Key Indicators & Assessment of Sustainable Buildings for (EU) Market Uptake through Housing Green Mortgages

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Abstract. This paper discusses the approach and implementation strategy of the Green Homes/Green Mortgages (GH/GM) programme being developed by the H2020 funded project SMARTER Finance for Families. We analyse the potential of this project for making step-change in the mainstream market of housing construction for it to adopt consistent environmental friendly practices at a large scale and involving all the value chain and stakeholders involved. One key feature of the project being analysed is the task to align the Green Certification requirements of the programme to the institutional initiative of the European Commission’s Directorate for Environment of an environmental performance reporting framework: The Level(s) framework.

1. Introduction and context
Building upon environmentalist concerns and the sustainable development concept origins in the ’70s [1], during the last two decades, contemporary architectural and engineering solutions have been developed to achieve minimal negative environmental impact an even a restorative approach to potentiate the environmental and health benefits coming from buildings [2]. Even if best practices become available in growing numbers and high ratings, and have proven effectiveness and feasibility, the upscaling of such practices remains a pressing and complex challenge [3].

The high energy efficiency and overall environmental friendliness of a Green building imply the improved quality of design and construction, followed then by the appropriate operation [4]. Quality in design and construction requires a coordinated effort and potentially a higher upfront economic cost than that of a business-as-usual lower standard [5]. A conventional lower standard construction implies not only a larger environmental footprint but higher operation and maintenance costs, thus a higher “total cost of monthly ownership”. Despite this fact, to limit upfront investment and financial costs, homebuyers and housing developers would often be taking suboptimal decisions and under-investing in the initial project process, regarding only to a “cost per square meter value”. As the earliest moments of planning and design being precisely the most cost-effective ones to invest to achieve higher quality, green and energy-efficient homes (considering in the “building envelope” in particular, that would be otherwise locked-in with low-performance attributes), it is essential to address the way financing solutions are perceived and offered [6].
This paper discusses the experience of two complementary projects: The first, the Green Homes/Green Mortgages (GH/GM) programme being developed by the SMARTER Finance for Families project consortium, aiming the implementation in twelve European countries of such a programme. The second project is the institutional initiative of the European Commission’s Directorate for Environment of an environmental performance reporting framework: The Level(s) framework [7]. All certification systems being applied for the SMARTER project seek their criteria to be aligned with this a framework and its key performance indicators (KPIs).

With a holistic approach to the building sector and the financing of housing projects, this research addresses several of the UN SDGs. Namely, the potential of reduction of poverty and energy-poverty (SDG1) and also the promotion of health and wellbeing (SDG3) mainly at indoor spaces of housing (which are of the highest use rate) are considered. Programme’s requirements for high building environmental quality imply that water protection and its sound management are promoted (SDG6), as well as energy efficiency and cleanliness (SDG7). The stimulated development of green housing projects will also entice market development and upskilling of workforce and industry (SDG8 + SDG9) and the integration within sustainable cities and communities (SDG11). The reduction of inequalities (SDG10) is also addressed by the SMARTER project as the lower-income population will be benefitting most from the green mortgage loans that are specifically considered by the programme.

2. Approach and methodology
The basic principle by which a Green Mortgage is issued from a financial institution to a Green Homebuyer/client at preferential rates is that the technical characteristics of the house or apartment, subject to the mortgage are, on the one hand, support to the financial and physical health of the borrower - who is saving in energy and other maintenance lowered costs. On the other hand, such a building is a higher value asset serving as a guarantee to the bank, who benefits thus of lower-risk investment profiles [8]. Different strands of research have been critically analysing these principles and have nourished, in qualitative and quantitative terms, our evaluations and propositions. Some of theses strands investigate the lending and energy costs relationships [9], others embrace more holistic sustainability criteria in commercial property value [10], or address the cost optimality definition in energy performance policy and investment decision making processes [11].

It is fundamental for the building characteristics – that allow banking institutions de-risking of their portfolios and to offer lower interest rates for borrowers – to be objectively considered, measured, and certified. In this sense, we analysed the market use of rating systems, referring e.a. to the SBI and GXN certifications overview [12], and evaluations of specific markets and approaches [13].

We analysed typologies of buildings and market shares to identify opportunities, context constraints and best options for determining a certification choice for each of the partner implementing countries of the SMARTER project. Upon this contextualisation of such systems, we listed sets of implications on every building phase of their implementation – focusing on value creation for key stakeholders.

We’ve considered the implications of the alignment of the certification schemes relevant for the SMARTER project with the Level(s) framework [7] – now, with the current testing beta version of Level(s) and with the foreseeable evolution in the 2020 market release version.

| Indicator or life cycle tool | Unit of measurement |
|----------------------------|---------------------|
| 1.1 Use stage energy performance | kWh/m² /yr |
| 1.2 LC Global Warming Potential | kg CO2 eq./m²/yr |
| 2.1 LC tool: Bill of materials | Reporting Building / Materials |
| 2.2 LC tool: scenarios lifespan, adaptability, deconstruction | Reporting according to level of assessment |
| 2.3 Construction and demolition waste and mat. | kg waste and materials/m² |
| 3.4 Credit to green LSF | Impact category indicators |
| 3.1 Total water consumption | m³ of water/occupant/yr |
| 4.1 Indoor air quality | Ventilation, CO2 and humidity + List of pollutants |
| 4.2 Time outside thermal comfort range | % of time out of defined max. & min. temperatures/ season |
| 5.1 LC tool: scenarios for future climatic conditions | Protection health and thermal comfort 12030 2010 scenarios |
| 6.1 Life cycle costs | €/m²/yr |
| 6.2 Value creation + risk factors | Reliability ratings/ indicator. |

Table 1: Level(s) structure and core indicators
3. Results
Some Green Building Council (GBC) national chapters are currently present in the SMARTER implementing countries. These GBCs integrate the project consortium and offer certification schemes for rating building environmental performance. This is the case for Italia, Ireland and the Czech Republic where these schemes are thus the first tool of reference – without exclusion of other approaches as long as the principle and alignment with Level(s) are respected. For Turkey, the certification required for the implementation of the programme refers to well-established ratings (LEED, BREEAM, EDGE) providing also Level(s) compatibility. The take of the remaining partnering countries is to use an upgraded and locally adjusted version of the scheme from the RoGBC GH/GM programme. The task of selecting certification schemes for each implementing country allowed to confirm clear and shared principles, as well as spotting differences in the local/national definition of “green criteria”.

The goal of alignment with the Level(s) initiative has the potential to ensure long term coherence. Moreover, a noticeable mark of the Level(s) framework is its building’s full lifecycle approach. Level(s) Life Cycle Assessment and Life Cycle Cost modules provide a clear and interlinked assessment of environmental quality and economic value, which underpins the aim of supporting de-risking and financial valuation.

Current Level(s) approach avoids setting minimal benchmarks, only offering sets of indicators and a "common language". Required minimum performances are then to be determined by the designated certification scheme parameters in correspondence with the local context.

4. Conclusions and perspectives
We claim that lean management and transparency of building information during all phases is essential to successful improvement of energy and environmental performances of buildings. This process and information management schemes support as well the accurate valuation of building assets.

The systematic use of standardised data formats concerning key performance indicators would help, as intended by the SMARTER project, the reporting and communication between stakeholders. This practice would entice the involvement and engagement of investors (from small and private to institutional and large scale ones) and financial institutions in the green-building market uptake.

This systematic key-indicators approach, applied from the inception of residential projects, will help integrative collaboration and the fine-tune of simulations and modelling in regards to clear aimed outcomes and engagements to ensure the corresponding performance and financing. The key indicators and their reporting will also inform and conduct attention in the actual construction process - lead by developers and contractors. In the in-use phase, sets of such indicators will finally also be allowing an optimal operation and management with a reduced ‘performance gap’.
Benefits of a large-scale implementation of such a programme will be offering as well long term qualitative and quantitative data availability for assessment of non-energy benefits of green attributes of construction that are currently scarce and approximative.

The interaction between stakeholders at all phases of construction projects – that the SMARTER project scheme requires and enables – can benefit from increasingly digital handling of the building information. Digital information management and modelling can indeed support the process that building and financial sector stakeholders are required to follow in a collaborative and integrative approach. Financial institutions databases and management of such green-building portfolios may also benefit from reliable data and quality assurance of assets.

The SMARTER approach has so far focused on the new construction of housing projects. One field of further development and research is the “renovation wave” challenge that the existing European building stock faces today. This challenge has the potential to be developed in the implementation phase of the project according to the particularities of local markets concerning housing retrofitting projects.

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