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The Most Frequently Cited Topics in Urban Planning Scholarship

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Abstract: Analyses of faculty citation activity usually focus on counts as a function of author characteristics such as rank, gender, previous citation levels, and other factors influencing productivity and career path. Citation analyses of publications consider aspects such as number of authors, author reputation, author order, length of the title, methodology, and impact factors of the publication. While publication topics or discipline are considered to be important factors, they are more difficult to analyze, and therefore performed less frequently. This paper attempts to do that for the field of urban planning. Urban planning is multi-disciplinary and includes consideration of social, economic, technological, environmental, and political systems that shape human settlement patterns. It has been suspected that some topics are more "popular" and have larger audiences, therefore are cited more often. Using nearly 15,000 urban planning publications, this paper presents an analysis of topics to assess which are cited most frequently. The classification of publications was performed using a Support Vector Machine (SVM), a machine learning (ML) approach to text classification, using citation data from Google Scholar. The citation levels for the resulting categories are analyzed and discussed.

Keywords: urban planning; bibliometrics; citation analysis

Introduction

Urban planning is a diverse field involving a broad range of disciplinary expertise. At the core of planning research is an understanding of human settlement patterns as they relate to the natural and built environment (see Hall and Tewdwr-Jones 2010). While being a relatively small discipline that is sometimes situated within design disciplines (e.g., architecture), policy disciplines (e.g., public administration), and social sciences (e.g., geography), urban planning scholars generate research that is published in a wide array of academic journals. For just over 1,100 urban planning faculty in U.S. and Canada, there are likely over 300 journals where their publications appear[1]. It is difficult to say whether this is a significantly large number of outlets without similar metrics from other disciplines.

With urban planning interests representing several disciplines, we can assume that there is a shifting hierarchy of topics over time. These include but are not limited to changing perspectives on infrastructure policy, architecture, social conditions, environmental conditions, economic activity, and governance – all of these representing significant aspects of urban systems. Not all of these are given equal attention over time, as particular concerns or interests are more visible at certain times compared to others. From the public's perspective, these interests may be driven by changing policies or politics, or by the flow of information from sources such as the news media. From an academic

[1] A previous analysis by the author showed that a publication by Ewing, Schmid, Killingsworth, Zlot, & Raudenbush (2003) was cited in 257 different academic journals.

and institutional standpoint, themes of research are certainly influenced by the availability of funding and the priorities of funding organizations (Hicks, Stahmer, and Smith 2018; Shneiderman 2016). While there are no reliable data sources about funded research activities related to urban planning, it would be interesting to know how or whether these topics differ from those of scholarly output. This remains a topic for future research.

Within urban planning there is also the question of how academic research represents the needs of the practicing professionals (Alexander 2018; Burton 2018). Planning professionals are confronted with new and different types of urban questions, as well as seeking solutions to on-going questions. Loh (2017) argues that "planning is very much an action-oriented field" and therefore, research "not closely focused on what planners actually do is of limited relevance to the profession" (p.25). Urban planning faculty are expected to contribute to professional practice through their teaching, research, and service activities, while at the same time meeting traditional academic expectations through scholarship (Wachs 1994). Urban planning students seek practical training and academic departments are expected to play a role in connecting directly with local communities through service and outreach (Spain 1992; Wiewel, Carlson, and Friedman 1996). But the question remains whether planning academics are more responsive to topics where funding is available, research needed by the profession, or topics of personal interest. Ultimately, the prominence of scholarship over teaching and service or outreach in urban planning programs results from institutional preferences for planning faculty with PhDs rather than professional degrees. However, the emphasis on "a productive history of publication in refereed journals," is itself seen as contributing to the disconnect between planning research and practice (Krumholz 1975, p.63).

Citation Analyses

Citation analysis for scholarly evaluation has an extensive literature that weighs appropriateness within and across disciplines as well as offering nuanced discussion of several metrics (see, e.g., Garfield 1972; Garfield and Merton 1979; MacRoberts and MacRoberts 1989, 1996; Adam 2002; Moed 2006). Citation analysis is one way to evaluate scholarly activity, but is often limited to assessing only productivity or output rather than other dimensions including aspects of visibility, reputation, and impact (see Sanchez 2014). The following provides a brief discussion and background on citation analysis and urban planning scholarship.

This analysis uses Google Scholar (GS) as a source of citation data. There are hundreds of articles that discuss the application of GS to citation analysis, and make comparisons to Elsevier's Scopus and Thomson Reuter's Web of Science (WoS; previously, ISI Web of Knowledge). With its release in 2004, one question about GS is whether its coverage of scholarly publications can match that of Scopus or WoS (Yang and Meho 2006; Meho and Yang 2007; Falagas et al. 2008; Li et al. 2010; Harzing 2013). Acknowledging that coverage issues are discipline specific, there are many examples of GS-based citation analyses for particular fields ranging from oncology and condensed matter physics (Bakkalbasi et al. 2006), to business and economics (Levine-Clark and Gil 2008), to health and medical research (Kulkarni et al. 2009). Most comparisons focus on citation counts for small samples of academics while others compare citation rates for academic journals (see Bauer and Bakkalbasi 2005; Jacsó 2005a; Moussa and Touzani 2010). Other meta-analyses are helpful in understanding patterns in bibliometric differences among data sources and analysis methods (see Schroeder 2007 and Franceschet 2010).

There are particular aspects of citation databases that emerge from comparative analyses including the age range of cited publication materials, languages included, types of materials cited, and disciplinary coverage (Mayr and Walter 2007; Shultz 2007; Kousha and Thelwall 2007; Harzing 2013). It is interesting to note that most of the analyses comparing GS with Scopus and WoS concentrate on citation totals and not on the accuracy of these data sources at the publication or author level. In other words, to determine how accurate citation totals are for an individual, the actual list of scholarly products (i.e., those listed in a curriculum vitae) should be compared to the results extracted from the citation databases for an author. This is currently infeasible without a

comprehensive source of accurate CV data that can be matched to publication records in Scopus, WoS, or GS.

Across all of the research on bibliometrics in relation to Scopus, WoS, or GS (and others including PubMed, SciFinder, Microsoft Academic Search), the overall theme is that there is a difference in coverage among these sources, which results in different metrics. Frequently mentioned is that GS differs from Scopus and WoS because it includes "non-traditional" publications that are not from scholarly, peer-reviewed sources (Noruzi 2005; Yang and Meho 2006; Walters 2007; Ortega and Aguillo 2014). This is a very significant question in the debate—whether non–peer reviewed or otherwise nontraditional scholarship should be recognized as valid sources for citations. In the case of GS, much of this qualifies as gray literature, which has been argued to reflect greater reach and impact compared to closed, pay-wall-protected publication and citation data like Elsevier and Thomson Reuters. For disciplines like urban planning, the gray literature produced by faculty is often research-based and reflects scholarly process, worthy of inclusion in measuring academic reputation and impact (see Kousha and Thelwall 2007; Pomerantz 2013; Harzing and Van der Wal 2007). Critics such as Jacsó (2005b, 2008) and Giustini and Boulos (2013) disagree and discount non–peer reviewed publications. However, referring to the trend toward inclusion of non–peer reviewed sources, Cronin remarked that "Pandora's box has been opened" (Cronin 2014, 16).

Pauly and Stergiou (2005) compared GS and ISI (predecessor of WoS) finding little difference between the two for a range of disciplines using small samples of authors from each. They state that "free access to these data provided by Google Scholar offers an avenue for more transparency in tenure reviews, funding and other science policy issues, as it allows citation counts, and analyses based thereon, to be performed and duplicated by anyone" (p.2). Along these same lines Harzing and Van der Wal (2007) discuss potential issues with GS because of its inclusion of nontraditional citation materials. Despite its differences, GS is seen as a viable source for citation analysis because results frequently correlate with other sources like Scopus and WoS even though being more inclusive means that GS can lead to higher citation counts. But as Harzing and Van der Wal (2007) state, it is very unlikely that high citation counts occur for academics who are not significant in their field.

As mentioned earlier, urban planning draws upon a diverse range of disciplines and expertise. These form urban planning subfields that are reflected in the types of publication topics as well as breadth of journals where these publications appear. Of the few journal articles about urban planning citation activity beginning with Stiftel, Rukmana, and Alam (2004), followed several years later by Sanchez (2017), Pojani, et al (2018) and Stevens, et al (2019) only Stevens, et al have explicitly tried to measure topical differences within urban planning citation patterns. In their analysis of factors effecting urban planning citations, they included variables indicating whether the publication topic was related to one of thirteen selected subtopics. They found that compared to "transportation", nearly all other sub-fields were cited less frequently, with many of the coefficients being insignificant. Compared to the current analysis, the findings of Stevens, et al are less reliable because of the sample size (580 compared to nearly 15,000 in this analysis) and the topic classification method (single label versus multi-label in this analysis). The sample size issue likely introduces bias in terms of under-representation of planning topics, and the classification method does not account for the multi-disciplinarity of urban planning research (discussed in more detail later).

The bibliometric literature has recognized the differential rates of citation by topics, following the assumption that certain sub-fields are more popular, have more publications and therefore greater chances of citation (see Bornmann et al, 2012). One methodological issue is how to classify or categorize publications so that citation rates can be accurately compared. These methods include topic analysis (see Mann, Mimno, and McCallum 2006), author-provided keywords (see Kim, Jiang, Kim, and Ohno-Machado 2011), thematic analysis (see Halverson, Graham, Spring, Drysdale, and Henrie 2014), or based on categorization defined at submission by authors or journal editors. Topics and keywords restricted by journals can have a limiting effect on topic or theme classification through unintentional exclusion. An alternative would be to analyze abstracts for these purposes, but it greatly increases the data collection and analysis task for uncertain benefit to the classification

process. In addition, titles are consistently available across publication types (i.e., journal articles, books, or reports) where abstracts and keywords are not. Therefore titles provide a rich and complete data source for the current analysis.

The title of a publication is considered to be important for not only indicating content, but also for attracting attention (Merrill and Knipps 2014; Paiva et al 2012). While author provided keywords are frequently used for discovery, titles themselves can distill several dimensions of a publication including subject, method, geographic context, and results (Goodman, Thacker, and Siegel 2001). Because distinct keywords may not convey an overall theme such as what can be represented in the sentence form of a title. This has to do with the linguistic structure of a title not intended by keywords (Yan, Liao, and Chen 2018). However, Levy and Ellis (2006) suggest that author provided keywords may be buzz-word laden, and perhaps unreliable in the long-term. In addition, besides the information retrieval aspects of titles, bibliometricians have examined how title characteristics correlate with citation rates (see Jamali and Nikzad 2011, Subotic and Mukherjee 2014, Jacques and Sebire 2010). Such analyses include title length, punctuation, structure, use of acronyms, and descriptiveness. However, in cases where title attributes are correlated with higher citation rates, it has not been suggested that this somehow indicates a higher level of publication quality.

Methodology

The first step in this analysis was to collect publication records for urban planning academics. Current planning academics with Google Scholar Citation Profiles were used as the source of these data. The suitability of Google Scholar Citations (GS) data or urban planning academics has been discussed by Sanchez (2017), and provides extensive coverage of planning scholarship. Currently 54 percent (598 out of 1,109) of planning faculty in U.S. and Canada have profiles and their publications have accumulated over 75 percent of total citations (as of June 2018) within urban planning[2]. The second step was to identify the key topics based on word frequencies and terms from publication titles. Thematic analysis[3] was used for this purpose and produced 30 key topics (see Table 1). The set of publication titles obtained from GS Citation Profiles were then labelled using these topics with a Support Vector Machine (SVM).[4] Based on the classification of all publication titles, citation frequency for the resulting multi-label themes were then analyzed. Three metrics were used to compare groups of publications: 1) the total number of publications, 2) the total number of citations, and 3) the average number of citations per publication per year. The number of total citations for a topic was normalized by the total number of publications and the year published. This is important because topics with greater publication activity would most likely have the largest number of citations, and older publications have had a longer amount of time to accumulate citations.

[2] See http://tomwsanchez.com/by-the-numbers-urban-planning-faculty-and-program-citations/

[3] See: https://www.qsrinternational.com/nvivo/enabling-research/thematic-analysis

[4] The publication titles were retrieved during December 2018

Table 1. Nodes from thematic analysis (in alphabetical order).

	Topics	
Analysis	Governance	Policy
Change	Hazards	Public
Cities	Health	Regional
Community	Housing	Social
Design	Impacts	Spatial
Development	Land Use	Sustainable
Economic	Local	Systems
Engagement	Management	Technology
Environmental	Neighborhood	Transportation
Global	Planning	Urban

Themes can be identified through classification of full text, abstracts, or titles. Full text, abstracts, and titles obviously contain different levels of detail given the amounts of data (total words) associated with each. In this case, the purpose was to identify fairly high level groupings of topics, so titles were used for this because they are intended to be a distillation of publication content as previously discussed. This parallels the work of Sanchez and Afzalan (2017) who used self-reported areas of research interest from urban planning faculty (see Table 2 for the list of top 30 research interests). Comparing Tables 1 and 2 suggest that in the case of urban planning publications, titles are useful sources of this information, with significant similarity in topic identifiers between stated research interests and publication titles. There were 21 of 30 faculty research interests that matched the topics from the thematic analysis, while others were very closely related, such as "studies" and "analysis"; "spatial" and "GIS"; "participation" and "engagement"; and "growth" and "change". The comparison of these two lists helped to confirm the appropriateness of the labels derived from the thematic analysis.

Table 2. Top 30 urban planning faculty research interests (in alphabetical order) .

	Labels	
Analysis	Growth	Planning
Change	Health	Policy
City	History	Public
Community	Housing	Regional
Design	International	Social
Development	Land-use	Studies
Economic	Management	Sustainable
Environmental	Methods	Theory
Finance	Neighborhood	Transportation
GIS	Participation	Urban

Support Vector Machine

Machine learning (ML), natural language processing (NLP), and text classification are being applied to a wide variety of unstructured data. These include sentiment analysis of customer comments, recommendation systems, and web page classification. Text analysis is used to find word usage patterns that help to identify themes or clusters, especially from very large data sets. Data sets can be manually labelled, which can become infeasible when the volume of words (data) or records reaches the thousands, millions, or billions. In addition, automating this process with machine learning can also insure that labels are assigned in a consistent manner (Zhang, Yoshida, and Tang

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2008). This analysis used the support vector machine (SVM) approach to classify all publication titles using the labels shown in Table 1.

A SVM is a machine learning algorithm used for object classification. The process maps observations in high-dimensional space which are then partitioned by "support vectors" that optimize how associated points are distinguished from others. The process typically involves training the algorithm by using previously classified records so the algorithm can "learn" the differences among classes (i.e., groups) (Mertsalov and McCreary 2009). Training usually occurs during manual classification or a "supervised" stage, and once trained, the algorithm can classify other observations automatically, during an "unsupervised" stage. The algorithm can also be improved as items are validated (see Joachims 1997 and Vapnik 2013 for detailed background on SVM).

Using SVM, each of the urban planning publications was classified using the 30 labels identified (see Table 1). The process does not simply classify text (publication title) based on a single label (e.g., "transportation" or "housing"), instead uses multiple labels for more effective topic specification. This accounts for the multi-topic nature of publications (and titles) that often reflect a subject, method, and results within a publication. This differs from the single-label approach used by Stevens, et al (2019) as mentioned earlier. For example, a publication about integrating transportation and land-use planning should not likely be classified as being primarily about transportation or primarily about land-use. Therefore, a multi-label, SVM assigns two labels, "transportation" and "land-use". Figure 1 shows the resulting distribution of labels across each of the 30 themes. Each row shows the proportions of co-labeling for each theme and the size of the dot is the relative number for that topic. The first row shows that "analysis" was frequently co-labeled with nearly themes with the exceptions of "governance" and "engagement." "Economic" and "environment" were also frequently co-labeled across topics. Other particular cases that are noteworthy are "housing" and "land use", "planning" and "engagement", "policy" and "governance", "policy" and "local", and "social" and "health". The diagonal values have been removed because they represent a topic labelled by itself.

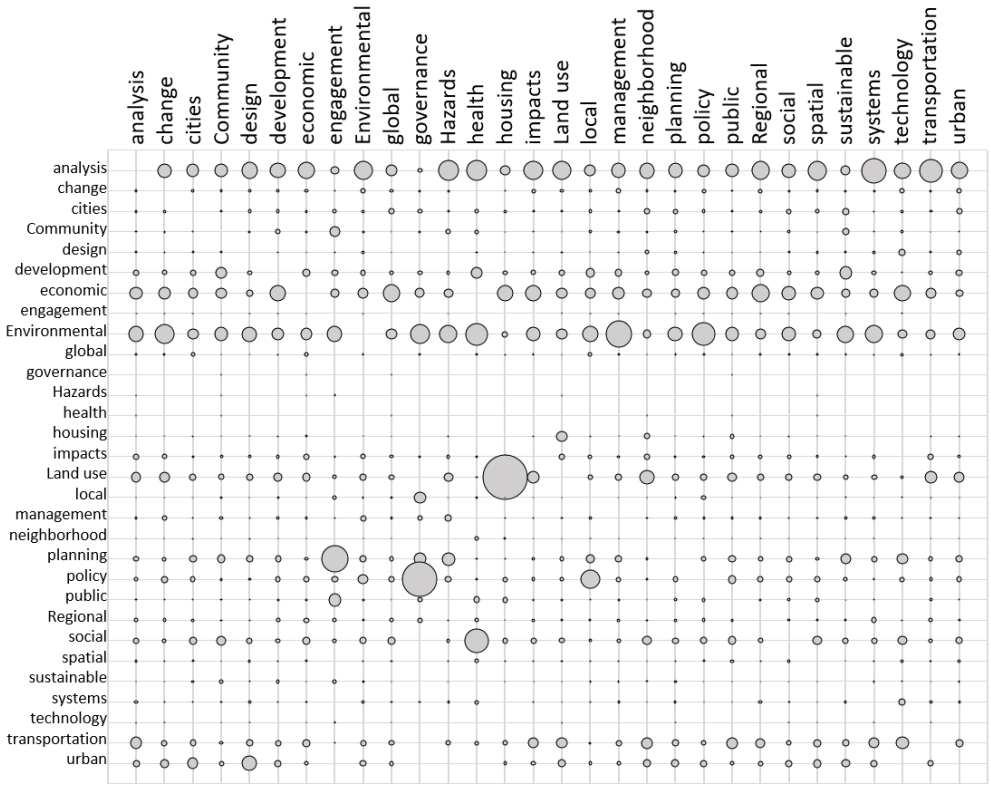

Figure 1. Co-labelling Distribution Across Publication Themes.

A sample of 100 labelled titles were randomly selected and manually checked for accuracy. Of the 100 titles, 92 percent of the labels were assessed as being accurate. Overall there were 272 labels applied to this sample, averaging 2.7 labels per title.

Results

Using 14,757 publications titles retrieved from 598 Google Scholar Citation profiles, the method generated 3,674 topics or themes. While this may sound like a large number of topics, the 30 classifiers resulting from the thematic analysis means that there were over 1 billion possible combinations of these 30 topics[5]. These themes resulted from the assignment of multiple labels using the SVM approach described earlier. The top 20 percent of publications (by citation totals) represents nearly 80 percent (79.8%) of total citations in the sample. Sanchez (2017) found that the 80-20 rule applied in the case of faculty citations, where the top 20 percent of faculty generated 80 percent of all citations. Table 3 shows the 20 themes having the highest levels of citation activity.[6]

Table 3. Top 20 topics by mean cites per publication per year.

Rank	Topic	N	Total Cites	Mean Cites	Mean Cites/Yr
1	Development Economic Global Regional	3	4,874	1624.7	76.8
2	Change Management Transportation	5	5,539	1107.8	75.5
3	Policy Spatial Urban	4	3,779	944.8	67.6
4	Environmental Social Systems	4	2,571	642.8	58.6
5	Analysis Urban Environmental Social Systems	3	1,189	396.3	36.2
6	Cities Urban Environment	9	1,526	169.6	29.7
7	Environmental Planning Policy Analysis	6	1,250	208.3	29.0
8	Impact Analysis Urban Systems	3	1,064	354.7	28.7
9	Sustainable Community Policy	3	891	297.0	23.5
10	Urban Social Change	4	828	207.0	22.4
11	Urban Environmental Systems	4	580	145.0	22.1
12	Land Use Transportation Impacts	11	3,414	310.4	20.6
13	Social Sustainability	3	408	136.0	19.5
14	Global Regional Economics	9	1,969	218.8	19.5
15	Urban Environmental Land Use Impacts	3	589	196.3	19.3
16	Cities Environmental Change	4	659	164.8	18.4
17	Sustainable Development Planning Analysis	3	927	309.0	18.3
18	Design Impacts Analysis	3	755	251.7	17.4
19	Housing Land Use Environmental Planning	12	964	80.3	17.0
20	Social Design	11	762	69.3	16.7

[5] 2^30 = 1,073,741,824

[6] Referred to as Lotka's law. See: https://en.wikipedia.org/wiki/Lotka%27s_law

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The results show that key themes in urban planning scholarship are related to economics, analysis, environment, transportation, regional, social, planning and urban. These represent the core components underlying scale (urban and regional), systems (economic, environment, social, mobility), and methods (planning and analysis). Of the 30 unique topics that were generated, analysis, environment, economic, and transportation each had over 100,000 total citations (see Table 4).

Table 4. Topic frequency (in single or multiple topics).

Topic	N	Total Cites	Mean Cites	Mean Cites/Yr
Global	795	51,382	64.6	5.3
Urban	1,897	96,802	51.0	5.1
Spatial	688	34,816	50.6	5.0
Regional	972	59,964	61.7	4.7
Cities	1,179	51,755	43.9	4.6
Governance	20	894	44.7	4.5
Neighborhood	280	11,969	42.8	4.3
Systems	697	28,893	41.5	4.3
Environmental	3,739	161,408	43.2	4.1
Social	1,935	77,942	40.3	4.0
Sustainable	474	17,932	37.8	4.0
Change	951	40,893	43.0	3.9
Transportation	2,609	100,091	38.4	3.9
Health	20	498	24.9	3.6
Land Use	2,465	91,732	37.2	3.5
Analysis	4,787	171,487	35.8	3.5
Policy	1,442	56,212	39.0	3.5
Impacts	1,293	42,989	33.3	3.5
Management	823	35,366	43.0	3.4
Planning	1,756	61,550	35.1	3.3
Housing	532	18,097	34.0	3.3
Economic	3,650	145,779	39.9	3.3
Design	803	28,213	35.1	3.3
Development	1,699	68,765	40.5	3.3
Local	402	14,618	36.4	3.1
Public	696	21,452	30.8	3.0
Community	757	26,347	34.8	2.9
Hazards	42	1,776	42.3	2.9
Engagement	20	553	27.7	2.3
Technology	28	387	13.8	1.7

Discussion

A key finding of this analysis is that instead of particular topics having high rates of citation activity, differences are primarily driven by particular, highly cited publications. Comparing the multi-label results in Table 3 with the single-label results in Table 4, it appears that as classification becomes more specific, particular highly cited publications influence the identification of a topic. The top 20 topics only averaged 5.4 publications compared to nearly 1,250 for the 30 themes identified. The citation rates also differ significantly. For instance, the leading topic, "Development Economic Global Regional" averaged 76.8 citations per publication per year, and the top theme,

"Global" averaged 5.3 citations per publication per year. Examples from the top 5 in Table 3 (averaging over 30 citations per year) include those shown in Table 5. Given the small number in each topic area, it is easy to see how the average number of citations are influenced by particular publications.

Table 5. Examples of highly cited publications.

Theme	Publication	Cites	Cites/Year
Development Economic Global Regional	Storper, M. (1997). *The regional world: territorial development in a global economy*. Guilford Press.	4,728	225.1
Change Management	Feldman, M. S., & Pentland, B. T. (2003). Reconceptualizing organizational routines as a source of flexibility and change. *Administrative science quarterly*, *48*(1), 94-118.	2,988	199.2
Policy Spatial Urban	Brenner, N. (2004). *New State Spaces: Urban Governance and the Rescaling of Statehood. Oxford University Press.*	3,674	262.4

Conclusions

The purpose of this analysis was to illustrate differential citation levels across topics within urban planning scholarship. While being a snapshot of scholarly activity, it draws from approximately 50 years of publication activity from current urban planning faculty in the U.S. and Canada to highlight topics that have received the most attention in terms of publications and citations. As demonstrated, the approach to identifying topics can impact the types of topics being compared, especially related to the level of specificity. It is likely that an analysis using more data such as from abstracts or full-text would lead to more finely grained groupings of topics because using more words could produce more nuanced labels. The analysis shows which general topics have been of most interest to planning academics (number of publications) and those of planning and related fields (number of citations).

It would not surprise urban planning scholars that the highest level of publication activity occurs in the areas related to analysis, environment, economy, transportation, and urban topics. Since these are areas with substantial audiences and publication opportunities both within urban planning and related fields such as environmental studies, economics, civil engineering, and urban studies.

Future analyses using these types of data can take many forms. This analysis used a relatively general level of topic analysis arriving at 30 single word topics. Subsequent analyses could be more granular to be more specific about topics of scholarly activities. For instance, a topic like transportation could instead be further divided into sub-topics such as freight, passenger, impacts, service planning, etc. However, as mentioned earlier, these topics may not be the best predictor of high citation activity, but rather other characteristics of individual publications.

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