Research Status and Trends of Design Driven Sustainable Community — Quantitative Analysis Based on CiteSpace

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Abstract. With the rapid advancements of sustainable design in recent years, the researches of design driven sustainable community are fruitful. Based on WOS database, this study aims to identify the research status and development trends of design driven sustainable community using visualization analysis with CiteSpace. Firstly, this study retrieved published papers (2000–2020) with two topics: sustainable community (communities) and design. Secondly, this study generated country co-authorship networks to identify the contributing of design driven sustainable community at country level. Thirdly, this study analysed the co-occurrence of keywords to find out the research status and hotspot of design driven sustainable community. Finally, this study got the highest keyword-time trends and predicted the developing trends of design driven sustainable community research in the future.

1. Introduction
Lately, design driven sustainable community has garnered considerable attention of scholars owing to its notable advantages such as user-centred innovation, meaning making and co-creation [1]. Traditionally, sustainable community innovation mainly comes from two ways: one is the subversive innovation that uses technological breakthroughs [2,3] such as IoT, 5th-Generation and Artificial Intelligence. The second type is incremental innovation based on market analysis and various micro-innovations [4,5]. The first type of disruptive innovation is actually an abbreviation of disruptive "technical" innovation. These two innovations are more concerned with community practicability and market share, but lack the real innovation for the intrinsic meaning of services and the full-link user experience. For a long time in the past, it seems that these two innovation models have become all of community innovation. But with the advent of the experience economy, the innovation gap began to appear. In this study, we focus on reviewing the third innovation model: design driven innovation, where the essence of design is to create a new design language (meaning) to promote sustainable community innovation.

This study used CiteSpace as an analysis software to make country co-authorship networks, co-occurrence of keywords and highest keyword-time trends of design driven sustainable community to identify the research status and development trends of design driven sustainable community.
2. Data collection and research methods
In this study, we used Web of Science (WOS) as the database, as it can provide the most crucial areas of science and technology research [6] and is often considered to be an ideal data source for bibliometric investigations [7]. The data used in this study have been retrieved on September 9, 2020, with retrieval strategies as follows:
- Topic = “sustainable community” or “sustainable communities” and “design” or “design driven”.
- Document type = article. Only data on original articles, which are peer-reviewed, represent original scientific development
- Timespan = 2000 – 2020
- Database = SSCI and SCIE databases

Based on the retrieval strategy described above, we extracted 367 articles and finally selected 246 representative articles as the data source of this study.

3. Country co-authorship analysis
Table 1 shows the top ten productive countries sorted by the quantities of their published articles in the descending order, Figure 1 shows the country co-authorship networks of design driven sustainable community.

Table 1. Top 10 productive countries of design driven sustainable community related articles.

| Ranking | Count | Centrality | Year | Countries        |
|---------|-------|------------|------|------------------|
| 1       | 90    | 0.65       | 2003 | USA              |
| 2       | 31    | 0.12       | 2001 | ENGLAND          |
| 3       | 28    | 0.27       | 2003 | CANADA           |
| 4       | 25    | 0.34       | 2005 | AUSTRALIA        |
| 5       | 19    | 0.22       | 2005 | P.R. CHINA       |
| 6       | 8     | 0.08       | 2010 | IRELAND          |
| 7       | 7     | 0.06       | 2008 | SCOTLAND         |
| 8       | 6     | 0.13       | 2011 | SPAIN            |
| 9       | 6     | 0.09       | 2014 | ITALY            |
| 10      | 6     | 0.03       | 2009 | INDIA            |

Figure 1. Map of country co-authorship network of design driven sustainable community research
Further analysis revealed that the United States also carried out design driven sustainable community research in the earliest period. In addition, although the numbers of articles from China is much higher than other Asian countries, Japan has many representative articles which are not calculated because these articles are in Japanese written and published in Japanese journals.

4. Keywords co-occurrence analysis & highest keyword-time trends

Keywords can provide information about the core content of articles. Over time, a knowledge map of keyword co-occurrence could reflect hot topics, and burst keywords (keywords that are cited frequently over a period of time) could indicate frontier topics [8]. Table 2 shows the top 10 keywords on design driven sustainable community in terms of counts and centrality. Figure 2 shows the map of the keywords co-occurrence network of design driven sustainable community related articles, Figure 3 shows the map of highest keyword-time trends.

Table 2. Top 10 keywords on design driven sustainable community in terms of counts and centrality

| Ranking | Count | Centrality | Year | Noun phrases               |
|---------|-------|------------|------|----------------------------|
| 1       | 95    | 0.54       | 2003 | sustainable community      |
| 2       | 12    | 0.56       | 2014 | sustainable development    |
| 3       | 9     | 0.85       | 2014 | practical implications     |
| 4       | 9     | 0.52       | 2013 | sustainable community      |
| 5       | 9     | 0.26       | 2012 | climate change             |
| 6       | 5     | 0.19       | 2016 | economic development       |
| 7       | 4     | 0          | 2010 | community development      |
| 8       | 4     | 0.04       | 2012 | community-based approach   |
| 9       | 4     | 0.34       | 2017 | community level            |
| 10      | 4     | 0.14       | 2017 | community engagement       |

Figure 2. Map of keywords co-occurrence network of design driven sustainable community research

As shown in Table 2 and Figure 2, the four main hot research areas of design driven sustainable community are social innovation [9], economic development, environmental innovation [10] and service innovation [11].
Figure 3 shows that there has been a marked increase in the number of emerging keywords in recent years, the situation of sustainable community is becoming more and more complex and unpredictable, and corresponding design thinking model is also proposed, for example the agent-interaction-adaptation (AIA) design thinking model [12] to be the crucial variable in the process of turning knowledge into value.

5. Conclusion
Based on the analyses of country co-authorship, keywords co-occurrence and highest keyword-time trends, this study has identified the research status of design driven sustainable community. The second major finding was that design driven sustainable community would involve more complex situations, especially due to human interventions, thus it requires bold designers where science and art meet technology and business to take iterative optimization measures in dealing with the increasing complexities of sustainable community.

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