not form co-citation networks with target outlets for servitization research, such as the *International Journal of Operations & Production Management* or *Industrial Marketing Management*.

Our results indicate a lack of dissemination of knowledge between servitization research (e.g., about product-service systems management; Baines and Lightfoot 2013) and research about the consumer behavior related to sharing services (Bardhi and Eckhardt 2012; Belk 2010). Overall, consumer research and manufacturing research have not yet been well connected.

Moreover, it must be acknowledged that special issues that feature several articles that are often co-cited influence the structure of co-citation networks. Taking the number of special issues in academic journals as an indicator for maturity it can be said that servitization research precedes research on the sharing economy. While there already have been a high number of special issues on servitization during the last decade, e.g. in *Industrial Marketing Management*, *Journal of Service Management* and *International Journal of Production Research* (Kowalkowski et al., 2017), it was only recently that the number of call for papers for special issues on the sharing economy rised, e.g. in *Journal of Management Studies*, *Electronic Commerce Research and Applications*, and *Journal of Marketing Theory and Practice*.

4. Discussion

The rise of the sharing economy and the dissemination of servitization have resuscitated scholarly interest in the significance of services consumption. Despite the manifold contributions in different disciplines, current research lacks a common foundation to explain and advise the transition processes between goods and services consumption. This article aims to stimulate scholarly enquiries on the transition from goods to services consumption as a field of research and aims to advise future directions for corresponding research streams.

To this aim, we analyzed the current academic landscape on the goods-to-services research field, which conflates the sharing economy and servitization fields, to detect the

sources and flows of knowledge between authors, institutions, and journals. Current systematic literature reviews (e.g., Annarelli et al. 2016; Frenken and Schor 2017) have presented an overview of sharing economy and servitization research in isolation. Contrary to this, this research combines both streams to construct and jointly analyze the overall goods-to-services research field. Further extending prior research, we used the SNA to identify emerging and fading themes in the goods-to-services domain, characterize author and institutions networks, and explore which journals are frequently co-cited. Our results reveal that the goods-to-services research field is fragmented into different loosely connected streams, several of which are relatively strong and tightly connected in their own right. Overall, the field is currently dominated by servitization research. However, assuming that manufacturing companies' servitization efforts often facilitate sharing service offers in the first place (e.g., BMW's carsharing service DriveNow), this dominance of servitization research in the field indicates the temporal precedence of research servitization over sharing economy. This finding suggests that sharing economy research potentially lacks consent on the unit of analysis, which hinders the establishment of coherent research streams. In fact, researchers frequently argue that the term "sharing economy" is a misnomer to describe the new economic patterns (e.g., Belk 2014; Richardson 2015; Frenken and Schor 2017). Therefore, consent on sharing economy terminology would be highly desirable in order to put forth theoretical insights beyond conceptual discussions.

As shown in the source co-citation analysis, references on consumer behavior studies and manufacturing research rarely appear jointly in academic publications that are devoted to the transition processes from goods to services consumption. However, such a setting may lead to a situation in which isolated research topics are investigated in great depth from singular perspectives, with the risk of neglecting other relevant topics, methodological approaches, or implications. Thus, in order to develop a more comprehensive understanding of the goods-to-services transition processes, four approaches are recommended.

First, a broader perspective in goods-to-services research is needed that translates findings from one perspective (e.g., consumer behavior) to another perspective (e.g., managing the goods-to-services transition), as evidenced in increasing calls in the servitization literature to derive insights on how to successfully manage manufacturers' shifts to service-based business models (Baines et al. 2009b). A better understanding of customer needs can guide management decisions in goods-to-services transition contexts. That is, future research on the goods-to-services transition should yield more consumer behavioral insights and translate them to managerial implications to

govern the business model transitional processes. Importantly, a better understanding is needed of the underlying psychological processes that guide consumers from goods to services consumption. Taken together, the research field is nascent, but the knowledge exchange between consumer studies and management research studies is still weak.

Second, research should be conducted that spans the boundary between B2C and B2B contexts in order to investigate the generalizable findings on the determinants and outcomes of the goods-to-services transition. While there appears to be a clear distinction in the literature between research on servitization (i.e., B2B) and studies on the sharing economy (i.e., B2C), both developments are evidence of a more general shift from goods to services. Future studies should therefore explore the commonalities and general mechanisms in both areas.

Third, we encourage future research to form stronger ties with other disciplines that are devoted to the same unit of analysis. Management research could particularly profit from insights that are proposed by other fields, such as transportation or sustainability research. For instance, *Transportation Research Record* published several articles that investigate adoption decisions of carsharing users and elucidate the influence of carsharing on customer behavior in mobility contexts. Specifically, Wielinski et al. (2015) revealed that shopping is the most important activity related to why customers use free-floating carsharing. Moreover, the authors compared different carsharing types (i.e., station-based vs. free-floating) and explored the alternatives that customers would have used in the absence of the free-floating service to meet their mobility needs (e.g., taxis, walking, and public transit). As such, Wielinski et al.'s (2015) study stimulates novel perspectives and research questions, such as the following. How can managers integrate novel product-service systems into existing consumption habits (e.g., platform induced cross-selling effects)? What is the nuance to markets added by access-based services compared to prior services that have not been that widespread in the past, such as renting? Does the turn from goods to services consumption cause a general rethinking of consumption and management practices? Future research can profit from multidisciplinary perspectives to allow for a more profound understanding of consumers' shift from goods to services.

Fourth, the scope of research on the goods-to-services transition should be expanded. By taking novel approaches, researchers can aim to fill in the blank spots and thus ensure a broader understanding of the focal phenomenon. For example, while sharing services have primarily, if not exclusively, been investigated in the context of developed economies and affluent consumer groups, Schäfers et al. (2018) investigated such services at the base of the economic pyramid.

In addition, the burst detection analysis reveals that recently upcoming topics in the field are platform business models and experience management. We expect that future discussions on the shift from goods to services based on these aspects will be leveraged by research on the influence of artificial intelligence (Huang and Rust 2018), the internet of things (Ng and Wakenshaw 2017), and digitalization (Kannan and Li 2017), since these developments will shape the customer experience and the role of business models in this regard (e.g., through the influence of algorithms and bots in the consumption processes). Moreover, the increasing importance of platform business models encourages critical reflections about the value of the traditional dichotomous market categorization of goods versus services for governing businesses that capitalize on the transitions in either direction (Perren and Kozinets 2018; Rust and Huang 2014; Vargo and Lusch 2017).

Finally, we hope that our study acts as a baseline study that future research can build upon to trace the field's development over time. Indeed, future research may consider using SNA more routinely to analyze and synthesize emerging or mature topics in the field. However, while SNA offers unique insights into knowledge network structures, some key publications might not appear as prominently in the current analysis as they might in their specific field of research. For example, Bardhi and Eckhardt's (2012) study on consumer behavior in carsharing contexts, which reached more than 190 WoS citations [6], does not stand out in our overall analysis. This is due to the fact that the current SNA constructs a field of research from a bibliographic analytical perspective rather than documenting the evolution of a field that follows commonly declared research directions and priorities. Therefore, individual key publications, their authors and their affiliated institutions might be absorbed in this analysis by a high number of publications, which have individually less dissemination in their field but jointly create an important knowledge cluster for the goods-to-services research discipline. Moreover, even one well-cited publication may influence an author's positioning within the network meaning that it determines the author's network metrics (i.e. degree, centrality, aggregate constraint). For instance, Boyko et al.'s (2017) article on how sharing can contribute to more sustainable cities features several co-authors involved in the Liveable Cities Project [5] that also includes civil engineering researchers that may otherwise would not have published in consumer behavior or manufacturing journals.

Taken together, we hope that our study facilitates building bridges among seemingly disjointed perspectives and sources of knowledge. We urge future researchers to join efforts across disciplines in order to shed light on the nature of transitional processes that increasingly guide goods consumption to services consumption.

Notes

- [1] For an isolated social network analysis on the sharing economy, see Cheng (2016).
- [2] This search was carried out on October 04, 2017.
- [3] Note that this analysis only considers articles whose journals were listed in the WoS at the time of publication.
- [4] www.cambridgeservicealliance.eng.cam.ac.uk
- [5] www.liveablecities.org.uk
- [6] Times cited: 198 (from Web of Science Core Collection); accessed June 5th 2018.

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Keywords

Sharing Economy, Servitization, Co-Authorship Networks, Knowledge Networks, Social Network Analysis