A comparative bibliometric analysis of the STI and the ISSI conference series

Marc Luwel, Ed C.M. Noyons, Nees Jan van Eck

{luwel, noyons, ecknjpvan}@cwts.leidenuniv.nl

Leiden University, Centre for Science and Technology Studies (CWTS), Wassenaarseweg 62A, 2333AL Leiden (the Netherlands)

Abstract
The profile of the STI and the ISSI conferences series are analyzed using the oral presentations. Both play a different role in the development of quantitative science and technology studies. The former is dominated by European authors and more oriented towards applied, policy relevant research. At the latter more fundamental contributions to the discipline are presented by an increasingly globalizing research community. The coexistence of both series is an added value for discipline’s further development. To fully contribute the STI conference series should geographically diversify both its author population and its venues.

Introduction
The past three decades are characterised by the rapid and turbulent development of the global knowledge society driven by (higher) education, research and innovation. Innovation based on basic results became the engine of economic growth and more generally societal prosperity. It is not surprising that R&D and subsequently Research, Development and Innovation came on top of the public authorities’ agenda, not only in the industrialised world but also in the emerging economies. China, India, Brazil and a host of other countries are making considerable efforts to evolve from being the world’s low cost commodity factories to becoming creators of new products and services. They realize their ambitions to create a more affluent society and a better world. All governments and supra-national organizations no longer perceive science and innovation policy as a rather marginal competence but of strategic importance.

From the groundbreaking work of Vanevar Bush, Robert Merton, Eugene Garfield and many others quantitative science, technology and innovation studies evolved over the same time period mainly from sociology and library sciences into a fully fledged research field with its own handbooks, journals and conference series. Moreover it illustrated very well the blurring between basic and more applied work as it supports policy making. These interactions generate positive feedback loops and stimulate the development of more sophisticated tools and generate new theoretical insides. The founding research field is 'scientometrics' and has basically been represented during the past decades in two biannual conference series:

1. The conference of the International Society for Scientometrics and Informetrics (ISSI); and
2. The International Science and Technology Indicators Conference (STI).

Both conference series started in the late eighties. The former traditionally focuses more on the fundaments of the field, while the latter covers more the application of methods and indicators in the area of science policy and research evaluation. It should be noted that in 2005 a new series has started, European Network of Indicators Designers, ENID, with an even

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50 It should be mentioned that there are a couple of other (smaller) conferences or workshops of importance (e.g., Collnet, Nordic Workshop). They are not included in this study due to their smaller focus or local scope.
clearer focus on evaluative indicators and application. As from 2010, this conference series has merged with the STI. We will include data from ENID, if available, in the future.

As the importance of applying quantitative indicators in evaluation grew, the scope of the ISSI and the STI conference series tended to converge. It has even been considered to merge them into one series. The objective of the present paper is to evaluate the two series particularly over the past 10 years and determine to what extent this observation is correct and investigate whether a merger would be sensible. In our analyses we focus on the series themselves and not so much on the effect they have on the field, on science in general or on society.


Data and method

The data were collected from the oral presentations published in the book of abstracts of the STI and proceedings of the ISSI series. The eleven STI editions were taken into account: 1988 (Leiden, Netherlands), 1990 (Bielefeld, Germany), 1991 (Leiden, Netherlands), 1995 (Antwerp, Belgium), 1998 (Cambridge, UK), 2000 (Leiden, Netherlands), 2002 (Karlsruhe, Germany), 2004 (Leuven, Belgium), 2006 (Leiden, Netherlands), 2008 (Vienna, Austria) and 2010 (Leiden, Netherlands). Of the last six editions an electronic version of the book of abstracts was available and processed. Data collection of the ISSI conference series was limited to the last four editions for which an electronic version of the proceedings was accessible on the ISSI website: 2003 (Beijing, China), 2005 (Stockholm, Sweden), 2007 (Madrid, Spain), 2009 (Rio de Janeiro, Brasil). For simplicity the book of abstracts and the proceedings will be referred to as ‘the proceedings’.

From the paper version or the electronic version of each oral presentation published in the proceedings, the author’s or authors’ name, title and affiliation, the conference type (STI or ISSI), the edition and the presentation’s title were collected. These data were entered in a Microsoft Access database and each oral presentation was given a unique identification number.

All the authors’ names were unified and the different authors got a unique identifier. The author’s gender was added. The gender’s identification was a cumbersome and time consuming process. In a fraction of the proceedings only the author’s initials were mentioned and depending on the language and culture first names can be used for both male and female authors. Using institutional web pages, personal web pages, journal articles and personal contacts, we were able to collect information on the gender of most of the authors. The institutional addresses were unified at the level of the main organisation.

To compare the results for the conference series, some of the analyses were based on the last four editions of the STI-conference series, covering roughly the same period as the last four ISSI editions.

For the different editions of both conference series the standard bibliometric output indicators (number of presentation per edition, geographic distribution of the authors, frequency and gender distribution of the authors, number of authors per paper, ...) were calculated.

To analyze the evolution of the composition of the authors' population a modified survival analysis was carried out and the fraction of the population that ‘survive’, i.e. make a

51 http://www.issi-society.info/
presentation past a certain edition was calculated. For each edition X of the authors population:

i) The number of authors contributing at edition (X+1), at edition (X+2), .... (no interruption between successive edition; further called ‘strong survival’ model);

ii) The number of authors contributing at (a) later edition (X+n) (allowing for interruption between successive editions; further called ‘weak survival’ model) was calculated. This analysis was carried out for both conference series.

The STI and the ISSI conference series were also analyzed and compared using bibliometric maps. For both conference series, a term map was constructed. This was done as follows. First, relevant terms were selected using a technique for automatic term identification (Van Eck N.J., Waltman L., Noyons E.C.M., Buter R.K., 2010). Next, co-occurrences of selected terms in abstracts/papers were counted. The co-occurrence counts were used as input for the VOSviewer software (Van Eck N.J., Waltman L., 201052). The VOSviewer software then produced a term map based on the co-occurrence counts. In general, the higher the number of co-occurrences of two terms, the closer the terms are located to each other in a term map. Colors indicate clusters of related terms. Mapping and clustering was done using the VOS mapping and clustering techniques (Van Eck N.J., Waltman L., Dekker R., Van den Berg J., 2010; Waltman L., Van Eck N.J., Noyons E.C.M., 2010), which are incorporated into the VOSviewer software.

Results

Of the eleven editions of the STI-conferences data from a total of 470 presentations (238 for the last four editions) were processed. The proceedings of the last four editions of the ISSI-conference series contained information on 321 oral presentations. Of a few keynote addresses no paper was published in the proceedings; as all the bibliographic information, including the presentation’s title and the authors’ affiliations were available in the programme, they were included in the database but no text was available for the bibliometric maps. Of the 2003 edition of the ISSI-conference the proceedings did not contain the papers of several oral presentations mentioned in the programme and they are not included in the analysis as insufficient bibliographic information was available.

Basic characteristics of the authors’ population

Table 1 shows the evolution of the number of oral presentations at the different editions of the STI and the ISSI conference series. For the former data of the eleven editions are presented: after a start-up phase the number remained fairly constant around 40 for four editions and after a decrease at the 2002 edition, it more than doubled over the next three editions to 74; at the last edition a decrease by 18% was observed. The introduction of parallel sessions from the 2006 edition onwards explains the observed increase. Over the last three editions of the ISSI conference series the number of oral presentations increased by 15%; the lower number of presentations at the 2003 edition can be partially explained by the already mentioned incomplete coverage of the proceedings.

Table 1. Number of oral presentations (#) published in the proceedings of the editions of the STI and the ISSI conference series

<table>
<thead>
<tr>
<th>Year</th>
<th>STI</th>
<th>ISSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

52 Software freely available at www.vosviewer.com
For the eleven editions of the STI conference series a total of 572 different authors contributed to the oral presentations; 331 to the last 4 editions. 468 different authors (co)signed an oral presentation at the last 4 editions of the ISSI conference series.

A first indication of the two conference series’ overlap or complementarily is given by the 130 authors presenting research work at both. Restricting to the last four editions of the STI conference series results in 111 authors, or 33% and 24% of the total number of authors contributing to these STI and the ISSI conference series’ editions.

For the different editions of the STI and the ISSI conference series the average number of authors co-signing an oral presentation varies between 1.8 and 2.7. Over the last four editions for both conference series the average is 2.40.

The distribution of the number of proceedings per author is highly skewed for the ISSI and the STI conference series with 67.5% and 72.0% of the authors (co-)signing only one oral presentation. For the STI conference series 14 authors (co-)signed more than 10 oral presentations with Glänzel (20) and Moed (19) as the most prolific authors. For the last four editions 17 authors have 5 or more contributions; ranking at the top Glänzel (13) and Van Leeuwen (11). For the four ISSI editions 34 authors (co-)signed five or more oral presentations and 3 authors signed 10 or more (Glänzel (13), Rousseau (11), Thelwall (10)). It should be noted that the most prolific authors are all men.

**Characteristics of the authors’ gender distribution**

Table 2 gives for the two conference series the gender distribution of the authors signing one or more oral presentations. For the ISSI conference series the fraction of authors without information on gender is somewhat higher in comparison with the STI conference series, mainly due to the difficulty of finding this information for Asian authors.

**Table 2. Gender distribution in percentages of the authors’ population of the STI conference series’ eleven editions (STI-11) and last four editions (STI-4) as well as of the last four editions of the ISSI conference series (ISSI-4)**

<table>
<thead>
<tr>
<th>Edition</th>
<th>%F</th>
<th>%M</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSI-4</td>
<td>2003</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>30%</td>
</tr>
<tr>
<td>STI-4</td>
<td>2004</td>
<td>32%</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>19%</td>
</tr>
</tbody>
</table>

Not only is the fraction of female authors somewhat higher for the ISSI conference series, the underlying patterns are different as well. At the ISSI conferences the proportion of female
authors remains at the same level of around 30%, while at the last four editions of the STI conference series the proportion female authors decreases from 30% to 20%. The ISSI editions show a stable situation regarding female authors. Hence ISSI conference series shows more diversity regarding the authors contributing to oral presentations in contrast with STI conference series. It should be noted however, that the low proportion of female authors in the 2010 STI editions could be an outlier.

**Survival analysis**

From the 2002 and 2003 edition onwards Table 3a shows the number of authors (co-) signing a paper at an edition of the STI and the ISSI conference series contributing without interruption to oral presentations at its successive editions (E+1), (E+2), ... For the two series the same pattern emerges: between 30 and 45% of the authors contributes to the next edition and for the following editions the fraction slowly decreases.

<table>
<thead>
<tr>
<th>Edition (E)</th>
<th>E+1</th>
<th>E+2</th>
<th>E+3</th>
<th>E+4</th>
</tr>
</thead>
<tbody>
<tr>
<td>STI-2002</td>
<td>0.35</td>
<td>0.21</td>
<td>0.20</td>
<td>0.13</td>
</tr>
<tr>
<td>STI-2004</td>
<td>0.30</td>
<td>0.24</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>STI-2006</td>
<td>0.43</td>
<td>0.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STI-2008</td>
<td>0.39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISSI-2003</td>
<td>0.30</td>
<td>0.19</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>ISSI-2005</td>
<td>0.44</td>
<td>0.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISSI-2007</td>
<td>0.33</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3b shows for the same editions as in Table 3a the results for the weak survival analysis allowing for an interruption in the contributions to oral presentations. These results show a stable core of researchers presenting if not at each edition, very regularly new results. A large fraction of authors is only once or occasionally contributing to an oral presentation and are marginally involved in the long term development of the discipline. The fractions show that the review process used to select oral presentations does not show a conservative character in neither of the two series but regarding the relatively high fraction of survivors we need to be aware that there will remain enough room for new people and new ideas.

<table>
<thead>
<tr>
<th>Edition (E)</th>
<th>E+1</th>
<th>E+2</th>
<th>E+3</th>
<th>E+4</th>
</tr>
</thead>
<tbody>
<tr>
<td>STI-2002</td>
<td>0.35</td>
<td>0.31</td>
<td>0.34</td>
<td>0.21</td>
</tr>
<tr>
<td>STI-2004</td>
<td>0.30</td>
<td>0.34</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>STI-2006</td>
<td>0.44</td>
<td>0.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STI-2008</td>
<td>0.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISSI-2003</td>
<td>0.30</td>
<td>0.36</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>ISSI-2005</td>
<td>0.44</td>
<td>0.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISSI-2007</td>
<td>0.33</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**The authors’ geographic and institutional origin**
To analyse the author’s geographical origin a full counting scheme was used. For example a publication with three Belgian institutional addresses, two French and one Dutch is assigned with weight 1 to Belgium, France and the Netherlands. The same counting scheme was applied in the institutional analysis.

For the last four editions of the ISSI and the STI conference series 38 and 29 different countries were mentioned in the oral presentations’ institutional addresses. Their distribution is skewed as illustrated in Table 4. Countries with ten or more contributions represent more than 80% of the total number of countries.

The STI conference series is more European oriented with a rather limited number of contributions signed by authors working in other continents: the United States, Canada and Australia together represent 12% and all the other non-European countries less than 6%. The ISSI conference series is a more worldwide event. Not only are oral contributions originating from more countries, North America and the BRIC-countries (Brazil, Russia, India and China) with 18% and 16% are active contributors.

Of the 38 countries contributing to the last four editions of the ISSI conference series 28 or 74% had oral presentations co-signed by authors from another country; 21 out of the 29 countries (72%) represented at the last four STI editions. These countries co-signed a total of 73 oral presentations (23%) at the ISSI conference series and 55 (23%) for the STI conference series. For the STI conference series the fraction of internationally co-authored oral presentations more than doubled over the last eight editions.

<table>
<thead>
<tr>
<th>Series</th>
<th>Country</th>
<th># pubs</th>
<th># co-pubs</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSI (4 eds)</td>
<td>USA</td>
<td>51</td>
<td>14</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Belgium</td>
<td>35</td>
<td>28</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Netherlands</td>
<td>32</td>
<td>13</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>China</td>
<td>29</td>
<td>15</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>26</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Spain</td>
<td>25</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Canada</td>
<td>22</td>
<td>6</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>India</td>
<td>17</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Germany</td>
<td>16</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Sweden</td>
<td>15</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Hungary</td>
<td>14</td>
<td>12</td>
<td>86</td>
</tr>
<tr>
<td>STI (4 eds)</td>
<td>Netherlands</td>
<td>55</td>
<td>18</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Belgium</td>
<td>29</td>
<td>19</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>25</td>
<td>16</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Germany</td>
<td>25</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Spain</td>
<td>18</td>
<td>8</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Austria</td>
<td>16</td>
<td>6</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td>16</td>
<td>5</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>15</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Canada</td>
<td>12</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Switzerland</td>
<td>12</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Hungary</td>
<td>11</td>
<td>8</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Sweden</td>
<td>11</td>
<td>6</td>
<td>55</td>
</tr>
</tbody>
</table>

Table 4 also provides information on the internationally co-authored papers. More than half of the research work presented by Belgium, Hungary and the UK presented at both conference
series was the result of an international collaboration. At the ISSI conference series half of China’s and Germany’s oral presentations were internationally co-authored. Overall, if we look at the distribution of the oral contribution, we see that the ISSI conference series have a much more global character than STI. The latter is much more biased towards Europe. Considering the history and tradition of STI this is not a surprise. The tradition is that (on average) every 4 years, the Leiden University hosts the conference, while all other editions were in other European countries. The 2012 edition will be first one outside Europe. In that respect it will be interesting to see whether the merger with ENID will change the character of the conference regarding the geographical distribution of the audience. ENID being a European network may cause an even more local character of the series, while the STI series seems to go beyond the European borders.

Table 5: Most active institutes (STI and ISSI) in the last 4 editions

<table>
<thead>
<tr>
<th>Institute</th>
<th>Country</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>STI (4 eds)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leiden University</td>
<td>Netherlands</td>
<td>38</td>
</tr>
<tr>
<td>Katholieke Universiteit Leuven</td>
<td>Belgium</td>
<td>20</td>
</tr>
<tr>
<td>Fraunhofer Institute for System and Innovation Research</td>
<td>Germany</td>
<td>15</td>
</tr>
<tr>
<td>IEDCYT-CINDOC</td>
<td>Spain</td>
<td>12</td>
</tr>
<tr>
<td>University of Sussex</td>
<td>UK</td>
<td>12</td>
</tr>
<tr>
<td>Hungarian Academy of Sciences</td>
<td>Hungary</td>
<td>11</td>
</tr>
<tr>
<td>Observatoire des Sciences et des Techniques</td>
<td>France</td>
<td>10</td>
</tr>
<tr>
<td>ISSI (4 eds)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Katholieke Universiteit Leuven</td>
<td>Belgium</td>
<td>20</td>
</tr>
<tr>
<td>Leiden University</td>
<td>Netherlands</td>
<td>16</td>
</tr>
<tr>
<td>Hungarian Academy of Sciences</td>
<td>Hungary</td>
<td>14</td>
</tr>
<tr>
<td>IEDCYT-CINDOC</td>
<td>Spain</td>
<td>14</td>
</tr>
<tr>
<td>University of Wolverhampton</td>
<td>UK</td>
<td>12</td>
</tr>
<tr>
<td>Hasselt University</td>
<td>Belgium</td>
<td>11</td>
</tr>
<tr>
<td>Catholic University College of Bruges–Ostend</td>
<td>Belgium</td>
<td>11</td>
</tr>
<tr>
<td>Indiana University</td>
<td>USA</td>
<td>10</td>
</tr>
</tbody>
</table>

At the last four editions of the ISSI conference series and of the STI conference series 206 and 139 different institutes signed an oral presentation. 155 of the 321 oral presentations (48%) at these editions of the ISSI conference series had more than one address; 107 out of 237 for the STI conferences (45%). Table 5 gives the institutes with 10 or more oral contributions for the two conference series. 72 institutes contributed to both conferences: one third of those presenting work at the ISSI conference series and even more than half of the institutes signing oral presentations at the last four editions of the other conference series. Regarding the contribution of main institutes, we discern a large bias towards the Leiden University in the STI conference series which is remarkable but not completely unexpected considering the hosting tradition. Hosting a conference yields a home advantage for researchers considering participating at a conference because of the low travelling cost. We don't want to suggest that a home advantage is reflected in the acceptance rate of submitted papers. We did not have data on submissions. Furthermore, we notice particularly the University of Wolverhampton and Indiana University as prominent actors at the ISSI, not at the STI conference series. In the next section we will get back to this.

Bibliometric maps

Figure 2a shows the bibliometric map based on a co-word analysis of the significant terms in the abstracts of the oral presentations at the last six editions of the STI conference series and figure 2b of the full papers presented at the last four editions of the ISSI conference series.
Figure 2a. Term map based on the abstracts of the oral presentations at the last six editions of the STI conference series.

Figure 2b. Term map based on the papers of the oral presentations at the last four editions of the ISSI conference series.
Luwel et al.

It should be noted that the structures emerge from the co-word data automatically. We did not manipulate the structure to make them comparable other than by choosing matching colors for similar clusters. These clusters have been roughly indicated by ovals in the maps. The two maps show overlapping topic clusters as well as significant differences. The coarse structure shows for the STI conference series three main topic clusters (between parentheses we indicate their location on the two maps):

1: Research performance, evaluation and (citation) indicators (a: West and b: South);
2: Science mapping and classification (a: North and b: Northwest);
3: Science, Technology and innovation policy indicators (a and b: East).

For the ISSI conference series we found the same clusters as in the STI structure but also an additional topic cluster:
4: Webometrics and web-based indicators (b: Southwest)

In this fourth cluster we find the most significant difference between the two series. An important actor responsible for this cluster is the University of Wolverhampton. Another striking difference between the two structures is the position of cluster 2 (Science mapping & Classification). For the ISSI conference series this cluster has been much more prominent than for STI conference series. We may expect that this cluster will also become more prominent in the forthcoming editions of the STI conference series as we detected a growing interest for the topic of visualization in the past decade. An important role was played by Indiana University.

These two differences indicate the different roles the STI and the ISSI conference series play for the discipline. The ISSI series tends to cover more the basic research contributing to the development of the field, while the STI editions are more focused on the more applied research with a clear emphasis on science policy. If a more foundational cluster or topic appears successful and useful in a science policy context, we may expect it to become more prominently present in the STI structure. Until now, this has not yet happened for webometrics, but we may experience this in the near future.

Discussion

In this study we compared the two most prominent international conference series in quantitative studies of science and technology using a set of relevant indicators developed in the same research field. The ISSI and STI conference series have a lot in common so that the tendency to merge is understandable. However, we have shown that on some important aspects they differ so significantly that a merger may yield a loss of their individual added value. In the past decade the different ways of organisation and scope has led to two stable series with a clear overlap but with distinctive profiles.

Although we have not included data of the ENID series, we assume that the merger between the STI and the ENID conference series makes more sense. In follow up research data on the ENID conference series will be added. It is up to the STI and ENID conference board to maintain the European focus. With a couple of high level institutes outside Europe and a growing interest and outstanding contributions from Asia, an indicators conference series limited to Europe may need reconsideration. The first step is taken by the STI conference series deciding to organise the 2012 edition in Canada.

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References


