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The Connection between Winter and Information Systems

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Abstract. The article documents a systematic literature review on the impacts of the season of winter on Information Systems. The search delivered 43 articles, of which 36 ended up to content analysis. On the contrary to the original research idea, winter seems to have no whatsoever impact on information systems, at least according to our sample. On the contrary, information systems are used to support key society activities in winter conditions. According to the findings the most important areas are road and airport maintenance and management in winter conditions, and increasing of wheat crops in winter time.

Keywords: Winter, Information Systems, Impact, Effect, Interaction

1 Introduction

The original research idea of this paper was to study the impact of professor Robert Winter on information systems and their research. After some preliminary investigations it was however concluded that the season “winter” might however have some more impact on those than the professor Robert Winter, whose impact by any means however is not marginal.

Also, the study is on the impact of the season winter on information systems, and how it is reflected in academic research. Again, after some initial analysis, it turned out that winter seems not much to be impacting information systems, but – on the other way around – information systems might impact winter conditions in offering support to understand, control and manage them.

2 Methodology

A systematic literature review was performed following the guidance of leading guidance in literature [1, 2]. For the sake of simplicity and free access to resources search was limited to the tool of Google Scholar.

In the search the option in which both words “winter” and “information system” had to be in the title of the entry included was used. The time frame of the entries was limited to this millennium, also to entries made in year 2000 or later. The search returned 43 entries.

To make some sensitivity analysis, similar search with terms. Combination “summer” and “information system” was not more popular than winter, 40 entries were found. To rise the abstraction level neither helped, the combination “season” and “information system” delivered just 30 entries. Search terms “winter” and “IS” were not successful, as the results made no difference between the acronym IS for information systems and the English verb “is”. Turning to German language neither helped, the search on terms “winter” and “informationssystem” delivered one entry, on gamekeeping. As a final test, the Finnish language was tried (in Nordic countries there is anyway hard winter). However, the search combination “talvi” and “tietojärjestelmä” provided zero findings on Google Scholar.

After reading the material provided by Google Scholar and some extra searches on Google and Google Scholar, seven articles were dropped out of the analysis. Three articles were dropped as “winter” in their data refereed to the issue of the journal, not to the title. One article was dropped out because it was a newspaper article. Of two potentially interesting articles no further trace was found. One article without further track would have been from Switzerland with an interesting topic: avalanche management. Sadly, the original article was not found. One article was dropped out of analysis as it seemed to be in Chinese, just the title was in English. Total of 36 articles were included in further analysis, these articles are in Appendix 1. The entries of the references are in the form that Google Scholar automatically exported to EndNote library, unfortunately all not very structured or neat.

Table 1. Alternative literature searches

Key terms	Entries found
winter IS	2300
winter information	690
winter data	2030
summer information system	40
season information system	31
winter, informationssystem	1
sommer informationssystem	0

3 Results

One central area of interaction between winter and information systems emerged as dominant in the content analysis. Logistic, and especially road maintenance and management. A total of 20 articles in this group was found, publications both in conferences and similar forums, and in academic journal. To the area of logistics also belonged airport management, again in challenges during the winter season in freezing countries at that season, with 4 articles found. One of these previous articles was discussing both airport and road management.

Another area of academic discussion was that of agriculture, and more exactly the increase of crops in winter time, especially for wheat. A total of 6 articles was found in this category. Also oat got its attention in one article.

Two articles were deemed to be in the area of biology. One was on systems support for browse use of trees and shrubs (by birds mainly) and one on the winter birth population in river and lake areas in Turkey.

Tourism was represented with one article on Geographic Information System support for winter tourism. One article was to support with Information Systems elderly people's housing. One article discussed also logistics, but this time waterway management (Caspian Sea in winter). One article aimed to support winter sports arrangement (Harbin 24th winter universiade). One article was on geosciences, more exactly on a information system support for evapotranspiration calculation.

Table 2. Content analysis of the articles

Area	Topic	Entries found
Logistics	Road management	19
Logistics	Airport management	3
Logistics	Airport and road management	1
Agriculture	Crop management (mainly wheat)	6
Biology	Wild birds and their and other species nurturing	2
Others		5

4 Discussion

It seems that we have built information systems as an artefact that is not impacted at all by seasons, not even the hard winter. On the contrary, information systems seem to be used to help in the control and management of winter conditions, especially for the management of road and airport infrastructures.

Another area of interest is related to nature, both from agriculture and biology point of view. Crop management for winter wheat seems to be an import topic, as well as the ornithological aspect of bird winter behavior. The later also seems to have some connections. With tourism, that has its special characteristics in winter, as discussed in one article.

The literature review was started with the idea that articles on how winter (or maybe seasons in general) affect information systems. Topics like electricity use and heat production and use on computing machinery were expected to be encountered. Likewise research on topics such as sensitivity of hardware on cold was anticipated, as well as how cold affects different telecommunication media. On the software side, one could for example how one models and displays snow in computer games and similar visual environments. A big area of research could be how electronic commerce, social media use, and healthcare IS solutions – just to take up a few key area examples - adjust to seasonal variations. However, all this was absent in the sample. Somehow the search neither caught any material from meteorology, a scientific area that surely must take seasons to its agenda. True, using just the term “information system” to represent information and communication technology in its various forms was of course limiting findings.

In total, seasons in general and winter in particular seem not to be important topics in IS research. Admittedly, our sample and analysis was rather modest, but it surely gives some basic understanding of the topic area. The positive finding was that the area in every case keeps up activity: articles were also found from the most recent years.

The topic is not without its merits. Worldwide, seasons affect the whole function of the society, and information systems surely get their share of these effects. Seasons are very different in different regions of the world, and seasonal variations in different activities can vary from non-existing to very strong. The topic surely deserves more attention in the future.

The study has of course its limitations. Using just database platform (Google Scholar) to find studies is a very much limiting factor. The search terms were also just kept simple and plain. Having more than one researcher analyzing the material could also have brought up new ideas to discussion.

5 Conclusions

It turns that the original research idea of studying the impact of professor Robert Winter on information systems and their research would have been more lucrative: Alone Google Scholar returned 3 420 000 entries with the search term “Robert Winter”. Also the season winter beaten with ample marginal in this setting! I want to congratulate professor Robert Winter for this achievement and for the occasion of his 60th birthday, also as a colleague born in the same year.

As an epilogue, even though absolutely so already before, after this article professor Robert Winter can be considered as seasoned.

References

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Appendix 1 The entries accepted for content analysis (n=36)

	Article	Forum	Area	Topic
1	Abdi, A., Lind, H., & Birgisson, B. (2012). Use of Road Weather Information System (RWIS) as assistive tool for effective winter road maintenance: Technical and contractual interactions'. <i>International journal of engineering and technology</i> , 2(12), 2002-2012.	Journal	Logistics	Road maintenance
2	Burkheimer, D. (2000). Iowa DOT weather information system to support winter maintenance operations. MID-CONTINENT TRANSPORTATION SYMPOSIUM PROCEEDINGS	Conference paper	Logistics	Road maintenance 7
3	Çelik, A. D. E. Determination Of Ornithological Richness Of Erçek Lake, Dönemeç And Bendimahi Deltas (Van/Turkey) In Winter Season And Mapping With Geographic Information System. INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 6, ISSUE 04, APRIL 2017	Journal	Biology	Ornithology
4	Harbaugh, C. R., & Norville, J. M. (2020). <i>Winter Severity Index: Using Road Weather Information System Data to Improve Preparedness for the Pennsylvania Department of Transportation</i> . Paper presented at the 100th American Meteorological Society Annual Meeting.	Conference paper	Logistics	Road maintenance
5	Hu, J., Wang, Q., Sadek, A. W., & Wang, Z. (2013). <i>Transportation System Performance Under Inclement Winter Weather: Perspectives from Weather-Induced Multiple Hazard Situations and Traveler Information</i> . Transportation Research Board 92nd Annual Meeting	Conference paper	Logistics	Road maintenance
6	Kochumman, G., & Nixon, W. (2003). A Prototype System to Extract Winter Weather Information for Road Users. <i>International journal of the computer, the internet and management</i> , 11(1), 42-50.	Journal	Logistics	Road maintenance
7	Kramberger, T. (2015). A Contribution to Better Organized Winter Road Maintenance by Integrating the Model in a Geographic Information System. In <i>Encyclopedia of Information Science and Technology, Third Edition</i> (pp. 5431-5441): IGI Global.	Book	Logistics	Road maintenance

8	Kurihara, T., Takebayashi, Y., & Oka, T. (2001). Field Test of Residential Remote-care System for Elderly People-Measuremental Study on Housing Indoor Environment and the Information Feedback in Winter. <i>TRANSACTIONS-SOCIETY OF HEATING AIR CONDITIONING AND SANITARY ENGINEERS OF JAPAN</i> , 77-88.	Journal	Housing	Indoor environment
9	Kwon, T. J., Fu, L., & Melles, S. J. (2017). Location optimization of road weather information system (RWIS) network considering the needs of winter road maintenance and the traveling public. <i>Computer-Aided Civil and Infrastructure Engineering</i> , 32(1), 57-71.	Journal	Logistics	Road maintenance
10	Köck, K., Paulitsch, H., Randeu, W., Teschl, R., & Perschl, G. (2006). <i>WIIS-Weather Image Information System: A new weather information and early warning system for winter road maintenance</i> . Paper presented at the World Road Association AIPCR, XII International Winter Road Congress.	Conference paper	Logistics	Road maintenance
11	LIANG, L., CHEN, Y.-q., GAO, W.-s., SUI, P., & CHEN, D.-d. (2009). 2, ZHANG Wei1 (1. Circular Agriculture Research Center, China Agricultural University, Beijing 100193, China; 2. Agricultural Information Institute, Chinese Academy of Agricultural Sciences, Beijing 100081, China); Life Cycle Environmental Impact Assessment in Winter Wheat-Summer Maize System in North China Plain [J]. <i>Journal of Agro-Environment Science</i> , 8.	Journal	Agriculture	Crops management
12	Mahoney, W. (2001). <i>An Advanced Weather Information Decision Support System for winter Road Maintenance</i> . Paper presented at the 8th World Congress on Intelligent Transport SystemsITS America, ITS Australia, ERTICO (Intelligent Transport Systems and Services-Europe).	Conference paper	Logistics	Road maintenance
13	Mahoney, W., & Myers, W. (2003). The Winter Road Maintenance Decision Support System (MDSS) Project Update and Future Plans, Preprints, 19 st Conf. on Interactive Information and Processing Systems, Long Beach, CA. <i>Amer. Meteor. Soc.</i> , 10.	Conference paper	Logistics	Road maintenance

14	Matsuzawa, M., Kajiya, Y., & Yamagiwa, Y. (2005). <i>Survey on the Effectiveness of Snowstorm Information Provision in the Winter Road Maintenance Decision Support System</i> . Paper presented at the 12th World Congress on Intelligent Transport SystemsITS AmericaITS JapanERTICO.	Conference paper	Logistics	Road maintenance
15	MINBASHI, M. M., RAHIMIAN, M. H., BAGHESTANI, M., ALI, Z. M., KHEIRKHAH, M., NAZER, K. S., & DIEHJI, A. (2013). DETERMINATION THE PHENOLOGY AND USING GEOGRAPHIC INFORMATION SYSTEM (GIS) FOR MANAGEMENT WINTER WILD OAT (AVENA LUDOVICIANA) IN WHEAT FIELDS.	Journal	Agriculture	Crops management
16	Mohammed, S., Alsafadi, K., Ali, H., Mousavi, S. M. N., Kiwan, S., Hennawi, S., . . . Ali, R. (2020). Assessment of land suitability potentials for winter wheat cultivation by using a multi criteria decision Support-Geographic information system (MCDS-GIS) approach in Al-Yarmouk Basin (S yria). <i>Geocarto International</i> , 1-19.	Journal	Agriculture	Crops management
17	Motoda, Y., Fujishima, K., & Ogata, Y. (2000). <i>Road surface condition information system for the winter season</i> . Paper presented at the 7th World Congress on Intelligent Transport Systems.	Conference paper	Logistics	Road maintenance
18	Nagata, Y., Hagiwara, T., Araki, K., Kaneda, Y., & Sasaki, H. (2008). Application of road visibility information system to winter maintenance. <i>Transportation Research Record</i> , 2055(1), 128-138.	Journal	Logistics	Road maintenance
19	Nelson, R. J. (2009). Information Flow System for Winter Service. <i>Routes/Roads</i> , 342.	Journal	Logistics	Road maintenance
20	Ohiro, T., Takakura, K., Maruyama, T., & Morinaga, H. (2014). <i>EFFICIENT WINTER ROAD MANAGEMENT USING A CONTACT AREA INFORMATION SENSING (CAIS)-BASED ROAD SURFACE CONDITION JUDGMENT SYSTEM</i> . PIARC. Paper presented at the XIV INTERNATIONAL WINTER ROAD CONGRESS, Session T5-5.	Conference paper	Logistics	Road maintenance

21	Oshima, J. (2000). Outline of a mobile collection system of winter road surface information. <i>Journal of Snow Engineering of Japan</i> , 16(2), 109-110.	Journal	Logistics	Road maintenance
22	Pasero, E., Moniaci, W., & Raimondo, G. (2008). AWIS: An airport winter information system. <i>Proceedings of the XIV Standing International Road Weather Commission (SIRWEC), Prague, Czech Republic</i> , 14-16.	Conference paper	Logistics	Airport management
23	Paulitsch, H., & Perschl, G. (2005). <i>An automatic Weather Information System for Airport Winter Operation</i> . Paper presented at the SWIFT 2005.	Conference paper	Logistics	Airport management
24	Paulitsch, H., Perschl, G., & Randeu, W. (2008). <i>WIIS-A versatile weather information and warning system for the winter service on roads and airports, for traffic control and air safety improvement</i> . Paper presented at the Proceedings of The Lakeside Conference-Safety in Mobility 2008.	Conference paper	Logistics	Airport management Road maintenance
25	Rea, R. V., Svendsen, J. D., & Massicotte, H. B. (2017). Combining photography and a geographic information system to measure winter browse use. <i>Alces: A Journal Devoted to the Biology and Management of Moose</i> , 52, 67-72.	Journal	Biology	Browse use of trees and shrubs
26	Sha, S., Zhang, M., Wang, W., Zhong, Z., Hong, S., & Li, M. (2014). <i>A remote monitoring system for winter jujube environment and growth information</i> . Paper presented at the 2014 Montreal, Quebec Canada July 13–July 16, 2014.	Conference paper	Agriculture	Crops management
27	Sukuvaara, T., Mäenpää, K., Stepanova, D., & Karsisto, V. (2020). Vehicular Networking Road Weather Information System Tailored for Arctic Winter Conditions. <i>International Journal of Communication Networks and Information Security</i> , 12(2), 281-288.	Journal	Logistics	Road maintenance
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31	WU, Q.-w., XING, W., MA, L.-h., & XU, Q.-h. (2010). The research and establishment of sports event information system model for Harbin 24th winter universiade. <i>Journal of Qiqihar University (Natural Science Edition)</i> (1), 20.	Journal	Sport	Event management
32	Xing, Q., Wu, B., Zhu, W., & Lu, S. (2013). <i>The improvement of et calculation in winter by introducing radar-based aerodynamic roughness information into ETWatch system</i> . Paper presented at the 2013 IEEE International Geoscience and Remote Sensing Symposium-IGARSS.	Conference paper	Geoscience	evapotranspiration (ET) calculation
33	Yaitskaya, N., Lychagina, Y., & Berdnikov, S. (2014). The ice conditions study of the Caspian Sea during the winter periods 2008–2010 using satellite monitoring data and geographical information system. <i>Fresenius Environmental Bulletin</i> , 23(11), 2771-2777.	Journal	Logistics	Waterway management
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