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The Emergence and Rise of Industry 4.0 Viewed through the Lens of Management Fashion Theory

Dag Øivind Madsen

Department of Business, Marketing and Law, School of Business, University of South-Eastern Norway, Bredalsveien 14, 3511 Hønefoss, Norway; dagmadsen@gmail.com

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Abstract: The Industry 4.0 (I4.0) concept is concerned with the fourth industrial revolution in manufacturing, in which technological trends such as digitalization, automation and artificial intelligence are transforming production processes. Since the concept's introduction at the Hannover Fair in Germany in 2011, I4.0 has enjoyed a meteoric rise in popularity and is currently high on the agenda of governments, politicians and business elites. In light of these observations, some commentators have asked the question of whether I4.0 is a concept that is hyped up and possibly just the latest in a long line of fashionable management concepts introduced over the course of the last few decades. Therefore, the aim of this paper is to provide a critical outside-in look at the emergence and rise of I4.0. Theoretically, these processes are viewed through the lens of management fashion, a theoretical perspective well suited to examinations of evolutionary trajectories of management concepts and ideas. The findings indicate that the I4.0 concept has quickly become highly popular and is dominating much of the popular management discourse. The concept has migrated out of the specialized manufacturing discourse to become a more general concept with mainstream appeal and applicability, evidenced by a multitude of neologisms such as Work 4.0 and Innovation 4.0. The numbers 4.0 have spread in a meme-like fashion, evidenced by the fact that the combination of a noun and the numbers 4.0 are used to signal and usher in discussions about the future of business and society. While there is much evidence that clearly shows that the concept has had a wide-ranging impact at the discursive level, the currently available research is less clear about what impact the concept has had so far on industries and organizations worldwide.

Keywords: Industry 4.0; fourth industrial revolution; management concept; management fashion; popularity; manufacturing; industrial production

1. Introduction

Industry 4.0 (I4.0) is currently one of the biggest buzzwords in the business and organizational world. The concept was launched at the Hannover Fair in 2011 and quickly attracted much attention not only in Germany, but also at the world stage. The I4.0 concept is concerned with the fourth industrial revolution in manufacturing, where technological trends such as digitalization, robots and artificial intelligence are transforming production processes (Marr 2018a). According to Hofmann and Rüsch (2017), I4.0 is sometimes referred to using other related terms such as "smart manufacturing, "industrial internet" or "integrated industry". I4.0 is often viewed as being a key part of the "great transformation" (Bessant 2018) that is currently taking place in the business world and is closely associated with other societal and organizational mega-trends such as digitalization, cloud computing, artificial intelligence and Internet of Things (Marr 2018a).

Despite the widespread use of the term I4.0 in public management discourse, the I4.0 concept can be difficult to get a firm grasp of since more than 100 definitions exist (Moeuf et al. 2018). The consulting firm McKinsey notes that I4.0 is a combination of many different managerial and technological concepts

and ideas, and calls I4.0 a "confluence of trends and technologies promises to reshape the way things are made" (Baur and Wee 2015, p. 1). A more precise definition of I4.0 is that it is "a new approach for controlling production processes by providing real time synchronisation of flows and by enabling the unitary and customised fabrication of products" (Kohler and Weisz 2016, cited in Moeuf et al. 2018, p. 1118).

I4.0 has spread rapidly and, over time, it has also become a broader and general approach encompassing much more than just conventional industrial production. As Pfeiffer (2017, p. 110) points out, I4.0 has "migrated quickly out of the specialized discourse to become a widely recognized catch word in the popular vernacular". The concept has also inspired numerous neologisms such as Work 4.0 and Innovation 4.0 (Reischauer 2018) and the numbers 4.0 have become a meme to signal discussions about the future of business, innovation and society as a whole (Pfeiffer 2017).

One explanation for the concept's mainstream appeal, societal legitimacy and perceived relevance is the fact that it is backed and boosted by many powerful actors (e.g., consulting and big tech firms), and that there is a high degree of consensus among socio-political actors about the concept's importance and applicability across borders (Hirsch-Kreinsen et al. 2016; Kopp et al. 2016). The topic of I4.0 has been high on the agenda of governments, politicians and business elites, evidenced by the fact that I4.0 was a key topic at the World Economic Forum in Davos in 2016, a year when there several other major events and crises related to, for instance, climate and refugees (Schneider 2018). I4.0 has also received much attention in academic research in recent years and there has been an exponential growth in publications about I4.0 (Durmuşoğlu and Çiftçi 2018; Piccarozzi et al. 2018).

The rise of I4.0 has also been fueled by government subsidies and attention, and I4.0 has quickly become a big and lucrative industry in its own right. Technology vendors (e.g., SAP), consulting firms (e.g., McKinsey, Boston Consulting Group) and conference organizers have thrown their hats in the ring to fight for a slice of the market related to I4.0, offering and providing support services and assisting firms and managers with the implementation of I4.0 (Hirsch-Kreinsen 2014; Hirsch-Kreinsen et al. 2016).

1.1. Aim and Contribution

Several previous papers have alluded to the possibility that the Industry 4.0 concept could exhibit some of the hallmarks and characteristics of typical management fads or fashions. For example, it has been pointed out that there has been a "loud buzz" surrounding I4.0 (Pfeiffer 2017) and that the concept is hyped up (Dastbaz 2019; Drath and Horch 2014; Mertens and Wiener 2018). Therefore, researchers have cautiously warned that "there might be a risk that Industry 4.0 becomes a so-called management fashion" (Hofmann and Rüsch 2017, p. 32). In the words of Kopp et al. (2016, p. 10), "[s]ometimes the vehemence of the debate strongly suggests that it is a fad". Others have noted that aspects of the rise of I4.0 as a concept and topic can be explained by clever marketing strategies and agenda-setting processes. To this point, it has been noted that I4.0 is a "marketing-style term" (Pfeiffer 2017) and a "masterly example of PR without equal" (Hirsch-Kreinsen et al. 2016, p. 15). Today, there is a broad constellation of actors (e.g., consulting industry, academia, technology and software firms) supporting I4.0 and marketing their products and services related to the concept (Hirsch-Kreinsen et al. 2016).

In light of these observations, the aim of this paper is to examine the emergence and rise of I4.0 through the lens of management fashion, a theoretical perspective which is commonly used to analyze the lifecycle of management concepts and ideas and their popularity trajectory across time and space (Abrahamson 1996; Abrahamson and Piazza 2019; Kieser 1997). The lens of management fashion is useful to understand the emergence and rise of I4.0 since it puts the spotlight on macro-level evolutionary trends and the various supply and demand-side forces that shape the marketplace for a particular management concept (Madsen and Slåtten 2015b; Perkmann and Spicer 2008).

The current paper contributes to the rapidly expanding literature on I4.0 by being, to the best of the author's knowledge, the first attempt to explicitly view the emergence and rise of I4.0 through the lens of management fashion. This paper uses management fashion theory to analyze the characteristics and framing of the concept, and the various supply and demand-side forces which have shaped the

concept's evolutionary trajectory since inception. In doing this, this paper provides new insights into the emergence and rise of I4.0.

1.2. Research Approach

This paper is based on desk research and follows an explorative and qualitative research approach. This paper can be characterized as an in-depth case study of the I4.0 concept with the aim of sketching a "mosaic" (Morrison and Wensley 1991) or "overall picture" (Nijholt and Benders 2007) of the concept's emergence and rise from its inception to present day. As pointed out by Nijholt and Benders (2007, p. 649), assessing a concept's impact is complicated, and it is often necessary to utilize qualitative and interpretive approaches. To be able to obtain an overview of the topic of I4.0 and how this concept has emerged and evolved over time, the current study pieces together and synthesizes findings from a wide variety of different sources in both the scholarly and practitioner-oriented literature on I4.0. In practice, this literature search process started by using Google Scholar to find key papers raising the possibility that the I4.0 concept could be characterized as a fad, fashion and/or a buzzword. Based on these initial searches, some key papers were identified (Hofmann and Rüsch 2017; Kopp et al. 2016; Pfeiffer 2017). These identified key papers can be considered the "seed set" (Felizardo et al. 2016). Then, the rest of the search process resembled a snowballing-type procedure where the goal was to identify more related papers on the topic. A combination of backward snowballing (examining the reference lists of the initial papers) and forward snowballing (examining more recent papers that cite the initial papers) was used (see e.g., Felizardo et al. 2016; Jalali and Wohlin 2012; Wohlin 2014; Wohlin 2016). This search process continued until a point of saturation was reached and no other relevant papers were found.

As will be discussed towards the end of this paper, there are certain limitations associated with this research approach. Using a snowballing-type procedure can be challenging due to the high volume of new articles on I4.0 and the fact that the I4.0 field is rapidly evolving. Moreover, relying extensively on secondary sources (e.g., surveys or case studies carried out in other contexts and at other times) can be problematic since the researcher becomes dependent on the methodological choices made by others (Nijholt and Benders 2007). However, it is arguably a pragmatic choice given the study's exploratory and rather modest aims of sketching a preliminary picture of the emergence and rise of I4.0.

The rest of this paper proceeds in the following way. Section 2 provides a brief history of the origins and emergence of I4.0 and an overview of the concept's evolution during the first years since its birth point. Then, in Section 3, an analysis of the I4.0 concept and an identification of its key characteristics and framing follows. Sections 4 and 5 provide an analysis of the marketplace for I4.0, focusing on the supply and demand sides, respectively. Section 6 provides a theoretically informed discussion of the findings in the context of management fashion theory, while Section 7 concludes this paper, identifies contributions, limitations and maps out directions for future work.

2. A Brief History of the Industry 4.0 (I4.0) Concept

This section sketches a brief history of the I4.0 concept, first looking closer at the origins and emergence of the concept, followed by an overview of some factors which could explain the meteoric rise of the concept over the course of the last few years.

2.1. Origins and Emergence

The I4.0 concept was launched at the Hannover Fair in 2011 and can therefore be considered a nascent phenomenon with a relatively short history spanning less than a decade. Arguably, this makes it relatively easier to trace the roots and origins of I4.0 than is the case for many other management concepts and ideas, which in some cases (e.g., quality management and benchmarking) have histories and roots that go back decades. In the case of I4.0, it is easy to define and pinpoint the epicenter of the idea. It is well documented that the I4.0 concept (German: Industrie 4.0) was introduced at the Hannover Fair in Germany during the spring of 2011 as a result of a government initiative

(Hirsch-Kreinsen et al. 2016). Although the "official" birth year of I4.0 is 2011, Pfeiffer (2017) shows that the narrative behind I4.0 can be traced back to the global financial crisis of 2008/2009. Similarly, Dastbaz (2019) argues that the concept emerged in the aftermath of the financial crisis as a way for industries to improve profitability and competitiveness, and at the national level to trigger and spur economic growth and recover from the recession.

An interesting question is why this concept emerged in Germany. To this point, it has been argued that the concept is deeply rooted in the "German national-specific character" (Hirsch-Kreinsen et al. 2016) and is closely associated with Germany's historically largely manufacturing-based economy. For example, manufacturing's share of the total value creation is much bigger in Germany than in comparable economies such as the US and the UK (Fuchs 2018). However, the manufacturing sector is relatively less profitable than other sectors of the economy (e.g., services), and a key aim of I4.0 is therefore to improve the profitability of the manufacturing sector (Fuchs 2018).

In the years following its introduction, there have been numerous formal and informal activities and initiatives to further develop I4.0. For example, in 2012, a working group was founded, which later resulted in the creation of an "Industry 4.0 Platform" (Kopp et al. 2016). Moreover, it has been noted that there has been a "vivid public debate" (Fuchs 2018) surrounding I4.0. There has, however, been little critical discussion among the various actors involved in the I4.0 field about the merits and effects of the concept and whether it can live up to the lofty promises and high expectations. In the words of Kopp et al. (2016, p. 7) "there is a broad, almost unbroken consensus between social partners and policy makers".

2.2. Popularization

There are several factors which may, at least partly, explain why the I4.0 concept has risen very quickly in popularity and become a buzzword and catch phrase not only in the business sphere but also society as a whole. This section will discuss three factors: (1) the familiarity of the industrial production paradigm, (2) the active role of governments in terms of supporting and legitimizing the concept, and (3) the timing and fit with the dominant zeitgeist of the 2010s.

2.2.1. Familiarity of the Industrial Production Paradigm

Familiarity is a factor which has made the introduction of the I4.0 concept much smoother and has reduced societal resistance. To this point, Fox (2018) argues that the popularization of I4.0 has been facilitated by the fact that it is built on the industrial production paradigm which enjoys a high degree of familiarity across the world. Fox (2018, p. 5) notes that "hype can be especially contagious when that hype is associated with an old paradigm that is already familiar to people all over the world". Fox (2018) argues that a reason why I4.0 spreads rapidly across the globe is that "humans everywhere tend to have a preference for the familiar: in this case, industrial production".

2.2.2. The Active Role of Government

Another factor which has contributed to the rise of I4.0 is active roles played by the governments of numerous countries around the world in supporting and boosting the concept. The early launch and emergence of I4.0 was to a large extent government-led and national-level actors have been strongly involved since the beginning, evidenced by the fact that Germany has had an Industry 4.0 strategy for some time (Schroeder 2016). Moreover, there has also been much government money subsidizing research and development of the I4.0 concept in many countries. Governments of several countries have enacted policies in support the concept, and in effect legitimized the concept. For example, there have been several national strategic initiatives related to I4.0 such as "Made-in-China 2025" (Kopp et al. 2016; Xu et al. 2018) as well as similar efforts in countries such as Sweden, Belgium, Spain, Austria and Japan (Hamada 2019).

2.2.3. Timing and Zeitgeist

Timing and zeitgeist may also have played a role in the rise and popularization of I4.0. As Kieser (1997) points out, timing is critical in determining whether new management concepts catch on and become popular and fashionable. Similarly, Huczynski (1992) names timing as one of the success criteria of new management concepts. The new concept must, as Kieser (1997, p. 61) points out, hit the "nerve of today's managers" in order to catch fire and generate a "wave of interest" in the business and organizational world. Concepts that fit with the current zeitgeist will stand a greater chance of becoming fashionable than those that are perceived as outdated and irrelevant.

As described in the introduction, I4.0 is a broad concept that encompasses many of the mega-trends which are current sweeping the business world such as digitalization and the associated technological concepts Internet of Things (IoT) and Big Data Analytics (BDA). As pointed out by Hirsch-Kreinsen et al. (2016, p. 15), I4.0 is "to a great degree compatible with the rapidly growing general focus in society on digital technologies and Internet, and with the dominant conviction that this is no less than a societal mega-trend". Johansson et al. (2017) argue that the 2010s are dominated by technological optimism. Thus, it can be argued that I4.0 fits well with the dominant zeitgeist in the business community during the 2010s, a time period during which managers have the appetite for new digital approaches and are ready to turn the page on older approaches which are perceived as outdated in today's digital society.

2.3. Conceptual Evolution

This section takes a brief look at the conceptual evolution of I4.0. The I4.0 is hardly a static concept; instead, it has evolved considerably over time. One interesting development is that the concept has morphed from a specialized and rather narrow concept focused on industrial production and the manufacturing context to gradually become a much more all-encompassing concept with nearly universal applicability. As Pfeiffer (2017, p. 110) points out, the concept has "migrated quickly out of the specialized discourse to become a widely recognized catch word in the popular vernacular". The discourse around the concept has inspired numerous neologisms such as Work 4.0 and Innovation 4.0 (Reischauer 2018), which is indicative of the concept's broad application and appeal. Moreover, the numbers 4.0 have become ubiquitous and have attained a meme-like status, often used to signal discussions about the future of business, innovation and society as a whole (Pfeiffer 2017).

This mainstreaming and universalization of the concept has increased the reach of the concept and, in recent years, I4.0 has become a big and influential concept which has taken center stage in the public management discourse both in print and social media. I4.0 is now to a large extent overshadowing other contemporary management concepts and ideas such as "lean production" and familiar buzzwords and catchphrases from the 1990s and 2000s such as "knowledge-based economy" and "knowledge work" (Kopp et al. 2016).

3. Characteristics and Framing of the I4.0 Concept

The previous section provided a sketch of the history and trajectory of the I4.0 concept and identified some contextual factors which could explain aspects of its rapid rise in popularity. In this section, the focus shifts to an analysis of the characteristics and framing of the I4.0 concept, which in turn shapes the concept's popularity potential in the marketplace for management concepts and ideas. Before proceeding, however, a brief discussion of the extent to which I4.0 can be considered a management concept follows.

3.1. I4.0 as a Management Concept

In recent years, much has been written on the nature of management concepts and ideas and how they develop, spread and evolve over time (Sturdy et al. 2019; Örtenblad 2015). Management concepts can be defined as "prescriptive, more or less coherent views on management" (Benders and Verlaar 2003, p. 758). There is a large number of management concepts in circulation in the market

for management concepts and ideas (Bort 2015; Hindle 2008), with some of the most well-known and widely used contemporary examples being Agile Management, Big Data Analytics and Customer Relationship Management (Rigby and Bilodeau 2018). Common traits shared by such concepts are that they tend to be highly normative in nature and that they provide clear recommendations to managers about how to organize different aspects of business operations and processes with the aim of improving efficiency and profitability (Benders and Van Veen 2001; Røvik 1998).

I4.0 arguably fits the definition of a management concept provided by Benders and Verlaar (2003) since it is a highly normative concept and provides a clear prescriptive view on the management of firms. More specifically, it provides prescriptions about how production processes can be controlled using new technological innovations, with the aim of improving areas of performance such as flexibility, productivity and quality. However, it can be argued that I4.0 is an umbrella or catch-all concept (Mertens and Wiener 2018; Sharma 2019) since it encompasses other management concepts such as IoT and Big Data (Marr 2018a). To this point, Mertens and Wiener (2018, p. 370) note that "the meaning of Industry 4.0 is so ambiguous that many different concepts can be subsumed under this umbrella term".

Another feature of the I4.0 concept identified in previous research is that the concept can be viewed as a positive and optimistic vision of the future of business (Table 1). For example, Meyer (2019) refers I4.0 to as an "envisioned future". Another distinguishing feature of the I4.0 concept is that it is heavily technology infused and what Kopp et al. (2016) call a "technology-centered vision".

Table 1. Visionary aspects of the Industry 4.0 (I4.0) concept (Source: Author's own elaboration).

Quote	Reference
"envisioned future"	Meyer (2019)
"technology-centered vision"	Kopp et al. (2016)
"Industry 4.0 does not equal technologies but communicates an envisioned state of manufacturing industries"	Reischauer (2018, p. 3)
"big, visionary picture"	Pfeiffer (2017, p. 108)
"The German vision paints a bright picture of the future industry"	Johansson et al. (2017, p. 282)

3.2. Characteristics and Framing

In the previous section, it was shown that the I4.0 concept can be considered a very broad management concept and general technology-focused vision of the future of business, innovation, and to some extent social as a whole. In this section, the focus shifts to the identification and discussion of the characteristics and framing of the I4.0 concept. Researchers studying management concepts and ideas have identified several key characteristics of the framing of concepts, which are considered to be success criteria since they give a concept a higher popularity potential (Benders and Van Veen 2001; Huczynski 1992; Røvik 2002). In the following, the discussion will center around four characteristics which are often highlighted in this literature on fashionable management concepts: (1) label, (2) interpretive space, (3) performance improvements, and (4) universality. According to Røvik (2002), the extent to which a concept contains the ingredients of this "winning formula" will influence how easily the concept will "flow" between organizations.

3.2.1. Label

In order to attract the attention of an audience consisting of mostly busy managers, management concepts tend to be labeled in a catchy and appealing way (Røvik 1998, 2007). Often a three-letter acronym such as Total Quality Management (TQM), Customer Relationship Management (CRM) or Business Process Reengineering (BPR) is used to refer to these concepts (Grint 1997; Røvik 2007). While an acronym is not used to refer to the I4.0 concept, the label "Industry 4.0" is short and very catchy and has a "buzzword character" (Straßburger 2019). Therefore, it can be argued that the label scores relatively high on this criterion. In past research, researchers have noted that I4.0 is a "marketing-style

term" (Pfeiffer 2017). The label I4.0 signifies a radical shift from the status quo, and as pointed out by Reischauer (2018, p. 2) the "revolutionary scope is already mirrored in the label".

It has also been noted that the label I4.0 is a "reminiscence of software versioning" (Lasi et al. 2014). The numbers 4.0 (i.e., the fourth version) implies that this is something new and a significant improvement over previous versions (e.g., 3.0). From a management fashion-setter's perspective, the use of a version number in the label may not be optimal since it implies that the last word has not been said with respect to industrial production. In a way, it has invited others to propose new versions (e.g., Industry 5.0) at some point in the future. It is notable that some researchers have already proposed the term Industry 5.0 (Demir and Cicibas 2017; Haleem and Javaid 2019; Javaid and Haleem 2019; Ozkeser 2018; Sachsenmeier 2016; Skobelev and Borovik 2017; Özdemir and Hekim 2018). Similarly, the notion of Society 5.0 has been introduced in Japan (Sayer 2017). The question then becomes why a version label was chosen and, to some extent, this could be attributed to the fact that the I4.0 concept was not coined by a typical fashion-setting actor (e.g., consulting firm) and was likely not "created" with the sole intent of launching a new fashionable concept, for example with the aim of selling books and seminar seats.

In previous research on I4.0, it has been pointed out that the different neologisms (e.g., Innovation 4.0) have been inspired by the original I4.0 concept (Reischauer 2018). Similarly, Straßburger (2019) notes that the extension 4.0 is often used in combinations with other words. A search of the literature shows that there is a multitude of neologisms which are connected to and inspired by the original I4.0 concept (Table 2). Table 2 shows that there already exists a large number of different derivations of the I4.0 concept, and that the I4.0-related thinking and ideas have been adapted and applied in a wide variety of contexts (e.g., work, education, marketing, innovation, fashion). It should be pointed out that the term Fashion 4.0 in Table 2 refers to applications of I4.0 within the garment and textile industry. This is unrelated to how the word fashion is used throughout the rest of this paper, i.e., as a theoretical lens and metaphor through which the emergence and rise of the I4.0 concept is viewed (see e.g., Clark 2004b; Scarbrough and Swan 2001; Örtenblad 2007).

A further observation is that most of these neologisms have appeared during the last few years (in particular 2017–2019). The emergence of a multitude of neologisms can be explained by the fact that the I4.0 concept has attained a meme-like status that can be attached to almost any topic in business, innovation and society. As pointed out by Pfeiffer (2017, p. 107), "the numbers "4.0" have developed into a well-known meme that adorns conferences all over the country, signaling fundamental discussions on no less a topic than the future of work and the future of the society as a whole".

Table 2. Neologisms inspired by the I4.0 concept (Source: Author's own elaboration).

Area	Neologism	Reference
Work, leadership and knowledge management	HRM 4.0	Liboni et al. (2019)
	Smart HR 4.0	Sivathanu and Pillai (2018)
	Arbeit 4.0	Botthof and Hartmann (2015)
	Work 4.0	Fischer et al. (2017), Salimi (2015)
	Leadership 4.0	Kelly (2019), Prince (2017)
	Knowledge Management 4.0	Neumann (2018)
Operations, quality and logistics	Quality 4.0	Johnson (2019), Radziwill (2018)
	Lean 4.0	Mayr et al. (2018)
	Six Sigma 4.0	Schäfer et al. (2019)
	Logistics 4.0	Barreto et al. (2017), Ten Hompel and Henke (2014), Tijan et al. (2019), Winkelhaus and Grosse (2019)
	Supply Chain Management 4.0	Frazzon et al. (2019)

Table 2. *Cont.*

Area	Neologism	Reference
Industry/sector specific	Services 4.0	Paschou et al. (2018)
	Service Management 4.0	Kans and Ingwald (2016a, 2016b)
	Retail 4.0	Lee (2017)
	Fashion 4.0	Behr (2018), Bertola and Teunissen (2018)
	Agriculture 4.0	Zambon et al. (2019)
	Airport 4.0	Koenig et al. (2019)
	Pharma Industry 4.0	Ding (2018)
	Building Management 4.0	Rogers (2018)
	Construction 4.0	Maskuriy et al. (2019)
	Field Service Technician Management 4.0	Vössing and von Bischhoffshausen (2018)
	Care 4.0	Chute and French (2019)
Education	Higher Education 4.0	Xing (2019)
	Education 4.0	Almeida and Simoes (2019), Almeida and Simoes (2019), Buasuwan (2018), Ciolacu et al. (2017), Hariharasudan and Kot (2018), Mourtzis et al. (2018), Puncreobutr (2016)
	Engineering Education 4.0	Schuster et al. (2016)
	Learning 4.0	Janssen et al. (2016)
	University 4.0	Lapteva and Efimov (2016)
Innovation management	Innovation 4.0	Reischauer and Leitner (2016)
	Innovation Management 4.0	Völker et al. (2019)
Marketing and consumers	Consumer Behavior 4.0	Roblek et al. (2016)
	Marketing 4.0	Bergemann (2019), Jiménez-Zarco et al. (2019), Kotler et al. (2016), Vassileva (2017), Wereda and Woźniak (2019)
	Customer 4.0	Wereda and Woźniak (2019)
Management and governance	Controlling 4.0	Heimel and Müller (2019), Obermaier (2016)
	Enterprise 4.0	Ferreira et al. (2019)
Society	Neighborhood 4.0	Cooper and Sebake (2018)
	Revolution 4.0	Zambon et al. (2019)
	Society 4.0	Mazali (2018)

3.2.2. Interpretative Space

Another defining characteristic of management concepts which succeed in becoming popular is "interpretive space" (Benders and Van Veen 2001; Clark 2004b). Management concepts are ideational innovations and are formulated in a relatively vague and open way (Benders and Van Bijsterveld 2000), thereby making it possible for both suppliers and consumers to interpret and tweak the concept to fit their organization-specific needs and circumstances. This room for interpretation and ambiguity increases the chance that the concept will become popular and fashionable (Kieser 1997), since "any concept must necessarily lend itself to various interpretations to stand a chance of broad dissemination" (Benders and Van Veen 2001, p. 38).

The room for interpretation varies between different concepts (Fincham and Roslender 2003, 2004) and, in the case of I4.0, this room for interpretation is very large. Different authors have defined the I4.0 concept in a multitude of ways, and according to Moeuf et al. (2018) more than 100 definitions exist in the literature. Table 3 provides a selection of illustrative quotes from researchers who have examined the challenges related to defining the concept in the practice. Reasons why the I4.0 concept is particularly difficult to define include the broadness of the term (Maresova et al. 2018) and its rather

vague and fuzzy nature (Hofmann and Rüsch 2017; Mertens and Wiener 2018, Pfeiffer 2017). To this point, Pfeiffer (2017, p. 108) notes that even those who came up with the term I4.0 are "astonishingly vague about the technical details" and instead focus on painting a "big, visionary picture" which is relatively light on specifics.

Table 3. The interpretive space of the I4.0 concept (Source: Author's own elaboration).

Quote	Reference
"the meaning of Industry 4.0 is so ambiguous that many different concepts can be subsumed under this umbrella term"	Mertens and Wiener (2018, p. 370)
"image of Industry 4.0 is still quite fuzzy"	Hofmann and Rüsch (2017, p. 33)
"astonishingly vague about the technical details"	Pfeiffer (2017, p. 108)
"Industry 4.0 is a broad term, and different authors interpret it in different contexts"	Maresova et al. (2018, p. 2)

Several researchers have observed that there is little consensus on what Industry 4.0 really is and, both among academics and practitioners, the I4.0 concept has different meanings (Pereira and Romero 2017). The vagueness and different perceptions and understandings of the concept may also contribute to a level of "conceptual confusion" (Mertens and Wiener 2018), particularly in organizational practice. Therefore, it should come as no surprise that there is a demand for short articles which seek to provide more simplified explanations of the concept (Marr 2018a).

3.2.3. Promises and Expectations of Performance Improvements

A third key characteristic of management fashions is that their creators and proponents make lofty promises and create high expectations of performance improvements in case of adoption and implementation of the concept in question (Kieser 1997; Ten Bos 2000). Moreover, suppliers of new concepts typically warn managers that they are at danger of being left behind if they abstain from adoption (Benders and Van Veen 2001; Røvik 1998). Benders (1999) argues that these promises are necessary in order for a management concept to stand the chance of broad popularity and diffusion since managers are only going to be enticed to learn about and adopt a new concept if they perceive potential benefits as a result of its implementation and use.

Promises of substantial performance improvements can easily be identified in the I4.0 discourse, and researchers have noted that there in recent years has been a very strong hype surrounding I4.0 (Fox 2018). Many large promises have been made, which has led to the creation of very high expectations in the business community. Table 4 provides some illustrative quotes from researchers who have examined the nature of the debate on I4.0.

Table 4. The promises and expectations related to I4.0 (Source: Author's own elaboration).

Quotes	References
"promising technology"	Hirsch-Kreinsen et al. (2016)
"exhibits the character of a techno-utopia with its far-reaching generalization"	Hirsch-Kreinsen et al. (2016, p. 2)
"is not just a desirable but ultimately an inevitable development, which fundamentally has no alternatives"	Kopp et al. (2016)

Supporters and boosters of I4.0 typically emphasize that I4.0 represents a "paradigm shift" and a "revolution". An interesting aspect of the hype around I4.0 is that the concept's supporters "proclaim a revolution before it has taken place" (Fuchs 2018, p. 281). Therefore, I4.0 can be considered perhaps the first revolution which is announced ex ante (Lasi et al. 2014). Propagators of I4.0 highlight that it is a "promising technology" which will bring about positive technological, economic and social effects (Hirsch-Kreinsen et al. 2016). According to Hirsch-Kreinsen et al. (2016), the originators of I4.0

highlighted that the concept could improve the flexibility and efficiency of manufacturing firms and increase the competitiveness of Germany industry.

The general implication is that I4.0 will have very large consequences for businesses worldwide. There is also the threat of being left behind in case of non-adoption of I4.0, and propagators of the concepts are playing to managers' psychological fears of "missing the boat" (Kieser 1997; Sturdy 2004). As noted by Hirsch-Kreinsen et al. (2016, p. 13): "whoever joins this transformation endeavor will be successful practically by default and in a position to achieve enormous profit gains".

3.2.4. Universality

Management concepts are typically framed and presented as universal in nature and decontextualized from the particularities of any single organization (Røvik 2007; Strang and Meyer 1993). Wittrock (2015) argues that this can be referred to as the "context independence" of management concept, i.e., that the concept is presented as useful irrespective of cultural or geographical context. Universal applicability also has the effect of making just about any organization a potential consumer of the concept and a potential client of consultants and trainers (Fincham and Evans 1999, p. 35). Therefore, universality has the effect of increasing the total market size related to the concept.

To what extent is the I4.0 concept presented as universal? In its initial presentation, the I4.0 concept was mostly centered on applications in the manufacturing industry. As Fox (2018) points out, the familiar nature of the industrial production paradigm may have facilitated the acceptance and spread of the I4.0 concept to other sectors and across different countries around the world. To this point, it has been noted that I4.0 has "rapidly gained great prominence far beyond the relevant specialist public" (Hirsch-Kreinsen et al. 2016, p. 6). As showed in Section 3.2.1, I4.0 has inspired a multitude of neologisms, which indicates that the concept can be easily adapted and tailored to a multitude of different contexts (e.g., Service 4.0). The I4.0 concept can therefore be seen as reflective of a more universal trend, which will leave almost no area of business and society unaffected.

4. The Supply Side of I4.0

In this section, the focus turns to the supply side of I4.0, which comprises the various actors involved in the promotion, propagation and preservation of the concept. In the management fashion literature, these supply-side actors are referred to as the "fashion-setting community" (Abrahamson 1996) or the "management fashion arena" (Jung and Kieser 2012; Klincewicz 2006). The actors involved in the fashion arena around management concepts include consulting firms, management gurus, software firms, conference organizers, professional organizations, business media, as well as social media (Madsen and Slåtten 2013; Madsen and Slåtten 2015a; Clark 2004a; Jung and Kieser 2012).

4.1. The Management Fashion Arena Around I4.0

In the case of I4.0, commentators have observed that there is a diverse group of actors dedicated to the promotion, preservation and persistence of I4.0 (Hirsch-Kreinsen et al. 2016, Kopp et al. 2016). Kopp et al. (2016) cite Hirsch-Kreinsen (2014, p. 432) who pointed out that I4.0 is promoted "by computer scientists, engineers, innovation policy-actors, influential business associations and larger technology-intensive enterprises".

It has also been observed that the fashion arena around I4.0 over time has expanded in terms of the number of actors involved: "actor constellations participating in the discourse have continually broadened" (Hirsch-Kreinsen et al. 2016, p. 6). A similar development is often seen in the marketplace for management concepts and ideas; when new concepts reach a critical mass of followers and succeed in becoming popular, other supply-side actors perceive a lucrative market opportunity and want to get in on the action (David and Strang 2006; Klincewicz 2006).

4.2. Conferences and Seminars

Conferences and seminars play an important role in the diffusion of management concepts. According to Kieser (1997), the conference/seminar scene constitutes "an arena within an arena" and functions as a meeting point where suppliers and consumers of new concepts interact, network and are exposed to new concepts and ideas (Madsen 2014). In the case of I4.0, conferences have played a key role. As discussed in Section 2, the I4.0 concept was launched at the Hannover Fair in 2011. Conferences have also been important later in the lifecycle of the concept as it has taken the center stage at high-profile conferences. A case in point is the fact that the I4.0 concept was the leading topic of the World Economic Forum 2016 in Davos (Schneider 2018). In recent years, researchers have noted that there has been a rapid increase in the number of conferences and congresses about I4.0: "conferences, congresses and expositions on the topic are now so many as to hardly permit any concise overview" (Hirsch-Kreinsen et al. 2016, p. 3).

4.3. Academia

Academic and in particular business schools play an important role in legitimizing new management concepts and ideas (Sahlin-Andersson and Engwall 2002). For example, business school professors may incorporate new management concepts in business school curricula, textbooks, and in scholarly articles.

In recent years, I4.0 has received much attention in business research (Piccarozzi et al. 2018). According some researchers, the popularity of I4.0 in the academic community reached a peak point in 2017 (Durmuşoğlu and Çiftçi 2018). However, a search of the SCOPUS database shows that the concept is still on an upward trajectory in terms of published research (Figure 1). Figure 1 shows the number of SCOPUS-indexed publications during the period 2012–2018. The figure shows clearly that the number of publications about I4.0 has grown exponentially in recent years. In particular, it is notable that there has been a massive increase in the output of research during in the last couple of years (2017–2018).
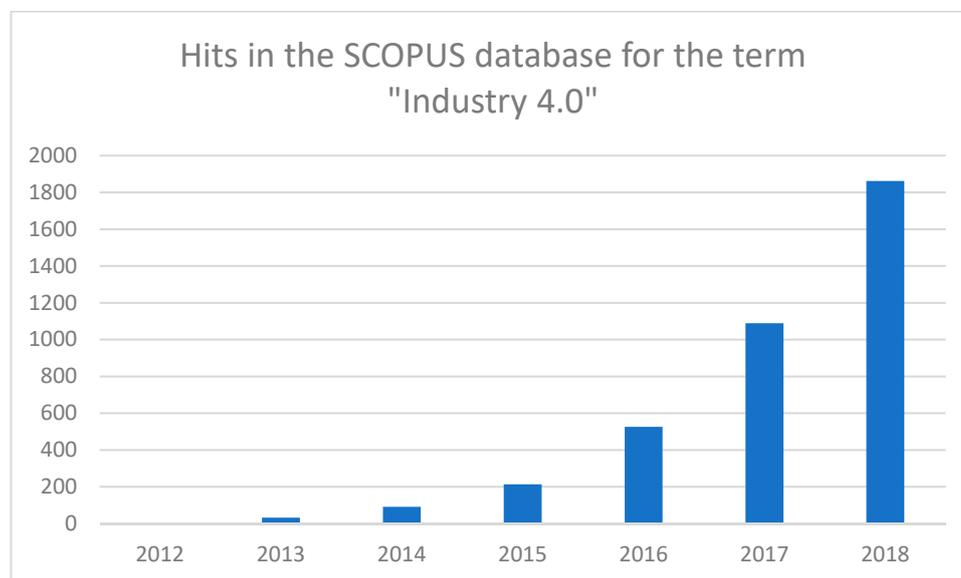

Figure 1. Hits in the SCOPUS database for the term "Industry 4.0" (Source: www.scopus.com; Retrieved 5 February 2019 and displayed using Microsoft Excel).

Moreover, since academic publication processes are relatively slow-moving, there might be much I4.0 research currently in the pipeline, which means we may well see a further increase in the publication volume in 2019 and beyond. The very intense academic discourse surrounding I4.0 is particularly noteworthy since academic discourse around new management concepts and ideas tends to lag discourse in the popular business press, sometimes by several years (Heusinkveld 2004). In the

case of I4.0, however, it appears that academics to a much larger degree have jumped on the I4.0 bandwagon relatively early.

Some of this could also attributed to academics following fashionable concepts and theories. In previous research, it has been suggested that even academics are not immune to following fads and fashions, and often publish articles on popular and fashionable concepts and theories (Bort and Kieser 2011; Clark 2004b). This behavior could be exacerbated by the general trend in academia toward a greater reliance on the external funding of research and researchers are facing increasing pressure to chase funding from, for example, industry partners (Gulbrandsen and Smeby 2005). Therefore, it is possible that the very high growth in academic articles about I4.0 may have been fueled by the extensive government subsidization of I4.0 research, particularly in countries such as Germany.

4.4. Technology Vendors

Technology vendors (e.g., software firms) play an important supporting role in the management fashion arena (Madsen and Slåtten 2013; Klincewicz 2006), particularly in relation to technologically-infused management concepts such as Enterprise Resource Planning or Big Data Analytics (Madsen and Stenheim 2016; Wang 2010; Westrup 2005). As noted in Section 3, the I4.0 concept is a prime example of a technology-infused management concept. It is therefore not surprising that technology and software vendors such as SAP have been very active in terms of promoting new technological solutions and applications related to the I4.0 concept (Lu 2017; Rojko 2017).

4.5. Consulting Firms

Consulting firms are usually seen as perhaps the most important suppliers of new management concepts (Heusinkveld 2013; Jung and Kieser 2012). While consulting firms did not spearhead the creation of I4.0, they quickly jumped on the I4.0 bandwagon. In recent years, a wide spectrum of consulting firms have been involved in the I4.0 market (Reischauer 2018), both the strategy-focused consulting firms (e.g., McKinsey & Company, Boston Consulting Group, Bain & Company) as well as the large generalist consulting firms (e.g., Accenture, PWC, KPMG, Deloitte).

The websites of these firms reveal that I4.0 currently is perceived as an important service offering. Most of the firms are devoting much online space to showcasing their service offerings in relation to the I4.0 concept. For example, Deloitte Insights provides many different resources related to I4.0, including articles explaining different aspects of the concepts. Most of the firms have also published longer reports about the merits and effects of I4.0 (Table 5).

Table 5. Examples of consulting firm reports about I4.0 (Source: author's own elaboration).

Consulting Firm	Report	Reference
McKinsey & Co	"Manufacturing's next act"	Baur and Wee (2015)
Roland Berger	"Industry 4.0—The new industrial revolution—How Europe will succeed"	Roland Berger (2014)
Boston Consulting Group	"Industry 4.0—The future of productivity and growth in manufacturing industries	Rüßmann et al. (2015)
Accenture	"Industry X.0: Realizing digital value in industrial sectors"	Schaeffer (2017)
KPMG	"A reality check for today's C-suite on Industry 4.0"	Harris et al. (2018)
PwC	"Industry 4.0: Building the digital enterprise"	Geissbauer et al. (2016)
Deloitte	"How leaders are navigating the Fourth Industrial Revolution—Our latest survey of Industry 4.0 readiness"	Renjen (2019)

4.6. Business Media

Business media are heavily involved in the diffusion of new management concepts and ideas (Barros and Rüling 2019). In the case of I4.0, Hirsch-Kreinsen et al. (2016, p. 6) have pointed out that there has been an "unrelenting increase in press articles in big dailies and newsmagazines down to local papers". For example, the business magazine Forbes has published numerous pieces on the

topic (e.g., Marr 2018a, Marr 2018b). A simple search on Amazon.com also reveals a large number of practitioner-oriented management books about the topic of I4.0 (e.g., Gilchrist 2016).

4.7. Social Media

Social media platforms such as Twitter, LinkedIn and YouTube play an increasingly important role in terms of shaping the debate and discussion of new management concepts and ideas (Barros and Rüling 2019; Madsen and Slåtten 2015a). In the case of I4.0, it has been noted that there is much talk in digital and online media about I4.0 (Fuchs 2018). Fox (2018, p. 9) notes that social media have "brought debate about new technologies more into the public domain". Therefore, it is possible that the intensive social media discourse about this technology-infused management concept may have contributed to the mainstreaming and broadening of the concept (cf. Section 3) by lifting the concept out of the specialized and narrow business sphere to just about any area in society.

5. The Demand Side of I4.0

This section examines the demand side of the marketplace for the I4.0 concept. The demand side comprises potential consumers of the concepts such as managers of firms and organizations. The section covers three areas: (1) the interest in the I4.0 concept measured by Google searches, (2) the adoption and implementation of the concept, and (3) the possible effects of adopting and implementing the concept.

5.1. Interest

It is challenging to gauge the demand side's interest in management concepts and ideas. However, one analytical which can be used for this purpose is Google Trends. Google Trends can be used to shed light on consumer behavior in clothing and textiles fashion markets (Silva et al. 2019) and, in past research, it can has also been noted that it could be used to discover something about fashionable management concepts and ideas (Madsen 2016b; see also Strang and Wittrock 2019).

The Google Trends curve for "Industry 4.0" reveals that even though the concept was introduced in 2011, there was little searching interest until 2013–2014. In 2015–2017, there was a surge in search interest, which has continued to increase into 2019 (Figure 2). While it is of course difficult to speculate on the future trajectory of the Google Trends curve, it is likely that the search interest may wane as the concept peaks and becomes more well known among organizations on the demand side (i.e., less need for managers to "Google" a familiar term).
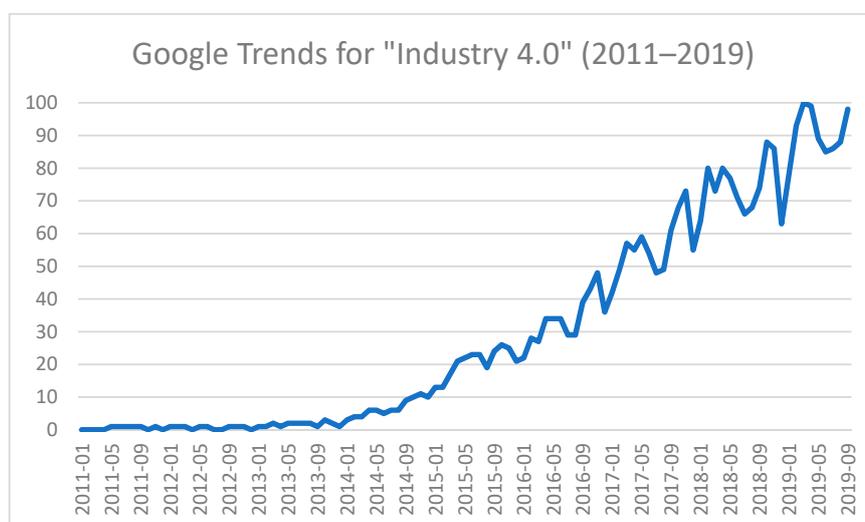

Figure 2. Google Trends for "Industry 4.0" (2011–2019) (Data Source: https://trends.google.com; Retrieved 9 September 2019 and displayed using Microsoft Excel).

5.2. Adoption and Implementation

There is relatively little evidence on I4.0 adoption rates in different parts of the world. There are, however, some studies that have examined related processes, such as whether organizations in different countries are "ready" for I4.0, and the various drivers and barriers related to adoption and implementation.

With respect to readiness for I4.0, some studies have examined this in the context of EU countries (Branco 2019; Castelo-Branco et al. 2019; Grenčíková et al. 2019; Sony and Naik 2019). In general, the findings of for instance Lobova et al. (2019) indicate that more developed countries have come a longer way in terms of I4.0 implementation. Horváth and Szabó (2019) find that there are differences between large multinationals (MNCs) and small- and medium-sized enterprises (SMEs) when it comes to the readiness for I4.0 implementation, and that larger firms are more ready than their smaller counterparts.

A recent study by Frank et al. (2019) about I4.0-related technologies shows that organizations differ greatly in terms of what types and the number of technologies they adopt and how advanced their level of implementation is. When it comes to drivers and barriers affecting implementation, this question has received some attention in recent contributions about I4.0 in SMEs (Stentoft et al. 2001; Türkeş et al. 2019; Vrchota et al. 2019). Related to this, researchers recognize that there is range of managerial and organizational challenges (Agostini and Filippini 2019) and inertia forces (Kovacs 2019) which can make it difficult to succeed with the adoption and implementation of I4.0. Sony and Naik (2019) argue that most organizations lack a detailed understanding of the I4.0 concept, which perhaps is not surprising in light of the review in Section 3 of this paper which showed that there is a large number of definitions of the concept in the literature (Moeuf et al. 2018). Moreover, there are still attitudinal and decision-making issues which makes some managers less inclined to adopt I4.0, and which may hinder the diffusion of the concept in organizational practice (Hamada 2019). To help organizations deal with all these organizational challenges, researchers have started proposing structure steps for the implementation of the I4.0 concept in practice (Cordeiro et al. 2019).

5.3. Effects

Another question concerns the effects and merits of I4.0 implementation. As shown earlier in this paper, the public discourse around I4.0 has thus far been predominantly upbeat and optimistic, and there appears to be great expectations with respect to the performance enhancing aspects of as a result of adoption and implementation of the I4.0 concept. While some studies suggest that I4.0 could, for example, have positive effects on certain industrial performance metrics (Dalenogare et al. 2018) or the performance of SMEs (Haseeb et al. 2019), so far there is relatively little systematic research on the actual effects and merits of I4.0 and what actual impact the concept has had on organizations and industries in different parts of the world (Liao et al. 2018).

6. Discussion

6.1. Emergence

In Section 2, it was noted that the origins and roots of the I4.0 concepts are relatively easy to identify and pinpoint, especially in comparison with other older management concepts and ideas such as Lean Production (Holweg 2007) or SWOT analysis (Madsen 2016a). These genealogies of Lean and SWOT are far more complex and ambiguous, with historical roots that go back decades. In contrast, there is an easily identifiable epicenter and birthplace in the case of I4.0, namely the Hannover Fair in 2011. Thus, I4.0 can be considered a concept with a clear country-specific origin, and an illustrative example of a management concept which has emerged in Continental Europe but has quickly has spread to other parts of the world. In recent history, there have not been many management fashions which have emerged in Continental Europe; instead, fashions tend to originate in the US (e.g., Balanced

Scorecard, Benchmarking, Business Process Reengineering) or be inspired by Japanese management ideas and practices (e.g., Lean Production, Kaizen) (Strang and Kim 2004; Wittrock 2015).

Another defining characteristic of the emergence of Industry 4.0 is the important role played by governments. The rapid diffusion of I4.0 has been fueled and facilitated by the massive subsidies for I4.0-related initiatives and research in some countries (Kopp et al. 2016; Xu et al. 2018). Several countries have devised national strategies related to I4.0 (Hamada 2019). The heavy involvement of governmental actors distinguishes I4.0 from other many other management fashions which have not had the same level of support from governmental actors.

6.2. Evolution

With respect to the evolutionary trajectory of I4.0, the evidence reviewed in this paper shows that the concept has enjoyed a meteoric rise in popularity. The concept has quickly moved to the forefront of public management discourse. According to the definition provided by Jung and Kieser (2012, p. 329), management fashions are those "management concepts that relatively speedily gain large shares in the public management discourse". I4.0 clearly fits this definition since the concept quickly has taken large shares of the public discourse around management in print media, social media, and on the conference scene. As the concept has become more fashionable and amassed a large following, new supply-side actors (e.g., technology providers and consultants) have jumped on the bandwagon to get a piece of this lucrative and growing market. This resembles a dynamic which can be observed in management fashion markets when management concepts reach critical mass and become fashionable (Benders et al. 1998; Klincewicz 2006).

While the evidence reviewed in this paper rather strongly suggests that the I4.0 concept has had a large impact at the discursive level, it is far less clear what impact the concept has actually had on the demand side. Studies indicate that many organizations and managers still find the concept vague and confusing (Mertens and Wiener 2018; Sony and Naik 2019), and some may still be too conservative and risk-averse to fully embrace this new concept and implement it wholeheartedly (Hamada 2019).

At the conceptual level, there are also a number of interesting developments which are worthy of further discussion. As noted earlier, a multitude of neologisms and variations of the original I4.0 concepts have emerged (Innovation 4.0, Construction 4.0, Service 4.0 etc.) (Reischauer 2018). The concept has expanded beyond industrial production and manufacturing to become a go-to solution to a wide range of issues in business and society (Fox 2018; Pfeiffer 2017). The multitude of definitions of the concept could also pose a future risk for the concept, since it is possible that the concept could turn into an empty buzzword (Scharl and Praktiknjo 2019).

There are also some indications that new versions of I4.0 could emerge. As mentioned, the labelling of I4.0 resembles software versioning (Lasi et al. 2014), and already some actors are trying to launch new versions of I4.0, making the case for going from Industry 4.0 to 5.0 (Demir and Cicibas 2017; Sachsenmeier 2016). As the I4.0 concept grows older, there could be attempts to re-launch the concept to stay relevant and be perceived as new. Finally, another evolutionary trend is that the I4.0 concept is increasingly linked to other management concepts such as Lean Manufacturing and Sustainability (Bonilla et al. 2018; Varela et al. 2019).

6.3. Is I4.0 Old Wine in New Bottles?

Some commentators have also criticized the originality of the I4.0 concept. Some see the concept as essentially a repackaging of ideas that have existed and circulated in the management community for quite some time, or what management fashion researchers refer to as "old wine in new bottles" (Spell 2001; Örtenblad 2007). For example, Oztemel and Gursev (2018, p. 1) note that "the idea is not new and was on the agenda of academic research in many years with different perceptions". In a similar vein, Fox (2018, p. 4) argues that suppliers of I4.0 have repackaged an old paradigm in a clever way: "slogans such as Industry 4.0 involve assertions that industrialization is now a new paradigm: rather than a paradigm than is actually more than 250 years old".

7. Conclusions

7.1. Contributions

The overall aim of the current paper has been to examine the emergence and rise of I4.0 through the lens of management fashion theory. While this paper is certainly not the first to make the observation that there has been and still is much hype surrounding Industry 4.0 (Mertens and Wiener 2018; Pfeiffer 2017) and that the concept displays some of the hallmarks and characteristics of management fads and fashions (Hirsch-Kreinsen et al. 2016; Hofmann and Rüsch 2017; Kopp et al. 2016), it is, to the best of the author's knowledge, the first detailed examination drawing on the management fashion perspective.

A further goal of this paper has been to provide an outside-in perspective on the current status and popularity of the I4.0 concept. In doing this, this paper could stimulate debate concerning how and why this concept in such a short period of time has attained such a dominant position in public management discourse and attained an almost meme-like status in such a short period of time, with the numbers 4.0 frequently invoked in discourse and discussions about the future of business, innovation and society (Fox 2018; Pfeiffer 2017).

While the practical implications of examining the historical emergence and rise of I4.0 may not be obvious at first sight, the findings of the studies reviewed in this paper suggest several areas in need of more research and development. In particular, the complex and elusive nature of the concept and the multitude of definitions has the effect of leading to a level of conceptual confusion among potential users, which could hinder the successful adoption and implementation of the concept in organizational practice. If these issues are not resolved, there could be many unsuccessful implementation attempts which fail to deliver the expected results. Over time, negative experiences could "wear out" the concept and lead to a downturn in popularity and use (Benders and Van Veen 2001). From the standpoint of the suppliers of I4.0, it would be in their self-interest to ensure that the concept becomes sustainable in the long run. In order to increase the success rate of the concept in practice, it is important that these supply-side actors continue to provide education and training, as well as help establish users group and networks that can foster organizational learning about I4.0 success and failure factors. Over time, this could help turn the I4.0 concept from a fashion into an institution (Perkmann and Spicer 2008).

7.2. Limitations

Due to its explorative nature, this paper has several limitations. The first limitation is related to the overall research approach employed in this paper, as this paper is largely based on desk research and utilizes a wide spectrum of different secondary sources. The heavy reliance on secondary sources can be problematic since the researchers becomes dependent on the methodological choices made by other researchers (Nijholt and Benders 2007). A second limitation is related to the complexity of studying the rapidly emerging and evolving field around the I4.0 concept, with a large number of different actors actively involved in the market. The use of a snowballing procedure to search for literature on the topic was also challenging due to the rapidly evolving nature of the I4.0 field and the very high volume of new articles on I4.0. Therefore, it should be cautioned that this paper gives a partial, and certainly not a complete picture of the emergence and rise of the concept.

A third limitation is related to the choice of management fashion as a theoretical lens. For example, it can be argued that management fashion theory is an overly socialized conception of managerial behavior (cf. Wrong 1961) which can lead to biased interpretations. Related to this, some readers might react to the use of the fashion lens since the term fashion is often used as a pejorative by those researching fashionable management concepts and ideas (Clark 2004b) and implies a certain level of managerial irrationality. The choice of this theoretical perspective as a prism in this paper was made due to the assessment that it is well suited to analyses of the macro-level emergence and evolution of management concepts (Madsen and Slåtten 2015b; Perkmann and Spicer 2008). Therefore, the choice of management fashion as a theoretical perspective should not be taken as a value judgement on the utility and merits of the I4.0 concept.

7.3. Future Research

The limitations identified above provide several fruitful areas for future research both in terms of choice of theoretical perspective(s) and research methods. With respect to the choice of theories, researchers could employ other theoretical perspectives (e.g., cultural, rational, political) (Sturdy 2004) to shed light on different aspects of the processes related to the adoption, diffusion and implementation of I4.0.

With respect to the choice of research methods, there is a wide range of methods that can be used to study management concepts and ideas such as I4.0 (Strang and Wittrock 2019). For example, in future studies, researchers could collect primary data using methods such as surveys and/or interviews to map the diffusion of the concept in different sectors or countries. Moreover, interviews with key actors involved in the field around I4.0 could be useful for understanding the evolution of the concept and its impact on demand-side organizations (cf. Braam et al. 2007, p. 876). Researchers could also focus on the supply side of the concept by performing bibliometric analyses of publications or by conducting other in-depth analyses of print and/or social media discourse (Benders et al. 2007; Madsen and Slåtten 2015a). As discussed earlier, the discourse around I4.0 is currently very optimistic and upbeat; therefore, a shift towards a more negative focus could spell trouble for the concept.

Lastly, since the field of I4.0 is still relatively new and is currently rapidly expanding and evolving, it is necessary to carry out follow-up studies to examine how the diffusion process unfolds over time. Will the I4.0 concept continue to increase in popularity and will the promises made come into fruition or fall short of expectations? Will I4.0 become an "enduring management fashion" that will have a long-lasting impact across time and space (cf. Grant 2011; Perkmann and Spicer 2008)? These are ultimately empirical questions that will have to be answered in future research.

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