Fr	B	C	NY	S	T	Total
2	3	5	6	10	8	34

Example:
Certifications are intended to provide property owners and tenants with certainty regarding the sustainability of buildings. Around the world, numerous rating systems have been developed which have more or less established themselves on the market. What are internationally widespread are, for example, the American system „LEED", the British system „BREEAM" and the German system „DGNB".

Deutsche Gesellschaft für Nachhaltiges Bauen e.V. - DGNB (Freiburg)
The German Sustainable Building Council (DGNB) was founded in July 2007 by 16 initiators from various subject areas within the construction and real-estate sector. The DGNB certificate is a system for assessing sustainable buildings and is one of the top seals of approval for the real estate industry worldwide. It is awarded to environmentally friendly, economically efficient and user-friendly buildings. An evaluation is based on the entire life cycle of the building, i.e. from production to decommissioning via operation. The central aim of the DGNB is the design of a building that is as holistic as possible. Another feature of the DGNB is the possibility of pre-certification. Under the aspect of better planning and marketing, a building can be pre-certified before construction even starts. However, final certification has to take place after completion and commissioning of the building. In 2012, a total of 493 buildings were awarded DGNB certificates.

Energy certificates to certify the energy performance of buildings
In Europe, the European Energy Performance of Buildings Directive (EPBD) has led to the introduction of energy performance certificates, which are increasingly being used to advertise real estate. Thus, for example, about 174 electronic adverts on the Immoscout real estate website include information on energy certificates. Especially in areas with high vacancy rates, this trend may lead to owners undertaking measures to achieve a better energy efficiency class, thus increasing the attractiveness of the building. In Denmark, the energy certifications of all buildings can be accessed online.

Leadership in Environmental & Energy Design – LEED (New York)
LEED was developed by the US Green Building Council (USGBC) in 1995. The American rating system defines precise standards for the site, water and energy consumption, environmentally friendly building materials and the indoor environment and distinguishes between new constructions, existing buildings and renovations. Sustainably designed buildings, such as homes, healthcare and educational institutions and airports, are certified according to four quality levels [certified, silver, gold and platinum].

LEED was created to:
- define a „green building" on the basis of a uniform standard
- support an integrated planning process that takes the entire building into account
- promote the construction industry as the leading sector in the field of sustainability
- stimulate competition in environmental matters
- increase awareness among users.

LEED is becoming increasingly important internationally. By the end of 2012, 40% of the square footage outside the United States was awarded LEED certification.

Green Mark Scheme (Singapore)
In 2005, the Singapore government adopted the „Green Mark Scheme (GMS)" rating system. It was developed by the BCA (Building and Construction Authority) to improve the energy efficiency of buildings and environmental sustainability in the construction industry. Using the „Green Mark Scheme", building owners, developers, construction planners and real estate operators can better evaluate the environmental impact and energy efficiency of the building. Since 2008, GMS certification for buildings has been mandatory for buildings in the private sector that have more than 2,000 m² of gross floor space. According to the Ministry of Construction, in 2013, there were already 1,500 buildings in Singapore (17% of the building stock) that met the requirements of the GMS. All public sector buildings have to be certified by 2020. According to the IMCSD (Inter-Ministerial Committee on Sustainable Development), the aim is for at least 80% of the buildings in Singapore to achieve the Green Mark Certified rating by 2030.

CASBEE and Green Building Programme (Tokyo)
Since 2002, the Japanese Comprehensive Assessment System for Built Environment Efficiency (CASBEE) has regarded itself as a tool for assessing and rating the environmental performance of buildings. The „quality" associated with a building is compared with the „burdens" caused by the building by determining a „Built Environment Efficiency Index". The higher the index, i.e. the smaller the „loads" and the higher the „quality", the more favourable the building rating. Topics that are taken into account include thermal comfort, energy efficiency, resource use (materials, water), air quality and freedom from hazardous substances, emission-related environmental impacts, flexibility and durability. Starting with the building variant called „New Office Building", the system is continuously being developed further, and is, among other things, available in versions for existing buildings, refurbishment, and urban neighbourhoods as well as the certification of urban systems. Approx. one-

fifth (9 out of 47) of the Japanese prefectures as well as several major Japanese cities (including Yokohama, Osaka, Fukuoka, Sapporo) have adopted the mandatory disclosure of the demands made on the building by the certification system even before building begins. In contrast, the city of Tokyo has defined its own requirements (similar to the certification CASBEE) as part of its „Green Building" programme and calls for their verification and implementation with new projects with more than 2,000 m2 of gross floor space. This system is embedded in a number of other laws that deal with the topics of energy performance and energy efficiency.

1. Differentiated description of the key field

Building certification is at the bottom of the process to determine and identify certain quantitative and qualitative building characteristics as the basis for quality management. Standards for environmental, energy, social and economic evaluation are defined using mostly measurable parameters. A uniform and consistent standard for all buildings certified according to this system ensures the comparability of results. The evaluation itself is performed by an impartial third party. The result of this process is indicated by a mark or seal of approval – the certificate.
The „Green Mark Scheme" and the already long-established rating systems (DGNB, LEED, BREEAM, etc.) demonstrate that the certification of a building can also be used as a marketing tool on the property market and thus contribute to the economic acceptance of sustainably planned and executed buildings.

The „little brother" of the sustainability certificate is the energy certificate, whose adoption in practice exceeds that of the sustainability certificate by a thousandfold. The first energy performance certificate was mounted on the town hall in Kassel by Prof. Hauser about 20 years ago; however, this tool only really gained in importance with regulation by the European Building Efficiency Directive. Meanwhile, the energy certificate forms the basis of real estate funding programmes and advertisements. It triggers renovations and thus influences activities in the city.

2. Reference to sustainability:

In terms of global trends such as climate change, resource depletion, globalization and urbanization, an increasing global population and demographic change, sustainable real estate or „green buildings" are an important challenge for the future and indispensable. They should offer numerous advantages over conventionally constructed buildings in the long term – such as lower management and maintenance costs coupled with higher rental income, increased resale value, increased tenant interest and thus a reduced risk of vacancy.
Thanks to a building certification system, clear and mostly comprehensive standards are defined for the building quality, thus contributing to sustainable neighbourhood and urban development. Moreover, a building certification system raises awareness about the importance of sustainability in the construction industry.
Risks associated with ignoring the key field (building certification) □certified buildings may be demanded in the premium locations (AAA) or non-certified buildings may not be in demand (Europe)
Risks linked the key field not working (building certification) □"money down the drain"

The energy certificate triggers renovation work, thus significantly improving the sustainability of a community.

3. Relevance to industrial sectors?

Mobility:	Medium
Energy:	Medium
Production & logistics:	None
Security:	Medium
ICT:	Medium
Water infrastructure:	Medium
Buildings:	High
Governance:	Medium

Brief description of the high level of importance:
- Creates a market for new technologies and sustainable building materials
- Energy conservation and illustration of the energy consumption of one's own building
- Raising awareness about energy consumption
- Demonstration of the possibility to reduce annual operating costs
- Improved energy efficiency in buildings causes changes to the infrastructure of the power supply companies (switch from centralised to decentralised systems)
- Good site development (transport, information and communication technology) is a prerequisite for many building users
- Building is also regarded as a place one can retreat to and offers protection against climatic influences

4. Impact:

Positive:
- Increase in the operating efficiency and the market value of a property
- Costs minimisation throughout the entire life cycle of the building (costs arising in the use, dismantling and disposal phases, etc.)
- The Energy Performance Certificate triggers the use of tradespeople's services

• Voluntary nature of the system may increase its acceptance with building owners, designers, planners, construction companies

Positive effect of sustainable properties:
• Value preserved or increased
• Planning security and cost certainty
• Higher tenant retention through increased user comfort and satisfaction
• Lower energy and operating costs (in the long run)
• More active marketing opportunities
• Improved image thanks to the active contribution to the environment
• Quality by means of optimised materials with a long service life and a reduced volume of waste

Positive effects of the certification systems:
• Diverse selection of building use types leads to a high level of impartialness
• Early goal-setting – fewer planning loops
• Greater transparency and clear processes in planning and construction
• Better risk management
• Guaranteeing of the planned performance targets during construction
• Resource savings over the life cycle
• Greater building quality levels
• Higher rents and lower operating costs
• Advantages when marketing the property

Negative:
• Due to high demands, increased construction costs and planning costs or the costs of the certification process ({Närdemann #18})
• Increased administrative expenses during the planning/ implementation phase
• Royalties depending on the size of the property of between € 40,000–€100,000
• Certification fees depending on the building size (€2,000–€28,000)
• Possibly higher planning costs for additional verification and measurements
• May be more expensive, depending on the certification objectives (ca. 0-8%)

5. Implementation measures:

• Incentives for certified buildings created (grants, low-interest loans, tax bonus, gross floor space bonus, etc.)
• Transparent rating system and easy-to-understand presentation of the results for investors and building owners
• Certification procedure: (e.g. DGNB):
• 1. Register the property with the DGNB
• 2. Define target values for building properties in accordance with gold, silver, bronze certification levels
• 3. Use pre-certification for marketing purposes
• Accompanying planning and construction documentation is reviewed by the DGNB
• Use the German seal of approval for sustainable building for marketing purposes
• The auditor collects, examines and evaluates all the necessary data and documentation relating to the building that are relevant for the catalogue of sustainable criteria. Then the auditor submits the entire package to the DGNB, where, the auditor's evaluation results are examined by an independent body and, finally, the certificate is issued.

6. Actors: Who can shape things? With whom?

• Important basic principles for the design of a building certification system are the expectations of users and investors, the policy objectives and research results. This requires the interaction of several actors to reach a consensus for the establishment of the building certification system. Actors: public authorities, NGOs, building owners, planners, operators, users, public agencies (building authority, land registry office, tax office), insurance companies, real estate agents, developers, auditors, construction companies, investors, research institutes, etc.

• The auditor (awarder of the certificate) should participate in the planning process from as early as possible and actively give advice so that the desired quality certification level is achieved. Furthermore, the auditor has the greatest amount influence towards sustainable qualities during the planning phase and the least amount in the event of any changes being made.

• When applying a certification system, one usually differentiates between two basic strategies: a top-down one (required by law, e.g. the Green Mark Scheme) and a bottom-up one (voluntary participation of stakeholders, e.g. the DGNB).

• The energy certificate includes individual citizens in the design phase. The energy consultants are often the initiators of impulses, while the owners are the players in the implementation phase.

7. Prerequisites:

• When developing the building certification system, regional climatic, social and economic constraints have to be taken into account. In addition, a high level of technical know-how in the construction sector is required.

• When taking into consideration environmental effects (emissions): provision of the necessary LCA databases; declaration and thus transparency and monitoring of all materials and products used during the tendering and execution phases; continuous recording of all the dimensions used.

• The energy certificate is a national instrument and qualified people are needed to issue them. The kinds of people involved in issuing certificates are often architects, engineers, plant designers, lighting designers, right through to technicians, master craftsmen and chimney sweeps.

8. Obstacles/barriers:

• Measurability of the economic and environmental impacts of a sustainable building after certification.
• Possibly high capital costs and long payback periods for sustainable buildings.
• Bureaucracy
• Cost of certification
• Ignorance regarding the benefits of certification
• Great complexity of the rating system
• Recognition of the certification system

9. Indicators:

• Monitoring of the environmental, social, energetic and economic impact on buildings and urban neighbourhoods
• Statistics regarding the certification rate of new and existing buildings
• Visualisation of the energetic quality of the building

10. Special features/remarks:

Besides regional climatic, social and economic conditions, a building certification system is also affected by the building culture of the country in question and is influenced by the regulatory framework, planning processes and technical features in the construction sector in the country. The energy certificates, however, are instruments that impact on both the planning process as well as on the way the buildings are presented to the general public.