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Structuring the Technology Entrepreneurship publication landscape: Making sense out of chaos

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ABSTRACT

Technology Entrepreneurship (TE) is a popular and interdisciplinary research field, which is currently published in many different journals. TE articles, once the proviso of management of technology and general entrepreneurship journals, can now be found in journals ranging from those focused on organizational behavior to those specializing in finance. Today's TE researchers embrace the field with vastly disparate disciplines and theoretical backgrounds. This adds to the complexity of the TE publication landscape and makes it difficult for readers and authors to navigate in and to contribute to TE.

Todays' journal rankings fall short in their ability to guide readers and authors searching for current thoughts and journals for specific TE research. This article structures the publication landscape in TE research. We provide a ranking of journals that focus specifically on TE. Our ranking is based on keyword searches that identify TE articles published until the end of 2011. We compile bibliometric indicators on both the impact of a specific journal and the impact of specific TE articles. We use primary indictors and combined indicators. Our analysis takes a reader-specific and an author-specific perspective. We identify a ranked list of TE journals.

1. Introduction

Technology Entrepreneurship (TE) TE has become a hotly debated topic between many researchers from diverse theoretical backgrounds. Many researchers harbor contrary near-held beliefs of the importance of entrepreneurial and small firms to our society. Neo-Marshallians, despite the mountain of data to the contrary, tend to negate the value of small and entrepreneurial firms to regional and national based job and wealth creation (Kirchhoff et al., 2013). However, a larger group of scholars has shown that entrepreneurial effort is a cornerstone of regional and national economies throughout the world (Birch, 1987; Phillips & Kirchhoff, 1989; Storey, 1994). The debate over the importance of TE does not stop there. The success that entrepreneurial firms have shown in embodying disruptive technologies into products (Abernathy & Clark, 1985; Abernathy & Utterback, 1978; Christensen, 1997; Walsh & Kirchhoff, 2002; Walsh & Groen, 2013) is hotly debated. Some TE authors argue that small firms that lack the capital, technology, history and the resources of their larger cousins (Christensen, 1997; Kirchhoff, 1994) can be as effective as large firms. Yet, other TE researchers have shown entrepreneurial firms often to be the underpinnings of Schumpeterian change or cycles (Linstone, 2011; Mangematin & Walsh, 2012; Schumpeter, 1912) based on disruptive technologies.

Now, due to TEs' popularity in the academic and public press, TE is under more scrutiny. More TE researchers than ever before are focusing on specific financial, ethical, organizational and other important issues. For example, the debacle that was Enron (McLean & Elkind, 2004) heightened awareness of TE researchers on subfields like sustainability and social entrepreneurship.

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We start with a definition of technology entrepreneurship (TE). We state that TE can be defined as recognizing, creating and exploiting opportunities, and assembling resources around a technological solution (Spiegel & Marxt, 2011; Bailetti, 2012), irrespective of the organizational context (Shane & Venkataraman, 2000). We further recognize that TE researchers have shown that technology entrepreneurs derive competitive advantage either by a combination or singularly utilizing three basis approaches. The three distinct competitive advantage pathways are the recognition of technological possibilities (Schumpeter, 1912), the ability to use technology to decrease transaction costs (Williamson & Kaiser, 2005), and the ability to use new technology product paradigm to provide a solution to a market gap (Kirzner, 1973).

The term "entrepreneur" conjures up positive social connotations. This is exemplified by the *International Encyclopedia of the Social Sciences* describing the entrepreneur as a "leading economic figure, even cultural hero, deriving from both the evident nature of the market system and the projected self-image of middle-class business leaders" (Darity, 2008, p. 604). Despite or perhaps because of the ambiguity, glorification and popularity of entrepreneurship, interested in and scope of the larger field has exploded. To demonstrate the increased research interest in the field we found that a Scopus query revealed 4555 entrepreneurship articles with "entrepr*" in their title or key words between 1992 and 2002. In the decade that follows, there were 16,317 articles, that is more than three times the amount of the previous decade. A source title analysis of this query reveals about 160 journals that publish entrepreneurship research.

Today traditional knowledge on TE is being extended by lines of inquiry that tap into the interface with neighboring fields such as innovation management (for example, the concept of customer development (Blank, 2013)), or expand into henceforth unrelated domains such as technology entrepreneurship for senior social entrepreneurship (Leadbetter, 1998). Researchers that are working on these and other emerging lines of inquiry in TE find outlets for their work not only in technology or general entrepreneurship journals, but in general management journals as well. We find that due to the silo approach of many current academic research communities, crosspollination, once the hallmark of TE research, is waning. In fact, many of these "new" concepts have deep roots in academic literature that is rarely acknowledged.

Are TE researchers, with their diverse academic backgrounds, benefiting from, disregarding, or unaware of prior knowledge generated in the field? Do the journals that publish TE research have mission fit (Linton et al., 2009)? Where are the leading journals in TE? The debate of TE importance, as harbinger of Schumpeterian cycles and its own popularity has increased researcher interest and ambiguity over where exceptional research in the field can be found. We provide this analysis of journals publishing TE research through a bibliometric effort.

We provide a novel method of ranking TE journals. We start by defining the locus of publication of TE by searching relevant pairs of keywords. We analyze articles and journals by addressing bibliometric indicators. We subsequently rank the journals using composite indicators that weigh the quantity and the quality of TE articles. We provide a ranked list of the top twenty journals that best serve the TE research community. We map the journal landscape and in doing so reflect a fractured field with the top 20 TE journals derived from Management of Technology and General Entrepreneurship journals. Finally, we find that those journals with exceptional mission fit can be more effective outlets for exceptional TE research. Hence, our contribution enhances the field by providing a clearer picture of exceptional TE journals for both readers and intending authors.

2. Growth and fragmentation of the TE field

From an academic point of view, the works of Schumpeter are the oldest cornerstone of TE research. Schumpeter placed the entrepreneur as the central driver of economic growth, as the actor most able to take advantage and drive technological change (Schumpeter, 1912; Schumpeter, 1942). The primary role that TE plays on developing creative advantage based on emerging technologies (Walsh & Groen, 2013) has deep roots in the works of Schumpeter (Schumpeter, 1912; Schumpeter, 1942), Birch (Birch, 1987), and Kirchhoff (Kirchhoff, 1994). Yet during the 1960s through today (Gartner, 1990; Davidsson, 2005; Grichnik & Harms, 2007), entrepreneurship research has decoupled from this explicitly technological dimension and become generally equated with the pursuit and exploitation of opportunities. The entrepreneurship field has become broader but more segmented. This has allowed journals to become more focused and to have tighter fit to their mission of serving subgroups of entrepreneurship research.

Still the importance of technological entrepreneurship to society is well known (Kirchhoff et al., 2013; Wong et al., 2005) and the cornerstone of the fields importance. Yet the search for relevant forums for entrepreneurship and more specifically TE is not as obvious. Indeed general entrepreneurship researchers only a few decades ago found it important to delineate the relevant forums for the general field of entrepreneurship (MacMillan, 1991). The process of delineating the relevant forums for specific fields such as TE is even more daunting.

As the field TE has become more and more popular, its scope has increased through the inclusion of different topics groups. The TE field was once exclusively tied to high-tech startups (Kirchhoff, 1994). Now the field encompasses successful formation of high and low tech firms (Yanez et al., 2010) as well as entrepreneurial action based on technology in established firms. TE is multidisciplinary in nature, requiring researchers to understand the fields of technology, management of technology and entrepreneurship (Yanez et al., 2010). Indeed both physical and social science researchers' are publishing in this field. A greater number of researchers are embracing TE with an ever more diverse academic background embracing topics such as incubation (Said et al., 2012; Sonne, 2012; Harms et al., 2010), academic spin offs (Freitas et al., 2013; Bathelt et al., 2010), research facility spin offs (Chang, 1992), entrepreneurial product development (Dowling & Helm, 2006), IP protection (Kidwell, 2013), entrepreneurship and emerging technology (Thukral et al., 2008), entrepreneurial competence development (Linstone, 2011), open innovation consortia and entrepreneurship (Allarakhia & Walsh, 2011), high technology opportunities for emerging and established economies (Romig et al., 2007), TE and family business (Kraus et al., 2011) and many more.

The field has also grown and diversified through the assimilation and development of new topics from the lager

entrepreneurship literature. One new concept in entrepreneurial action is the "Customer development" concept (Blank, 2013) that has found favor at the United States based National Science Foundation (NSF) and in entrepreneurship education (Harms, 2015). This work draws on generations of former Management of Technology (MOT) and general management research such as "muddling through" (Lindblom, 1959; Newbert et al., 2006), the "probe and learn process" (Lynn et al., 1996), and "disciplined entrepreneurship" (Sull, 2004). Similarly, the concept of "effectuation" (Sarasvathy, 2001) was developed in general entrepreneurship and is now often applied to the TE field. Its roots are found in entrepreneurial cognition. Yet it was born devoid of input from TE literature. The concept therefore downplays the role that the differing nature of technologies plays, which severely limits the concepts' transference between technology product paradigms (Linton & Walsh, 2003).

TE research can be found in a large and growing number of journals. Yet how should we define each journal's relative importance with respect to TE research? One pathway is journal rankings. Journal rankings are a perennial issue in research evaluation. Tenure processes, faculty promotion, salary increases and school rankings all depend strongly on journal reputation (Woodside, 2009; Marsh & Hunt, 2006). Indeed, entrepreneurship researchers are often guided by journal metrics. These rankings and metrics are often used by readers to select where they should start reading, and by authors on where to publish their research, and generally to estimate the prestige of schools or departments.

The field of entrepreneurship has a history of using the ranking approach. To help make sense out of chaos for those interested in the field of general entrepreneurship, a previous study used an opinion-based survey to identify a list of highly regarded outlets (MacMillan, 1991). This list included general management journals as well as specific entrepreneurship journals. Twelve years later a similar study was performed to update a journal list (Fried, 2003). Also, ranking efforts in Technology and Innovation Management exist (Linton & Thongpapanl, 2004; Thongpapanl, 2012). Yet no action to date has focused on the field of TE.

We fill this gap. Here we provide one way researchers from this highly fragmented field can find the best material on TE. Understanding in which journals TE is centric to their stated mission is critical to advance of knowledge in the field.

3. Method

Given the myriad of different journals that attempt to cover multiple themes of TE both novice and experienced researchers sometimes have difficulties when trying to identify the best journals to read. Traditionally academics have turned to opinion based survey methods to provide this navigation. Shortcomings with traditional approaches are the use of experts (Fried, 2003), temporal relevance (Thongpapanl, 2012), limitation to one dimension, and that their overuse suppresses interdisciplinary research (Rafols et al., 2012). Yet, the most important problem with rankings is their lack of content specificity or fit to a journal to a specific field (Linton et al., 2009). The problem of specificity impacts multidisciplinary subfields such as TE. If the scope of a ranking system is too broad, many smaller, specialty journals that are highly regarded in a specific community are often not included or diminished by larger fields even though sometimes showing comparable impact factors. Many journal ranking systems focus on broadly defined management issues and eschew journals with specific content such as TE. If a field or subfield definition is too narrow, then multidisciplinary journals fall outside the specific domain of certain rankings (Aksens et al., 1999). Further, the ability of rankings to guide researchers is exacerbated when a research field is growing rapidly, as existing rankings may become outdated.

Most rankings start by selecting base journals ex-ante (Aksens et al., 1999). This approach is particularly effective when the field is very narrow and includes only few specialty journals. However, in interdisciplinary fields, articles may be published outside the bounds of a few base journals. To address these issues of scope and ex-ante selection, we provide a different technique, based on a bibliometric analysis, starting with a keyword search (Aksens et al., 1999).

In providing this quantitative method based on objective data, we provide a pathway to identify seminal journals in the field. Often researchers rely on simple citation-based impact factors to provide an insight into journal quality, selecting journal outlets solely on that basis. They fail to take into account whether a journal has a specific emphasis that coincides with the emphasis of their work. The result is often exceptional work that does not fit with the journal's mission with both the journal and the authors spending a lot of effort without gaining desired results.

Our research takes a reader-specific perspective in selecting most relevant journals by analyzing the number of articles published, the number of citations, and composite indicators that incorporate quality and quantity indicators. Our research takes an author-specific perspective by analyzing the journals which maximize the researcher's reputation and the likelihood of having TE articles accepted. We performed our analysis in 2012. We were thus able to incorporate all article-specific data up to and including the calendar year 2011. For impact-factor based indicators, the study point in 2012 means that the 2010 journal impact is the most relevant indicator.

3.1. Defining the population of technology entrepreneurship journals

We identify the primary outlets for TE research by selecting peer-reviewed journals where most papers on this topic are published. As a starting point, we used Scopus. Scopus was chosen for its multidisciplinary nature. It lists currently more than 16,000 peer-reviewed journals in the scientific, technical, medical, and social sciences fields, while covering publications since the 1960s. The search words were "technolog* entrepreneur*", "technolog* small firm*" and "technolog* sme". We looked for these search words in the title, abstract or keywords.

We validated the list of resulting journals that publish TE articles by cross-checking the results against the more conservative Thomson's Institute for Scientific Information (ISI) Web of Knowledge database. Also, we compared the results with lists developed by Fried (2003) for general entrepreneurship journals and the Thongpapanl (2012) effort that listed management of technology journals, and we found significant overlap. Our final analysis is based on the 36 journals that score highest in terms of numbers of papers on TE published.

3.2. Operationalizating the bibliometric indicators used in this analysis

Our analysis is based on objective TE-specific and general journal-level indicators. The TE-specific indicators are based on citation analysis, that is at the core of research evaluation (Moed, 2005). A first TE-specific indicator is the total number of TE articles published in a given journal. Second, we list the total number of citations for a TE article in a given journal. Third, we calculate the average number of citations that a TE article receives in a given journal. Fourth, we calculated the *frequency of publication* of TE articles in a given journal by dividing the total number of TE articles by the number of volumes published till the end of 2011. This gives us an indication of the concentration of TE in a given journal relative to its total amount of published volumes. Frequency of publishing is related to the likelihood of a given journal to publish a certain topic. It also provides an insight on the degree of journal's specialization on TE. This does not say anything about the quality of the researcher or the work submitted but it is rather related to editorial line and the 'fit' between topic and journal. Journals more centered on general management issues are typically less inclined to accepted TE papers while others are centrally committed to publish TE research.

For general journal-specific indicators, we begin with the most widely-known indicator for evaluating journals, the *Journal Impact Factor* (JIF). JIF is calculated as the number of citations that a journal receives in a given year divided by the total number of citable articles of that journal of the previous two years. This ratio indicates the average amount of citations that a paper receives, but with a two year lag. A JIF of 1.0 means that, on average, every journal article is cited once. One of the frequent criticisms of JIF is that for some fields, the two year timeframe is too short to allow valid assessment of publication impact (Leydesdorff, 2008).

Second, *five year JIF* (5IF) ameliorates this shortcoming with a similar metric taking a longer time-frame for calculating the impact factor. The *Journal impact factor without self-citations* (JIFw) is computed by taking the total number of citations that a particular journal has received and subtracting the number of citations that come from articles published that same journal. The JIFw thus measures the impact of a given publication in the research community beyond its journal.

Third, the *Journal Immediacy Index* (JII) is the number of citations divided by the number of citations in a given year, giving an indication of how quickly the citable outputs become cited: like the JIF, a JII of 1.0 means that on average, every citable item is cited on one occasion during its publication year. Fourth, we calculated the number of *average citations*. This indicator is a ratio between number of total citations and the total number of citable items.

Finally, the *h-index* has become important for journals (Hirsch, 2005; Harzing & Wal, 2009). The *journal h-index* is defined as follows: reflects the number h of papers that have at least h citations. The *h-index* has several advantages over the other evaluation measures discussed above (Braun et al., 2006). It corrects for 'one hit wonder' papers as it is not a mean ratio: it combines both quantity (number of publications) as well as quality (citation frequency). Table 1 shows the several sources used to compile the data used in our analysis.

Table 1
TE-specific and general journal quality indicators.

	Indicator	Source
TE-specific indicators	Number of TE articles (total)	Scopus
	Number TE cites (total)	Scopus
	Number of TE cites (average)	Scopus
General journal indicator	Journal impact factor (JIF)	ISI
	5IF	ISI
	JIFw	ISI
	Average cites	Scopus
	h-index	Scopus

4. Results

4.1. Descriptive results

Table 2 serves as repository for the raw data of our TE-specific and general journal data. Table 2 is ordered along the lines of "number of TE articles published", in descending order. Already at first glimpse, the skewed distribution of two of the TE-specific indicators emerges. In terms of number of TE articles, the top ten journals publish more than two thirds of the articles. A similar pattern emerges for the number of citations of TE articles. For this indicator, the five top journals contain more than half of all citations. Specific journal level indicators are presented in Table 2. The distributions of JIF, JII, 5IF and the JIFw are also skewed. These indicators are not correlated to the number of TE articles.

We define the locus of publication of TE using two different, but related, approaches. First, we take the readers' perspective. Given the myriad different journals that attempt to cover multiple themes and to reach out across a wide range of disciplines, both novice and experienced researchers sometimes experience difficulties when trying to identify the best journals to read. Second, authors want to know where to submit their research to. Citation-based impact factors provide an insight into journal quality, but do not take into account whether a journal has a specific thematic emphasis, running the risk of misleading potential authors about the reception that their work will receive in the journal.

4.2. The readers' perspective

If one considers the academic endeavor as an ongoing scientific discussion (Huff, 1999), then specific research subfields take place in specific conversations in articles appearing in particular journals. Extending this metaphor, one must read the fitting journals to identify the voices that contribute to a particular conversation.

We first looked at *quantity indicators*, that is those journals which publish a larger number of articles on TE (Table 2). Results show that most TE work is published in five journals, namely TEC, RP, SBE, JBV and IJTM. In fact, for any reader new to the topic, these five journals account for more than half of the published academic papers ever written on TE.

Second, we looked at *quality indicators*, such as the total amount and the average citation per TE article. We found that four of these high-*quantity* journals (in terms of publishing larger numbers of TE papers) are also among the top five in terms of *quality* in terms of receiving a high total number of

Table 2
TE-specific and general journal data.

Journal	# articles TE	# cites TE	Average Cites TE	JIF 2010	5IF 2010	JIFw 2010	JII 2010	Average Cites 2010	h-index 2010	Volumes published
Technovation (TEC)	141	1492	10.58	2.993	2.783	1.608	0.579	7.19	36	30
Research Policy (RP)	114	4326	37.95	2.508	4.242	2.177	0.286	22.34	93	39
Small Business Economics (SBE)	93	1390	14.95	1.555	2.057	1.291	0.250	8.69	38	34
Journal of Business Venturing (JBV)	91	3614	39.71	2.149	3.914	1.959	0.780	24.60	65	25
International Journal of Technology Management (IJTM)	72	279	3.88	0.519	0.763	0.503	0.067	3.23	23	49
Entrepreneurship and Regional Development (ERD)	34	531	15.62	1.353	1.770	0.980	0.207	7.11	19	22
European Planning Studies (EPS)	31	323	10.42	0.645	1.184	0.491	0.089	3.38	21	18
IEEE Transactions on Engineering Management (ITEM)	31	410	13.23	1.344	2.172	1.183	0.062	9.17	45	57
Technology Analysis and Strategic Management (TASM)	28	197	7.04	1.040	1.437	0.848	0.115	5.46	23	22
Technological Forecasting and Social Change (TFSC)	27	123	4.56	2.034	2.212	1.566	0.540	4.99	40	77
Industrial and Corporate Change (ICC)	25	613	24.52	1.235	2.330	1.025	0.841	9.82	30	19
Journal of High Technology Management Research (JHTMR)	24	159	6.63	–	–	–	–	–	–	21
Journal of Small Business Management (JSBM)	22	365	16.59	1.189	1.703	1.019	0.148	8.19	27	48
R and D Management (RDM)	22	326	14.82	1.580	2.806	1.464	0.162	5.49	38	40
Industry and Innovation (II)	21	221	10.52	1.831	–	0.898	0.077	1.81	6	17
Management Science (MS)	21	945	45.00	2.221	3.966	1.990	0.221	32.43	171	56
Journal of Product Innovation Management (JPIM)	20	788	39.40	2.079	3.626	1.816	0.209	14.35	65	27
World Development (WD)	20	135	6.75	1.612	2.526	1.498	0.143	11.93	72	38
International Small Business Journal (ISBJ)	17	133	7.82	0.927	1.748	0.655	0.483	2.90	15	28
Strategic Management Journal (SMJ)	16	1461	91.31	3.583	6.818	3.165	0.500	66.71	165	31
International Journal of Industrial Organization (IJIO)	14	298	21.29	0.731	1.247	0.675	0.157	9.30	42	28
Entrepreneurship Theory and Practice (ETP)	12	105	8.75	2.272	3.839	1.772	0.647	9.00	29	34
Organization Science (OS)	12	217	18.08	3.800	5.838	3.287	0.394	51.34	104	21
Academy of Management Journal (AMJ)	8	859	107.38	5.250	10.779	4.821	0.603	49.28	168	53
Journal of Management Studies (JMS)	8	155	19.38	3.817	4.684	2.771	1.333	12.83	71	47
Regional Studies (RS)	5	5	1.00	1.259	2.212	1.182	0.140	5.46	58	12
Academy of Management Executive (AME), Academy of Management Perspectives (AMP)	3	20	6.67	2.470	2.500	2.197	0.600	2.88	14	24
Harvard Business Review (HBR)	3	36	12.00	1.873	2.666	1.873	0.235	6.27	97	88
Venture Capital (VC)	3	3	1.00	–	–	–	–	–	–	44
Administrative Science Quarterly (ASQ)	2	147	73.50	3.684	7.539	3.447	0.083	40.36	186	55
Academy of Management Review (AMR)	1	35	35.00	6.720	11.657	6.493	0.926	59.70	172	35
California Management Review (CMR)	1	12	12.00	1.706	2.524	1.608	0.207	13.02	76	52
Journal of Small Business Finance (JSBF)	0	0	–	–	–	–	–	–	–	–
Journal of Private Equity (JPE)	0	0	–	–	–	–	–	–	–	13
Journal of Management (JM)	0	0	–	3.747	6.206	3.389	1.018	38.77	97	36
Sloan Management Review (SMR)	0	0	–	1.452	2.317	1.411	0.125	11.91	78	51

citations of TE articles (RP, JBV, TEC and SBE). SME is new in this list as it appears to be a high-quality/low-quantity TE outlet. Looking at the average number of citations of TE articles per journal, the top five journals are SMJ, MS, JBV, JPIM and RP (Table 2). This result shows that apart from RP and JBV, journals that have a larger number of average citations per TE articles also publish far fewer TE articles. On the one hand, this implies a high degree of visibility of TE articles published on those journals. On the other hand, these journals do not publish large volumes of TE research, so they might find themselves at the fringe of the TE research community.

4.3. The authors' perspective

Researchers have to meet the dual challenge of publishing in journals which host the most relevant scientific discussions pertinent to TE, while at the same time making sure that the outlet has a high overall impact factor. For example, specialty journals may be very relevant to a particular discussion, but may not have a high overall impact. This difficulty in deciding for suitable outlets is particularly challenging for researchers in subfields of a discipline or a disciplines at the intersection of various fields. Composite indicators that account for quality and quantity can inform this discussion.

Indicators for overall impact are the Journal Impact Factor and its variants, that play an important role for determining researcher reputation, along with career promotions and tenure processes (Woodside, 2009; Marsh & Hunt, 2006). However, the impact factor does not illustrate the recognition of work in a particular field and can hence not be used in isolation. A companion to the JIF can be the total number of TE articles published in a journal. This indicates an editorial tradition of publishing TE articles, and signifies that TE articles have a chance to become accepted. Researchers that seek a balance between a high overall impact and the "right" audience and can do this by simultaneously considering two factors.

We used these indicators to balance the number of articles in a given journal against a number of scientific impact measures. This set of indicators translates into a balanced measure for the quality and quantity of published articles. The results are shown in Table 3. Table 4 indicates the rankings for every indicator. The top five are indicated in bold, the top 10 are indicated in italics. Again, we only report journals with more than 10 published articles on TE.

The results show that TEC, RP, JBV and SBE are in the top five of almost every ranking on composite indicators. This is a result of both their high number of TE articles and their above-average impact factors. Renowned management journals such

Table 3
Summary of composite indicators.

#TE articles × JIF: indicates the impact of each journal on TE community.
#TE articles × 5IF: indicates the long term impact of each journal on TE community.
#TE articles × JIFw: indicates the impact of each journal in the TE research community outside the own journal.
#TE articles × JII: indicates the immediate impact of each journal on TE community.
#TE articles × h-index
#TE articles × average cites (journal)
#TE articles / total number of volumes of each journal: indicates relative frequency of TE articles in a journal (called: relative frequency of publication)

as SMJ or OS also appear frequently in the top five. Other top Management of Technology journals such as ITEM, TFSC or JPIM also chart frequently in the top 10. Our results suggest that TEC, RP, SBE, and JBV are suitable journals to look readers in the field of TE. Both the new and experienced authors in this topic will find both the majority of published TE articles in those journals, as well as the most cited articles. For those researchers interested in a broader view on the field should add to their list journals such as ERD, ITEM, SMJ, MS, JPIM, OS and TFSC.

5. Conclusions

TE is growing in breadth and popularity. The multidisciplinary of the field creates a difficulty when trying to delineate the forums where researchers read and publish their work. We provide an up-to-date journal ranking that is specific to TE that takes a reader-specific and an author-specific perspective.

These results highlight that TE researchers should not be guided by rankings that were created for other related disciplines. For example, results from a well-published entrepreneurship ranking (Fried, 2003) lists RP and SBE only on a medium rank, ERD only at a low rank, and other TE journals, such as TEC or JPIM, are not even mentioned. Similarly, TIM rankings (Linton & Thongpapanl, 2004; Thongpapanl, 2012) tend to neglect TE outlets. Hence, suitable journals for TE are not reliably reflected in non-specific rankings. This underscores the importance of constructing field-specific rankings using the approach that we propose.

Our results also suggest to caution against relying on rankings that are somewhat dated. First, older rankings do not take into account the emergence of new journals. For example, in ER, the Strategic Entrepreneurship Journal was founded in 2007, and has become since influential in this research area. Second, older rankings do not take into account changes in journal impact. For example, the JIF of TEC has increased significantly over the past years. Therefore, a timely ranking such as we provide here for TE is more informative for researchers.

We argue that our method of delineating the TE field can also be fruitful for other subfields or interdisciplinary fields. For example, entrepreneurship research is now a very heterogeneous field with TE (Shane & Venkataraman, 2003), but also academic (Shane, 2004) corporate (Dess et al., 2003), ethnic (Zhou, 2004), female (Minniti & Nardone, 2007), institutional (Garud et al., 2007), international (Harms & Schiele, 2012), social (Fink et al., 2012), and strategic (Harms et al., 2012) entrepreneurship fields, to name a few.

Our research demonstrates that compared to other studies on general topics in entrepreneurship developed decades before a new set of journals support TE researchers even better. We show clear differences between our results and previous ER journals rankings, and we are able to confirm our initial insight on TE journals with a diverse set of journals. This

Table 4
Ranking of journals based on composite indicators (22 due to ties). Bold: top 5; italics: top 10.

Journal	# articles	#TEart*if rank	#TEart*avg cites rank	#TEart*5yIF rank	#TEart*IF without self-citations rank	+TEart*ii rank	#TEartart*h rank	Rel. frequency TE art.
Technovation (TEC)	**1**	**1**	**4**	**2**	**2**	**1**	**3**	**1**
Research Policy (RP)	**2**	**2**	**1**	**1**	**1**	**3**	**1**	**3**
Small Business Economics (SBE)	**3**	**4**	**5**	**4**	**4**	**4**	**5**	**4**
Journal of Business Venturing (JBV)	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**
International Journal of Technology Management (IJTM)	**4**	13	13	14	11	11	*7*	*7*
Entrepreneurship and Regional Development (ERD)	**5**	8	11	11	12	10	16	*6*
European Planning Studies (EPS)	*6*	20	20	19	20	19	15	**5**
IEEE Transactions on Engineering Management (ITEM)	*6*	10	*9*	*9*	*9*	21	*9*	16
Technology Analysis and Strategic Management (TASM)	*7*	17	15	17	16	17	17	*9*
Technological Forecasting and Social Change (TFSC)	*8*	*6*	16	12	*6*	*6*	12	23
Industrial and Corporate Change (ICC)	*9*	16	*10*	13	15	**5**	14	*8*
Journal of High Technology Management Research (JHTMR)	*10*	–	–	–	–	–	–	11
Journal of Small Business Management (JSBM)	11	19	14	18	17	16	18	20
R and D Management (RDM)	11	14	18	10	13	15	13	15
Industry and Innovation (II)	12	12	22	–	19	22	22	*10*
Management Science (MS)	12	7	*6*	*6*	*7*	13	**4**	21
Journal of Product Innovation Management (JPIM)	13	11	*8*	*7*	10	14	*10*	12
World Development (WD)	13	15	12	15	14	18	*8*	17
International Small Business Journal (ISBJ)	14	21	21	20	21	*7*	21	13
Strategic Management Journal (SMJ)	15	**5**	**3**	**5**	**5**	8	6	18
International Journal of Industrial Organization (IJIO)	16	22	17	21	22	20	19	19
Entrepreneurship Theory and Practice (ETP)	17	18	19	16	18	*9*	20	22
Organization Science (OS)	17	*9*	*7*	*8*	*8*	12	11	14

was not an unexpected result for entrepreneurship research, a field which has experienced a steep growth and broadening of boundaries in the last decade. Further earlier studies were based on opinion surveys rather than objective data. TE research has tended to be mostly concentrated in journals defined as excellent in specialty areas, such as TEC, JPIM and TFSC (Thongpapanl, 2012; Linton, 2011). A question for further research would be how this objective ranking method impacts general entrepreneurship research journal rankings. Also, we invite researchers to update the results and to provide an intertemporal illustration of how journal rankings develop for a specific discipline. Our biggest contribution is to the TE research community. We provide a novel journal ranking based on keywords and therefore necessarily focused directly upon this specific field of research. This ranking can provide a better understanding for researchers seeking promotion or tenure, as it allows the demonstration of the relevance of their publication portfolio. Further, we believe that our methodology may be readily generalizable to other adjacent subtopics within entrepreneurship research, as data on journal impact, and key words on published articles are available as well.

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