# Thirty Years of NIK: A Bibliometric Study of Paper Impact and Changes in Publication Patterns

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**Abstract**

The Norwegian Annual Informatics Conference (NIK) has served as the most important national meeting point for the academic community in Norway during the last thirty years. National conferences often have a reputation of being of lesser quality than international conferences. Yet, NIK have practiced peer review with relatively low acceptance rates which is a trait of quality. Based on the assumption that quality and impact are related, this study set out to explore the actual impact of NIK in terms of citations over its thirty-year lifetime. As NIK is not being systematically indexed there are no readily available source of citation data and these were thus manually extracted. The results show that NIK papers do get cited at a level comparable to reputable international conferences, and the ratio of papers that are cited is increasing. The results also show that the title length and the number of authors per paper have increased, whereas papers written in Norwegian do not get cited.

## Introduction

The annual Norwegian Informatics Conference (NIK) has been the main national meeting point for academics in Norway for thirty years. The main purpose of NIK is to serve as a forum for the exchange of research ideas among Norwegian academics with the presentation of peer-reviewed papers. Over the years NIK has grown to include several co-located sister-conferences including *Norwegian Conference for Organizations' Use of IT (NOKOBIT), Norwegian Conference for Education and Didactics in IT subjects (UDIT) and Norwegian Information Security Conference (NISK)*, as well as politically important activities such as the annual meetings for the National Councils for computer science and information sciences. NIK has also been one of very few venues where academics are encouraged to submit contributions using the Norwegian language.

The first NIK conference was arranged in 1988 (timeline in Table 1) and has during the years of existence been hosted at several academic institutions in Norway. One quality indicator of a conference is the type of delegate and the inaugurating conference was actively attended by the Turing award winner Ole-Johan Dahl. NIK has included a wide range of topics in informatics, from theoretical to applied computer science. Pedagogics and didactics has also been a recurring topic although sometimes referred to as inferior to technical topics although important to the institutions. One recent paper by John Markus Bjørndalen has also looked at publication patterns within computer science [1] where he points out that the Norwegian incentive system penalises high-quality computer science research published in prestigious conferences and rewards papers published in mediocre journals. This is the only NIK paper addressing publication patterns.

An important prerequisite for being cited is that papers are available to the public and the paper proceedings published by the Norwegian publisher Tapir had limited circulation. Around 1994 the World Wide Web emerged, and most papers for the 1995 edition are available online. Unfortunately, the proceedings are not available online for the years 1996-2000. The degree of self-deposit of research papers varies with notably a very good practice by the Norwegian Computing Centre (NR) which has deposited many of their early NIK papers for free electronic access. One may thus expect the citation counts to be lower for the years before 2000 except for 1995.

*This paper was presented at the NIK 2018 conference. For more information see http://www.nik.no/*

Table 1. Timeline of important events affecting the NIK-conference.

| Year | Event |
|---|---|
| 1988 | Inauguration of NIK |
| 1994 | Emergence of the WWW |
| 1995, 2000- | NIK papers available online |
| 2004 | Norwegian incentive system for publications |
| 2010 | NIK proceedings become a series (gets its own ISSN-number) |
| 2013 | Long term publisher Tapir disappears in a merger |
| 2014 | Proceedings published through BIBSYS Open Journal System |
| 2016 | Revised Norwegian incentive system for publications |

In 2004 the Norwegian incentive system of publications was first introduced, and one may expect a surge in publication intensity in the following years with a more pressure to publish at Norwegian institutions [2]. In 2010, the NIK proceedings was registered as a series with its own ISSN-number giving NIK papers a higher score in the incentive system aligned with journal publication. The incentive system was further revised in 2016 with more complex calculations including a bonus for international co-authors [3]. It is possible that this revised incentive system will lead to more international co-authors at NIK-papers in the years to come, yet it is too early to assess this hypothesis.

In 2012 the long-term publisher of the NIK conference proceedings, Tapir Academic Publishers, merged with a larger publishing house and published the last conference proceedings in 2013. Consequently, the NIK foundation has published its proceedings by itself under the assigned ISSN-number as open access though the BIBSYS Open Journal System. One interesting question is what the effect is of this change. Will the lack of the support from a professional publisher reduce the impact and visibility of NIK papers?

Opinions regarding national conferences in general and NIK specifically are mixed. Advocates of NIK value the national meeting point as one can discuss research and education in a national context and exchange good practices. Academics returning or immigrating from abroad find NIK a useful forum for establishing a network in Norway. The critics of NIK states that a national conference has limited impact and that one should publish in international venues in other succeed as an early career researcher.

This study set out to explore these claims. What is the actual impact of NIK? The impact of research is often measured in terms of citations [5, 6, 7] and journal impact factors [8, 9]. It is a controversial topic [5, 6, 7], yet the most practical and one of few quantitative methods for measuring research impact. Surely, a paper that has generated a citation has sparked some interest and hence can be taken as hard evidence of impact. However, a citation can also be negative in that the work is mentioned in a negative context. Citations measures can easily be manipulated through self-citations and citation cartels and may therefore not necessarily reflect actual impact. Citation coverage is also a challenge as there is no guarantee that all citations are captured by a given citation database. Moreover, different academic disciplines have different citation patterns and caution should be taken when comparing citation measures across discipo8ines. And, informatics is a wide multidisciplinary and heterogenous field in its own right. Unfortunately, NIK has not been systematically indexed by any of the indexing services and there are thus no easily available citation databases applicable to evaluate NIK. For instance, NIK is not indexed in SCOPUS which is often used to conduct bibliometric research. Papers from recent NIK editions (2014-2016) are indexed in the DBLP computer science bibliography, but this range is too limited for a full analysis. One does find citations to NIK papers in Google Scholar, ResearchGate and CiteCeer, but the

citation counts vary greatly [4]. It seems that Google Scholar is the most comprehensive source for citations [10, 11]. Note that citation counts only confirm the presence of citations, not their absence, and it is a risk that the citation engines miss important citations. Google Scholar prohibits the automatic extraction of citation data. This study was thus based on a manual extraction of citation data using Google Scholar.

# Method

The NIK association has maintained a relatively systematic archive of conference programs. The programs from all the NIK conferences from the start in 1988 to the most recent in 2017 was extracted from the web, cleaned and put into a systematic format. A script was created to perform simple bibliometric analysis. Unfortunately, no download information is available for NIK-papers. Counts of unique downloads can be used as a rough measure of interest in a paper as a paper that has been downloaded more is likely to have been read by more people than a paper with a low download count. It would have been useful to analyse which NIK papers that have sparked the most interest.

Citation analyses were also conducted using Google Scholar. The citation counts for each NIK publication had to be retrieved manually as Google Scholar does not allow for automatic retrieval of information using web-robots. The manual process revealed that the quality of the paper metainformation of the indexed NIK papers are highly irregular with many mistakes, for example family names treated as surnames, variations in use of the conference name, etc.

Statistical analyses were performed using Spearman's rank correlation as it evaluates the monotonic relationship between two variables and is not limited to linear relationships. Analyses were performed using JASP version 0.8.6.0 and the results are reported using standard APA notation.

# Results

The results of the bibliometric analysis are presented in the following sections.

## Quantity of Paper Presentations

There is a total of 654 listed presentation titles for the 30-year history of the conference, of which most have been published in the NIK conference proceedings. There is a mean of 21.8 paper presentations each year, but in 1997 there were a peak of 29 presentations and in 2015 there were only 12 presentations (see Figure 1). The trend is a reduction in the number of paper presentations from the start to the present day, with a significant negative correlation between year and number of papers ($r_s(30) = -.572$, $p < .001$).

According to the Preface of recent proceedings the program committees have experienced fewer overall submissions and hence accepted fewer papers to maintain a certain level of quality. With larger number of submissions, one would expect the chance of receiving high quality submissions as higher than with fewer submissions.

## Norwegian Papers

NIK has promoted the use of Norwegian language and papers that address Norwegian contexts. NIK is one of very few venues where authors can author and publish their research papers in Norwegian. Of the 654 papers, only 43 were identified as being written in Norwegian, that is, only 6.6%. The level of Norwegian papers has been relatively stable over the 30 years and varies between 0 and 3 contributions each year.

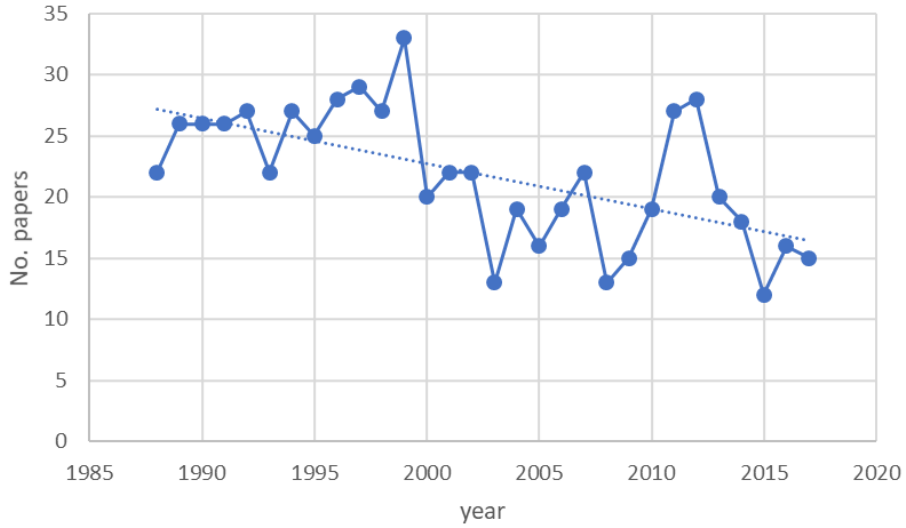


Figure 1 The number of paper presentations over time.

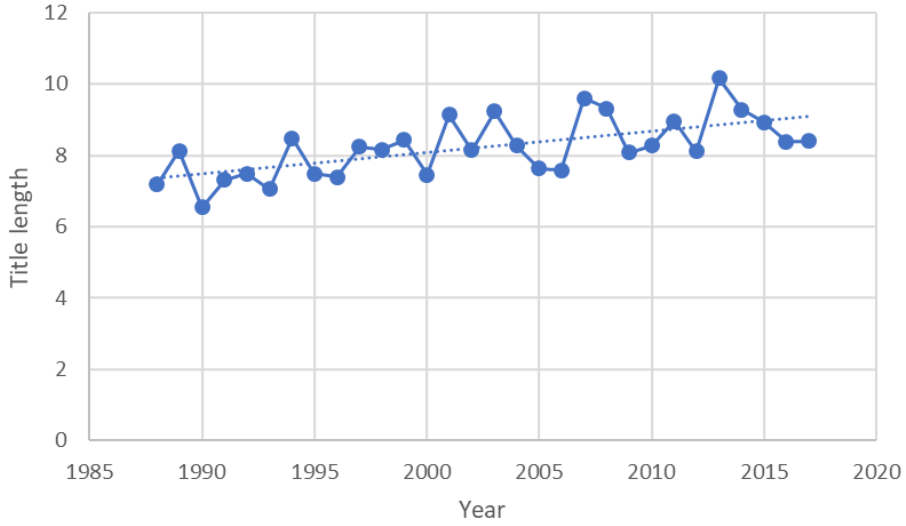


Figure 2 Mean title length over time.

## Publication Titles

Figure 2 shows the mean title length for each year of the conference. Interestingly, there has been a gradual increase from a mean title length of 7.2 words per title in 1989 to 8.4 words per title in 2017. The strong positive correlation between year and title length is statistically significant ($r_s(30) = .632$, $p < .001$).

One may hypothesize that this change reflects a shift from general and broad papers requiring fewer words in the title to specific and narrow papers addressing specific research problems requiring more words. Visual inspections of the titles support this hypothesis as many of the early NIK-presentations had more general, populistic and broad titles, such as “Redundancy in software design”, “Neural nets” and “Reliability and safety in software systems” (1988) while in recent years the titles have become more specific and focused, for example “Realistic face manipulation by morphing with average faces” and “Baseline Requirements for Comparative Research on Cross-Platform Mobile Development: A Literature Survey” (2017).

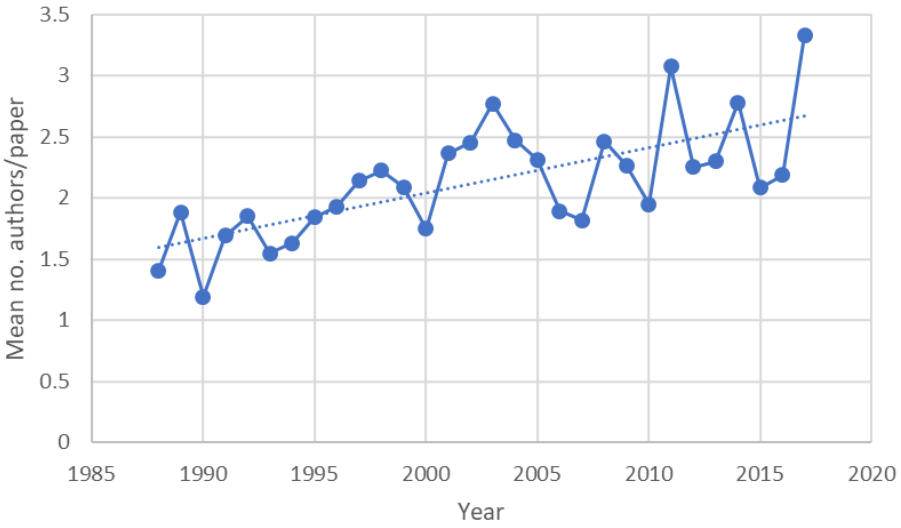


Figure 3 Mean number of authors per paper over time.

## Number of Authors per Paper

Figure 3 shows the mean number of authors per paper for each year. Clearly, there is a dramatic increase in the number of authors from 1.4 authors per paper at the first conference in 1988 to a peak of 3.3 authors per paper in 2017.

The strong positive correlation between year and the number of authors is statistically significant ($r_s(30) = .685$, $p < .001$). The doubling in the number of authors per paper can be an effect of the increased trend of researchers working increasingly together in teams as opposed to conducting individual "lone wolf" research.

## Author Frequency

NIK is one of very few gathering spots for Norwegian computer scientists and many participants are loyal attendees to the conference. Several participants have also contributed consistently with many publications over a period of many years. As there are usually few slots on the NIK presentation schedule it is rare for an author to have more than one paper on the program. Table 2 lists the top 11 most frequently published authors at NIK. The list is topped by Randi Karlsen at University of Tromsø with 15 NIK papers which would be enough to fill the entire program of a single NIK conference. Reidar Conradi at NTNU comes in second place with 14 papers, and the third place is shared by Frank Eliassen, Arne Maus, Kai A. Olsen and Olaf Owe with 12 publications each. Common to all the authors in the top list in Table 2 is that they have followed and contributed to NIK over several decades.

In total, 878 unique authors have had their names listed on NIK publications during the first thirty years. In addition to the authors listed in Table 2, the distribution of the remaining authors is shown in Table 3. Most authors, that is 698, have only (co-)authored one NIK paper, while 87 authors have (co-)authored 2 papers, 34 individuals have (co-)authored 3 NIK-papers.

Table 2. Most frequently published authors

| Papers | Author | Years active |
|---|---|---|
| 15 | Randi Karlsen | 1991-2014 |
| 14 | Reidar Conradi | 1989-2011 |
| 12 | Frank Eliassen | 1988-2004 |
| 12 | Arne Maus | 1991-2015 |
| 12 | Kai A. Olsen | 1991-2016 |
| 12 | Olaf Owe | 1989-2014 |
| 11 | Weihai Yu | 1994-2011 |
| 11 | Arne Løkketangen | 1996-2012 |
| 11 | John Markus Bjørndalen | 2001-2017 |
| 10 | Roger Midtstraum | 1994-2012 |
| 10 | Otto J. Anshus | 1988-2013 |

Table 3. Distribution of remaining authors not listed in Table 2.

| publications | authors |
|---|---|
| 1 | 698 |
| 2 | 87 |
| 3 | 37 |
| 4 | 12 |
| 5 | 13 |
| 6 | 6 |
| 7 | 6 |
| 8 | 5 |
| 9 | 1 |

## Citations

The NIK papers have been cited a total of 1 259 times during the last thirty years giving an overall impact factor of 1.925 for the conference, where the impact factor is defined as the total number of citations divided by the number of papers. The h-index of the NIK conference is 16. The h-index is a measure of impact denoting where the conference has $h$ papers with $h$ or more citations. That is, 16 NIK papers have been cited 16 times or more. NIK papers have been cited all years throughout the history of the conference even though the proceedings are not available online for some of the first years. Figure 4 shows the number of citations per year for the thirty-year time-period. In the beginning of the conference history the citations were relatively moderate. At year 2001 there was a sudden increase in the number of citations and this level has persisted until 2015. This sudden increase is consistent with the availability of the online proceedings from 2000 an onwards. The years 2001, 2002 and 2007 stand out as years with particularly high impact as the papers collectively have received more than 100 citations. There is however no significant correlation between year and the number of citations ($r_s(30) = .125$, $p = .51$).

The citations per paper at NIK is relatively high compared to renowned international conferences. Table 4 lists a small arbitrary selection of statistics from other international computer science conferences retrieved from SCImago[1]. Clearly, there are renowned international conferences with lower citation counts per publication than NIK.

[1] http://www.scimagojr.com/journalsearch.php?q=conference&tip=jou

Table 4. Comparison with international computer science conferences

| Conference | Citations /paper | h-index |
|---|---|---|
| ACM SIGGRAPH Conference on Computer Graphics | 9.1 | 132 |
| IEEE Conference on Computer Vision and Pattern Recognition | 4.6 | 192 |
| International Conference on Data Engineering | 3.1 | 108 |
| International Joint Conference on Artificial Intelligence | 2.8 | 89 |
| International Conference on Software Engineering | 2.7 | 105 |
| Conference on Human Factors in Computing Systems | 2.5 | 131 |
| **NIK** | **1.9** | **16** |
| Electronic Components and Technology Conference | 1.3 | 57 |
| International Conference on Communications | 1.3 | 94 |

However, all the conferences listed have a much higher h-index. This can be explained by the fact that these international conferences include many paper presentations each year, while NIK is comparatively small. Hence, it is easier to establish a high h-index with larger conferences than small conferences as the probability of soliciting highly cited papers is higher.

Although there are fewer citations to papers prior to 2001 the manual exploration of the citation data revealed that many authors had published works with the same title at other international conferences and journals and some of these papers have attracted high citation counts. However, these citations are discarded herein as they are not crediting NIK specifically. The number of citations has not picked up since the peak year of 2007 although the number of citations has been stable. It is natural to expect newer publications to have gained fewer citations than older publications. Thus, not many citations have yet been made to NIK papers for the last two years.

Another, issue is that NIK has not relied on a professional publish service since 2013 and hence the lack of professional support may have led to less visibility. However, it is too early to conclude on this given the set of data. Nevertheless, this is a factor that could be followed closely in the coming years unless NIK decides to collaborate with an established publisher.

Figure 5 shows a normalised view of the citation patterns with the number of citations per paper per year. This plot emphasizes the impact of the papers from 2000 to 2005 and reveals a dip in the number of citations for 2006. There is a weak non-significant positive correlation between year and the citations per paper ($r_s(30) = .215$, $p = .25$).

The citation counts are highly sensitive to outliers in that one highly cited paper will reveal itself in the results. The citation patterns where thus analysed using the ratio of cited papers. The number of cited papers does not take the actual citation count into consideration but count all publications with at least one citation per year. This measure gives an indication of the breath of citable papers and hence more consistent quality of the papers. Figure 6 shows the ratio of cited papers per year. Except for the last two years, there has been a steady increase in the ratio of cited papers from 4.5% in 1988 to a maximum of 73.6% in 2004. There is a relationship between year and the ratio of cited paper is strongly positively correlated and the correlation is statistically significant ($r_s(30) = .602$, $p < .001$).

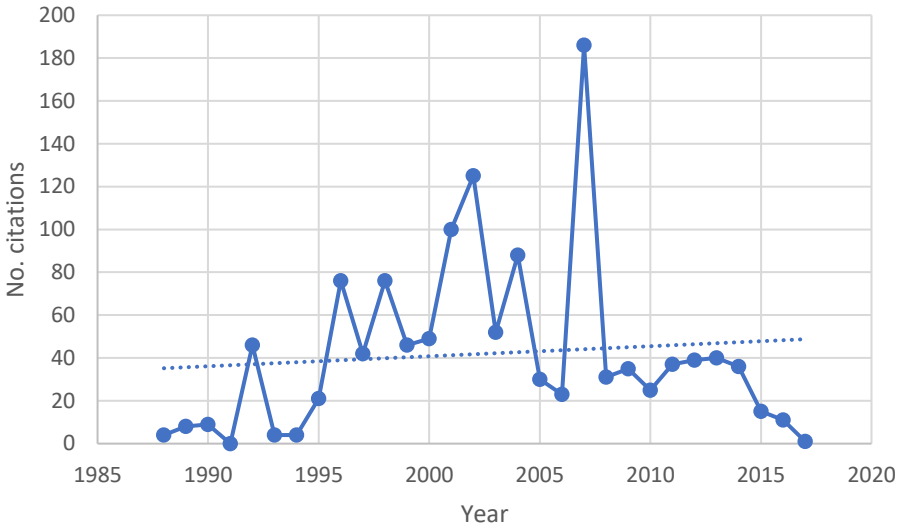


Figure 4 Number of citations per year.

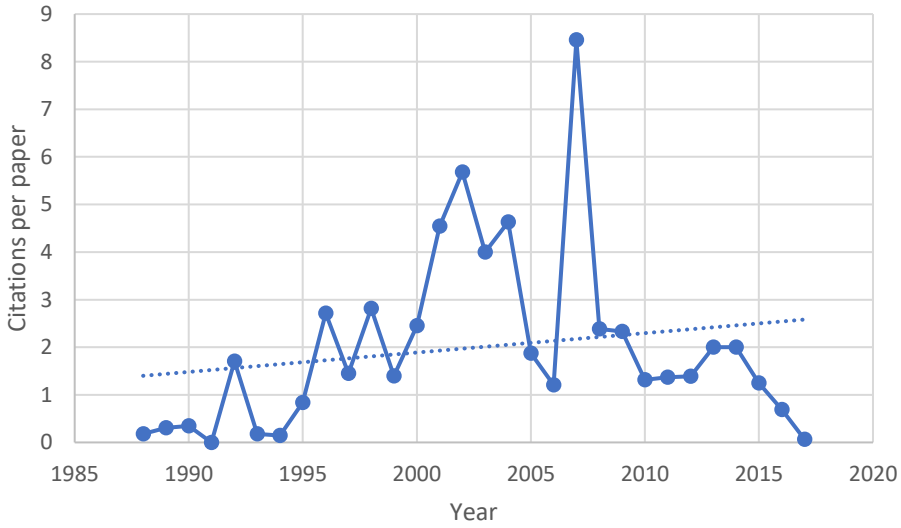


Figure 5 Citations per paper per year (impact factor).

The citation results revealed that all the citations are made to papers written in English with just one citation to a paper written in Norwegian, and, this reference is a self-citation. Given the fact that none of the 43 Norwegian papers in the history of NIK has received any external citations one may conclude that writing papers in Norwegian is not a desirable strategy for impact. This is logical as a paper written in Norwegian is inaccessible to an international audience.

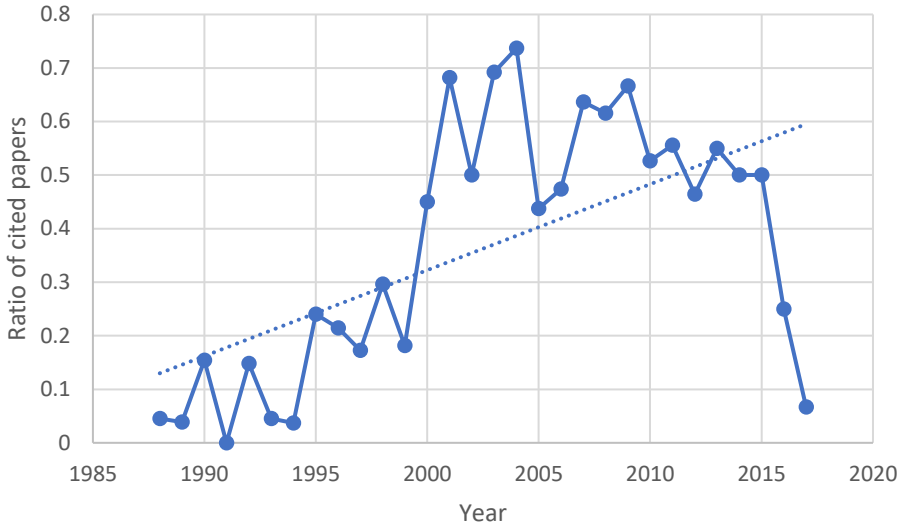


Figure 6 Ratio of cited papers per year.

Finally, Table 5 shows the list of the 20 most cited NIK papers during the first thirty years of the conference. The list is topped by a survey by Davrondzhon Gafurov (Gjøvik, now NTNU campus) with 109 citations. In second place with 50 citations are researchers from Molde University College including Arne Løkketangen who was a regular NIK attendee. The paper by Jens Kaasbøll in 4th place confirms that didactical papers also can achieve high citations (41 citations in this case). The 5th place is occupied by Magne Jørgensen who has been ranked a top scholar in software engineering research by the Journal of Systems and Software on several occasions [12]. Frequent authors at NIK are also represented on the list including Randi Karlsen at 9th place, Arne Maus at 13th place, John Markus Bjørndalen at 16th place and Frank Eliassen at 12th and 14th place.

# Conclusions

The impact and changes in publication patterns for papers presented at the NIK conference was presented. The results show that NIK papers do get cited and that the mean citations per paper is comparable to that of many international conferences. Also, the ratio of papers that are being cited is increasing. By taking steps to strengthen the impact of NIK the conference is likely to attract more submissions and even more high-quality submissions. A key to achieving this is for the conference organizers to work hard to increase the visibility of the conference. The first step is to ensure a consistent, standardized and long-term solution for the online deposit of papers. Moreover, steps should be taken to provide additional metainformation allowing papers to be correctly indexed by third-party databases. One possibility is to partner with an established publisher who may provide professional archiving and dissemination services. If the objective is to increase the impact of NIK one should consider abolishing the Norwegian language category as these papers are not cited by a global audience. Finally, one should take steps to regularly monitor both the citation patterns and download patterns of NIK publications.

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Table 5. Highly cited NIK papers

| Rank | Publication | Citations |
|---|---|---|
| 1 | Davrondzhon Gafurov: *A Survey of Biometric Gait Recognition: Approaches, Security and Challenges* (2007) | 109 |
| 2 | Arild Hoff, Arne Løkketangen, Ingvar Mittet: *Genetic algorithms for 0/1 multidimensional knapsack problems* (1996) | 50 |
| 3 | Kjetil Stølen, Folker den Braber, Theo Dimitrakos, Rune Fredriksen, Bjørn Axel Gran, Siv-Hilde Houmb, Mass Soldal Lund, Yannis Stamatiou, Jan Øyvind Aagedal*: Model-based risk assessment - the CORAS approach* (2002) | 45 |
| 4 | Jens J Kaasbøll: *Exploring didactic models for programming* (1998) | 41 |
| 5 | Magne Jørgensen: *An empirical evaluation of the MkII FPA estimation model* (1997) | 33 |
| 6 | Pavel Petrovi: *Solving Lego brick layout problems using evolutionary algorithms* (2001) | 28 |
| 7 | Frank Alexander Kraeme: *Ramses and Arctis: Extensible Tool Suites for Service Engineering* (2007) | 27 |
| 8 | M Haveraaen, V Madsen, H Munthe-Kaas: *Algebraic programming technology for partial differential equations* (1992) | 24 |
| 9 | Thomas Strandenæs, Randi Karlsen: *Transaction compensation in web services* (2002) | 24 |
| 10 | Einar Broch Johnsen, Olaf Owe, Marte Arnestad: *Combining active and reactive behavior in concurrent objects* (2003) | 23 |
| 11 | Pauline Haddow, Gunnar Tufte: *Evolving a robot controller in hardware* (1999) | 22 |
| 12 | Anders Andersen, Gordon S Blair, Frank Eliassen: *OOPP: a reflective component-based middleware* (2000) | 20 |
| 13 | Arne Maus: *AR - a faster in-place, cache friendly sorting algorithm* (2002) | 20 |
| 14 | Sten Amundsen, Ketil Lund, Frank Eliassen, Richard Staehli: *QuA: Platform-managed QoS for component architectures* (2004) | 19 |
| 15 | Mark Burgess: *CF-engine as a component in computer immune systems* (1998) | 16 |
| 16 | John Markus Bjørndalen, Otto Anshus, Tore Larsen, Brian Vinter: *PATHS - integrating the principles of method-combination and remote procedure calls for run-time configuration and tuning of high-performance distributed applications* (2001) | 16 |
| 17 | Jacqueline Floch, Svein Hallsteinsen, Arne Lie, Hans I Myrhaug: *A reference model for context-aware mobile services* (2001) | 15 |
| 18 | Thomas Plagemann, Vera Goebel (Unik, UiO), Arne-Jørgen Berre, Mads Nygård: *OMODIS - object-oriented modeling and database support for distributed multimedia systems* (1996) | 13 |
| 19 | Fritjof Boger Engelhardtsen, Tommy Gagnes: *Using JavaSpaces to create adaptive distributed systems* (2002) | 13 |
| 20 | Lars-Jacob Hove: *Extending image retrieval systems with a thesaurus for shapes* (2004) | 13 |