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Construction Information Classification System Adapted to Sustainability:

International Experience

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Introduction

The Architecture, Engineering, Construction and Operation (AECO) sector is one of the most demanding in terms of the use of natural resources. It is estimated that this sector has a 10% stake in the Portuguese economy and a consumption of natural resources and energy of around 50%.

One of the causes for this disproportion is a production model based on a linear economy, where there is great waste of raw material and little rationalization for recycling and reuse.

A major challenge is then imposed to all those involved in this area - to develop production models that involve the sharing, reuse, repair, renovation and recycling of existing materials and products, thus extending their life cycle.

The SECClasS Project

Challenges

- Construction represents **10% of GDP but 50% of energy and raw materials consumption**;
- **Fragmentation of the production cycle** - design, construction, management, demolition -makes collaboration and sustainable and well-informed choices difficult;
- **Digitalization of the sector** based on BIM - Building Information Modelling;
- **Difficult communication between models** used in design and construction and materials;
- **Materials selection and impact accounting** is difficult and not rigorous.

The SECClasS Project

Goals

- To **reduce construction and demolition waste through digital tools** for the selection and management of materials and elements with less environmental impact;
- **Facilitate communication and collaboration** between agents of the AECO sector;
- **Improve the selection** of materials and components;
- **Analyze impacts on buildings** throughout their life cycle.

The SECClasS Project

Solution

The SECClasS Project proposes to develop and implement a CICS – Construction Information Classification System, with focus on BIM models, optimized and oriented for sustainability, based on the principles of circular economy, aiming to reduce construction waste and demolition, through the use of digital tools that promote and anticipate the careful selection and management of products with less environmental impact.

Circular Economy Concepts

BIM Methodology

SECClasS
Sustainability Enhanced Construction Classification System

National CICS

Construction Information Classification System (CICS)

Concept and Use

The correct insertion of **information in the objects** is fundamental for the advantageous performance of the BIM methodology use. To this end, there is a need to adopt methods and strategies that enable the correct definition and implementation of these elements.

This is the case of the CICS - **Construction Information Classification Systems**, which guide and organize the way in which information is made available to intelligent objects.

The objects are grouped into classes relating them according to the particularities of their properties, enabling the use of simulation tools through three-dimensional models used in BIM methodology.

Construction Information Classification System (CICS)

Standardization

To improve and unify the way systems are classified and standardized, the International Organization for Standardization (ISO) has developed standards for this purpose:

ISO 12006-2

Building construction — Organization of information about construction works — Part 2: Framework for classification

This standard defines basic concepts on knowledge organization, considerations of guiding principles for a classification system and suggests a model for structuring information, which allows us to design tables that classify elements and functions.

ISO/IEC 81346 SERIES

Industrial systems, installations and equipment and industrial products — Structuring principles and reference designations

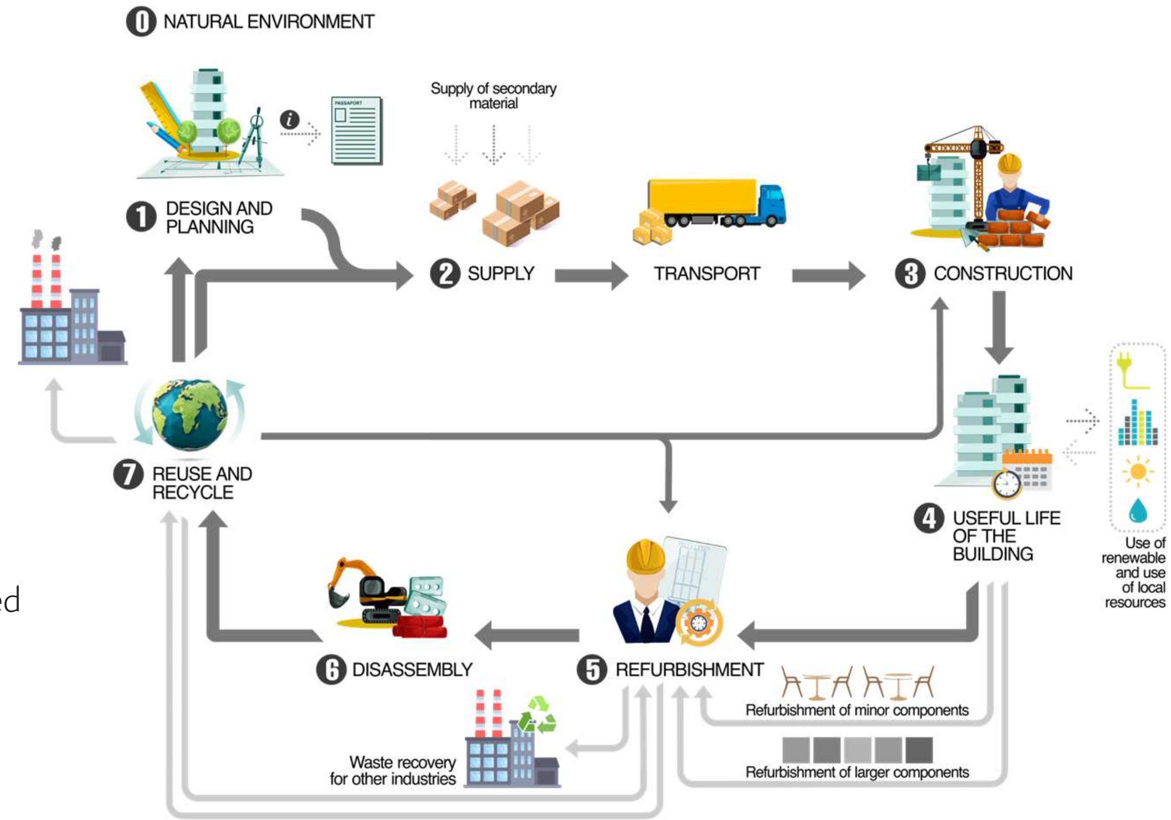
The new code of practice adopted to better define and classify functional, building systems and components. The purpose has been to establish a new international and transversal method to navigate and understand what is increasingly complex among the technical systems that are designed and built.

Circular Economy

Concept

The concept of Circular Economy has received political and academic prominence in recent years as an alternative capable of social, economic and environmental impacts mitigating associated with the current economic model and thus achieving the sustainable development goals of the United Nations.

Wit, Hoogzaad, & Daniels, 2020.



Building life cycle stages according to CE, adapted from (Arup, 2016).

Circular Economy

The European Union Circular Economy Action Plan

In the Circular Economy Action Plan (CEAP), renewed in 2020, the European Union (EU) presents measures for the sector to encourage circularity in construction:

- addressing the performance of construction products in terms of sustainability;
- promote measures to improve the durability and adaptability of assets built;
- use the Level(s) approach to integrate life-cycle assessment into public procurement and the EU framework for sustainable financing;
- consider a review of the targets set out in EU legislation for the recovery of construction and demolition waste;
- promote initiatives to reduce the level of soil waterproofing, rehabilitate abandoned or contaminated industrial spaces and promote the safe, sustainable and circular use of excavated soils.

Circular Economy

The European Union Level(s) Approach

"Level(s)" is an approach proposed by the European Commission for the Action Plan Circular Economy and are designed to improve the **sustainability of buildings throughout their life cycle**, helping professionals deliver better buildings - while accelerating Europe's transition to a more circular economic model.

Environmental performance is the main focus, but it also allows other aspects to be assessed, including health and comfort, life cycle cost and potential future risks.

The approach uses basic **sustainability indicators**, to measure carbon, materials, water, health, comfort, life cycle costs and climate change impacts, assessed from the initial design and concept phase through to the reality of completed construction.

Circular Economy

The European Union Level(s) Approach

The Level(s) thus aims to make a clear contribution to the broader objectives of European environmental policy and the framework is divided into:

- 3 levels of application based on the stages of the life cycle of buildings that will determine how advanced the sustainability reporting of the project will be;
- 3 subject areas, each with its own subject and desired outcomes;
- 6 macro-objectives that contribute to EU and Member State policy objectives in areas such as energy, material use, waste management, water and indoor air quality;
- 16 indicators that, together with a Life Cycle Assessment (LCA) methodology, can be used to measure the performance of buildings and their contribution to each macro-objective.

Circular Economy

The European Union Level(s) Approach

Levels of application

The common framework is organized into three levels that represent the increasing complexity of the stages of a construction project:

Level 1

The **conceptual design** for the building project – the simplest level as it entails early stage qualitative assessments of the basis for the conceptual design and reporting on the concepts that have or are intended to be applied.

Level 2

The **detailed design and construction** performance of the building – an intermediate level as it entails the quantitative assessment of the designed performance and monitoring of the construction according to standardized units and methods.

Level 3

The **as-built and in-use** performance of how the building performs after completion and handover to the client – the most advanced level as it entails the monitoring and surveying of activity both on the construction site and of the completed building and its first occupants.

Circular Economy

The European Union Level(s) Approach

Subject Areas	Macro-objectives	Indicators			
Resource use and environmental performance	1. Greenhouse gas and air pollutant emissions along a building's life cycle	1.1 Use stage energy performance	1.2 Life cycle Global Warming Potential		
	2. Resource efficient and circular material life cycles	2.1 Bill of quantities, materials and lifespans	2.2 Construction & demolition waste and materials	2.3 Design for adaptability and renovation	2.4 Design for deconstruction, reuse and recycling
	3. Efficient use of water resources	3.1 Use stage water consumption			
Health and comfort	4. Healthy and comfortable spaces	4.1 Indoor air quality	4.2 Time outside of thermal comfort range	4.3 Lighting and visual comfort	4.4 Acoustics and protection against noise
Cost, value and risk	5. Adaptation and resilience to climate change	5.1 Protection of occupier health and thermal comfort	5.2 Increased risk of extreme weather events	5.3 Increased risk of flood events	
	6. Optimised life cycle cost and value	6.1 Life cycle costs	6.2 Value creation and risk exposure		

European Comissiion, 2020.

International CICS

Based on a study developed by the Faculty of Civil Engineering of the Czech Technical University in Prague (Czech Republic), in association with the Czech Agency for Standardization, and taking into consideration key aspects for the Portuguese AECO sector, five CICS were chosen for further analysis in order to choose the base system for the CICS proposed by the project SECClasS:

- CoClass (Sweden)
- CCS (Denmark)
- UniClass 2015 (United Kingdom)
- OmniClass (North America)
- CCI (Czech Republic, Finland, Norway, Denmark, Sweden and Estonia)*

*Under development

International CICS

Analysis Results

	CoClass	CCS	UniClass 2015	OmniClass	CCI*
Linking with BIM models	✓	✓	✓	✓	✓
Compatibility with ISO 12006-2	✓	✓	✓	✓	✓
Compatibility with ISO/IEC 81346	✓	✓			✓
Systematic updating	✓	✓	✓		NA
Sustainability parameters	✓	NA		✓	NA
Considers the state of the structures	✓		✓	✓	NA ✓
Documentation in English or Portuguese			✓	✓	✓
License for use at no additional cost			✓		
Free authorisation for translation	✓	✓	✓	✓	NA ✓
Allows expansion of the system	✓	✓	✓		
Digital tools for use	✓	✓	✓	✓	NA ✓
Connection with the modeling software, Revit and ArchiCAD					

*Under development

Conclusions

Based on the results of the study developed by the Faculty of Civil Engineering of Prague and confronted with the objectives of the SECClasS Project, the conclusions found were:

- None of classification system is perfect, as the requests of each user group are distinct. The **flexibility and adaptability of the system is essential**, as each country will always have its own classification needs;
- The CICS purpose must be in **accordance with the BIM methodology** and able to increase the **sustainability and circular economy**, responding to current uses, but also to future uses;
- Systems that are hyper-adapted to a specific type of construction or a life cycle phase should be avoided;
- **Correspondence with other systems is essential**, so they must be in accordance with international standards, in this case ISO 12006-2:2015;
- More complexes CICS have greater breadth of future application and development. However, the level of complexity should always be evaluated, so as not to derail **human interaction and perception**.

Conclusions

- The oldest/traditional CICS have advantages such as greater consolidation in the market, acceptance by professionals and the language availability;
- The CICS future maintenance, including, but not limited to, its expansion, updating and maintenance, are factors to consider, and it is important to define a clear methodology, including and defining responsible and resources;
- The license to use and adapt, the current dynamism of the entity(s) holder of the rights in the expansion, correction and improvement and responsiveness to external contributions should be considered in decision making for a basic CICS.

Based on the analysis results presented, and the existence of an open license and the authorization for its translation and adaptation, degree of dissemination and implementation in object libraries, the choice for the base system for the SECClasS Project falls on the UniClass 2015 system, managed by NBS.

Next Steps

Next Steps of the SECClasS Project are:

- Revise the translation of the UniClass 2015 tables;
- Include new classifications specific to the Portuguese AECO sector;
- Test the use of CICS on prototypes modeled in BIM methodology;
- Connect and automate CICS classifications with Autodesk Revit and Graphisoft ArchiCAD softwares;
- Tests of the web application for searching in SECClasS tables;
- Translate documentation of the "Levels" approach proposed by the European Commission into Portuguese;
- Develop sustainable parameters based on the indicators suggested in the "Levels" approach, in order to support users in making more sustainable decisions.

Thank you for your attention.

Iceland Liechtenstein Norway grants

SECClasS Sustainability Enhanced Construction Classification System

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