Scientometrics (2012) 91:895–910
DOI 10.1007/s11192-011-0566-8

Global competition and technological transition in electrical, electronic, information and communication engineering: quantitative analysis of periodicals and conference proceedings of the IEEE

Nobuyuki Shirakawa · Takao Furukawa · Minoru Nomura · Kumi Okuwada

Received: 13 September 2011 / Published online: 6 December 2011

Abstract This study analysed the technical and publication activities of the Institute of Electrical and Electronics Engineering (IEEE), the most influential academic publisher in engineering. We first constructed an original comprehensive database of periodicals (journal and magazine) and conference proceedings published by the IEEE between 1980 and 2008, which comprised approximately 0.36 million periodical articles and 1.14 million conference articles. We analysed the transitions in technical innovations from two perspectives: trends within (1) individual countries and (2) specialized fields represented in IEEE societies. The number of published periodical articles increased fourfold between 1980 and 2008, while that of published conference articles increased nearly 20-fold in the same period. In particular, the number of conference articles published by China increased dramatically from 2002, exceeding even the number published by the US in 2008. The IEEE has increasingly shifted away from its US-centred origins to literally becoming the 'electrical and electronics association of the world'. The proportion of articles published by authors in North America, Europe and East Asia has increasingly balanced, thus leading to the formation of a tri-polar structure of IEEE technological activities. This comprehensive analysis of IEEE publications over a period of almost 30 years revealed that with the emergence of more active international competition, 'glocalisation' is occurring among publications and research activities of the IEEE. Consequently, quantitative analysis revealed structural changes in global competition and technological transition characterized by five phases.

Keywords Globalisation · Conference proceedings · Quantitative analysis · Tri-polar structure · Technological transition

N. Shirakawa (✉) · T. Furukawa · M. Nomura · K. Okuwada
National Institute of Science and Technology Policy, 16th Floor, Central Government Building No. 7. East Wing, 3-2-2 Kasumigaseki, Chuyoda-ku, Tokyo 100-0013, Japan
e-mail: shirakawa@nistep.go.jp

Introduction

Historically, scientific and technological research has advanced in tandem with economic development in general. Specifically, electrical and electronics (E&E) industries have obviously driven economic growth as well as technical innovation in the twentieth century. This study identified the global research system for the fields of E&E and information and communication technologies (ICT). To achieve this goal, under the assumption of a definite correlation between research and publication activities, this study analysed technical and publication activities of the Institute of Electrical and Electronics Engineering (IEEE), the world's largest professional engineering association and engineering publisher. Because the IEEE is responsible for a high percentage of publications in E&E and ICT fields and thus has a great quantitative impact, the organization has a great qualitative impact on these fields. For the quantitative and qualitative analysis of this impact, the present study focused on the coverage and impact of IEEE publications in scientific publishing and the structure of its societies, the IEEE sub-communities that pursue interests and address concerns regarding technical activities within specific specialized areas.

The Organization for Economic Co-operation and Development (OECD) reported comprehensive and multifaceted benchmarks to analyse science and technology as well as economic and labour conditions (e.g. OECD 2009). Biotechnology, nanotechnology, environmental sciences, etc. were internationally compared as emerging key technologies (OECD 2009). In terms of international benchmarks of scientific research based on bibliometric analysis, Shelton and Holdridge (2004) demonstrated that the EU surpassed the United States in the late 1990s in the number of scientific articles in science and technology. In addition to confrontation between the United States and the EU, Glänzel et al. (2008) discussed structural changes in science from the triad, including Japan, to the tetrad, including China. They analysed the share of publications obtained from the Science Citation Index Expanded (SCIE) of the Web of Science (WoS) for 1991–2005. They also compared country profiles for twelve disciplines in Brazil, Taiwan, Korea and Turkey as well as the EU, the United States, Japan and China. Leydesdorff and Wagner (2009) analysed temporal trends observed in international benchmarks focusing on nanotechnology, on the basis of the SCIE of the WoS for 1995–2006. They indicated that the share of scientific publications in the United States has decreased in response to the emergence of China. Zhou and Leydesdorff (2006) also discussed, by analysing the SCI of the WoS for 1993–2004, the emergence of China and demonstrated the exponential growth of China in nanotechnology publications.

The status of conference proceedings was not evaluated as much as that of journal papers in past years. Godin (1998) noted reasons for the lower valuable research on conference proceedings as follows.

- Proceeding articles were considered as first drafts to be revised and published in a journal.
- Proceedings were difficult to obtain because of their limited distribution.

Libraries often needed to exert special efforts to archive conference proceedings (Drott 1995); therefore, limited accessibility to conference proceedings might be related to poor evaluation from the perspective of distribution of scientific information. However, the emergence of electronic publishing and electronic archiving on the Web has recently been changing this situation. In addition to reduction in the time required for publication of conventional journals (Ginsperg 1996), accessibility to conference proceedings has

improved (Kling and McKim 1999; Goodrum et al. 2001). These contexts have been changing the evaluation of the importance of conference proceeding publications.

Importance of conference articles

In computer science, a conference article has come to be regarded as a final product equivalent to a journal article (Drott 1995; Goodrum et al. 2001; Meho and Rogers 2008). It has been observed that the proportion of proceedings articles is relatively high in computer science, electronics and other engineering fields. Bar-Ilan (2010) extracted highly cited authors in computer science from the Conference Proceeding Citation Index and the SCI of the WoS in 2008 to compare the authors' journal and conference articles. Results indicated that conference proceedings were a major source of citations in the extracted articles. Wainer et al. (2011a) showed that 40% of references of all articles published by the Association for Computing Machinery (ACM) were conference articles.

Glänzel and Schoepflin (1999) showed that the percentage of periodicals in references of journal articles in electronic engineering account for 62%, which is lower than that in physics, chemistry and life sciences, as obtained from indexed documents in the SCI of the WoS in 1993. Therefore, this finding indicates that the remaining 38% of references are conference articles and books, and indirectly suggests that the percentage of conference articles is relatively high in these engineering fields compared to that in physics, chemistry and life sciences. Moreover, roughly half of the indexed articles in the ISI proceedings' database in 1994–2002 were categorized as engineering (Glänzel et al. 2006), which shows that conference articles in proceedings are treated as an important information source in engineering.

The WoS and Scopus remain insufficient to index articles in computer science and electric engineering compared with those in physics and mathematics (Wainer et al. 2011b) because of the shortage of indexed conference articles. Furthermore, Lisée et al. (2008) indicated that the percentage of proceeding articles in journal article references has been increasing, from the SCI for 1980–2005. These studies suggest that conference articles are necessary for research benchmarks in E&E engineering covered by IEEE publications (Shirakawa et al. 2011), because journal articles do not sufficiently reflect actual research activity in these fields.

Methodology

Data analysis

Using the data collected from the periodicals and conference proceedings published by the IEEE, we analysed transitions in technical innovations from two perspectives:

(1) trends within individual countries, specifically the country represented by the first author listed in each IEEE publication, and
(2) trends within specialized fields.

To perform our analysis, we first constructed an original comprehensive database of periodical articles in journals and magazines and conference articles in proceedings that are published by the IEEE between 1980 and 2008.

Data collection and flow

The official IEEE database, referred to as IEEE Xplore, is indexed using metadata from the Inspec database. Therefore, we first extracted the metadata from Inspec, which comprised approximately 0.36 million periodical articles and 1.14 million conference articles, to assess the coverage of the data by IEEE Xplore at the end of February 2010. The details regarding the database that we constructed are described in Table 1.

Figure 1 illustrates the data flow diagram for IEEE publication analysis to discuss global competition and technological transition. For global competition, we calculate the number of periodical and conference articles by country, the number of countries appearing in periodicals and conference proceedings and the number of conferences by host country. The first author affiliation maps an article to a country so that periodical and conference articles are classified by country. Because of the limitation of Inspec data, we process only the first author. For technological transition, we calculate the number of periodical articles by IEEE society and the number of conference proceedings by specialized field. For conference proceedings, we adopt the IEEE Xplore subject for the classification owing to the treatment of joint conferences and the insufficiency of sponsor attribution of conference proceedings data. Furthermore, we count the number of conference proceedings instead of conference articles, which have insufficient conference title attributes for the classification.

Results

This section describes our findings regarding the number of articles by country and region. Figure 2 presents a summary of IEEE publication activities. In the figure, histograms illustrate the number of periodicals and conference proceedings, and broken lines illustrate the total number of articles. The total number of articles published increased markedly over the 30-year span examined in proportion to the increase in the number of periodicals and conference proceedings. The data demonstrate particularly rapid growth in the number of articles in conference proceedings after 2002. The number of published conference articles increased nearly 20-fold between 1980 and 2008. The annual number of conference proceedings surpassed the number of periodicals from 1994. These trends support the importance of conference proceedings in bibliometric analysis for E&E and ICT.

Table 1 Compendium of sampled data on IEEE publications

Article type	Publication media	Period	Number of articles	Number of publications	Notes
Periodical articles	Journal and magazines	1980–2008	355,891	201	114 Transactions 18 Journals 69 Magazines
Conference articles	Conference proceedings	1980–2008	1,148,164	8,706	Year in which the conference was held Repeated conferences are counted one by one

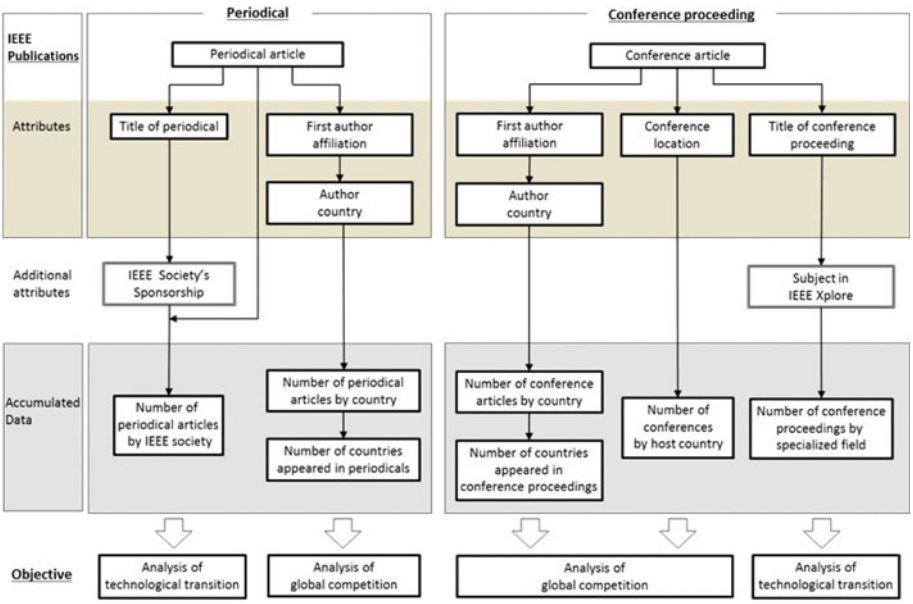

Fig. 1 Data flow diagram for IEEE publication analysis

Global competition

IEEE publications reflect the technical activities currently being conducted in each country or region, as represented by their authors. Figure 3 shows the number of articles published in periodicals by year. Thirty major countries are shown in the order of the number of articles in 2008. In the number of periodical articles, the United States has always been at the top, although the second position and below changed between 1980 and 2008. Japan had maintained the second position till 2005, but China ranked second from 2007. Canada had maintained the third position till 1998, although several countries ranked third from 1999. Most countries, particularly China, have steadily increased their number of periodical articles.

Figure 4 shows the number of conference articles in proceedings published in the year in which the conferences were held. Thirty major countries are shown in the order of the number of conference articles in 2008; Germany and Russia were previously labelled as West Germany and the USSR, respectively. A characteristic common to most countries is the increased number of conference articles. In the number of conference articles, the United States had ranked at the top through 2007 and Japan had ranked second through 2002; however, China exhibited an explosive increase in the number of conference articles, ranking second in 2003 and, in 2008, overtaking the United States for the top position. In 2008, China published the largest number of conference articles in the world, approximately 1.7-fold that of the United States, which then ranked second.

Throughout the early and mid-1980s, the majority of IEEE publications were attributed to authors from the United States, Japan and Canada. From the late 1980s to the 1990s, the IEEE experienced increased internationalisation of its technical activities, with an increase in contributions mainly to articles from Europe, primarily the United Kingdom, Italy, France and Germany, as well as from East Asia, primarily South Korea and Taiwan. In

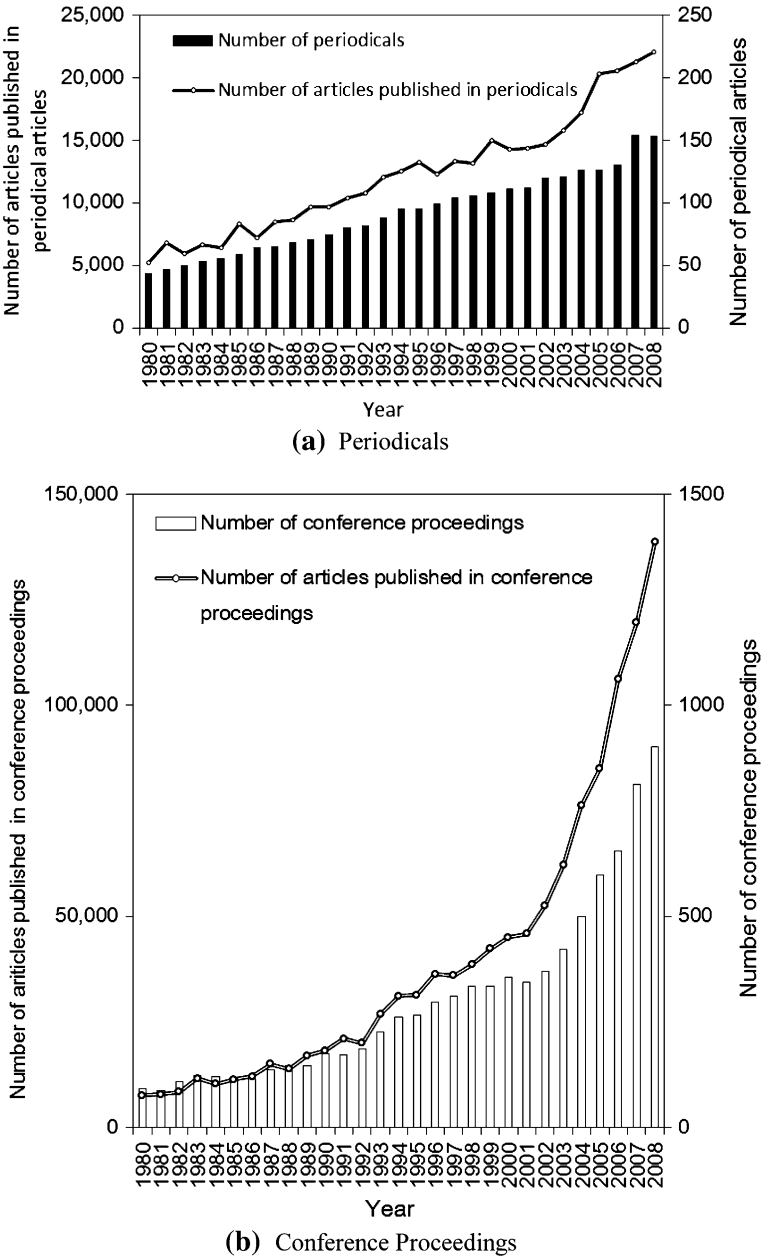

Fig. 2 Number of IEEE publications between 1980 and 2008

2000, the IEEE began experiencing a global structural change because of political developments and increased globalisation. After the retrocession of Hong Kong, China began to increase its technical activities and subsequently sharply accelerated its pace of periodical article publication, which indicates structural changes appearing more strongly

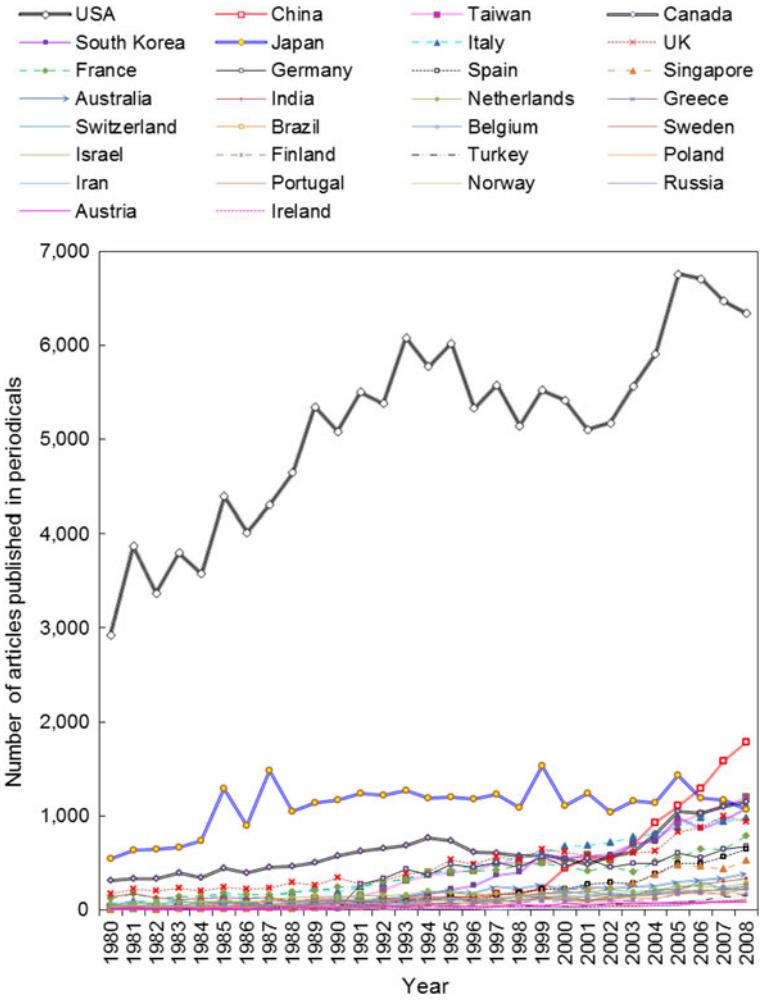

Fig. 3 Number of articles published in periodicals by country between 1980 and 2008

in conference articles. The rapid progress of globalisation has resulted in more emerging countries, including Singapore and Spain, increasing their relative contributions to IEEE periodical articles.

Technological transition

Figure 5 shows the number of periodical articles published by the top 20 IEEE societies, in descending order, between 1980 and 2008. Because a society publishes several periodicals, we aggregated the number of periodical articles by society. In the number of periodical articles by IEEE society, the Nuclear and Plasma Science Society had ranked by average at the top until 1985. The Electron Devices Society increased its number of periodical articles from 1980 and attained the top rank in 1986. The Magnetics Society markedly increased its number of periodical articles from 1986 and then ranked by average at the top from 1987 to

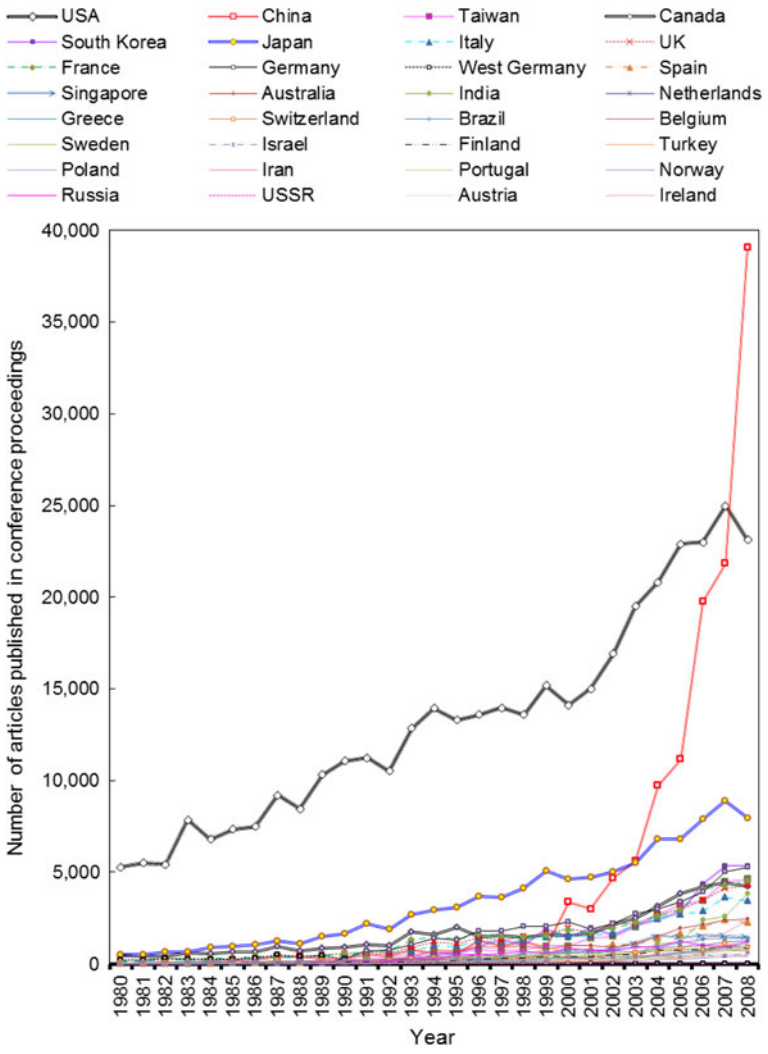

Fig. 4 Number of articles published in conference proceedings by country between 1980 and 2008

1991. The Photonics Society had ranked first in 1992, 1993, 1995 and 1996, and second for 4 years from 1997 to 2000. The Computer Society maintained the top rank from 1996. The Communication Society showed rapid growth from 2002, when its rank increased from the fifth to second place.

As we can observe, the number of periodical articles in IEEE publications clearly reflects trends in technical activities by specialized field, with a shift occurring in the leading society approximately every 5 years. The dominant field in each era can be described as follows:

- *Early 1980s*: nuclear science.
- *Late 1980s*: magnetics and electron devices.
- *Early 1990s*: electronic devices, photonics and computers.

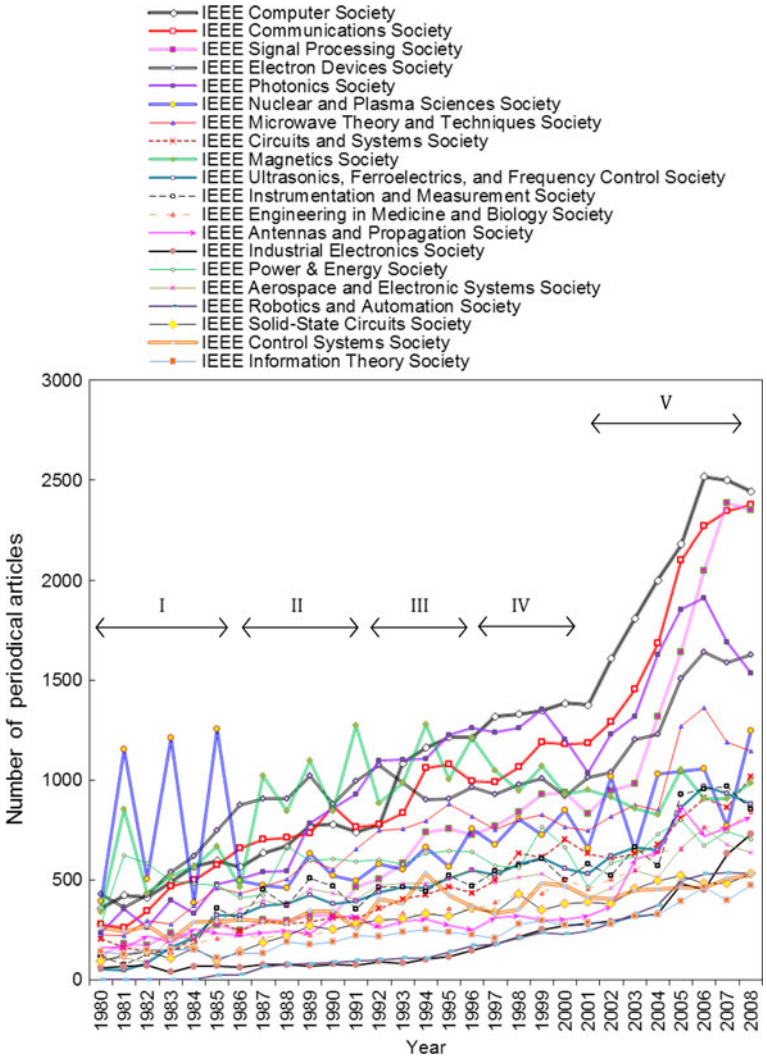

Fig. 5 Number of periodical articles published by IEEE societies between 1980 and 2008

- *Late 1990s*: computers and communications.
- *2000s*: networks, wireless communications, signal processing and computers.

The increasing number of ICT-related periodical articles, accounting for a particularly high proportion of periodical articles, caused dramatic growth in the number of articles published after 2002. The major societies are evolving in tandem by fostering newly established specialized fields that are within, or even beyond, each society's traditional area of specialization.

Figure 6 shows the number of conference proceedings by specialized fields between 1980 and 2008. There are many joint conferences among IEEE societies as well as institutions such as the ACM in the ICT field. Attributes represented by IEEE societies sponsoring conferences were insufficient to classify joint conferences because of the

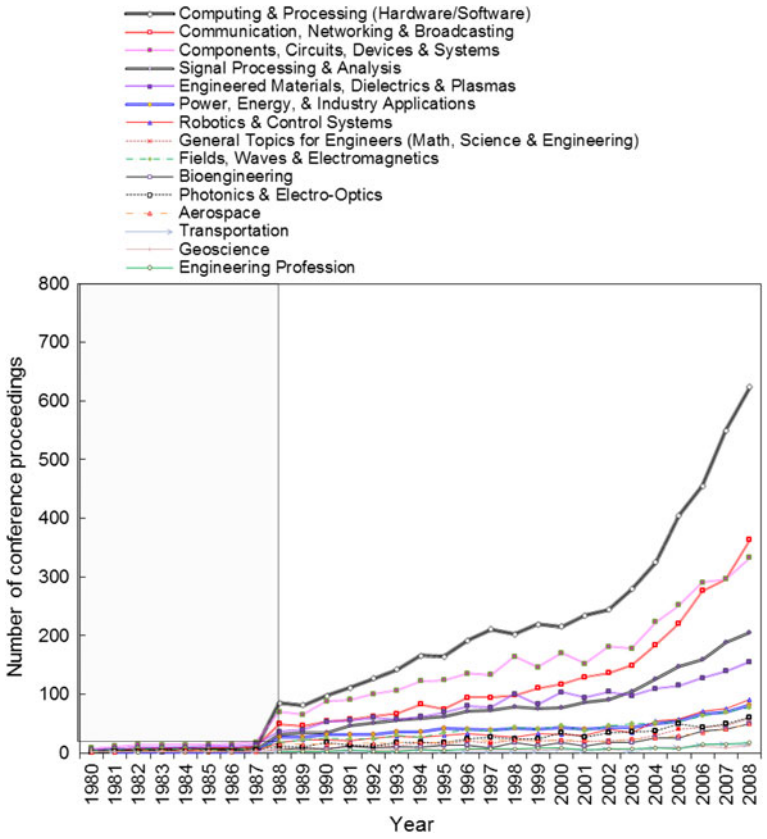

Fig. 6 Number of conference proceedings by specialized field between 1980 and 2008 (before 1988, full coverage was not assured by IEEE Xplore)

inconsistency of indexed conference data. We therefore adopt specialized fields based on IEEE Xplore and classify conference proceedings on the basis of mapping tables describing the relationship between conference titles and specialized fields. Figure 6 shows that the top three specialized fields between 1980 and 2008 were (1) Computing and Processing (Hardware/Software), (2) Communication, Networking and Broadcasting and (3) Components, Circuits, Devices and Systems. In particular, the number of conferences in ICT-related fields had dramatically increased from 2002, which corresponds to the trend of periodical articles. Although the transition of the major players observed in Fig. 4 is not evident in Fig. 5, except for the growth of ICT-related fields, these results reflect the shift in major technologies from E&E to ICT.

Discussion

Globalisation and international competition

To quantitatively evaluate the process of internationalisation, we calculated the Herfindahl–Hirschman Index (HHI) also known as Herfindahl Index (Michelini and Pickford

1985), a commonly accepted measure for analyzing the degree of concentration calculated by the sum of squares for each percentage, and we analysed the changes in the nature of publications in IEEE research activities over the years. In year t, the HHI of periodical articles $H_p(t)$ and that of conference articles $H_c(t)$ are defined as follows:

$$\begin{cases} H_p(t) = \sum_{i=1}^{n_p(t)} p_i^2(t) \\ H_c(t) = \sum_{i=1}^{n_c(t)} c_i^2(t) \end{cases},$$

where $p_i(t)$ and $c_i(t)$ denote the percentage of periodical articles and that of conference articles by country, respectively. $n_p(t)$ and $n_c(t)$ are the number of countries in which the institutions of the first authors of periodical articles and conference articles, respectively, are located. If a country monopolizes the periodical and conference articles, $H_p(t)$ and $H_c(t)$ are equal to 10,000 in percent units. If many countries share the periodical and conference articles, $H_p(t)$ and $H_c(t)$ approach zero.

Figure 7 shows that $H_p(t)$ and $H_c(t)$ have exhibited a declining trend over the past 29 years, during which one nation has monopolized research activities and publications. The downward trend of $H_c(t)$, which is even steeper than $H_p(t)$, implies the advancement of internationalisation because of structural changes. Although the United States continues to maintain an overwhelming presence in the IEEE, the downward trend of the HHI reflects

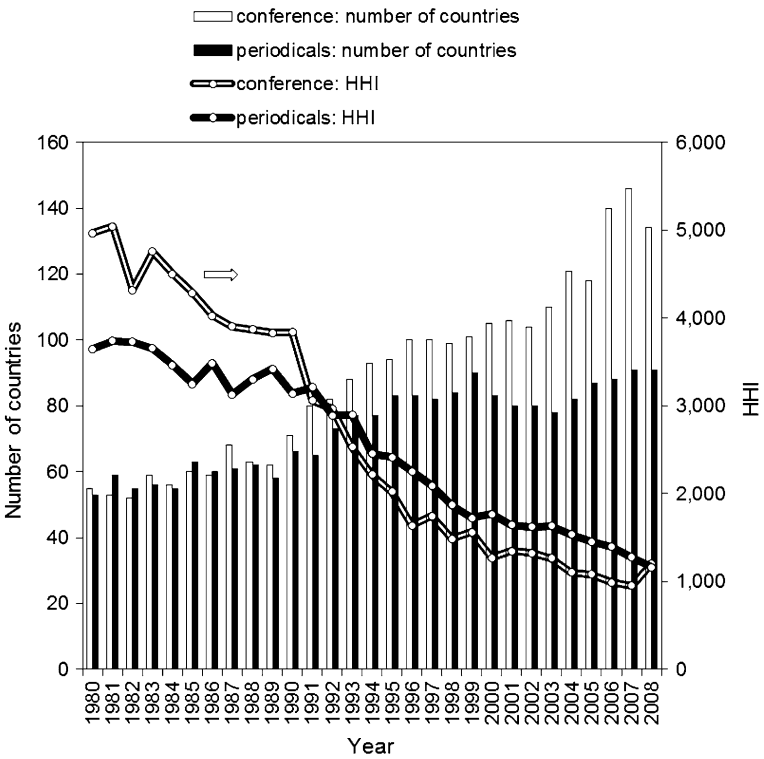

Fig. 7 Number of countries appearing in periodicals and conference proceedings and the HHI trend

the development of an environment characterized by a strong degree of effective international competition. As the IEEE continues to pursue globalisation by promoting active international competition and transitioning from its US-centred origins, it is literally becoming the 'E&E association of the world'.

Emergence of a tri-polar structure

Figure 8 shows the changes in the percentage of periodical articles by region from 1980 to 2008. Since the beginning of the 30-year span, the United States has contributed an overwhelming volume, followed by several European countries, Canada and Japan. Although Japan was virtually the sole representative of East Asia in article publication in the initial years, China, Taiwan and South Korea soon began to increase their contribution dramatically. We consider four countries—Japan, South Korea, Taiwan and China including Hong Kong as a special administrative region in China—as East Asia4. Since Singapore is geographically categorized into South East Asia, we exclude Singapore from East Asia4. The increased contributions of China, Taiwan, South Korea and Singapore soon led it to become the third greatest contributor to E&E and ICT research activities, following North America and Europe (EU27). As these three regions increasingly progress toward a state of nearly equal contribution, a well-balanced tri-polar structure of global contribution is emerging, reflecting the success of the IEEEs pursuit of globalization via the promotion of active international competition. Although the transition from a triad composed of the United States, Europe and Japan to a tetrad including China has been discussed (Glänzel et al. 2008), Fig. 8 suggests the balance of a tri-polar structure composed of North America, Europe and East Asia including Singapore.

Globalisation of conference location

We also analysed the conference proceedings published by the IEEE to examine the cross-border expansion of IEEE publications. Figure 9 shows the number of international conferences by host country between 1980 and 2008. As shown in Fig. 9, the number of international conferences held outside the United States has increased, with the greatest proportion currently being held in China, a nation that has exhibited the most remarkable growth in conference production as well as article publication. One possible factor for the rapid increase post 1999 in the number of articles produced by China is the reversion of Hong Kong. Another possible factor is the increase in the number of international conferences held in China, which reduces obstacles to Chinese scientists' and engineers' participation in international conferences.

The results of the data analysis indicate that IEEE technical activities have become increasingly globalized. Although IEEE publications are globally distributed, they are designed to accommodate local users, especially in China. As indicated by the results of the analysis of the conference proceedings, pursuing a strategy of global distribution and local accommodation, which is referred to as 'glocalisation', appears to be a primary objective of the IEEE.

Structural and technological changes observed from IEEE publications

Table 2 summarizes the transition observed from this study's analysis of IEEE publications. As we mentioned above, the period 1980–2008 can be divided into five phases, as

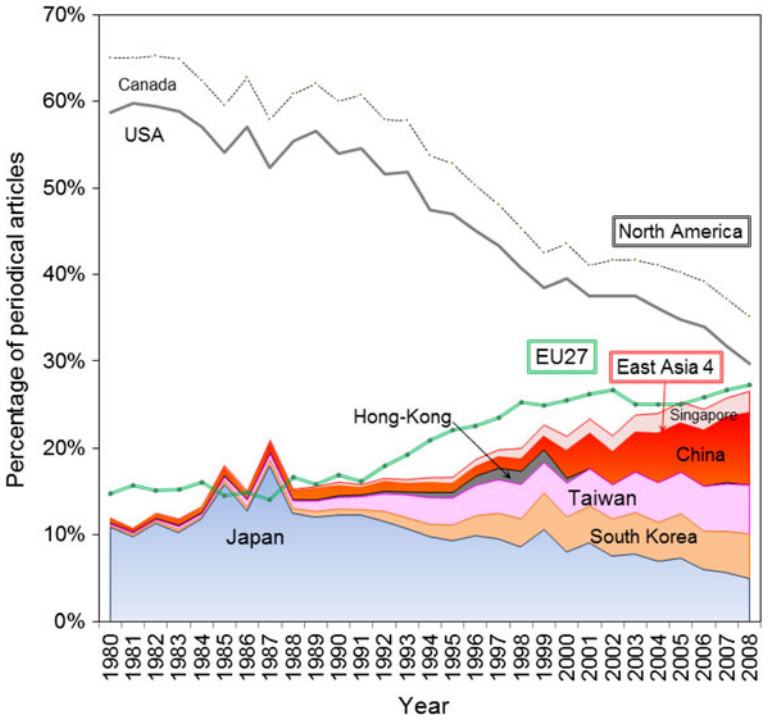

Fig. 8 Percentage of periodical articles by region (China includes Hong Kong after reversion)

shown in Table 2. These phases are characterized by monopoly, duopoly, internationalisation, globalisation and glocalisation. In phase I (monopoly), the United States was the centre of IEEE activities, and nuclear science was the major technology, reflecting the era of the cold war. In phase II (duopoly), Japan's emergence created polarization between the United States and Japan, with the expansion of magnetic and electron devices. In phase III (internationalisation), European countries led by Italy and Germany increased IEEE publications, while major technologies shifted to photonics, computers science and communications. In phase IV (globalisation), we observe the growth of East Asian countries such as South Korea and Taiwan, with accelerating ICT activity owing to the Internet's growth. In phase V (glocalisation), tri-polar regional structure with North America, Europe and East Asia maintains the balance and signals progress of the ICT wedge into major technologies underpinning mobile communications, which have become widespread.

Conclusion

This comprehensive analysis of the IEEE publications over a period of almost 30 years revealed that the IEEE technical and publishing activities have expanded not only globally but also locally. Specifically, we found that with the emergence of more active international competition, largely on account of the IEEEs promotion thereof, the IEEE has experienced gradual structural changes among its research and publication activities. As the IEEE research activities have globalized with alternation of major technologies, IEEE

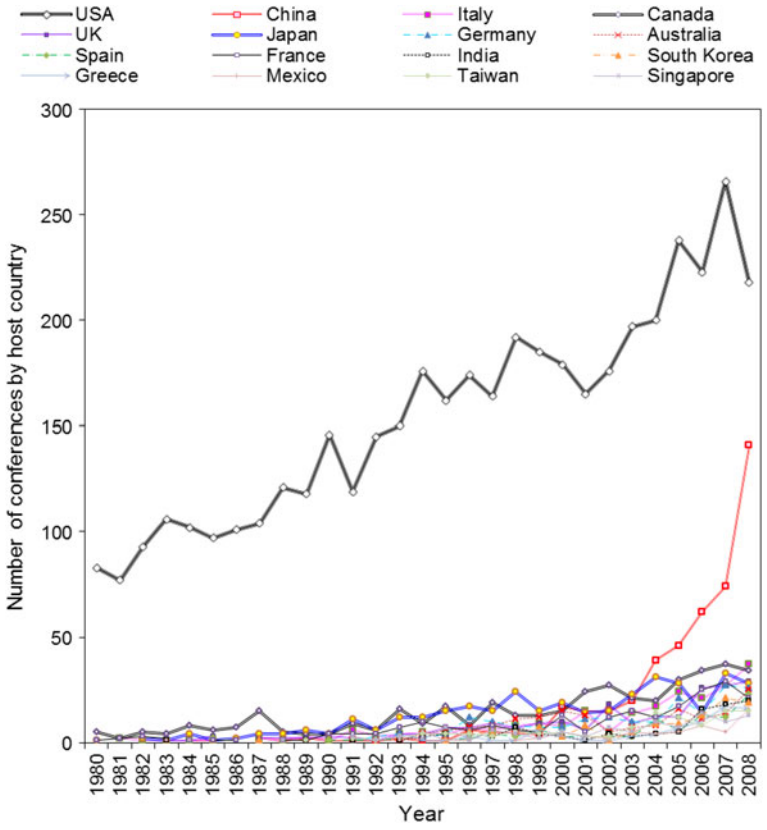

Fig. 9 Number of conferences by host country between 1980 and 2008

Table 2 Transition observed in IEEE publications

Phase	I	II	III	IV	V
Period	1986	1987–1991	1992–1996	1997–2001	2002
Structure	Monopoly	Duopoly	Internationalization	Globalisation	Glocalisation
	North American	Cross-border	International	Transitional	Tri-polar
State	US-centred	Polarized between US and Japan	European participation and the rise of East Asia	Global transition by emergence of China	Tri-polar balanced among North America, Europe and East Asia
Main player	North America	North America, Japan	North America, EU15 and Japan	US, EU15 and East Asia	North America, EU27, East Asia
Major technology	Nuclear science	Magnetics, electron devices	Photonics, Electron devices, Computer, Communications	Computer, Communications, Electron devices	Computer, Communications, Signal processing

publications are distributed globally and accommodated locally. In other words, glocalisation is occurring in the IEEE, the largest professional engineering association and the most influential academic publisher in engineering.

Our specific findings and their implications are as follows.

- IEEE publications have been consistently expanding not only globally but also locally for almost 30 years. As technologically emerging countries have increasing contribution to article publication, the IEEE has increasingly shifted away from its US-centred origins to literally becoming the 'E&E association of the world'.
- The number of conference proceedings published has increased nearly 20-fold since 1980. In particular, the number of conference proceedings published by China has increased dramatically since 2002, even exceeding the number published by the United States in 2008.
- The number of periodical articles published increased fourfold between 1980 and 2008. The proportion of articles published by authors in North America, Europe and East Asia has increasingly balanced, leading to the formation of a tri-polar structure of IEEE technological activities.
- Quantitative analysis of IEEE publications reveals structural changes in global competition and technological transition represented by five phases.

This study faced one primary limitation. As we analysed only the article metadata pertaining to the country of the first author listed among all the authors of an article, we could not analyse the global collaboration networks that often form among authors from different countries. Future research should endeavour to examine the nature of these networks and the formation of international science partnerships. Because of this limitation, the primary value of this study may be its use as a basis for pursuing more practical applications of the findings. However, despite this limitation, we strongly believe that the findings presented here contribute to the understanding of the global nature of E&E and ICT observed from IEEE technical activities and publications.

Acknowledgments This study was partly supported by a Grant-in-Aid for Scientific Research (C) No. 22500875 from the Japan Society for the Promotion of Science.

References

Bar-Ilan, J. (2010). Web of Science with the Conference Proceedings Citation Indexes: the case of computer science. *Scientometrics, 83*(3), 809–824.

Drott, M. C. (1995). Reexamining the role of conference papers in scholarly communication. *Journal of American Society for Information Science, 46*(4), 299–305.

Ginsperg, P. (1996). Winners and losers in the global research village. *Serials Librarian, 30*(3–4), 83–95.

Glänzel, W., & Schoepflin, U. (1999). A bibliometric study of reference literature in the sciences and social sciences. *Information Processing and Management, 35*(1), 31–44.

Glänzel, W., Schelemmer, B., Schubert, A., & Thijs, B. (2006). Proceedings literature as additional data sources for bibliometric analysis. *Scientometrics, 68*(3), 457–473.

Glänzel, W., Debackere, K., & Meyer, M. (2008). 'Triad' or 'tetrad'? On global changes in a dynamic world. *Scientometrics, 74*(1), 71–88.

Godin, B. (1998). Measuring knowledge flows between countries: The use of scientific meeting data. *Scientometrics, 42*(3), 313–323.

Goodrum, A. A., McCain, K. W., Lawrence, S., & Giles, C. L. (2001). Scholarly publishing in the Internet age: A citation analysis of computer science literature. *Information Processing and Management, 37*(5), 661–674.

Kling, R., & McKim, G. (1999). Scholarly communication and the continuum of electronic publishing. *Journal of the American Society for Information Science, 50*(10), 890–906.

Leydesdorff, L., & Wagner, C. (2009). Is the United States losing ground in science? A global perspective on the world science system. *Scientometrics, 78*(1), 23–36.

Lisée, C., Larivière, V., & Archambault, É. (2008). Conference proceedings as a source of scientific information: A bibiliometric analysis. *Journal of the American Society for Information Science and Technology, 59*(11), 1776–1784.

Meho, L. I., & Rogers, Y. (2008). Citation counting, citation ranking, and *h*-index of human-computer interaction researchers: A comparison of Scopus and Web of Science. *Journal of the American Society for Information Science and Technology, 59*(11), 1711–1726.

Michelini, C., & Pickford, M. (1985). Estimating the Herfindahl Index from concentration ratio data. *Journal of the American Statistical Association, 80*(390), 301–305.

OECD. (2009). *OECD Science, Technology and Industry Scoreboard 2009*. Paris: OECD.

Shelton, R. D., & Holdridge, G. M. (2004). The US–EU race for leadership of science and technology: Qualitative and quantitative indicators. *Scientometrics, 60*(3), 353–363.

Shirakawa, N., Nomura, M., Okuwada, K., & Furukawa, T. (2011). On global diffusion of electrical and electronics engineering research: An extensive quantitative analysis of IEEE publications (1980–2008). *Proc. IEEE 1st International Technology Management Conference* (pp. 165–172). San Jose, CA, USA.

Wainer, J., Oliveira, H. P., & Anido, R. (2011a). Patterns of bibliographic references in the ACM published papers. *Information Processing and Management, 47*(1), 135–142.

Wainer, J., Goldenstein, S., & Billa, C. (2011b). Invisible work in standard bibliometric evaluation of computer science. *Communications of the ACM, 54*(5), 141–148.

Zhou, P., & Leydesdorff, L. (2006). The emergence of China as a leading nation in science. *Research Policy, 25*(1), 83–104.