Quality Label in Buildings and Construction – a Green Label Supporting the Sustainability of Buildings in Slovenia

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Abstract. Sustainable actions in the building sector need to be supported by appropriate quality assurance (QA) and control protocols and tools. In late 1990s the first – and to this date the only comprehensive – quality label for construction products and services was established in Slovenia: the Quality Label in Buildings and Construction (ZKG). It is a voluntary green label addressing not only the specific technical characteristics of products and services, but among other also the production process quality, internal QA schemes, regular training and education of staff, innovation and development activities, economic aspects, the impact of the activities on the environment, and the social role of the company in the local area. In this way it addresses the three core pillars of sustainability. The label has gained a prominent status and is being referred to in calls for tenders both in public and private sectors and in national subsidy schemes. The paper presents the structure and content of the assessment scheme and ranking system exposing their core elements. A more detailed approach is presented on the case of a window as a construction product and on the case of installation of windows as a service, underlining the positive role of the label with regard to raising the quality standards in the building sector on the national level.

1. Introduction

Enhanced overall quality, constant quality assurance and use of tested methods of permanent internal and external quality control represent a common denominator of established certification and assessment schemes in the building sector EU- and worldwide. Their scope and targets may vary, from treating particular aspects of a single product to comprehensive evaluation of a whole building project. Also, some are usable and transferable in a broader framework, some are specifically linked to a particular national environment [1]. Among the most well-known are DGNB, BREEAM, LEED, HQE, Blue Angel, Nordic Ecolabel, and RAL, to name just a few, each exhibiting its own methodology and level of extensiveness with regard to the item of assessment in question.

In the first half of the 1990s a voluntary national labelling system was developed, called the Quality Label in Buildings and Construction, or, with the Slovenian acronym, the ZKG. This process went alongside with the evolving national technical legislation with the key goal to raise the quality of products and services on the domestic market. Following – but not copying – the concept of international certification schemes, the applicable aspects of sustainable construction were taken into account from the very start, initially for the evaluation of products and services, and later also devices and technologies. The idea was prepare an adaptable criteria structure to enable adding of new categories.
The methodology was set up in such a way that it is possible to evaluate the overall quality of all applied projects, divided into six sets: from the technical-technological, quality of work processes, the role of management to the social, environmental and economic framework.

For example, in developing detailed criteria with an emphasis on energy efficiency for assessing windows and balcony doors as construction products, certain aspects of sustainable construction were incorporated already 23 years ago, but can be complemented and modified according to the latest state of the art and technology. This is also true for environmental and social aspects. Similarly, detailed criteria for evaluating the installation of windows and doors as a service were created 18 years ago, taking into account the latest state of the art (RAL guidelines and national regulations).

2. The method

2.1. Principles and cornerstones of the ZKG development

The ZKG methodology is based on the principle of equality and impartiality. The entire procedure must be systematic, planned and professionally managed, as described in the ZKG acts. The ZKG label has a distinctive graphical image, as shown in figure 1. The approach consists of two phases, which are described in more detail below.

Taking into account the aspects of sustainable construction and the business excellence model INKAGRA [2], the development of the national voluntary green label ZKG was carried out in the direction of a comprehensive quality, consisting of six cornerstones that must apply to all assessment subjects, whether they are building products, technologies, devices or services, while allowing for the preparation of detailed criteria and an independent assessment process, as shown in figure 1. In other words, even if a single construction product is assessed, the evaluation does not consider only its individual characteristics (like technical performance, environmental friendliness etc.), but looks at it in the overall context of manufacturer's activities within a particular environment – in the social, economic and literal sense.

![Figure 1. Comparative evaluation – assessment of overall quality; applies to all products and services (left) and the ZKG label (right) [3]](image)

In the first set of the scheme – technical and technological quality – it is envisaged that criteria shall be developed in accordance with the state of the art technology (following the example of the RAL Quality Mark), even though it may be that at present a very low level has been achieved in some cases. The reason lies in the fact that one of the objectives of the ZKG certification scheme is to raise the overall quality.

In the second set – efficiency and quality of processes – quality assurance in all processes is crucial. It does not only apply to corresponding ISO standards, but also puts a major focus on development, research and improvement, quality control and reduction of environmental impacts resulting from the production process or service. This includes the sales and after-sales activities by servicing, purchasing and managing subcontractors and the business system.

In the third set – strategy and leadership – the strategies related to further development, and operations and management excellence are examined in line with contemporary guidelines, as these are the key indicators for the potential further development of the company.

The fourth set – satisfaction of customers and users – relates to important priorities of a modern and development-oriented business entity. This includes consulting and informing customers about responsible consumption and the appropriate and efficient use of a product, plant or technology throughout their lifetime.
The fifth set – impact on society and the environment – does not relate to the environmental impacts of production or service delivery, but to the attitude of management and owners towards employees (including the payment of taxes and contributions) and their working environment, and towards cooperation, status and role of the company in the local and the wider community, including the relation to the cultural and environmental issues.

The last, sixth set – financial and business success – consists of a comprehensive verification of the company’s performance in given circumstances compared to competition.

2.2. Preparation of detailed criteria with a preliminary analysis

The methodology envisages that the need for and interest in the preparation of calls to apply for a particular ZKG award is verified first, be it on the side of state bodies and local communities, investors, associations, or other stakeholders. Starting from the interest shown, a project task is conceived based on an analysis of the actual situation. A Project Group is formed, which consists of independent experts, investors and representatives of the economy. The basic task of the Project Group is to develop and prepare detailed criteria for a specific product or service. The available number of points and precise scoring conditions that are based on a single model within the ZKG system are determined and adapted to the subject in question, so they may differ from field to field. If necessary, the appointed Evaluation Committee adjusts and completes the detailed criteria and the available number of points and confirms the prepared tender documentation from the expert point of view [3].

The final result is tender documentation, which is a public document, accessible to all interested parties, as are the benchmarking criteria. A public tender is valid for the entire year and forms the basis for commencement of comparative assessment.

2.3. The comparative assessment

The comparative assessment process is precisely defined to enable impartiality and professionalism of the implementation of the procedure for all applicants. It is conducted in two rounds and takes place under the watchful eye of the Evaluation Committee and independent external expert rapporteurs. In the first round, it is verified that the applicant fulfils the entry conditions, while in the second, the comparative assessment process is carried out. Depending on the subject, various types of desk analysis and on-site inspections including interviews with stakeholders are carried out during the entire awarding process.

The Evaluation Committee also presents a proposal for granting a construction product, service, device or technology in question with the ZKG label. All ZKG recipients can acquire the right to use the brand name under conditions that are already pre-determined.

3. Rules for obtaining the ZKG label

The Evaluation Committee prepares a proposal for the ZKG award to the applicant who acquires the highest number of points among all, and to further applicants, who fall behind the maximum achieved score by no more than ten percent. So, the scaling is not reduced to absolute scoring values. The minimum number of points to be achieved (entry level) is also set out, as shown in Table 1. The Evaluation Committee may also decide not to grant any award in the subject area due to the insufficient number of applications despite the achieved minimum thresholds, or make a proposal to award only one applicant.

| Condition | No. of points |
|-----------|--------------|
| 1. The total number of points achieved shall not be less than 571 | Total points > 570 |
| 2. The total number of points achieved shall not be more than 10% below the maximum score (Max Total) | Total points > 90% of Max Total points |

Table 1. Two conditions for the ZKG award [4]
4. Example: detailed criteria for evaluating windows, balcony doors and panoramic walls with an emphasis on energy efficiency

The first selected pilot project on which the development of the ZKG system and methodology were checked were windows and doors. It turned out that when preparing the criteria for each subject of assessment, the most important thing is to determine precisely what is being assessed. In the concrete case, this meant that it was necessary to specify also the building types (e.g. residential or office building, holiday home, temporary building, and similar), which properties should be achieved by the assessed elements (simply compliant with the regulations, or with a higher level of quality required), and who can apply for a call (every or particular manufacturer or seller).

After a detailed analysis the following were selected as the assessment elements: windows and balcony doors (single- and multi-wing with or without mullions) and panoramic walls intended for permanent installation in buildings as parts of the building thermal envelope, since they have a significant impact on the energy balance of the building and on indoor comfort. They must consist of a frame and sash (wooden, plastic and metal profiles, or combinations of these materials), insulating glazing and fittings as a single complete product, assembled by the manufacturer. The eligible applicants are only those who have the appropriate certificates by independent certification bodies with regard to essential technical characteristics, and who have been producing the elements for at least three years, or who have installed at least 400 elements.

Quality criteria were developed and evaluated according to the relative importance of technical criteria in line with the product standards and other regulations. These criteria are determined by checking of various features documented on the basis of studies and analyses valid for climatic conditions at the national level, such as water tightness, airtightness, light and solar radiation transmittance, acoustic and thermal insulation, mechanical characteristics, and similar. In addition, the product's functionality is checked (handling, adaptability of dimensions, replacement of components, instructions for use and maintenance, possibility of installation, ease of maintenance), as well as environmental friendliness of the product (like use of raw materials, energy use and emissions during production, and technical lifetime) and the aesthetic aspect (precision of the workmanship and design quality).

Managing product life cycle processes from the initial concept and gathering of information about the user's needs and wishes to the processes of servicing and removal and recycling of the product is assessed as part of the process efficiency and quality. This system does not only examine solutions within ISO standards, but also other measures and means (like organization, management, technology, procedures) to ensure quality and improve all processes. More detailed checks are carried out on the development activities within the company and the production process itself, where special attention is paid to systematic internal control and testing taking into account occasional external verification, the system of purchasing the input and other materials, the manner of storage and transport to the place of installation, sales and after-sales activities, and installation and servicing.

Using various strategies, the company's management influences further development and performance of the business in the long run. Within this framework, strategies related to quality enhancement and assurance are being evaluated, orientations in the development or improvement of products, as well as other processes and the efficiency of implementation of strategies. Targeted leadership is a guarantee for higher long-term revenues, which are linked to flexibility and constant market and development trends analysis.

Modern approaches are not only aimed at customers' or users' satisfaction with products, which is being measured through annual surveys, references at home and abroad, or analysis of competitive advantages, but are also aimed at informing and raising awareness about responsible and environmentally friendly consumption.

Socially responsible companies take care of employees' satisfaction, health and well-being at the workplace, which is not only related to compliance to ISO standards, but also to other measures, such as work from home or recreation during work breaks. Another aspect is integration in the wider social environment with projects, donations, awareness raising, events and care for the environment, natural resources and cultural values.
In the year 1999, two years after the first evaluation of products, adjusting of the assessment methodology and development of detailed criteria for services began. The current scheme has two stages. In the first stage ten reference buildings with installed products are examined on the basis of the description and drawings. Evaluation of quality is then performed on three reference buildings with windows or doors already installed, where compliance with regulations, good construction practice and project documentation are checked, as well as for example log input and technical inspection reports.

In the second step, the procedures are checked on site on three or more buildings. This is the most important part of the assessment, where all phases of the installation are checked. The solutions and quality of performance are examined considering the recognition of the state of the art (with a reference to the RAL Guidelines), building physics and technical and technological conditions, mechanical and aesthetic conditions, manner of carrying out all details according to the requirements of the technical regulations and suppliers of materials used, as well as taking into account the accuracy of the implementation, and the final functional operation of installed products.

5. Evaluation elements
Components of good building practice in a specific thematic area, such as windows (product) or installation of windows (service), consist of various elements and criteria. They include characteristics of products and services, and related requirements for the production and technology, and organizational and business system, as well as the level of fulfilment of business excellence criteria, as presented in figure 2.

| Elements of good building practice | Description of comparative assessment / note | Total points |
|------------------------------------|---------------------------------------------|--------------|
| Area | Group | Element | Sub-element | Name / short description | The technical and other characteristics of the product are evaluated in a comparative manner on the basis of tests, examinations, measurements and conformity with technical regulations | 475 |
| 1. | 1. | Energy efficiency criteria | Measured quality results | Achieving the energy performance requirements set out in the reference standards and determined on the basis of test reports. Reports on the testing of individual components or the signed agreement on the use of test reports by another manufacturer or supplier, are not taken into account. | 175 |
| 1. | 1. | Window thermal transmittance, Uw | | The requirements set out in the tender documentation; requirement is higher than in the technical regulations; Uw may be measured or calculated | 50 |
| 1. | 1. | Air permeability | Determined by technical regulations - reference air tightness at 100 Pa (m³/(hm²) OR m³/(hm)), class 1 (150 Pa) to 4 (over 600 Pa) | 45 |
| 1. | 1. | Visible light transmittance (TV) | Determined by technical regulation, depends on the type of glazing, from 50 to 85 % | 40 |
| 1. | 1. | Total energy transmittance (g) | Determined by technical regulation: 0.35 for solar protection glazing, ca. 0.70 for double glazing | 40 |

Figure 2. A short section from a comprehensive list of elements that refer to energy efficiency criteria in the applied project "Windows, balcony doors and panoramic walls with regard to energy efficiency" [4]

The inventory of works and possible additional optimizations and additions in the documentation are checked on the basis of the written description of the work process. Further subjects of evaluation are the offer, plans and details, technology used, environmental friendliness of used materials, and plans of organizational and technical measures that help to ensure quality, such as the list of responsibilities and authorisations, qualifications of workers, maintenance of technical equipment, and arrangement of the access to the site [4].
The elements are divided into a tree structure and weighted by a system of points, the number of which is exactly 1000 for a particular thematic area. Almost half of the points refer to the technical and technological aspect of the product or its properties, or the technical quality of the service, such as the comparative evaluation of windows and their installation taking into account energy efficiency. The other half of the points are dedicated to the production and technological aspects, and to the organizational and business system.

The criteria of good building practice form the qualitative part, which includes a description of the quality requirements. The permissible construction practice includes the minimum requirements laid down by regulations. Requirements for targeted good building practice are defined as developmental guidelines for each element. In developing good building practice in a particular thematic area, special emphasis is placed on these criteria. The general guidelines for the preparation of good building practice criteria are shown in figure 3. A detailed evaluation scheme is developed by a project. The available points for each element are allocated approximately linearly according to the criteria used.

| Good practice criterion code | M1 | M2 | M3 | M4 |
|-----------------------------|----|----|----|----|
| Criterion name              |     |     |    |    |
| Criterion description       | Defined in regulations. This also includes the general requirements arising from the tender documentation (the threshold criterion). | Requirements for the medium level of quality that could be achieved with existing knowledge, skills, information, technologies, without increasing the price of individual services/products/building elements, but with better utilization of technical and human resources, taking into account the requirements of good construction practice. | Requirements for the medium level, but with greater performance of individual elements, which are due to higher requirements for quality and greater engagement of technological and human resources. Raising costs and prices is noticeable, but still negligible in terms of the life cycle cost. | Requirements for superior performance of certain elements that correspond to the highest quality products, services, technologies at the right prices. The return rate of this level of quality is substantially shorter of the technical lifetime. |
| Quality level               | Permissible - threshold | Low to medium | Medium | High |
| Scope                       | Quality for normal conditions regarding the requirements of clients/users and normal conditions of competitiveness. | Quality for more demanding conditions regarding the requirements of clients/users and more demanding conditions of competitiveness. | Comprehensive quality - the satisfaction of all participants in the processes - in the short term. | Comprehensive quality - the satisfaction of all participants in the processes - in the long-term and developmental sense. |
| Technological aspect        | Threshold technology | Newer technology | Improved technology | Advanced technology |
| Starting point              | Requirements of technical regulations | Improved practice, special projects | Technological development, technological clusters, participation of the economy and research institutions | Technology clusters, continuous research and development technology cooperation between the economy and research and development institutions |
| Level of advancement        | Controlling the process according to the minimum requirements of the technical regulations and good practice | Preparation for the introduction of new solutions, process management, efficient exploitation and management of processes in accordance with good practice. | Introduction of modern solutions and integration of professional solutions in process management. Technological development measures are envisaged. | The most up-to-date solutions are used that are European comparable and include a large amount of added value. |

**Figure 3.** Criteria for good building practice – energy efficiency; a section from the ZKG official documentation [4]

### 6. Results and discussion

The process of establishing the ZKG national voluntary assessment scheme successfully followed the key guidelines: incorporating all three main pillars of sustainability – environmental, social and economic one, methodology and detailed criteria for individual application projects updated in accordance with the state-of-the-art, achieving higher quality than prescribed by regulations, systematic
provision of quality in all processes, impartiality of peers (professionally qualified and trustworthy), possibility of self-assessment and thus comparison with competition, and establishment of a credible certificate that can be placed in public tenders [5].

The methodology for the development and support of good construction practice has contributed to the key goal of the ZKG project, namely raising the quality and technological competitiveness of Slovenian products, technologies and services. Development activities must not end at the level of certificates or CE labels, but efforts must be made to exceed the requirements of clients, since only such a business philosophy provides a successful business path for Slovenian companies in the EU market.

In the last 22 years over 175 various products and services were awarded with the ZKG label. During the first three years, six ZKG labels were awarded to energy-efficient windows, balcony doors and panoramic walls, and in 2001 the first installation was awarded. In total, 22 windows, balcony doors and panoramic walls have so far been awarded as products, and so have 21 installations, see figure 4.

![Figure 4. Number of ZKG awards per year (left) and shares of the awards granted in total since 1997 (right) [5] [4]](image)

Although ZKG was the first (and up until today remains the only) attempt of such kind in the national context, the methodology did not show any significant weaknesses when put into practice. The involvement of a wide range of experts, extensive analytical and comparative work and careful study of potential inter-influence and implications of individual components of the scheme and of the proposed rating system resulted in a fairly mature system already at the start, which needed only slight adaptations through the years of use.

The ZKG scheme is not directly comparable to other assessment schemes (as we can compare LEED and DGNB, for example). It sources sensible items from other schemes and incorporates them into its own system, but the philosophy is distinctively different.

The assessors do not make specific calculations, proofing or on-site tests. It is the obligation of the applicants to present as comprehensive documentation as possible to allow the assessors to make valid decisions. For example, it is not demanded from the applicant to perform testing of a certain technical feature of a product in the assessment phase. If, however, the applicant presents a particular test report (perhaps obtained as part of his regular quality assurance routine) within the documentation, this positively affects the scoring. Similarly, when assessing environmental parameters it is not demanded from the applicant to acquire an LCA analysis. But, an existing recent LCA document or an Environmental Product Declaration based on LCA brings him important bonus points.

The ZKG award is seen as an advantage in market competition, where companies use it as a proof of excellence of their products and services. It is being referred to in public calls by the national Eco Fund as a certificate cancelling the need to submit sets of test reports and various verifications. It has found its role in the same way also in the green public procurement procedures, where public entities specify certain mandatory criteria above the minimum requirements. Individual clients express trust and have a positive if not preferential attitude to products and services awarded with the ZKG label.
Confirming the suitability and technical correctness in practical application on individual products and services, the system has laid foundations for possible near-future expansion and adaptation towards more complex assessment and awarding procedures. In this sense, further development of the ZKG label has been included as one of the important activities into the work plan of the integral LIFE IP CARE4CLIMATE project, which started its activities in the beginning of 2019. To define, promote and foster the increase of quality of energy renovation of buildings according to bounding national strategies new focused areas for awards will be developed in the framework of the existing scheme.

The ZKG categories will be extended with criteria for at least 5 new assessment categories. New ZKG assessment categories will cover the processes, services and/or renovated buildings and specific products or systems that are recognised as key elements of successful energy renovation and decarbonisation for more sustainable and green buildings. Also, existing criteria and methods of evaluation of quality of products and services, which aim in the final consequence at tightened environmental indicators, will be upgraded.

7. Conclusion

The practice of quality assessment through a specific voluntary green label, ZKG, has been well accepted among professionals, financing institutions and general public, having so far covered over 25 areas of products and services. The ZKG award has – together with evolvement of criteria in various national subsidy schemes and periodic tightening of technical regulations – played an important role in the development of the national market of products and services, contributed to the overall higher quality of works and significantly helped in raising the awareness of end-users about the importance of sustainability parameters.

The scheme now needs a new boost to be adapted to current and future higher demands with a specific focus on topmost energy efficiency, not only oriented solely at products and services, but possibly also at projects as a whole, and at engaged stakeholders like building owners, managers, designers and contractors.

These activities will lead to a more mature market, demanding quality of the works done and the compliance of actual impacts with the expected ones related to energy efficiency, indoor comfort, environmental impacts, RES integration and, finally, to reduction of greenhouse gases. They also go in line with the established need and concrete plans for the development of country-specific sustainable building indicators, based on the EU Level(s) framework of core sustainability indicators and the related macro objectives, on the priorities of climate and energy as well as resource-efficiency policy in the Slovenian building sector, and allowing consideration of environmental impacts over the buildings’ lifecycle.

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