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Standardization:
Towards an Agenda for Research

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ABSTRACT

Standardization research is a fairly new and is a still-evolving field of research, with possibly major practical ramifications. This article presents a summary of the authors' subjective views of the most pressing research topics in the field. These include, among others, standards (e.g. incorporation of ethical issues), the potential impact of standards, the corporate management of standardization and legal issues like Intellectual Property Rights (IPR). In addition, gaps have been identified with a respect to a basic understanding of standardization, suggesting a need for better education in the field.

KEYWORDS

EURAS, Impact of Standards, Intellectual Property Rights (IPR), Research Agenda, Standardization Research

INTRODUCTION

As readers of this journal will know, standardization research is highly multidisciplinary. Contributing disciplines include engineering, social sciences, and humanities. Researchers in these disciplines may have very diverse views and ideas regarding necessary future research priorities. In order to further research in the field – and to keep it relevant for practice – these different views need to be aligned and incorporated into an overarching research agenda.

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So, the question for the standardization research field as such is: What should be the future emphasis in standardization research? This question was discussed at the annual conference of the European Academy for Standardisation (EURAS) in Dublin, in June 2018. This paper summarizes the individual contributions that had been submitted by the co-authors of this paper. Obviously, this introduces a certain bias, as these contributions tend to reflect the research interests of the respective individual contributors. But we feel it does give a reasonably good insight into the open problems at hand in the field of standardization research.

Trends

Research tends to reflect current trends in a field (of course, it should also set trends) and standardization research is no exception. A first trend is that individual products and services are increasingly incorporated into systems. Looking back in history, most standards were developed to set requirements on products and production processes, and to specify the associated test methods. After the Second World War, but in particular during the last three decades, numerous standards for services and for management systems have been developed as well. More recently, standards relating to complex systems have been added. This creates the need for 'architectures' of standards, the exact nature of which certainly represents a topic for standardization research.

Companies and other organizations are increasingly interconnected through supply chains and networks. This is another more recent trend, which is obviously related to the one above. In such an environment, standards at different levels (e.g. technical, semantic) are crucial to enable interoperability. This need as such is not new, but the ongoing integration of physical flows and information flows via e.g. the Internet of Things puts common standards higher on the agenda. Many ICT standards have been developed by industry consortia and sometimes by individual companies, whereas most other fields mainly rely on formal standards. However, the integration of technologies (into e.g. smart manufacturing or intelligent transport systems) brings the different areas of standardization closer together and will eventually render the distinction between ICT and other standards meaningless. In addition, standards coming from such diverse sources raise new questions about the coherence of the set of standards needed for a field and the implications this may have for standardization processes and the governance of standardization. Especially the increasing trend of software-driven value generation increases the pressure on formal standards making in non-ICT-related areas. Research about this digitalization can help finding a balanced approach to not just making more standards but maintaining an opportunity for consensus creation in a way that benefits not just commercial companies but society as a whole.

The decrease of market share of formal standardization in the growing market for standards may be considered a third trend that still needs further analysis. Not only is the number of consortia that develop standards growing, also NGOs increasingly develop standards for e.g. fair trade or environmental aspects, and the increasing attention for sustainability may further enhance this proliferation of standards. This leads to a mess of standards – one might conclude that the world is in need of an International Organization for Standardization. Apparently, the current ways of working of ISO and IEC (and their national members) and ITU, and, at the European level, of CEN, CENELEC and ETSI need some reforms to make them better fit to meet market needs – but how? And is this feasible at all in the first place? Or do the close links to policy making at the global, regional and national levels hinder rather than stimulate effective standards creation?

The fact that also NGOs become active in standards setting highlights a fourth trend. For quite some time now standardization has moved away from working mainly in the technical domain to also cover the business domain and, more recently, also addressing societal issues. For instance, all 17 United Nations Sustainable Development Goals (United Nations, 2018) link to standardization in one way or another.

CONTENTS OF STANDARDS

As already suggested above, standardization activities continue to cover new ground. Especially for new and emerging technologies 'pre-normative' research may be necessary to provide the technical underpinning for the contents of standards. New materials, e.g. those that are based on nanotechnology or that are 'bio-based', constitute new areas of technical research for standardization and are also likely to have societal ramifications. For instance, the impact of nanotechnology or genetically manipulated crops on health, safety and the environment is highly uncertain; here, standards may provide rules how to manage and mitigate risks and how to weigh potential stakeholder benefits against possibly harmful properties.

Other ethical questions may pop up when ICT is integrated into all kinds of other technologies (e.g. privacy and information security). Accordingly, a research question would be to which extent ethical aspects can, and should, be incorporated into standards. The financial sector provides an example for behavioural standards (e.g. Basel III standards that emphasize the need for transparent accounting rules and for improved corporate governance). Along different lines we may note the need for e.g. safety standards for robots – recent accidents with autonomous vehicles provide an illustration of the relevance of this topic.

The move towards systems mentioned above triggers the need for new standardization topics such as life-cycle methodologies or, even more general, standards for complex societal systems such as 'circular economy,' 'sustainable supply chains,' 'sharing economy', and 'smart cities.' Standards may prove to be a valuable tool to creating a level playing field among conventional and new products, services and processes, unlocking the system and accelerating the transition towards new and more sustainable production and consumption models.

In some areas, well established standards may turn out to be inadequate. This is, for example, the case in the field of cybersecurity, where a multitude of standards do exist which, apparently, do not solve the problem for which they had been designed. Whether this relates to their actual functionality, to inadequate marketing and distribution, potentially poor implementation or, in contrast, to the unwillingness of users to actually deploy them –due to e.g. usability issues or economic barriers – remains unclear. Another question leads back to the standards themselves – are they implementable in the first place?

In some fields, standards are notably absent. In sectors like tourism and insurances this seems to be related to business interests (in both sectors internal standards prevail), in other fields it may have to do with taboos – just think menstrual hygiene products and cannabis (recently, the US-based international standards body ASTM International and the Swiss Association for Standardization (SNV) started standards development for cannabis).

Another taboo topic – albeit of a very different breed – is the enormous number of standards. Do we have too much of a good thing? The resulting, virtually impenetrable maze of standards, including those that overlap and/or compete with each other, represents a considerable burden for SMEs and even for multinationals. Which mechanisms and perhaps agendas are behind this – from a user perspective undesirable – proliferation of standards?

Basic Understanding of Standardization

One might assume that a field with a history that goes back to ancient China and with almost a century of academic research has an accepted body of basic knowledge upon which both the research community and the profession can rely. Unfortunately, this is not necessarily the case. For one, even basic definitions and classifications – though available – lack broad acceptance. For instance, even simple terms like 'de-facto' and 'de-jure' standardization are used in very different ways, some of which are plain wrong (no, 'de jure' has got nothing to do with jurisdiction). Second, knowledge about some basic constituents of the standardization process such as the role of individuals, the way consensus is achieved, the unbalanced involvement of stakeholders and the underlying reasons is still

frustratingly limited. Third, the nature of the links from standardisation to adjacent fields such as law, quality management and innovation management is in urgent need of further research. In particular, the links between standards as 'soft regulation' and regulation by governments continue to be a source of confusion in the research community (and also has practical ramifications). The above suggests that there might be a business case for educating standardization professionals. Is this indeed the case?

Diversity in Standardization Practices

Standardization research takes place mainly in China, the Republic of Korea, Japan, Northern and Western Europe, Canada and the USA. Some researchers in developing countries and countries in transition address standardization as well, but rather more in teaching than in research and they rarely publish in recognized international journals. As a consequence, the role of standards and standardization in these countries receives less attention in academic research. More generally, the diversity of standardization practices, cultures and institutions is an under-investigated topic. Africa, Australia, Asian countries such as China, Indonesia and Japan, Europe, the Middle East, the Russian Federation, South America and the USA all differ in these respects. Getting research data to investigate such differences is difficult, many standards bodies are not transparent about relevant details of actual standardization projects (despite transparency being one of the World Trade Organization's (WTO) principles).

Quite some research addresses formal standardization, but the diversity of consortia gets less attention and the same applies to standardization by trade associations, governments, NGOs, and open source communities, and to in-company standardization.

Technology can and does change the processes of setting standards, through e.g. virtual meetings, shared documents or new ways of decision making. The open source community has realized this. The question now is if and how standardization can make use of such technologies while at the same time sticking to the principles formulated by the WTO such as openness and consensus. These principles may be seen as general elements of 'responsible standardisation.' Yet, this concept also relates to, for instance, the UN sustainability agenda: How to design the standards development processes in such a way that the resulting standards are technically sophisticated, easy to implement and extend, economically viable and socially desirable, and can serve as a platform for future innovations?

Currently, the standardization process deploys a step by step approach, with different periods of decision making based on interim documents that eventually result in a final and approved document: the standard. Researchers may investigate if and how agility and systems approaches may be applied, making use of, for instance, test labs, use cases and roadmaps, to develop better standards more quickly. The challenge will be to combine that with adequate stakeholder involvement and consensus-based decision making.

Impacts of Standards

Numerous studies on the economic impact of standards are available, mostly focusing at the country level but also at the level of business sectors and companies. Many of these studies suggest positive impacts of standards but they give evidence of correlations rather than causal relationships. Many studies on impacts of specific standards, frequently including management standards, make use of surveys that are prone to non-response- and respondent biases. Actually, we know less about the impact of standards than the huge number of publications suggests. Perhaps even worse, the research on the impact of active involvement in standardization is very limited. That is, cost benefit analyses are needed at the level of both companies and standardisation projects. Moreover, impact studies related to the trends mentioned above, such as e.g. the impact of standards in supply chains, are notably missing. Implementing and deploying standards may affect the distribution of profits within a supply chain, and may change the balance of power between downstream and upstream parties. Also, research on standards' impact on SMEs and societal stakeholders is limited. Studies on their impact on innovation are available but more needs to be done –at the level of both individual companies and at the level of

technology sectors. Moreover, differences between countries should be studied, for instance linking innovation performance to innovation and standardization policies.

Management of Standardization

Most companies do not manage standards and standardization in a systematic way and the integration of standardisation into innovation projects tends to be operational rather than strategic, or may even be non-existing. Previous research identifies lack of awareness, understanding and vision as important reasons. More research on this topic will be necessary, including the investigation of best practice cases, the integration of standardization into innovation projects (and vice versa), the role of open innovation, standardization and platform strategies, and the integration of standards and standardization into business model innovation.

A second management issue occurs at the level of standardization projects – either within companies or – more interestingly – inter-organizational. The challenge is to manage projects in such a way that not only the standards are being developed but that these are also being used and have the intended impact.

A third managerial area is at the level of standards bodies (e.g. business model innovation) or even broader: technological sectors that need standardization – how should that be managed? This is another white spot on the map of standardization research.

Along slightly different lines, questions like e.g. how do standards relate to knowledge dissemination and, at company level, to knowledge management need to be addressed.

Conformity Assessment

Today, practice suffers from a malfunctioning system of conformity assessment. In particular, third party conformity assessment, i.e. certification, is problematic. This could, at least partly, be changed by more research that should also address the role of certification bodies, inspection authorities and legislators (e.g. the New Approach in Europe). Likewise, to keep pace with new developments such as 'smart' solutions (e.g., digital testing, dynamic certification) is a challenge for conformity assessment, as are issues relating to IPR in standards and the role of non-formal standards in conformity assessment schemes as well as a shift from product toward process certification (also incorporating e.g. "security by design" principles). The signalling function of certification seals relates to branding of both products and these seals themselves – another topic of research.

Intellectual Property Rights

Literature quite strongly suggests that patents are an important topic in relation to standards but empirical data are mainly from the ICT field. So, a first research question would be to which extent patents play a role in other areas of standardization. Even if patents are not important yet, this may change because of the merger of ICT with many other fields (e.g. smart manufacturing, smart cities). Moreover, also in the ICT field the role of IPR in relation to standards is changing. For instance, increasingly companies play a role that earn money from license fees without producing products in which the patents are used ('non-practicing entities'). The development of complex systems makes bundles of patents more necessary and next to patent pools even 'pools of pools' can be observed. In standards development, 'patent neutralization strategies' may be needed.

RESEARCH METHODS

The field of standardization is in need of a unifying theoretical framework. These should allow a systematic description of the field and to obtain empirical evidence about current practices. This requires multi-method research including quantitative studies based on 'real data' rather than perceptions. For getting such data, researchers will have to team up with organizations that store or can gather data, such as standards bodies, statistical offices, and trade associations.

The above shows many how questions, which suggests case studies as the appropriate research method. It will eventually be followed by other forms of research.

Action research might be an appropriate way to identify further improvements in current practice: measure before, design and implement actions, and measure impacts.

CONCLUSION

Standardization is an under-investigated area of research. More research is needed and this needs to be multidisciplinary. This research will need to start with the fundamentals of the field like e.g. terms, definitions and theoretical frameworks. It remains to be seen if this also includes the development of own theories or if using theories from adjacent research fields will be sufficient for getting a better understanding of the field. This requires cooperation between researchers and high-quality scientific journals. These journals should ideally be open source, in order to better allow researchers to stand on each other's shoulders.

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