Development of a Sustainability Assessment System for Education Buildings – Relevance, Specifications and Differences from other Building Types

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Summary

An interdisciplinary task group has developed a Sustainability Assessment System for Education Buildings, which is based on the existing system for administration buildings (BNB). Changes to the system were only made with respect to the building type, so the different versions of the system are identical where possible and different where necessary. 'Soft' and less quantifiable factors, i.e. spatial qualities or a building's influence on social behaviour constitute the main differences between the two building types and were thus closely examined.

Keywords: Assessment, Education, Building, Socio-Cultural, Quantifiable, Interdependence, Holistic, Urban Design, Architectural Design

Introduction

In order to develop an assessment system for sustainable education buildings, the German Federal Ministry of Transport, Building and Urban Development (BMVBS) have established a task group consisting of members from federal state and communal building administration, social scientists and architects. The system is derived from the existing system for administration buildings and will be tested on a series of newly completed buildings until February 2012.

The structures of the German assessment systems, BNB and the German Sustainable Building Council's similar DGNB System, are derived from the three pillar model of sustainability. The economical, social and cultural qualities are equally weighted and complemented by technical and procedural aspects. Additionally, a location profile is given for information.

In adapting the Sustainability Assessment System for Administration Buildings to the functional requirements of education buildings, differences between the two systems should be principally related to differences between the two building types. For example, the floor to ceiling height in schools has to be at least 3.00 m, compared to 2.50 m in office buildings. Accordingly, the target values in the criterion 'Capability of Conversion' were adjusted.

Reversely, issues in the system for administration buildings that need revision, but are not related to differences between the two building types, should not simply be adjusted within the system for education buildings. Instead, a list of recommendations for the administration building system was compiled to ensure a synchronous future development of the various systems. In short, the different versions of the systems should be identical where possible and different where necessary.

The task group identified that about half of the criteria needed no significant changes. The Target values of criteria concerning the life cycle assessment and life cycle costs were adjusted to the different building type. Wherever different standardisation or legal requirements applied, the implications on the sustainability assessment were examined and addressed. As a result for instance, the criterion ‘Sound Insulation’ was abandoned because exceeding the strict legal requirements promises no significant gain in terms of sustainability.

Socio-Cultural Aspects

The most significant differences were identified among the socio-cultural criteria. A major concern of the task group was to reflect international currents in contemporary educational theory in the new assessment system. For example, in modern education concepts, informal learning-, communication-, and recreation areas are part of the circulation spaces, which should thus not be too compact. Accordingly, the criterion ‘Space Efficiency’, which encourages compact circulation areas by simply measuring the net usable floor area against the total floor area, was abandoned.

Furthermore, the more general socio-cultural significance of education buildings was examined. By providing the best possible learning environment, sustainable education buildings can improve the success in educating young people. Since knowledge is considered the single most important resource, this is an obvious contribution to a sustainable future, not only socially, but in a wider context even in economic terms. Future concepts are expected to connect traditional schools into integrated learning networks that will include adult education as well as communal services. In that way, not only young people will benefit, and the equality of opportunities is supposed to increase.

It was also acknowledged that ideally, the building should serve as a good example and a good setting for learning. Young people are open and able to learn, and their built environment should thus offer an experience of aesthetics (for example through space, light, colour and form), of ecology (for example by demonstrating sustainable ways of handling air, energy and materials), as well as of structure, i.e. in the layout of the building.

Beyond that, education buildings are seen as a crucial element in urban development strategies: A major challenge that cities face is identified in high unemployment and social exclusion in certain neighbourhoods. Considerable increase in social distinctions and differences in economic development within one city are recognised to threaten to destabilize the cities. Leipzig Charter on Sustainable European Cities recommends a policy of social integration in which “… a crucial starting point for improving the situation in deprived neighbourhoods is the improvement of the education and training situation in the local community …”

Numerous aspects of sustainability are related to the design qualities of a building. For its assessment the judgement of a qualified jury is necessary, as required in the criterion 'Quality of Architecture and Urban Planning'. Since the discussion showed, that this criterion subsumes many socio-cultural aspects, and in fact, describes a process quality, it could be assessed additionally as a process quality thus giving it a significantly higher share in the overall weighting.

Discussion

The variety of different international assessment systems shows that a general consensus, as to how sustainability should be assessed, does not yet exist. The necessary techniques and tools are just starting to be developed. Also, the data that will eventually allow for much more definite predictions about the effects and implications of our various assessment systems is still limited.

In this context of exploring ways to assess and improve the sustainability of the built environment, the presented draft for an Assessment System for Sustainable Education Building focuses on the socio-cultural aspects of sustainability. These are often less quantifiable and harder to capture in a schematic system, but they are just as important as the ecologic and economic criteria.

Thoroughly addressing the very particular socio-cultural relevance of this building type, the system aims to render an appropriate approach to the sustainability assessment of education buildings.

1. Introduction

The need for sustainability in all fields of our everyday life has become common ground. Starting in the 1970s, the acknowledgement that most of our resources are limited, led to initial efforts to save energy. Environmental awareness has since continuously grown and today, the holistic concept of the Three Pillar Model of Sustainability, which aims to balance ecological, economical and social requirements, is generally accepted.

Nachhaltiges Bauen

fig. 1 BNB Logo

After the German reunification, relocating the seat of government to Berlin in the 1990s required significant building activities. This, in conjunction with several international agreements, led the Federal Government to adopt a policy of acting as a role model in the field of sustainable construction. To achieve that, the Federal Ministry of Transport, Building and Urban Development (BMVBS) introduced the ‘Guideline for Sustainable Construction’ in 2001.

Subsequently, BMVBS commissioned the research and development necessary for a scientific sustainability assessment and set up the so called Round Table for Sustainable Building. Associations of the construction industry, planners, building authorities, as well as scientists are represented here. These actors are involved both in the updating process of the ‘Guideline for Sustainable Construction’, which was re-issued in 2011, and in the development of the Assessment System for Sustainable Buildings (BNB), introduced in 2008.

BNB was initially developed for new administration buildings because this building type has a significant share in public and private construction activities. For reasons of practicability, the initial system dealt with new buildings rather than with refurbishments, which are expected to have a higher share in future construction activities. On the basis of this system, other building types and the refurbishment of existing buildings are currently being addressed.

In 2010, a task group within the Round Table for Sustainable Building was set up in order to develop a Sustainability Assessment System for Education Buildings that should be derived from the existing version for administration buildings. To represent a wide spectrum of experience and knowledge, the group consists of stakeholders from federal state and communal building administration, social scientists, architects and planners. The system is scheduled for testing in summer 2011. In this article, the Author will present how different functional requirements of education buildings result in changes compared to the original system for Administration buildings.

2. Framework and Objectives of the Assessment System for Sustainable Administration Buildings

2.1 The German Assessment System for Sustainable Building

Sustainability Assessment methods had been well established in other countries such as Britain and the United states when BMVBS started to develop the German assessment system that was later continued in cooperation with the German Sustainable Building Council (DGNB). The necessity for an alternative system originates primarily from the wish to have a holistic system that would address all three pillars of sustainability equally.

Additionally, the different legal and regulatory framework for construction in Germany had to be addressed. Relatively high standards, for example in energy efficiency, insulation, and work regulations needed to be reflected in the sustainability assessment method. As a result, the German systems (which are currently continued by BMVBS and DGNB independently) are based on the following principles:

2.2 Principles of the Assessment System

The Structure of the System is derived from the Three Pillar Model of Sustainability. Additionally, the economical, social and cultural qualities are complemented by technical and procedural aspects (*Fig. 2*).

A comprehensive life cycle assessment (LCA) is required, presuming a life span of 50 years. Environmental Impacts from production, use and end of life are to be assessed, whereas currently, transport from production to site is not considered.

In economic terms, not only the investment costs are to be considered, but the costs over the entire life cycle of the building (LCC). As a result, follow-up costs can be reflected in investment decisions in order to achieve long term economic efficiency and value stability.

Fig. 2 Principles of the German Sustainability Assessment Systems. The Location Profile is not incuded in the weighting but given for information

To foster innovation and to reflect the interdependence of the assessed criteria, BNB aims to define targets and incentives rather than definite measures or methods. This integrated approach is intended to provide flexibility to the designers. In turn, it tends to make the building assessment more complex.

Ideally, quantitative methods are employed, such as LCC or LCA. Alternatively, objectives and measures can be defined and their implementation can be assessed.

Through a limited extra effort in documentation, a standard building that conforms to all German legal and regulatory requirements should achieve a degree of performance of 50%, equivalent to a 'bronze' certificate. A 'silver' certificate is awarded to a building with a degree of performance between 65 and 80%, and beyond that, a building is certified as 'gold'. The 2011 version of the 'Guideline for Sustainable Construction' requires that new federal buildings need to achieve at least 'silver' standard.

The new assessment system for education buildings should be based on the same principles that had been established for the assessment of administration buildings. Consequently, the new version was to be developed from that system. However, international assessment systems for education buildings had to be analysed, to make sure that all relevant aspects were going to be assessed.

2.3 System Boundary

Because it was argued that planners usually do not have much influence on the choice of a site, the assessment system boundary is generally the outer edge of the building. The characteristics of the building location are thus listed separately and are not counted in the assessment of the building.

The interaction of a building with its immediate and wider context, the significant impact of the choice of site on traffic, infrastructure and subsequent consumption of energy and resources are thus left out of the assessment.

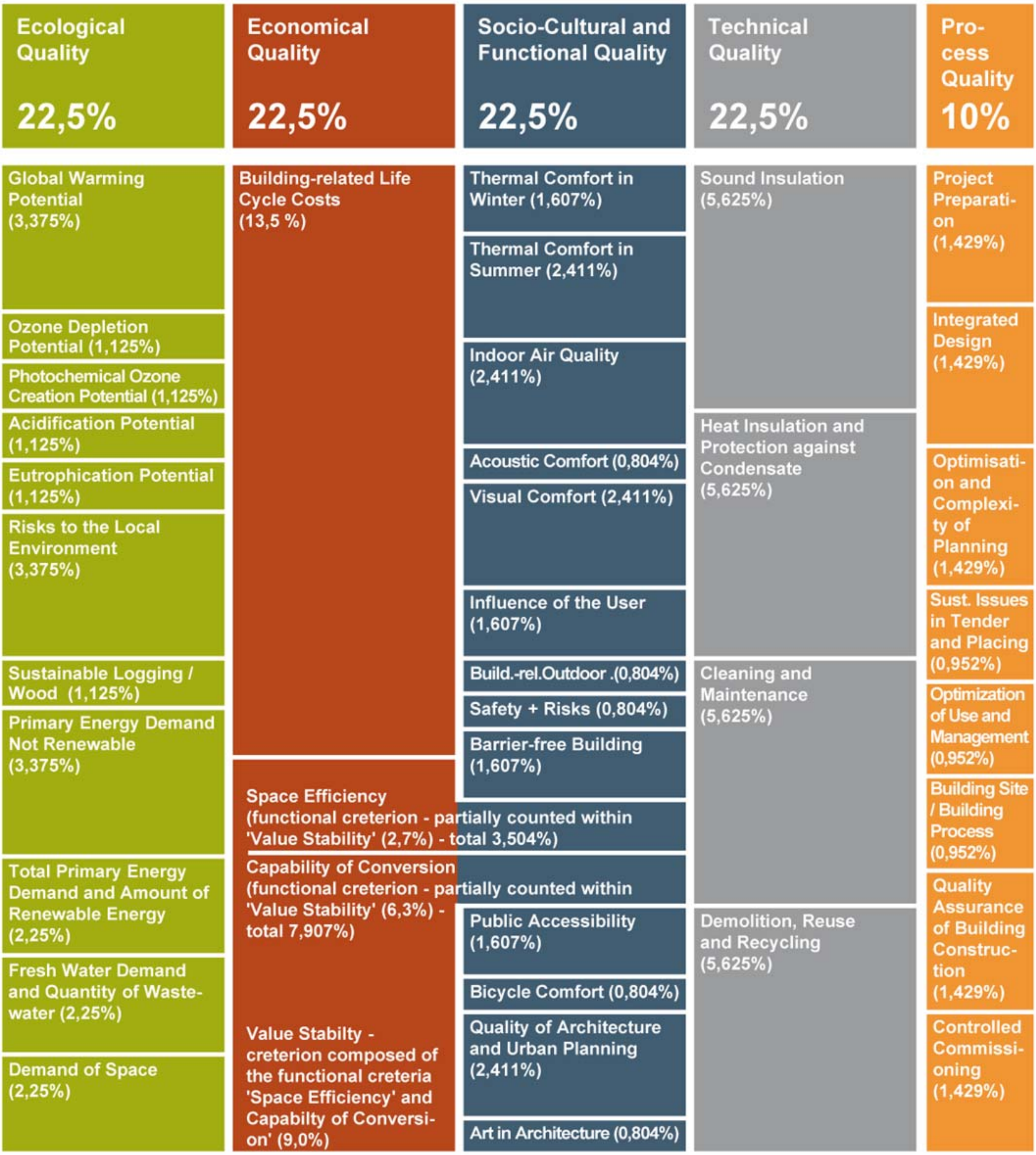

Fig. 3 Sustainability Assessment System for Administration Buildings - Weighting of the main criteria groups and the individual criteria. The functional criteria 'Space Efficiency' and 'Capability of Conversion' are re-counted in the economic criterion 'Value Stability'. The Values shown are aggregations of both the weightings in the functional and in the economic group.

3. The Task Group

3.1 Building Authorities Representatives

Unlike the Federal Government, the federal states and communes are not obliged to implement federal sustainability standards that exceed legal requirements. The aspiration though, is to apply the principles of sustainable construction to all public building activities eventually. Thus the majority of representatives from government agencies, federal states and communes support the task group by conviction. With their expertise, they ensure that the system complies with the administrations' requirements and that implementation will be as simple as possible.

3.2 Scientific Advisors

The Fraunhofer Institute for Building Physics (IBP) acts as a scientific advisor to the task group. IBP had also been involved in the initial development of the assessment system for office buildings and has a rich experience in the fields of sustainability assessment in building in general, and in life cycle assessment in particular.

3.3 Academic Consultants

This expertise is complemented by academics from the fields of planning, architecture theory and educational theory. Their field of expertise lies generally outside that of sustainability assessment. Instead, these scientists' concern is that international currents in contemporary educational theory will be reflected in the future Assessment System.

4. General Relevance of Education Buildings for a Sustainable Development

The principles of sustainability can be applied to almost all human activities: the production and use/consumption of energy, food, goods and buildings, as well as the transportation of people and goods. Though all these aspects are interrelated, the sustainability assessment of buildings so far tends to isolate the building from other activities such as transportation.

However, the building sector is under high scrutiny, and among all building types, education buildings have a distinctive relevance with regard to the socio-cultural aspects of sustainability. That is because in general, children and young adults spend a large quantum of their time in education facilities. In Germany that time is currently increasing because of a widespread implementation of all-day school programmes that respond to many parents' wishes to balance work and family.

4.1 School Buildings in Germany

Though new buildings are still required, the majority of education building projects today consist of refurbishments and predominantly minor extension buildings. For the Sustainability Assessment System for Education Buildings, the initial focus on new construction has thus - similar to administration buildings – rather practical reasons. A version adapted to refurbishment projects is projected for the near future.

In the last decades, the education building stock, which accounts to approximately one third of public buildings, has been generally poorly maintained because of weak public finances. As reaction to that, the Federal Government have included the refurbishment of schools into the fiscal stimulus package after the financial crisis in 2008, although schools are generally a responsibility of the federals states.

Demographic shifts and changes in the school system result in the opening of new and closing of old schools. In this process the number of private schools is increasing. (Private schools in Germany usually receive 75% of the public funding of public schools. In this way public schools appear to save money to the public administration and are seen as a way to cut spending by some communes.)

Often, these new private schools occupy former public school buildings. It can thus be assumed that in future, a growing number of public school refurbishments will be commissioned by private clients rather than public building authorities.

4.2 The Building as a Good Example and a Good Setting for Learning

The Montag Foundation for Youth and Society states in the 'Design and Building Handbook for Houses for Learning', which will be published this year: "In an age in which young people are open and able to learn, education buildings can set good examples in terms of:

- Aesthetics, for example through space, light, colour and form,
- Ecology, by demonstrating sustainable ways of handling air, energy and materials
- Structure, i.e. in the layout of the building. " [1]

The interrelations of good studying environments – in this case especially acoustic conditions - and good learning results have been empirically proven. [2] In this way, sustainable education buildings can improve the success in educating young people. In Germany, where knowledge is considered the single most important resource, this is an obvious contribution to a sustainable future, as it is everywhere else.

In the 'Design and Building Handbook for Houses for Learning' it is also suggested that future concepts will connect traditional schools into integrated learning networks that will include adult education as well as communal services. In that way not only the young members of society will benefit from a better learning environment and equality of opportunities is expected to increase. [1]

4.3 Urban development

Beyond that, education buildings are seen as a crucial element in urban development strategies as a whole: In the Leipzig Charter on Sustainable European Cities, the ministers responsible for urban development in the EU-member states lay out common principles and strategies for urban development policies. A major challenge that cities face is identified in high unemployment and social exclusion in certain neighbourhoods. Considerable increase in social distinctions and differences in economic development within one city are recognised to threaten to destabilize the cities. A policy of social integration is recommended in which "… a crucial starting point for improving the situation in deprived neighbourhoods is the improvement of the education and training situation in the local community …"[3].

Frauke Burgdorff, board member of the Montag Foundation for Youth and Society states that "it is obvious that especially well planned investments in quarters with a great need for refurbishment will have a particularly large impact. Beyond the improvement of the immediate surrounding, schools are the single place in an urban society where all religious believes and lifestyles meet at eye-level." [4]

5. Principals of the new Assessment System for Education Buildings

5.1 Functional Differentiation

The System is intended to be applicable to all kinds of education buildings both for children and adults. This will include such different functions as elementary schools, universities and teaching facilities in army barracks. Pre-school education is not explicitly included, but when completed, the system is expected to work for kindergartens etc., too.

The requirement for different versions of the assessment system with regard to different functions of buildings arises from numerous variations among building types. These can be building costs, technical installation and the number of users relative to the built area, for example. A significant challenge in assessing a building can be to determine which system should be applied, as the boundaries between the different functions are blurred.

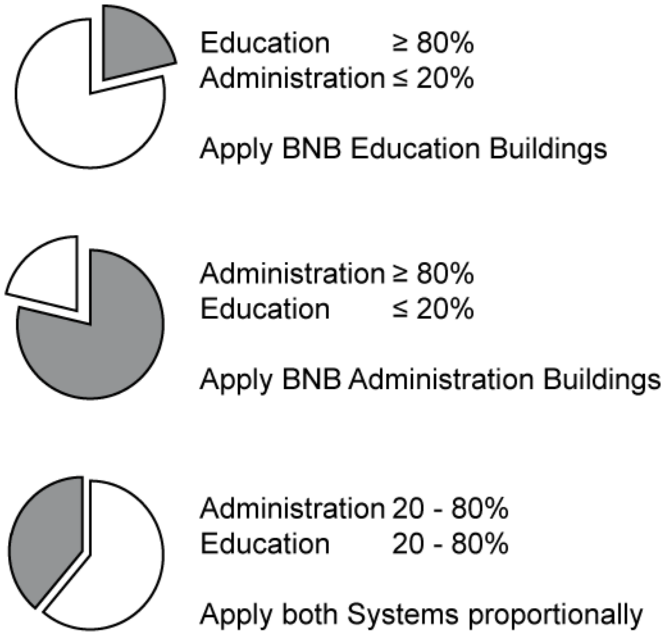

Fig. 4 Application of Different BNB-Versions depending on the Function of a Building

For instance, a faculty building for humanities tends to be quite similar to standard office buildings. Reversely, the differences between a faculty building for humanities and one for natural sciences with its laboratories can make two university buildings fundamentally incomparable in financial and energetic terms.

As a result, in a first step, the object of the Assessment System for Education buildings had to be defined and differentiated from other functions. It was estimated that for a significant number of buildings a partial application of different assessment systems to one building (for instance a multi disciplinary university building) will be necessary. The principles for the differentiation are laid out in *Fig. 4*. The practicability of using two systems on one building will have to be tested in the pilot assessment phase.

5.2 Principal Changes compared to the System for Administration Buildings

When adapting the Sustainability Assessment System for Administration Buildings to the functional requirements of Education Buildings, differences between the two systems should be principally related to differences between the two building types. For example, by legal requirements, the floor to ceiling height in schools has to be at least 3.00m, compared to 2.50m in office buildings. Accordingly, the target values in the criterion 'Capability of Conversion' need adjustment.

In turn, those issues in the system for administration buildings that need revision, but are not related to differences between the two building types, can not simply be adjusted within the system for education buildings. Instead, a list of recommendations for the office system is set up to ensure a synchronous future development of the different systems.

In short, the different versions of the systems are intended to be identical where possible and different where necessary. On reviewing the existing system, the task group established three options in dealing with a criterion that requires adjustment to the different building functions:

- Abandoning a criterion. If different legal or normative requirements apply, and an alternative indicator with a proven effect on sustainability cannot be established, the criterion is left out. For example, exceeding legal requirements for education buildings concerning sound protection has no significant benefit in terms of sustainability, so the criterion 'Sound Protection' was abandoned.
- Adjusting target values according to different functional requirements. For example, calculating new Life Cycle Cost target values.
- Adjusting Indicators. If required by the function of the building, indicators can be taken out, added or altered. For example, an indicator that measures the capability to communicate the technical functioning of the building to the students is appended to the criterion 'Influence of the User'.
- New criteria can be added, as well. The majority of new criteria are part of the Socio-Cultural and Functional Qualities Criteria Group, for example the criterion ‘Interior Qualities’.

6. Overview of Changes

The changes sorted by main criteria groups:

6.1 Ecological Quality:

The target values of those criteria concerning the life cycle assessment were adjusted to the different building type. Energy and water consumption data of existing education buildings were analysed and used to establish new target values [5]. The experience that will be gained in future building assessments is expected to allow for more differentiated and precise target values.

6.2 Economical Quality:

6.2.1 Building-Related Life Cycle Costs

The target values for this criterion have been adjusted. However, the quality of the empirical data that is used to establish target values is not consistent: On the one hand, the investment costs for many different types of education buildings are well documented and differentiated. On the other hands, data concerning the costs for running and maintaining the buildings are hardly at hand. As a result, the proposed values will have to be carefully examined and if necessary adjusted after the pilot assessment phase.

6.2.2 Value Stability

In the system for administration buildings, this criterion re-evaluates the functional criteria 'Capability of Conversion' and 'Space Efficiency'. The latter criterion simply measures the net usable floor area against the total floor area, thus encouraging compact circulation areas. In modern education concepts however, informal learning, communication and recreation areas are part of circulation spaces, which for that reason should not be too compact. It was therefore seen as counterproductive to incentivise compactness for these spaces. Consequently, the criterion 'Space Efficiency' was abandoned as a whole, and the criterion 'Capability of Conversion' replaced that of 'Value Stability' in this criteria group.

6.2.3 Prevention of Vandalism

This criterion was developed from scratch. Here, a wide range of measures can be assessed. The practicability of the criterion may have to be worked on during the pilot assessment phase. For instance, the question, whether a certain measure to prevent vandalism is appropriate in a specific setting, needs to be taken into account.

6.3 Socio-Cultural and Functional Quality

6.3.1 Indoor Air Quality

The adaptation of this criterion proved to be challenging, because of the following conflict of objectives: On the one hand, for best learning conditions, the carbon-dioxide concentration in class rooms should ideally be kept below the mark of 1000 parts per million (ppm), which is the peak value for work spaces in the Assessment System for Administration Buildings. Because of the relatively high number of users per area in education buildings, this value results in high air exchange rates, which during winter, can not be guaranteed by using natural ventilation only. The alternative to window ventilation, however, would then have to be mechanical ventilation that can result in drought, disturbing sounds, high energy demand, investment- and maintenance costs.

To achieve an average grading, it was decided to follow technical standards, which allow for the use of natural ventilation. In order to encourage and reward good ventilation rates, the peak level for the exchanged volume of air per person is defined so that the carbon-dioxide concentration in class rooms will remain less than 1000 ppm. Future research is expected allow for a more precise assessment of the matter.

6.3.2 Acoustic Comfort

Here**,** the speech transmission index (STI) is used as an indicator instead of the reverberation time, which is employed in office spaces. The reason is that in class rooms and auditoria, the speech transmission quality is obviously of particular relevance, especially with regard to hearing impaired people.

6.3.3 Visual Comfort

The criterion remains unchanged, so the high standards with regard to computer work in administration buildings is applied to education buildings, as well. The rationale behind this decision is the increasing use of portable computers, both at school and university.

6.3.4 Influence of the User

As mentioned above, the criterion now additionally measures the capability to communicate the technical functioning of the building to the students.

6.3.5 Building-Related Outdoor Qualities

The criterion was tailored to the different requirements of school and university buildings. To reflect the differences between various types of education buildings, indicators that are not appropriate to a building type can be left out - climbing frames in university buildings, for example. Currently a sustainability assessment system for outside facilities in federal properties is being developed, too. Once this system is available, the sustainability for example of school yards can be assessed in a more detailed way.

6.3.6 Barrier-free Building

In this case, the requirements of the criterion need to be balanced out against practical considerations. The compliance with the new DIN 18040-1 norm, which is a challenge for designers and all parties involved, will be the peak value for this criterion [6].

6.3.7 Space Efficiency

As described above, the criterion has been abandoned.

6.3.8 Capability of Conversion

The target values for this criterion needed adjustment to the different building type. The building geometry and technical installations differ significantly, for example, as stated above the ceiling heights are very different.

6.3.9 Public Accessibility

The openness of an education building to the public has a significant impact on its potential to act as a catalyst for urban development as described above. The criterion was re-written with respect to these requirements.

6.3.10 Bicycle Comfort

In this criterion, the number of bicycle racks is adjusted to the widespread use of bikes among pupils and students.

6.4 Technical Quality

6.4.1 Sound Insulation

In the course of testing the system for administration buildings, a number of criteria of the technical quality proved difficult to assess. As a result, only four technical criteria are currently in use in that system. Among these, the criterion Sound Insulation appears not relevant for education buildings (see above) and will be left out in the version for education buildings That is because the norm DIN 4109 [7] has different requirements for this building type. It was estimated that exceeding these requirements would not have a relevant impact on the well-being of the users.

6.5 Process Quality

6.5.1 Integrated Design

In the criterion, a higher emphasis is given to participatory efforts. That is because the practical experience of the task group showed that user-participation is a particularly important measure to ensure quality and widespread acceptance of the project.

6.5.2 Optimisation and Complexity of Planning

The discussion in the task group showed, that many aspects of sustainability need to be addressed in a very early stage of a building project. A first step should be an assessment of what can and what needs to be achieved (for example in terms of prevention of vandalism, strengthening the local community etc.). This should be followed by strategic concepts on how to achieve these targets. Compared to the system for administration buildings, more room is given for such concepts.

6.6 Location Profile

As described above, the Location Profile is not included in measuring the degree of performance of the building. Instead, the assessment of the location is given for information. For that reason, a distinction is made between positive impacts the building has on its immediate environment, and environmental impacts of the site on the building. The former should be assessed in the criterion 'Public Accessibility’; the later are documented in the location profile.

For education buildings, the criteria ‘Risks at the Micro-Site’ and 'Image and Character of Location and Quarter' are abandoned, because their relevance for the sustainability of education buildings was not evident.

7. Adjustments in the weighting of the various criteria

7.1 Incentives

The weighting of the different criteria within the system is not only relevant for the actual assessment of a building. Even more important for the implementation of an effective sustainable building practice are the incentives that are given by the assessment systems. For example: it is only natural that the majority of developers and designers aim to achieve the best possible assessment result at the lowest possible costs. Investors and designers therefore tend to focus on those criteria that offer relatively big points for relatively little money by adjusting the design primarily with respect to these criteria.

When defining the weighting of the criteria and criteria groups, this should be kept in mind. In other words, the percentage of weighting of each criterion must correspond to its actual relevance in terms of sustainability as much as possible.

7.2 Principles

One of the basic principles of the Sustainability Assessment System is the equal weighting of the three pillars of sustainability. In the office system, these are 22.5% of the total degree of performance for each of the three pillars, regardless of the number of criteria within each main criteria group. As a result, in a main criteria group with fewer criteria, the weighting of each criterion is relatively high. In return, in a main criteria group with a high number of criteria, the weighting of each criterion is relatively low (See also *Fig. 3*).

The high weighting of the criterion 'Building-related Life Cycle Costs' appears appropriate as it has a high relevance for the assessment of a building’s sustainability. On the other hand, the relatively low weighting of the criterion 'Quality of Architecture and Urban Planning' does not appear to reflect the relevance of these aspects – it can only be explained as a result of these principles.

However, the discussion within the task group showed the particular relevance of the socio-cultural aspects for education buildings, as shown in the paragraph *General Relevance of Education Buildings for Sustainable Development.* Consequently, the task group’s recommendation was to reflect this relevance in the weighting of the criteria.

To achieve this, and to account for the given structure of the assessment system for office buildings at the same time, two versions had to be developed for the weighting of the criteria: Version I follows the example of the system for office buildings very closely. It thus grants a maximum congruence between the two systems (*Fig. 5*). As a consequence, though, the weight of some criteria does not appear to correspond to their actual relevance, and misleading incentives for designers and developers could be a consequence.

In order to address this issue, version II (*Fig. 6*) introduces the following, fairly subtle changes to the weighting of the system that avoid radical alterations:

7.3 Technical and Process Qualities

By abandoning the criterion 'sound protection', each of the remaining technical criteria would have gained a very high significance in the system. To avoid an unbalance, and to account for the high relevance of the process related qualities, the shares of the technical and the process qualities have been exchanged: here, the technical qualities account for 10%, and the process qualities for 22.5% of the total system. The shares of the main criteria groups of the two systems are shown in *Fig. 4*.

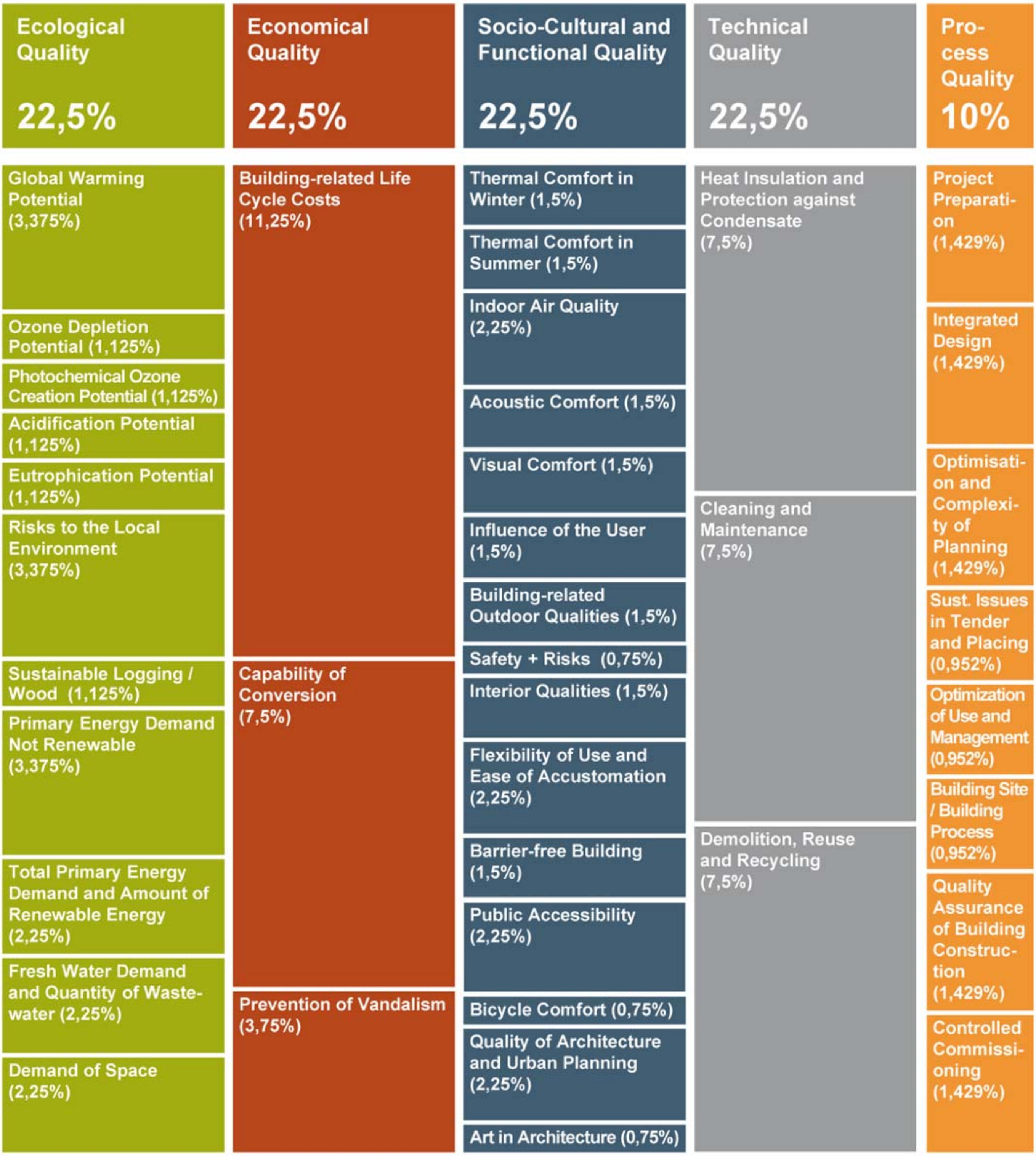

Fig. 5 Draft of the Sustainability Assessment System for Education Buildings - Weighting of the criteria with reference to the System for Administration Buildings (Version I). The Task group's general opinion is that the actual relevance of some criteria is not expressed which may result in misleading incentives. For instance the relevance of the 'Quality of Architecture and Urban Planning' is not depicted appropriately, whereas the Technical Qualities are overweighted.

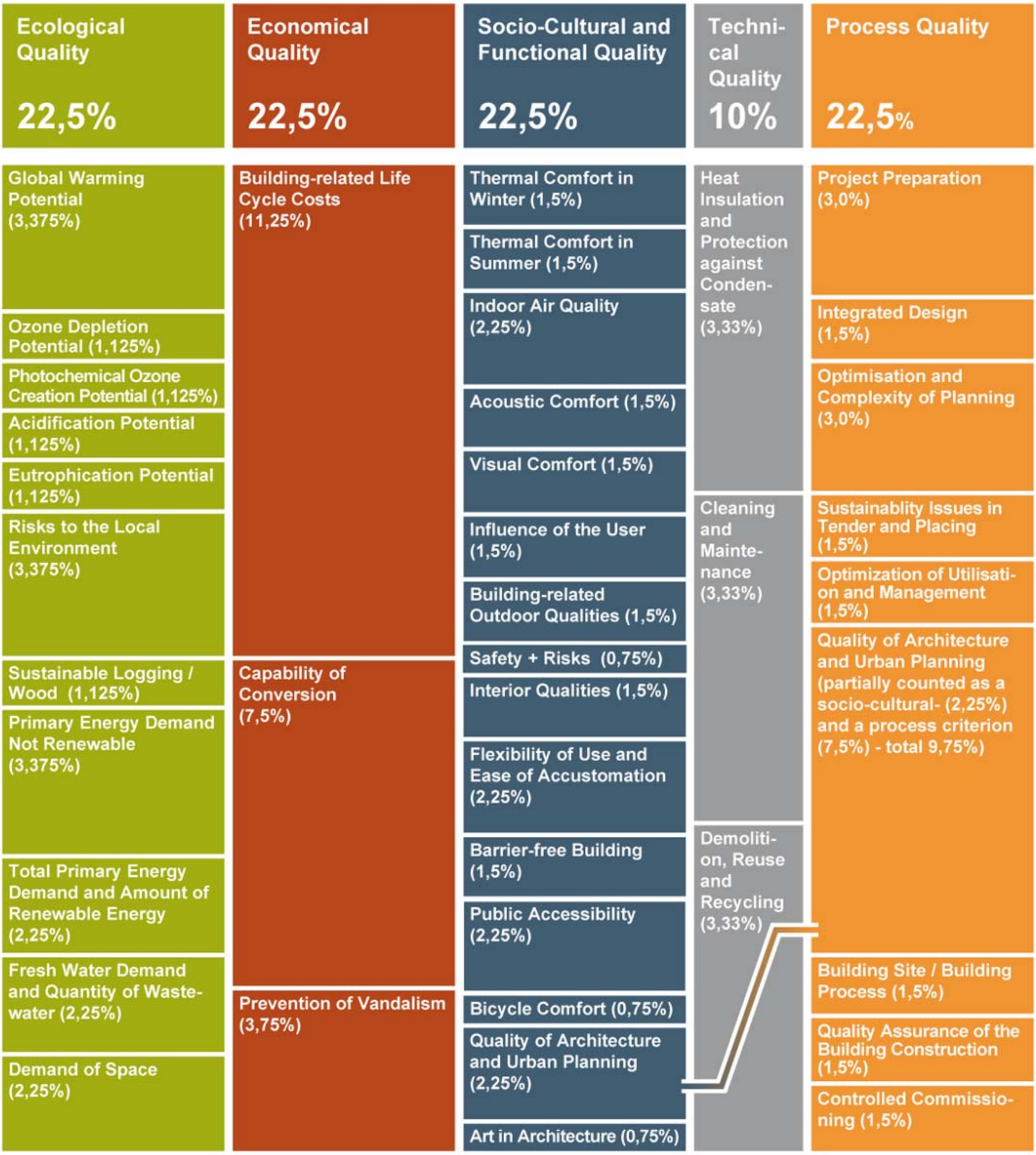

Fig. 6 Draft of the Sustainability Assessment System for Education Buildings - Weighting of the criteria with respect to the relevance of each criterion (Version II). Technical Criteria are given an overall share of 10%, whereas Process Criteria amount to 22.5%. The socio- cultural criterion 'Quality of Architecture and Planning' is re-counted as a Process Quality, which reflects the procedural nature of the criterion.

7.4 Quality of Architecture and Urban Planning

As described, the task group identified numerous aspects of sustainability that are related to the design qualities of a building. That is for example, the presence of a culture of architecture and planning, the respect for local building traditions, or sensitivity towards the context of the site. The discussion also showed that these qualities could not be assessed by the system directly. Instead, the judgement of a qualified jury is necessary, which is how the criterion 'Quality of Architecture and Urban Planning' in the existing system for administration buildings deals with this issue.

The criterion subsumes many socio-cultural aspects, and in fact, it describes a process quality, by assessing the procedures to ensure a good quality of architecture and urban design. It was therefore suggested to assess this criterion additionally as a process quality. In this way, the quality of architecture and planning is given a significantly higher weight in the sustainability assessment system for education buildings.

In the test assessment phase, an analysis of both versions of the weighting for the system is intended.

7.5 The Use of Quantitative Assessment

As shown above, education buildings have a very particular socio-cultural relevance because of their

- key role in sustaining and increasing our most valuable resource - knowledge
- function as a trigger for improvement in socially deprived neighbourhoods
- utilisation by young people for a significant part of their time spent awake each day. This happens at an age in which they are generally very receptive to outside influences. Nevertheless, through integrated learning networks, that include adult education as well, all parts of society are likely to benefit from good education buildings.

The presented draft for an assessment system for education buildings reflects this relevance by thoroughly addressing the socio-cultural criteria. This results in a modest increase of qualitative assessment within the system. Qualitative assessment however, is often criticised for relying on the knowledge and experience of the jurors and thus making the assessment less transparent and replicable.

The countless relations and interdependencies between the various indicators, however, make the assessment system highly complex in any case. Even for professionals, it takes high effort to understand how the system operates. For laymen on the other hand it is hardly possible to replicate the functioning of the system in detail, they can either believe or not believe that a system operates appropriately. This gives the experts a responsibility to explain not only the possibilities, but also the constraints of their systems.

At this stage, a criterion that is relevant for the assessment of a building’s sustainability should be allowed to leave a certain liberty of interpretation to the juror. At the same time all efforts need to be made in order to clarify these criteria by defining precise requirements for the assessment.

8. Conclusion

The variety of different international assessment systems shows that a general consensus, as to how sustainability should be assessed, does not exist yet. Instead, we are only beginning to develop the techniques and the tools that are needed. Also, we are only just beginning to collect the data that will eventually allow us to make much more definite predictions about the effects and implications of our various assessment systems.

In this context of exploring ways to assess and improve the sustainability of the built environment, the presented draft for an Assessment System for Sustainable Education Building shifts the focus towards the socio-cultural aspects of sustainability. These are often less quantifiable and harder to capture in a schematic system, but they are just as important as the more quantifiable ecologic and economic criteria. The test assessment will help to examine the possibilities and limitations of this approach as well as the incentives that the system gives to developers, designers and planners.

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