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Standardizing the indoor climate in historic buildings: opportunities, challenges and ways forward

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ABSTRACT
Standardization for indoor climate control in historic buildings has recently taken a new direction with standards and guidelines that focus more on decision processes than outcomes. The objective of the paper is to explore and discuss how standards can evolve to both fit and guide decision processes to facilitate a sustainable management of historic buildings. Interviews with engineers and heritage professionals in the Church of Sweden in combination with indoor climate monitoring were used to understand the technical and organizational context. The results show that the development of process standards solves some of the problems related to the conventional outcome-oriented approach by opening up for a wider set of solutions. However, available guidelines are difficult to apply and integrate in the existing management of churches. A stronger focus on strategic feedback and an increased use of local guidelines are suggested.

KEYWORDS
Indoor climate control; process standards; knowledge sharing; sustainable management

Introduction

The overarching problem addressed in this paper is how scientific knowledge and best practices regarding indoor climate control should be shared to end-users in order to facilitate a sustainable management of cultural heritage. The use and preservation of the building and the collection, as well as the financial cost and environmental impact related to energy use are all dependent on the extent of indoor climate control. To determine an indoor climate control strategy is oftentimes a complex task, involving social as well as technical dimensions: conflicting objectives have to be negotiated, facets of management that commonly are separated have to be involved and different types of expertise is needed.\(^1\) Simple, generic advice is often not sufficient to guide decisions. Hence, the sharing of scientific knowledge and best practices, and their uptake in decision processes are paramount for the implementation of more energy efficient solutions. However, the way scientific knowledge is utilized in these processes is poorly understood.

Substantial effort has been devoted by the conservation community to address the technical aspects involved in determining target specification for the indoor climate in historic
We argue that the issue of knowledge sharing has not been given sufficient attention despite its key role, and suggest that it is the most important barrier to improvements of practice. An important means of knowledge sharing related to indoor climate control has been the production and use of guidelines, recommendations and standards. While there is an on-going debate on the scientific basis for current museum standards, there is little discussion or research about the ways in which standards and guidelines actually are used. Despite efforts to standardize indoor climate control in new ways, there is a shortage of empirical research as well as theoretical discussion about the nature of standardization and the use of standards related to indoor climate control in historic buildings.

Universal advice regarding set points for indoor climate has substantial shortcomings. It therefore seems to be wise to produce standards that support decision making, rather than forego it. The diversity of historic buildings, collections and the ways they are managed imply that the decision processes regarding indoor climate control unfold in myriad ways dependent on the specific contexts. Hence, it is unlikely to find a simple, generic roadmap for the decision process to establish an indoor climate control strategy. In practice, such processes are often intertwined with other planning and management activities.

Given this background, is there a role at all for standards, which by definition have to give advice about common problems? A number of recently published standards indicate that there is a shift in standardization both in terms of scope and overall approach, with the ambition to deliver advice customized to the individual situation. As discussed in more detail below, these new standards and guidelines are increasingly influenced by ideas found in formalized risk management protocols. However, previous research has shown that risk management guidelines have to resonate with existing management processes to be effective; otherwise they tend to ‘live a life of their own […] detached from the practical reality of actors’.

The objective of the paper is to explore and discuss how standards can evolve to both fit and guide decision processes to facilitate a more energy efficient management of historic buildings. To achieve this objective, we discuss the recent progress in the standardization of indoor climate control for historic buildings in general and the European standardization of the indoor climate in churches in particular. By drawing on the scholarly literature on standardization we identify key issues that both the makers and users of standards have to address.

The Church of Sweden is used as a case study with the objective to identify opportunities and challenges with contemporary standards for churches in Sweden. By combing a qualitative study of how indoor climate control is managed with a discussion of the use of existing outcome-oriented standards in Swedish churches we outline both the organizational and technical contexts in which standards are to be implemented. We hypothetically apply the recommendations given by two different outcome-oriented standards in two intermittently heated Swedish churches located in different climatic zones. This exercise is made to identify the strengths and limitations of the more traditional outcome-oriented approach.

The final part of the paper relates the results of the case study with the key issues regarding standardization identified earlier. Based on this analysis, we suggest ways forward for the standardization of indoor climate control in historic buildings in general.
Recent development of standards for indoor climate control in historic buildings

The aspiration of standard makers has generally been to identify safe ranges based on scientific evidence, or, when science has been unable to deliver enough facts, on precaution in combination with practical experience and the potential of existing technologies. Efforts to specify single, universal, ‘ideal’ targets have been persistent despite ‘a steady undercurrent of thoughtful critique’. Overly simplifying interpretations of standards have distorted the original intentions. The most famous example is how recommendations in Gary Thomson’s textbook The Museum Environment inadvertently contributed to a de facto standard for museums. The development of standards has not been a linear process where accuracy and precision has increased along with the development of scientific knowledge. Rather, there is a great variety in how standards are written, how they are intended to be used and finally in how they actually are being used in practice. The following account point at recent developments in standardization and connects these with findings from a broader scholarly literature on standardization.

An important distinction to keep in mind when discussing standards is between the intention of standard makers and the actual use of standards. There is a process of interpretation and translation to make a standard work in practice, and standards are generally not used as intended by standard makers. The history of indoor climate standards tells us that advice or specifications are transformed when applied in practice, and that widespread adoption of standards is not to be taken for granted. Furthermore, there is a dynamic between practices and standards in both directions. Brown and Rose illustrate in their account of the development of indoor climate standards how practices, technologies and recommendations have co-evolved into a de facto standard for indoor climates in museums. This dynamic of standardization is often neglected. Standards and conventions are at times difficult to distinguish, and in practice they tend to reinforce each other.

In the last years there has been an intensified discussion about the optimal set points for T and RH in museums and archives, fuelled by the wish of cultural institutions to become more environmentally sustainable. The scientific community is now increasingly focused on a better understanding of damage functions with the intention to inform evidence-based risk assessment. Even though the discussion of set points historically has been, and to some extent still is, focused on ‘proper’ museums, it is also relevant for historic buildings housing collections, such as churches or historic house museums. Historic buildings have been treated as exceptions to the rule, which require special treatment. Suggested targets in standards and guidelines for museums and archives have sometimes been perceived as unachievable ideals to strive for. The pragmatic way to address historic buildings in standards has been to widen the allowable climatic range used for museums, accepting a slightly higher level of risk. The more recent development in standardization has been a gradual shift away from definite guidance in the form of universal numbers towards more flexible approaches. There has also been a shift in scope, that is, what phenomenon that is to be standardized. In the following, four recent standards with bearing on churches are briefly presented.

The major revision made in 2003 of the ASHRAE Handbook was based upon a risk-based approach to decision-making for preventive conservation. The revised standard,
as well as its revisions in 2007 and 2011, essentially consists of risk information about different types of deterioration.\textsuperscript{17} There is also a table included where target specifications of T and RH are given for different risk levels. The risks and benefits associated with different classes, ranging from AA (best) to D (worst) are summarized in the table. An intention behind the revision was that the \textit{ASHRAE Handbook} should incorporate risk management principles and common knowledge in the field.\textsuperscript{18} The information about different kinds of deterioration given in the standard provides decision-makers with tools and heuristics to make trade-offs between risks and benefits. However, the demand of simple and quick advice is also recognized with the provision of a table with target specifications. Taken together, the \textit{ASHRAE Handbook} provides heuristics to support decision-makers as well as generic advice in the form of target specifications for different levels of risk. It emphasizes the negotiability of the end result as well as the limitations given by different types of building envelopes and climatic conditions.

The European standard \textit{EN 15757:2010 Specifications for temperature and relative humidity to limit climate-induced mechanical damage in organic hygroscopic materials}\textsuperscript{19} describes a methodology to establish allowable fluctuations based on the historical climate. It is based on the assumption that objects in the collection have adapted to their environment and that by limiting deviations from the historical climate there will be less risk for further damage. In contrast to many other standards targeting the preservation indoor climate, it is exclusively focusing on mechanical damage in organic hygroscopic materials. The method to establish allowable RH fluctuations in EN 15757:2010 is based on the climate history of a specific building. Rather than specifying a constant target level for the whole year or season, this method is based on a moving seasonal average around which variations should be limited.

The limitations of standards that attempts to give universally valid recommendations about outcomes have resulted in a development towards standards that focus on decision processes. The European standard \textit{EN 15759-1:2011 Guidelines for heating of churches, chapels and other places of worship}\textsuperscript{20} describes in its first stage a process for how to establish a target indoor climate, but does not suggest any numbers. In the following stages, the standard describes how to identify appropriate climate control strategies and technical solutions. Rather than specifying an expected end-result, this standard describes a decision process which aims at identifying an appropriate solution for the individual case based on a compromise between comfort and conservation requirements. In essence, it describes a procedure that needs to be followed rather than suggesting the outcomes.

The UK \textit{PAS 198:2012 Specifications for Managing Environmental Conditions for Cultural Collections}\textsuperscript{21} outlines a risk-based framework for indoor climate management. It is emphasized how universal ranges for RH or T cannot be established, based on their different dependencies on various deterioration mechanisms. There is also an explicit emphasis on fostering low energy strategies. The standard does not suggest target specifications but it is, in the same way as the \textit{ASHRAE Handbook}, accompanied by a summary of existing knowledge regarding damage functions in an appendix. The scope of this standard is somewhat broader than the \textit{ASHRAE Handbook} or EN 15759-1:2011; it includes both the overall management process and the decision process to determine target specifications.
The dilemma of standards: generic advice for specific needs

A dilemma pertinent to all standardization is to find the right balance between firm advice and flexibility. This dilemma originates in the basic condition that a standard is general whereas practice is specific. Experience from how standards are used in practice show that more loosely defined standards with greater adaptability may work better than rigidly defined standards. This might be particularly relevant for conservation practice. The problems to be solved by conservation practitioners call for approaches where the unique characteristics of a place guide decision-making. Standards, which by definition aim for some kind of universal guidance, can therefore prove difficult to apply in a strict way. This is a challenge pertinent also to indoor climate control standards for historic buildings, as the demands on the indoor climate varies widely between different buildings, not only due to technical differences, but also due to differences in how buildings and collections are used.

A possible way out of this dilemma is to standardize the organizational processes instead of the end-results. To separate between these two approaches to standardization, we use the distinction suggested by Brunsson et al between outcome standards and process standards, where the former require the user to deliver a certain outcome, and the latter is intended for standardizing organizational processes.

Process standards are widely used for quality management and for managing risks in organizations. They generally do not require compliance with an objective or a specific result. Instead, they standardize procedures, duties and roles. The requirements of such standards are abstract and generic to the extent that almost any organization can adopt them. The obvious drawback with process standards is that an adoption of the standard does not guarantee desirable consequences. Knowledge and best practices have to be transferred to the user of the standard via complementary sources. Achieving desirable end-results requires a well-organized collaboration of qualified professionals whom have access to guidance focusing on specific expert knowledge. In the context of this paper it means that a non-qualified user may come up with technical solutions that are more or less inappropriate while still adhering to a process standard. This problematic situation is emphasized in the ASHRAE Handbook: 'No two collections are identical. [...] Experienced experts are best equipped to identify areas of special risk and devise solutions, and to properly manage economic and other tradeoffs, although this level of expertise is not always easily available'. A possible remedy to this dilemma is to link process standards with outcome standards, an approach that is increasingly common in other domains of standardization.

The multiple forms and ways of using indoor climate standards point at a dilemma, where end users expect general and clear cut advice, whereas the complexity of the problem requires individual solutions based on risk assessment and negotiation of objectives. Standards have evolved from simple prescriptions of universal specifications to become more sophisticated, informative and flexible. The scope of standards is shifting: there is a tendency to standardize processes on behalf of outcomes. However, the lack of testing and evaluation of how standards are used suggests that this development emerges mostly from a lack of success with former approaches. There is therefore a need to advance the understanding of the role of standards as decision support tools. To become useful, process standards have to be complemented with both expert
knowledge and value judgements. They require more resources than outcome standards to be successfully implemented but promise improved end-results.

**Case study: indoor climate control in Swedish churches**

The Church of Sweden owns and manages, in total, 3384 churches, of which 2976 are protected by the Cultural Heritage Act. In most of these churches there are conflicting objectives associated with indoor climate control. The use of a church has to be balanced with objectives for preservation, on an oftentimes tight budget. Interestingly, there are no national standards or recommendations for the indoor climate formally endorsed by the Church of Sweden. Arguably, the organization should therefore have a potential to improve building management by using indoor climate control standards. Considering this situation there is a timely opportunity to discuss the recent development of indoor climate control standards from the viewpoint of the organization as a whole.

Both the technical and organizational contexts are outlined in order to understand the needs and challenges of improved indoor climate control. The following section uses two Swedish church buildings as examples to illustrate the challenges with the application of existing outcome standards to determine climate specifications for historic buildings. In the next section, we outline the organizational context in which decisions about indoor climate control are made within the Church of Sweden.

**Traditional outcome-oriented standards**

In this section we discuss the application of two outcome standards (*ASHRAE Handbook* and EN 15757:2010) in two Swedish churches, Jukkasjärvi in the north and Atlingbo in the south (Figure 1). We derive target specifications from the standards, and then discuss the practical consequences from a hypothetical implementation of these targets. The objective is to investigate the use and applicability of different types of standards rather than trying to compare them. These two chosen churches have indoor climates and heating regimes which are common, but as cases they do not aspire to be representative for all churches in each region. The determination of target specifications from these standards demands some degree of interpretation by the user, and we have carefully sought to use the standards in a plausible way.

**Jukkasjärvi church**

Luleå Diocese is situated in the extreme north of Sweden. The churches in the Diocese illustrate how the indoor climate is affected by the climatic conditions in northern Sweden, which is characterized by long and cold winters. The extremely dry indoor climate resulting from heating makes it difficult to use common recommendations for the indoor climate. During 2009–2011 the indoor climate and energy use in 51 churches in Luleå Diocese were monitored.

As in the rest of Sweden, there are no common recommendations used neither for temperature nor relative humidity for the churches in Luleå. In practice, the temperature during services varies from church to church in an interval from 12°C to 22°C. In Luleå Diocese some churches are permanently heated, some intermittently heated and some
are not heated at all and therefore not used during winter. All churches that are heated for services during winter become extremely dry with RH often going below 10%. The monitoring campaign suggests that comfort has been the overriding priority in most churches and preservation of the building and the artefacts have been more or less neglected in the design and operation of heating systems.

Jukkasjärvi church is a wooden church built in 1726, located near the 68th latitude. The church is intermittently heated, and in between heating occasions there is a base heating to a constant level. Figure 2 shows temperature and relative humidity over a year in Jukkasjärvi church. It is characterized by moderate short term variations and substantial seasonal variations of RH in an interval between 5% and 65%. The temperature is kept at a minimum of around 7°C and during services it is raised to around 21°C.

Figure 1. The location of Jukkasjärvi and Atlingbo churches.
The outdoor climate during winter in combination with comfort requirements makes it unfeasible to comply with the ASHRAE class C recommendation to avoid RH below 25% in order to reduce the risk for mechanical damages. The only viable option for maintaining relative humidity over 25% would be to dramatically reduce temperatures, well below comfort levels, or to use humidification. Humidification would cause secondary risks associated with condensation in the building envelope. Therefore, to use 25% relative humidity as a lower limit in Jukkasjärvi church or the other churches in the Diocese would compromise the use of the church as a place for worship and thereby threaten the main condition for its long-term preservation. The upper limit of 75% RH is not a problem for this church.

EN 15757:2010 is focused on RH- and T-fluctuations in relation to mechanical damages. The historical climate is used to come up with an allowable band for short-term fluctuations which reduces the risk for further damage to hygroscopic materials. In Figure 3, the suggested method has been used to determine the allowable band of RH for Jukkasjärvi church. The lower and upper limits are calculated as ±10% from the moving 30-day average. There are a number of short term departures from the target range related to the intermittent heating. When the church is heated, RH drops and when the church cools off, RH rises above the upper limit due to surplus moisture released from the building envelope or visitors during services. As these excursions from the allowable band are few and modest, only small changes to the current indoor climate are needed. The excursions could be mitigated, for example, by reducing the heating, prolonging the period for cooling off and/or increased ventilation after services. However, the benefits for preservation of reducing the small excursions over the allowable band are difficult to assess. It is no trivial task to implement the allowable band as a target indoor climate.
climate. This translation requires engineering competence as well as insights to the rationale behind the standard.

For Jukkasjärvi church, an obvious drawback with the method suggested by EN 15757:2010 is that long-term fluctuations or absolute levels are not considered risky. There are caveats about these issues in the standard, but to take these into account requires a high level of competence from the user of the standard.

The yearly fluctuation of RH is not considered when calculating the allowable band. This fluctuation in Jukkasjärvi church is exceeding 50% in the extremely low region of RH. The coefficient of expansion in many hygroscopic materials is greater in this lower region, which increases the moisture-related strain in objects in comparison to fluctuations in the mid RH region. Clearly these long-term fluctuations pose a significant risk for mechanical damage, although most damage would already be evident as the current heating regime has been in place for several years. Interestingly, in a study of an unheated church in Portugal a similar conclusion was drawn about the standard’s inattention to seasonal fluctuations.

To sum up the use of the two standards in Jukkasjärvi church, it can be concluded that the specifications suggested in the standards should not be used without modification. In the case of the ASHRAE Handbook, the lower limit of 25% is unfeasible and has to be moderated to the extremely dry conditions in the church. The application of EN 15757:2010 does only require small changes to the indoor climate, but a sophisticated control system is needed. The benefit of adhering to the standard is likely small and difficult to
assess, while the major threat for mechanical damages, in this case the yearly fluctuation of RH, is not considered.

**Atlingbo church**

There are 92 medieval churches on Gotland, an island located in the Baltic Sea near the 57th latitude. During 2009–2012 the indoor climate and energy use in 31 churches in Gotland Diocese were monitored. A few of these churches are permanently heated, but most are intermittently heated during winter. Atlingbo church is used as an example of problems related to intermittent heating in a humid stone church. The indoor climate for one year is shown in Figure 4. The church was heated on around twelve occasions during the year, with no or little background heating in between. The indoor climate is characterized by strong short term fluctuations caused by the intermittent heating and a moderate yearly variation of RH. RH is above 70% during summer and slightly lower during winter.

The application of the specifications from *ASHRAE Handbook* requires no action in the lower range, as RH is never near the lower limit of 25%. The indoor climate is often above 75% for extended periods which points at a risk for mould and insects. Dehumidification and/or conservation heating would be needed in order to reduce RH below 75%.

The target range proposed by EN 15757:2010 is also shown in Figure 4. The intermittent heating causes a number of excursions well below the suggested range. Hence, a compliance with the standard would limit the possibility of intermittent heating, which is

![Figure 4](image_url)  
**Figure 4.** Temperature, RH and allowable band of fluctuations according to EN 15757:2010 from the period 1 September 2009 to 31 August 2010 in Atlingbo church. The logger was situated in the middle of the nave.
currently considered a feasible heating regime for this church given its use and the cost for heating. To reduce the short-term fluctuations would most likely reduce the mechanical damage to artefacts in the church, but this has to be weighed against expectations of thermal comfort.

**Outcome standards require interpretation and thoughtful application to be useful**

The case studies illustrate how the seemingly simple adoption of plausible science-based recommendations to improve the indoor climate becomes a difficult undertaking in practice. We have two cases where a strict application of a standard would be inappropriate (*ASHRAE Handbook* in the northern church, EN 15757:2010 in the southern church). One reason for this is the different outdoor climates in Luleå and Gotland Dioceses. Figure 5, which shows max, min and average indoor RH in more than 80 monitored churches, clearly illustrates the challenge to come up with a universal target specification for RH applicable for all Swedish churches.

A lesson drawn from this exercise is that universal guidance regarding the indoor climate always has to be used with care. It has to be adjusted to the specifics of the local context in order to be useful for effective decision-making. The user has to be able to decide how the standard should be used, modify it based on the requirements of the specific situation and judge if the benefits of an implementation outweigh the costs. We

**Figure 5.** Distribution of max, min and average RH over a year in 51 churches in Luleå Diocese (light grey) and 31 churches in Gotland Diocese (dark grey). The upper and lower whiskers represent the highest and lowest values; the line in the middle of the box shows the average value and the upper and lower lines of the box show one standard deviation.
suggest that the experience that standards should be chosen and used with care is not specific for *ASHRAE Handbook* and EN 15757:2010, but generic. A problematic situation also occurs when standards which have been developed with ‘collections’ in mind are to be used in buildings such as churches, where fragile objects on display are rare and the preservation of the building fabric plays a more important role. There are in practice always trade-offs needed between different aspects of indoor climate control. The weight given to different factors determining indoor climate control, such as preservation, use and resource use, varies between the studied churches. Such variations are difficult to incorporate in generic outcome standards.

The organizational context of the management of Swedish churches: opportunities and challenges for future standardization

To further the understanding of existing decision processes regarding indoor climate control in the churches, as well as the role of standards in these processes, we conducted interviews with a group of professionals employed at the Diocese level. The individuals in this group consist of engineering and heritage professionals employed to support parishes with all aspects of the management of churches. In total, twenty interviews were made with engineers and building conservators employed at the Diocese level in the Swedish church. The interviews were made over telephone in 2014 and lasted about one hour each. A survey questionnaire was sent to the interviewees beforehand. The questionnaire consisted of questions related to indoor climate control and indoor climate-related risks. All interviewees were probed to discuss the role and usefulness of standards, irrespective if they were used in the Diocese or not.

Only one of the interviewees reported that indoor climate standards were used in a deliberate or systematic way. The most common rationale for the unwillingness to use standards was that they were perceived as too general and not customized for churches. Handbook recommendations found in the conservation literature, even those intended for historic buildings and churches have been so far away from the actual conditions in the churches that they have not been perceived as realistic.

The management of Swedish churches is to a large extent organized as a decentralized layman-led activity, both regarding decision-making and practical work. Organizational deficits, inadequate decision processes and a lack of in-house expertise were described as the most important barriers to improved indoor climate control. Organizational deficits were often mentioned in tandem with a lack of professional competence within the organization. The status of parishes as one-time clients with limited competence is a cause of an oftentimes weak position in relation to contractors. This situation leads to problems with the acquisition of new technical systems, which turn out to be overly complicated or inappropriate for the specific conditions.

Generally there is an organizational division between continuous daily management and more infrequent projects related to major changes of control strategies and/or technical systems. The organizational and financial framework favour that major changes of indoor climate control systems are made as part of a package of other renovation or conservation work. In these projects there is a different set of actors involved than during daily management. The decentralized structure and the division between daily management and one-shot projects make it difficult to systematically use feedback for continuous
There is generally a lack of communication between the permanent organization responsible for daily management and the temporary organization that emerges in connection with renovation projects. The feedback loop between these two is weak or non-existent. This results in a problem with knowledge sharing within the organization as a whole.

The present situation, with a lack of systematic decision making, can to some extent be explained by a complex decision context with conflicting views on the use of the churches and many stakeholders at local, regional and national level. It is not clear where the responsibility for strategic planning of the indoor climate is or should be.

Based on the results of the interviews we identify three major issues for the Church of Sweden regarding the future of standards: (a) The management processes for daily operation and renovation of indoor climate control systems are decoupled. Standards for indoor climate control have to address both processes, link them and integrate them better with the regular management of churches; (b) A lack of evaluation and feedback regarding indoor climate control is evident at both the level of individual churches, as well as on aggregated levels; (c) There is a need for simple and unambiguous advice to support parishes. The lack of competence and lack of resources make demanding decision processes, that is, as suggested in process standards, unattainable in most cases.

**Conclusions and ways forward**

For long, the purpose of an indoor climate standard was undisputed: to recommend targets for the indoor climate. Some recent standards, acknowledging the complexity of the problem, are deviating from this approach by focusing on decision processes. Instead of debating if one approach is superior to the other, standard makers and users of standards should embrace the idea that standards with different scopes can be used in parallel to serve different purposes at different levels of abstraction. At the top level there can be management standards that define processes, duties and roles for the long term management. The decision process to come up with target specifications and technical solutions could be the scope of another standard. Outcome standards focusing on various damage functions could be used as decision support tools, complementing other sources of risk information. Finally, there will probably always be a demand for standards that give simple and universally applicable advice. We suggest that there is a need for all these kinds of standards; the question is when and how to use them. The idea of such a landscape of standards opens up for the individual standard to be more specific about its scope, and thereby more focused.

If an evaluation of indoor climate control is performed, it is almost exclusively to evaluate whether the indoor climate is in accordance with specified targets (tactical improvement), not whether the targets are the right ones (strategic improvement). This results in a situation where technical systems and control strategies are implemented, but it is not known if the consequences of the implementation are in line with strategic objectives such as energy use, preservation and use of the building. In order to achieve strategic improvement there is a need to use feedback of relevant parameters. We suggest that the addition of such feedback loops is both necessary and possible, and that the main feedback needed is about preservation, use and resource use (Figure 6).
A major problem regarding the use of standards in churches is the huge diversity between individual churches, sometimes even when they belong to the same parish. Process-oriented standards such as EN 15759-1 clearly have an advantage in such situations. Still, for churches which are similar in construction, use and geographic location there might be a potential to use process standards to establish local guidelines for the set of churches in question. This simple solution could help to overcome the problem that process standards are time and resource demanding in their implementation. It would probably not be feasible to go through all suggested steps in a process standard for every Swedish church. However, there is an option to use a process standard to establish common advice regarding set points for a specific type of church, within the same climatic zone, and with similar use. In reality such local praxis is already in place, for example, on Gotland, but it is not formalized and used in a systematic way. This approach would overcome some of the problems associated with the production of individual guidelines for each building which, given the decentralized management of Swedish churches and the lack of resources, almost certainly would fail.

Standards and guidelines are and will be an important tool for quality assurance in cultural heritage management. We have tried to point at some possible areas of improvement relating to indoor climate control of Swedish churches in particular and historic buildings in general. However, the issues raised in this paper have bearing on other areas of cultural heritage management subjected to standardization. While there is a discussion about the scope and role for standards in conservation, there is a lack of empirical knowledge on how standards actually are used in conservation, how they affect practices and the organizational processes that forms the infrastructure for decision-making.

Notes

3. In the rest of this paper, we use the term standard as defined by Brunsson et al (616): ‘... a rule for common and voluntary use, decided by one or several people or organizations’. This definition includes documents issued by international standardization bodies as well as institutional guidelines and recommendations in handbooks. This is of course a very all-
encompassing definition, but it reflects how general recommendations that have not been officially sanctioned still have had major impact on practice. Nils Brunsson, Andreas Rasche, and David Seidl, ‘The Dynamics of Standardization: Three Perspectives on Standards in Organization Studies’, Organization Studies 33, nos. 5–6 (2012): 613–32.


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