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Open Data Research in the Nordic Region: Towards a Scandinavian approach?

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Abstract. Since 2009 open data has been growing into a specialized research area, including in the Nordic countries. Historically Information Systems research from this region has managed to develop a distinct identity on the international research arena. Hence, the expectation is that also in the context of open data there exists room for unique contributions of Nordic researchers. However, no systematic overview exists yet of the open data research conducted in these countries or of the emerging research community. This paper, therefore, aims to fill this gap by conducting a comprehensive literature review. Our study focuses on the following aspects: (1) which perspectives and topics are examined and (2) which empirical settings and methods are applied in Nordic open data research. Finding answers to these questions will enable us to propose a future research agenda and thereby stimulate debate in the Nordic open data research community.

Keywords: open data, open government data, open government, literature review, Scandinavian, Nordic

1 Introduction

Since 2009 governments around the world have been implementing programs to provide public sector information online in the open data format. Open data refers to data which is legally and technically open, i.e. it can be accessed, reused, and redistributed freely by anyone and it is available in machine-readable and bulk form (Open Data Handbook, n.d.). Open data programs are driven by expectations that open government data will be reused by actors outside the government and thereby deliver a wide range of benefits, such as economic growth and increased transparency.

Responding to these rapid developments, in the past five years the field of open data has been growing into a specialized research area. Presently all major e-government conferences (IFIP Electronic Government, International Conference on Theory and Practice of Electronic Governance, International Conference on Digital Government

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Research, and European Conference on e-Government) host dedicated open data tracks, and a number of special issues focusing on open data problems and themes have been lately announced in various e-government journals (Government Information Quarterly, Social Science Computer Review, Journal of Organizational Computing and Electronic Commerce). This contributes to the growth of national and international research communities and networks in the field of open data (e.g. Open Data Research Network²).

In the Nordic countries open data research has been taking root as well in the past years. These countries have already made considerable progress in open data publication and use according to existing open data benchmarks. For instance, currently the Nordic countries are ranked in the top 25 globally by the Open Data Barometer survey³.

However, no systematic overview exists yet of the open data research conducted in these countries or of the emerging research community. This paper therefore aims to fill this gap by conducting a comprehensive literature review. The objective of the literature review is to describe the body of knowledge focusing on open data and originating from this region. Zooming in on the Nordic region is motivated by the fact that historically Information Systems research from this region has managed to develop a distinct identity on the international research arena (Iivari & Lyytinen, 1999). Hence the expectation is that also in the context of open data there exists room for unique contribution of Nordic researchers. Is such a contribution taking shape yet? This literature review thus aims to answer the following research question: *What progress is made in research to understand open data in the Nordic context?* This question will be answered by focusing on the following aspects: (1) which perspectives and topics are examined in the studies and (2) which empirical settings and methods are applied in the studies. Finding answers to these questions will enable us to propose a future research agenda and thereby stimulate debate in the Nordic open data research community. With this study we aim to open a discussion of (a) whether there is an emerging Nordic contribution to the international open data research and (b) to what extent such a contribution can and does build on the Scandinavian school of Information Systems research.

2 Open data research and the Scandinavian tradition

Internationally open data research has seen rapid development in the past several years. Although it is an emerging field, important first steps have been taken to lay the conceptual foundations and explore the empirical evidence of open data benefits and impacts. Only a few attempts have yet been undertaken at literature reviews in the field of open data, but even those few offer valuable lessons.

The review by Zuiderwijk et.al (2014) found that the body of literature on open data consisted of 143 articles globally (as of October 2013). They were mainly conceptual articles, descriptions of empirical cases, or descriptions of design of systems and technologies (ibid). Only a handful of articles in that sample (19 articles) mentioned, used, or extended some theory, which points to the need for theory development in the open

² <http://www.opendataresearch.org/>

³ http://opendatabarometer.org/data-explorer/?_year=2015&indicator=ODB

data field. Furthermore, there are topical gaps where future research is needed such as open data policies, process innovation, innovation resulting from open data, and stimulating open data use (ibid). In sum, open data is a nascent yet thriving research field where many future research directions exist.

Historically, some research directions have been in focus of the Nordic Information Systems (IS) research to a larger extent than others. The so-called Scandinavian School of IS can be summarized in the “grassroot” perspective on IS development (Iivari, 2003) with close collaboration with relevant stakeholders (Mathiassen and Nielsen, 2008). According to Iivari (2003), the Scandinavian school has emphasized four elements: IS evolution, user participation, alternative IS development models, and a search for a variety of theoretical IS foundations. In the Scandinavian tradition information systems are not necessarily aligned with organizations through deliberate one-time design decisions but rather through continuous alignment processes. This is due to organizations becoming less formal and more socially complex, as well as technology becoming more flexible. From the user participation perspective, the Scandinavian school has favored close collaboration with users to understand the work practices that information systems should support and to tap into the tacit requirements of users. In terms of IS development models, the Scandinavian school has favored prototyping, as well as incremental and cooperative approaches. Moreover, the Scandinavian school has used a variety of theoretical foundations including activity theory, structuration theory, and class theory while at the same time neglecting organization theory as a reference discipline (ibid.).

Considering this, there is much potential for capitalizing on these four elements of the grassroots approach in the Scandinavian school of IS for the benefit of open data research in these countries. Our literature review aims to shed some light on the state of the art of Nordic open data research and hence build the first bridge towards aligning it with the Scandinavian IS tradition.

In this paper we use the term “Scandinavian” in reference to the Scandinavian school of IS and the term “Nordic” in reference to the geographic region we focus on, i.e. Sweden, Norway, Denmark, Finland, Iceland and their territories. In the literature describing the school of approaches to IS development from these countries the term “Scandinavian” has been more common.

3 Method

The literature review proceeded according to the guidelines of Webster & Watson (2002). The literature search was conducted using keyword search in Scopus. This is arguably the most comprehensive database listing the majority of journals and conference proceedings in Information Systems. Prior literature reviews of open data (Zuiderwijk et al., 2014) referred to this database as the primary source of literature in the field.

The first search parameter was keywords ‘open data’, ‘open government data’, and ‘open government’ searched against the categories of keywords, title, and/or abstract. The second search parameter was the country of researcher affiliation; the selection

criterion was that at least one of the co-authors was affiliated with a Nordic country (Sweden, Norway, Finland, Denmark, or Iceland). The review considered the time period up until the date of the search (16 November 2015).

The keyword search yielded 158 results in total. The search results were refined by document type to include only articles, conference papers, and book chapters and by subject area to include only results in the subject areas of Computer Science and Social Sciences (113 papers were selected). These two subject areas included the majority of found articles.

The relevance of the articles was determined by reading the abstracts. Only papers written by authors with an academic affiliation were considered. Only papers positioned in the Information Systems discipline were included in the review. Papers describing rather technical issues, such as e.g. data format conversion, data cubes, or data assimilation frameworks, were omitted. This might be seen as a limitation of this study, but our primary objective is to examine how IS and e-government researchers approach open data rather than to investigate cross-domain research.

Consequently, out of the 113 found articles 44 were selected for in-depth analysis based on the aforesaid criteria. The distribution per country was as follows: 8 papers from Denmark (out of 24 found), 15 papers from Finland (out of 39 found), and 21 papers from Sweden (out of 35 found). No relevant papers were identified from Norway, those found (20 papers) predominantly focused on technical issues. No relevant papers were identified originating from Icelandic researchers.

4 Results

The 44 articles included in the review are listed in the Appendix. The earliest articles in the list were dated year 2012. A number of different research institutions per country are involved in open data research. The author affiliations show that there is a fair degree of collaboration in the open data community, as the majority of papers (25) were coauthored with another researcher(s) either nationally (10), from another Nordic country (1), or abroad (14). Cross-border Nordic collaboration in open data research has so far been limited, since in our review we found just one article (37. Vogel et al., 2014) coauthored by researchers from two Nordic countries (Sweden and Finland). The lowest degree of collaboration is found in open data research from Denmark with all papers included in the review being authored by a single institution, with one exception (1. Henriksen, 2015) with a double affiliation.

4.1 Perspectives and topics

Examining which perspectives and topics are used in the papers can reveal what lies in focus of open data researchers from this region. This knowledge can help identify the niche for the Nordic contribution to international open data research.

Table 1 below classifies the reviewed articles by the topics examined in them. The topics were identified by screening the keywords provided by the authors and by reading the abstracts. Many articles examined several concepts in connection with one another and therefore were placed in several categories in Table 1.

Table 1. Topics of Nordic open data research

Concepts	Reference Number
Open innovation	11, 41, 31, 33, 35, 23, 39, 40, 42
Innovation contests	31, 33, 35, 22, 40, 17, 16, 10, 43, 41, 42
Service innovation	24, 30, 41, 35, 23, 20, 21
Open data adoption	24, 25, 27, 28, 31
Open data entrepreneurship	24, 12, 13, 31, 33, 41, 35, 39
Open data evaluation	26, 28, 42
Open data applications	30, 22, 38, 37
Open data stakeholders	11, 28
Open data value	2, 3, 13, 4, 6, 21
Open data marketplace	9, 31, 20
Open data business models	12, 13
Open data barriers	14, 15, 35, 41
Open data benefits	18, 5
Open data discourse	29, 44, 7, 8, 43, 32
Open government	29
Open data research	1, 34, 36

Table 2 which follows below provides an overview of the perspectives adopted in the surveyed articles. In our analysis we applied the perspectives suggested by Zuiderwijk et al. (2014): social, economical, institutional, operational, technical, legal and political. The perspectives were identified by reading the abstracts.

Table 2. Perspectives adopted in Nordic open data research

Perspec- tive	Reference Number
Social	40, 35, 28, 41, 33, 31, 11, 1, 20, 30, 38, 15, 10, 16, 17, 24, 27, 34, 25, 44
Economi- cal	12, 42, 9, 39, 13, 21, 4, 6
Institu- tional	43
Operational	
Technical	7, 37, 14
Legal	19, 36
Political	29, 8
Multiple	5, 22, 23, 18, 3, 2, 26

From Table 2 we conclude that the social and economical perspectives are dominating. Some authors adopt multiple perspectives, primarily a combination of the social and economical ones. No author takes an operational perspective; while the paper comparing the discourses of open data and modern archiving (32. Borglund and Engvall, 2014) did not fit any of the listed perspectives and was labeled as ‘Discourse’. It should be noted that, since we deliberately excluded papers from our sample focusing predominantly on technical issues, this has had an effect on the number of papers in the technical perspective. It was also found that authors focus on different actor roles: in the social perspective the actor roles are shared between user, developer, supplier and intermediary (e.g. open data consultant or innovation contest); while in the economical perspective the focus is on the actor role of developer.

More specifically, as evidenced in Table 1, Nordic open data research focuses on a wide range of issues, however, certain aspects of open data have been highlighted to a greater extent. It appears that the stronghold of Nordic open data research so far has been the innovation-related topics. The most widely discussed topics in the reviewed articles were open innovation, open data entrepreneurship, service innovation, innovation contests. The authors focusing on innovation issues agree that, whereas there is much potential for businesses to generate value from open data (2. Jetzek et al., 2014; 39. Lakomaa & Kallberg, 2013; 13. Lindman et al., 2014), many barriers to realizing this potential remain (35. Hjalmarsson et al., 2014; 24. Susha et al., 2015).

Another observation we can make is that, contrary to the global trend in open data research of being supply- and publication-focused, Nordic open data research (in this case exclusively from Sweden) has paid more attention to open data adoption. In this category studies focused on such issues as motivation of open data users (33. Juell-Skielse et al., 2014), measures to stimulate open data adoption (27. Susha et al., 2015), expectations and perceptions regarding open data use (25. Hellberg & Hedström, 2015), among others.

As open data is an emerging research domain, the community of active researchers is quite small. Considering this, we observe that in different countries and institutions different core expertise concerning open data has been accumulating. For instance, research at Copenhagen Business School (Denmark) has prominently focused on open data value; research at Stockholm University and University of Borås (Sweden) has extensively studied innovation contests; research at Hanken School of Economics (Finland) offers expertise on open data market and business models. This provides an opportunity for learning from one another and combining expertise to undertake more holistic studies.

The aforesaid paints a picture of research gaps as well. There seems to be a lack of studies which focus explicitly on the democracy perspective of open data. Only one paper (29. Hansson et al., 2015) was identified which investigated open data in the context of open government and democracy principles. Another finding is that there is ample room for research on the effect of open data on public services including e-government services. The paper examining the use of open data in the e-government service process (30. Johansson et al., 2015) is a starting point in this respect.

4.2 Empirical settings and methods

Analyzing the empirical settings and methods applied in the papers is intended to reveal (1) on which level (international, national, or regional/local) open data issues are examined by Nordic researchers and (2) which methods are in use by this open data research community. This knowledge provides an insight into how researchers in the Nordic region choose to approach research problems in the open data field. Table 3 below provides an overview of the empirical settings examined in the selected papers. Theoretical papers (reference numbers 3, 7, 8, 17, 23, 29) are not listed in the overview of empirical settings.

Table 3. Empirical settings examined in the articles

Country	International	National	Regional or local
Denmark	4, 2	1, 5, 6	
Finland	11, 16, 18, 9, 19	12, 13, 14, 15, 20, 21	10, 22
Sweden	24, 27, 26, 28, 31, 34, 36, 37	42, 41, 32, 33, 35, 38, 39	25, 30, 43, 44, 40

As follows from Table 3, open data research produced by Nordic researchers is not only focused on the Nordic country contexts but extends beyond the borders of the region. An important factor in this respect is the fact that other countries (in particular the US and UK) have advanced much further in open data, thereby presenting an opportunity for researching cutting edge issues and problems empirically. Nonetheless, there is also emerging knowledge about regional and local open data activities (in particular in Sweden) which may be utilized for cross-border knowledge transfer between Nordic researchers.

Table 4 below lists the methods which are used in the papers in our sample. It includes both empirical and conceptual papers. Papers without any mentioning of any particular method used (reference numbers 8, 14, 18, 36) are not listed in the table.

Table 4. Methods applied in the articles

Methods	Reference Number
Empirical	
Case study	11, 25, 27, 28, 2, 44, 4, 43, 22, 38, 19
Interviews	12, 13
Survey	24, 39
Stakeholder analysis	34
Mixed	1, 41, 15, 31, 32, 33, 35, 21
Design science	30, 37, 40, 42, 20
Regression analysis	6
Goal modelling	10, 16, 17
Conceptual	
Literature review	29, 23, 9

Meta-analysis	26
Theory building	3, 7

From Table 4 it follows that case study is the most widely used research method to study open data issues. This can be explained by the fact that open data is an emerging practical development receiving varying levels of attention of different organizations. There is hardly any systematic evidence or uniform implementation, especially at the subnational level. A case study is thus a well-suited method for studying emerging initiatives.

Nordic open data research has not only investigated ongoing open data applications (such as e.g. use of open data in decision support systems in the maritime industry, use of open data for smart cities) but also includes research in the design science tradition. Namely, Aaltonen et al. (20. Aaltonen et al., 2013) in their paper developed a proof-of-concept implementation of a mash-up system built on wellness data and Ayele et al. (42. Ayele et al., 2015) developed a measurement model for open digital innovation contests. Furthermore, the work of Johansson et al. (30. Johansson et al., 2015) resulted in a digital prototype allowing citizens to generate and acquire open data, as well as develop and publish their own e-services. Design science research is however less represented than descriptive and analytical work in the review sample.

Another observation is that the majority of papers used qualitative research methods, although mixed research designs were also well represented. There is a notable exception (6. Jetzek et al., 2013) in which the authors used regression analysis (Partial Least Squares method) to test their open data value framework using open secondary data sources.

5 Discussion and conclusions

Based on the findings of this literature review we hereby propose an agenda for future research. This agenda highlights the research gaps identified in the previous section and aims to help advance the field forward. Our point of departure in this discussion is that such a research agenda must also be aligned with some of the key developments in practice in these countries.

In our review we established that some *topics* received more attention of Nordic researchers than others, namely the innovation-related topics were better represented than the democracy-related ones. At the same time in Denmark and Finland there is limited evidence of political and social impact of open data compared to the economic impact (Open Data Barometer, 2015). This therefore calls for research into how and to what extent open data has an impact on political and social aspects, such as trust in government, citizen empowerment, quality of public services, improvement of public policies etc.

Furthermore, our analysis found that Nordic open data research focusing on *perspectives* other than economical and social is limited, hence a more nuanced approach also including legal, operational, institutional, political, and technical perspectives could provide a fruitful way forward. More specifically, based on our analysis we find that

there is a lack of research on open data policies and process management, as well as on infrastructures for open data. We also believe that the work already done on the topic of open data adoption and citizen participation in the Nordic countries could be further strengthened, for example in the direction of user participation. So far in our sample we only found some seeds of the emerging focus on user participation which traditionally characterizes the Scandinavian IS school.

In terms of *empirical settings*, our review concluded that different levels (international, national, regional/local) are represented in the sample of articles. However, the number of contributions focusing on regional or local open data contexts are much smaller (only 7 articles). This finding may be seen as surprising considering the prevalent focus of the Scandinavian Information Systems research tradition on small scale development (the grassroots approach). We envisage that a stronger emphasis on regional and local open data initiatives and on the benefits they create for the communities on the ground provides good opportunities for future contributions.

Finally, as regards the *methods* used in Nordic open data research, we find that there is a lack of theory building research, while case studies prevail. Thus, there is room for more theoretical work in the field which can examine the utility of existing IS theories for the studies of open data. As mentioned in section 2, traditionally Scandinavian IS research is characterized by a variety of theoretical foundations. These are yet to be reflected on in the context of Nordic open data research.

To conclude, when we compare our results with the future research directions proposed by Zuidervijk et al. (2014), we find that the Nordic researchers have made a most prominent contribution towards the research direction of open data innovation and use. The contribution is mainly concerned with open innovation, digital service innovation, innovation contests and the stimulation of use in terms of open data markets, adoption, benefits, and business models. In our future research we aim to continue our survey of the Nordic open data research in order to identify specific opportunities to further strengthen the Nordic contribution towards the global open data research community based on the legacy of the Scandinavian School of IS.

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Zuiderwijk, A., Janssen, M., Gil-García, J., & Helbig, N. (2014). Innovation through open data: A review of the state-of-the-art and an emerging research agenda. *Journal of Theoretical and Applied Electronic Commerce Research*, 9(2), pp. 258-268.

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Appendix. Articles included in Literature Review

Nbr	Reference
<i>Denmark</i>	
1	Henriksen, H. Z. (2015) Scrutinizing open government data to understand patterns in eGovernment uptake. <i>Vol. 9248. Lecture Notes in Computer Science</i> , pp. 144-155.
2	Jetzek, T., Avital, M., & Bjorn-Andersen, N. (2014). Data-driven innovation through open government data. <i>Journal of Theoretical and Applied Electronic Commerce Research</i> , 9(2), 100-120. doi:10.4067/S0718-18762014000200008
3	Jetzek, T., Avital, M., & Bjorn-Andersen, N. (2014) Generating sustainable value from open data in a sharing society. <i>Vol. 429. IFIP Advances in Information and Communication Technology</i> (pp. 62-82).
4	J Jetzek, T., Avital, M., & Bjorn-Andersen, N. (2013). <i>Generating value from open government data</i> . Paper presented at the International Conference on Information Systems (ICIS 2013): Reshaping Society Through Information Systems Design.
5	Hansen, H Hansen, H. S., Hvingel, L., & Schröder, L. (2013) Open government data - A key element in the digital society. <i>Vol. 8061 LNCS, Lecture Notes in Computer Science</i> , pp. 167-180).
6	Jetzek, T., Avital, M., & Bjorn-Andersen, N. (2013). <i>The Generative Mechanisms Of Open Government Data</i> . Paper presented at the ECIS.
7	Marton, A., Avital, M., & Jensen, T. B. (2013). <i>Reframing Open Big Data</i> . Paper presented at the ECIS.
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<i>Finland</i>	
9	Lindman, J., & Kuk, G. (2015). <i>From open access to open data markets: Increasing the subtractability of open data</i> . Paper presented at the Proceedings of the Annual Hawaii International Conference on System Sciences.
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12	Lindman, J. (2014). Similarities of open data and open source: Impacts on business. <i>Journal of Theoretical and Applied Electronic Commerce Research</i> , 9(3), 59-70.
13	Lindman, J., Kinnari, T., & Rossi, M. (2014). <i>Industrial open data: Case studies of early open data entrepreneurs</i> . Paper presented at the Annual Hawaii International Conference on System Sciences (HICSS).
14	Jaakkola, H., Mäkinen, T., & Eteläaho, A. (2014). <i>Open data - Opportunities and challenges</i> . Paper presented at the ACM International Conference Proceeding Series.
15	Rohunen, A., Markkula, J., Heikkilä, M., & Heikkilä, J. (2014). Open traffic data for future service innovation - Addressing the privacy challenges of driving data. <i>Journal of Theoretical and Applied Electronic Commerce Research</i> , 9(3), 71-89. doi:10.4067/S0718-18762014000300007
16	Shiramatsu, S., Tossavainen, T., Ozono, T., & Shintani, T. (2014) A Goal matching service for facilitating public collaboration using linked open data. <i>Vol. 8654. Lecture Notes in Computer Science</i> , pp. 114-127.
17	Tossavainen, T., Shiramatsu, S., Ozono, T., & Shintani, T. (2014) Implementing a system enabling open innovation by sharing public goals based on linked open data. <i>Vol. 8482 LNAI. Lecture Notes in Computer Science</i> , pp. 98-108.
18	Jaakkola, H., Mäkinen, T., Henno, J., & Mäkelä, J. (2014). <i>Openn</i> . Paper presented at the 2014 37th International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2014 - Proceedings.
19	Palmirani, M., Martoni, M., & Girardi, D. (2014) Open government data beyond transparency. <i>Vol. 8650 LNCS. Lecture Notes in Computer Science</i> (pp. 275-291).
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28	Hjalmarsson, A., Johansson, N., & Rudmark, D. (2015). <i>Mind the gap: Exploring stakeholders' value with open data assessment</i> . Paper presented at the Annual Hawaii International Conference on System Sciences (HICSS).
29	Hansson, K., Belkacem, K., & Ekenberg, L. (2015). Open Government and Democracy: A Research Review. <i>Social Science Computer Review</i> , 33(5), 540-555. doi:10.1177/0894439314560847
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