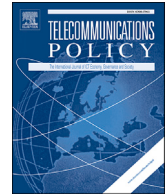


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## Telecommunications Policy

journal homepage: [www.elsevier.com/locate/telpol](http://www.elsevier.com/locate/telpol)

## An overview of Telecommunications Policy's 40-year research history: Text and bibliographic analyses

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### ABSTRACT

The journal, Telecommunications Policy (TP), marked its 40-year milestone in 2016. At this juncture of a 40-year milestone, this paper implements a text analysis with keyword frequency data derived from the abstracts of papers published over the past 40 years to take a look at the big picture of key concepts that constitute the journal's research subjects. With keywords and bibliographic data, this paper calculates key research indexes to overview the dynamic changes in research focuses in the journal. This paper found that the differences in research performance across research subjects within three continents has declined over time, even though wide differences in research performance across subjects within nations still exist, and that the mid-1990s marked a watershed dividing the 40-year history into two parts.

### 1. Introduction

The Journal, Telecommunications Policy (TP), marked its 40-year milestone in 2016. According to Thomson Reuters' Web of Science database, as of the end of 2016, the aggregated number of papers published in TP over the past forty years is 2532.<sup>1</sup> Today, it publishes about 90 papers per year, about one thousand reviewers participate voluntarily in review processes, and the rejection rate is about 70 percent. In passing this 40-year milestone, TP is entering its prime of life.

Since its inception, TP has been a key platform to share research ideas and outcomes, propose scientific and practical policy alternatives, and ultimately contribute to the advancement of the telecommunications industry worldwide and even more broadly the betterment of our daily lives. At this juncture of a 40-year milestone, we believe that an understanding of TP's history will help authors of published papers build a sense of pride and give the readership a glimpse into future research directions which are still changing incessantly in the telecommunications industry. With this intention, this paper tries to overview TP's 40-year research history that has evolved together with the telecommunications industry worldwide. Gómez-Barroso, Feijóo, Quiles-Casas, and Bohlin (2017), published together with this paper, pursues the same objective but this paper differs from that study in that this paper uses different methods of analyses and utilizes publication and citation data for the top 20 nations in order to investigate changes in research trends on a bit deeper level.

This paper first implements a text analysis to create a word cloud that graphically summarizes 374 keywords derived from the

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<sup>1</sup> For annual distribution of published papers in TP, refer to Exhibit 1 of Gómez-Barroso et al. (2017).

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abstracts of papers published in TP for the last forty years. This is a way to take a look at the big picture by highlighting the key concepts that constitute research subjects of TP. This paper then examines relative changes in key concepts over time by calculating annual key research indexes for the core five keywords. The following list of the top ten keywords identified from the text analysis represents the journal remarkably well: “telecommunications,” “service,” “policy,” “market,” “network,” “mobile,” “competition,” “development,” “technology” and “price.” Second, by calculating the Theil indexes with publication and citation data of research subject areas (clusters) across regions and over time, this paper explores whether there has been a convergence in the distribution of research performance across regions and over time. In addition, this paper also calculates key research indexes with publication data of research subject areas and presents the observed evolution of research subjects by regions and time over the past forty years.

The structure of this paper is as follows. The next section explains the data and the research methods of the paper, and Section 3 presents the outcomes of text analysis using the abstracts of the papers published in TP over the last forty years. This section illustrates a word cloud, summarizing the forty years' of TP research history, and discusses dynamic transition in key research concepts of TP. Section 4 reports the results of the Theil index analyses and discusses whether research performance across regions (continents) has converged. In addition, this section calculates key research indexes using publication data of research clusters to shed light on the evolution of research subject areas in TP over the past forty years. Section 5 concludes the paper with a succinct summary of the major findings of this research.

## 2. Data and research methods

### 2.1. Data

Analyses of this paper utilize word frequency data and paper publication and citation data classified by subjects, nations and regions (continents). Abstracts and titles of the papers published in TP for the past forty years were crawled with R from the Elsevier homepage, and paper publication and citation data for the top twenty nations were extracted from Thomson Reuters' Web of Science database. According to the Web of Science (WoS), TP published 2532 documents over the past forty years from 1977 to 2016. Out of the total number of documents, this research uses only 1773 research papers, excluding other types of documents such as editorial material (385), book reviews (285), proceedings papers (211), and notes (35). This paper also uses the subject classifications of paper published in TP offered by the authors of [Gómez-Barroso et al. \(2017\)](#).

### 2.2. Research methods

This paper applies a basic text analysis, word counting, to the abstracts of all papers published up to the end of 2016. The abstracts and titles of papers were crawled from the TP Elsevier homepage, stop words—such as “a,” “the,” “is,” and “which”—were cleaned, and words with the same root were counted as the same word ([Duke University Library, 2017](#)). A text analysis with the titles of papers was not satisfactory because those title words were not diverse enough to present forty years' rich research subjects and the word counts were small, as few as fifteen or so. Therefore, this paper used the abstracts of papers. This paper went one step further in creating a word frequency table using the abstracts of papers by removing such words as “country,” “sector,” “effect,” “level,” “model,” “impact,” “case,” “context” and “factors” that have little substantive meaning in overviewing research trends in TP. This is not a customary approach used in usual text analyses and this paper used this rather subjective approach in order to emphasize keywords that aptly describe changes in research trends. In addition, given the importance of pricing as a research topic, “rate” or “rates” counts were added to “price” word count.

We derived 50 keywords for each year from the abstracts of papers, based on the rankings of word counts, and then merged them into an aggregated word table. If the 50 keywords of each year had been all different, then the word table would have had 2000 distinct words. However, many words were duplicates and duplicate word counts were added. Ultimately, we obtained 374 words with a total of 28,530 word counts. With these 374 words, a word cloud was created with R and it is presented in Section 3, [Fig. 2](#). The word cloud summarizes key subject words that appeared in the abstracts of papers published in TP over the past forty years.

The word cloud does not show dynamic changes in research keywords over the past forty years. Changes in word frequencies and shares per year also do not effectively convey the transition of research subjects because word frequency distribution is skewed heavily, as shown in [Fig. 1](#) and changes in word shares are usually small, making comparison difficult. Furthermore, annual word frequencies and shares do not reveal the extent to which a particular word is concentrated in a specific year or in a time interval. To show the dynamic transition of research subjects over time, this paper calculates annual key research index (*KRI*) for forty years Eq. (1) where  $i (= 1, \dots, n)$  is an index for words and  $t$  is an index for year with the frequency data of the top 50 keywords (*FKW*) obtained from the abstracts of papers. As stated above,  $n$  is 374. The numerator of Eq. (1) is the share of a word  $i$ 's frequency in year  $t$ , and the denominator is the average share of the word  $i$ 's count in total counts, 28,530.

$$KRI_{it} = \frac{FKW_{it} / \sum_{i=1}^n FKW_{it}}{\sum_{t=1}^{40} FKW_{it} / \sum_{t=1}^{40} \sum_{i=1}^n FKW_{it}} \quad (1)$$

The key research index is calculated similarly to the trade specialization index ([Fink, Kwon, Rho, & So, 2014; Kwon & Cho, 2015](#)). The key research index, however, is different from the trade specialization index in that it compares the share of a keyword frequency at time  $t$  with respect to the average share of the same keyword for the whole time period, whereas the trade specialization index compares the share of an item in a country's trade with respect to the global share of the item in world trade at time  $t$ . The  $KRI_{it}$  of unity at time  $t$

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