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Perspective

Beyond Core Building Automation: Expanding the Smart Readiness Indicator Service Catalogue for Complex Buildings

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Abstract

The Smart Readiness Indicator (SRI) provides a European framework for assessing the capacity of buildings to optimise operation, respond to occupants and interact with energy grids. Its current catalogue covers nine domains: heating, cooling, domestic hot water, ventilation, lighting, dynamic envelope, electricity, electric vehicle charging, and monitoring and control. This Perspective argues that this boundary is too narrow for complex buildings, where services such as lifts, security, fire safety, swimming pools, irrigation, outdoor lighting, kitchens, laundries, refrigeration, laboratories, and information and communication technology (ICT) rooms may significantly affect energy use, water use, safety, resilience, maintenance and user experience. The paper proposes five additional service families for SRI 2.0: mobility and accessibility; safety and security; water and outdoor environmental services; outdoor and site infrastructure; and special energy-intensive and facility services. These should be introduced as optional, building-type-specific modules assessed through familiar SRI functionality levels. This would make the SRI more realistic, actionable and relevant.

Keywords: Smart Readiness Indicator; SRI 2.0; smart buildings; building services; service catalogue; building automation

1. Introduction: Why the SRI Service Boundary Matters

The Smart Readiness Indicator (SRI) has become one of the most visible European policy instruments for connecting building energy performance, digitalisation, automation and demand-side flexibility. The SRI was introduced within the Energy Performance of Buildings Directive framework as a common method for rating the capacity of buildings to optimise technical operation, respond to occupant needs and interact with energy grids [1]. Its emergence reflects a broader policy shift: buildings are no longer understood only as passive energy consumers, but as controllable and potentially flexible assets within decarbonised energy systems.

The SRI has already generated a substantial body of research addressing its methodology, applicability and implementation. Vigna et al. examined the SRI calculation process through expert-based case studies and highlighted the importance of methodological consistency in the assessment of smart-ready services [2]. Janhunen et al. assessed the applicability of the SRI in cold-climate countries, showing that local technical configurations, such as district heating, may challenge a uniform interpretation of smart readiness [3]. Lițiu et al. discussed the first implementation status of the SRI and its role as a voluntary

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European instrument supporting digitalisation, energy performance and user-centred building operation [4].

Further studies have explored how the SRI performs in specific building contexts and policy applications. Plienaitis et al. applied the SRI to educational buildings, demonstrating how the method can reveal smartness gaps in buildings with particular occupancy and operational patterns [5]. Ramezani et al. investigated the use of the SRI for Mediterranean buildings in retrofitting actions, showing that climate, building use and technical configuration influence the applicability of the service catalogue [6]. Apostolopoulos et al. connected SRI assessment with smart retrofitting scenarios and cost estimation in European residential buildings, indicating that SRI improvements may be linked to investment pathways [7]. Chatzikonstantinidis et al. positioned the SRI as a decision-making tool for low-carbon buildings, extending its relevance beyond simple rating and towards strategic building upgrades [8].

More recent work has shifted attention towards implementation, integration and performance interpretation. Kourgiozou et al. proposed a method for estimating smart readiness at building-stock level using display energy certificate data, illustrating the potential of SRI-related information for large-scale assessment [9]. Garzia et al. examined the relationship between SRI and energy performance in buildings in South Tyrol, contributing to the debate on whether smart readiness is reflected in energy outcomes [10]. Martinez et al. developed and implemented a standardised SRI on-site audit procedure, highlighting the importance of reliable data collection and assessor consistency [11]. Klitou et al. explored the possibility of an integrated certificate combining energy performance and smart readiness, suggesting that the SRI may become increasingly connected to broader building performance assessment frameworks [12].

Despite this progress, the increasing maturity of the SRI also makes its limitations more visible. The current service catalogue is structured around nine technical domains: heating, cooling, domestic hot water, ventilation, lighting, dynamic building envelope, electricity, electric vehicle charging, and monitoring and control [13]. These domains are highly relevant and reflect the first generation of smart building priorities: energy efficiency, automation, occupant comfort, system monitoring and grid interaction. However, they also reveal a boundary condition in the current SRI logic. The SRI mainly evaluates the smart readiness of core energy-related and building automation systems, while several other building services that are essential to the operation of contemporary buildings remain outside, or only weakly represented within, the assessment framework.

This limitation is partly explained by the policy origin of the SRI. Since the indicator was developed under the Energy Performance of Buildings Directive, its service catalogue naturally follows the traditional scope of building energy performance regulation. The EPBD has historically focused on the classical energy-consuming technical systems of buildings, particularly heating, cooling, domestic hot water, ventilation and lighting, later complemented by automation, monitoring, electricity, dynamic envelope and electric vehicle charging. Other services may also consume substantial energy or water, but they have not traditionally been considered central to building energy design, energy certification, or the sizing and assessment of building technical systems. As a result, they remain outside the main SRI service boundary, even when they are operationally important.

This boundary matters because real buildings operate as service ecosystems. A hotel, hospital, university campus, sports centre, shopping centre, airport, school, residential complex or public building is not only an assembly of HVAC, lighting and electrical systems. It may also include lifts and escalators, access control, fire safety and evacuation systems, swimming pools and spas, irrigation and landscape systems, outdoor lighting, car-park lighting, commercial kitchens, laundry systems, refrigeration, cold rooms, laboratories, ICT rooms, backup power, solid waste systems and other facility services. Many of these systems consume significant energy or water. Others are critical for safety, accessibility, resilience, maintenance, user experience and operational continuity. Nevertheless, they are not explicitly recognised as SRI technical domains.

This creates a methodological and policy gap. A building may achieve a relatively high SRI score because its core energy systems are automated, monitored and partially integrated with the grid, while still having major unassessed smartness deficits in other service areas. Conversely, a complex building may have advanced control, monitoring and optimisation features in services such as vertical transport, pool operation, irrigation, refrigeration or safety systems, but these capabilities may not be reflected in the SRI score. In both cases, the assessment risks providing only a partial view of building smartness. This is not a weakness of the SRI concept itself, but rather a limitation of the current service boundary.

The issue is particularly important as the SRI moves closer to regulatory and market application. Melero et al. discuss the relationship between smart-readiness assessment and building inspections under the EPBD recast, showing that SRI implementation may become increasingly relevant for non-residential buildings and technical system assessment [14]. In this context, the credibility of the SRI will depend not only on the robustness of its scoring methodology, but also on whether the service catalogue reflects the operational reality of the buildings being assessed. If the SRI is to support investment decisions, renovation roadmaps, digital building logbooks, smart building certification, energy flexibility and facility management, its scope must be broad enough to capture the major technical services that shape building performance in practice.

The purpose of this Perspective paper is therefore to identify and discuss building services that are currently missing or underrepresented in the SRI framework, and to propose a structured basis for their inclusion in a future expanded service catalogue. The paper focuses on five additional service families: mobility and accessibility services; safety and security services; water and outdoor environmental services; outdoor and site infrastructure services; and special energy-intensive and facility services. By doing so, it seeks to shift the discussion from "how should existing SRI services be assessed?" to a more fundamental question: "which building services should be included if the SRI is to provide a realistic assessment of smart readiness in contemporary buildings?" Specifically, this Perspective makes four contributions: it identifies the service-boundary gap of the current SRI; proposes five additional service families for complex buildings; introduces a modular, building-type-specific approach for their activation; and outlines implementation needs related to functionality levels, digital assessment and future validation. The approach is based on a conceptual analysis of the existing SRI service boundary and relevant literature, followed by the identification and functional grouping of additional services according to their operational relevance and compatibility with SRI functionality levels.

2. What the Current SRI Captures and What It Leaves Out

2.1. The SRI as a Classical Building Technical Systems Framework

The current SRI catalogue is best understood as an extension of the classical building technical systems framework that has shaped European energy performance policy. Its nine domains, namely heating, cooling, domestic hot water, ventilation, lighting, dynamic building envelope, electricity, electric vehicle charging, and monitoring and control, follow the logic of regulated building energy services rather than the wider logic of whole-facility operation. This makes the SRI highly compatible with the established tradition of EPCs, energy audits and technical system inspections, but it also defines the perimeter of what the indicator can meaningfully capture.

This connection with the EPC tradition is methodologically useful. A review of EPC and SRI calculation tools in Europe showed that the two assessment logics are already converging around data collection, calculation workflows and certification-oriented outputs [15]. The same direction is visible in work on next-generation operational energy performance certificates, where smartness, operational data and performance assessment are treated as complementary components of a more advanced building evaluation framework [16]. From this perspective, the SRI should be seen as a natural extension of the EPC family: it adds digitalisation, control and responsiveness to the classical energy performance assessment logic.

However, this also means that the SRI is not a whole-facility smartness tool. It does not assess all technical services that may exist in a building or site. Instead, it evaluates the smart readiness of those systems that are already recognised as central to building energy performance regulation. This distinction is important because the operational reality of many buildings extends well beyond the technical systems that are usually included in energy certification.

2.2. The Difference Between Energy-Relevant and Energy-Regulated Services

A useful conceptual distinction can therefore be made between energy-regulated services and energy-relevant services. Energy-regulated services are those that have traditionally been included in energy design, EPCs, inspections, building automation standards and technical system sizing. These include HVAC, domestic hot water, lighting, ventilation, envelope-related performance, electricity systems and controls. These are the systems that the SRI currently captures most directly.

Energy-relevant services are broader. They include any building or site service that consumes energy or water, affects operational performance, or influences comfort, safety, accessibility, resilience and maintenance. This category includes lifts, escalators, swimming pools, spas, commercial kitchens, laundry systems, refrigeration, cold rooms, ICT rooms, irrigation, outdoor lighting, security systems, fire safety systems and other facility services. These systems may be highly significant in practice, but they have not traditionally been central to the regulatory energy model of a building.

This distinction helps explain why the current SRI service catalogue is both logical and incomplete. It is logical because it follows the services historically managed by EPBD-related energy performance frameworks. It is incomplete because many energy-relevant services remain outside the assessment boundary. Research on discrepancies between energy efficiency and smart readiness has already shown that energy performance and smartness do not necessarily move together, which reinforces the need to interpret the SRI within its specific assessment boundary [17]. The issue is not only whether the SRI score is correct, but whether the service perimeter on which it is based is broad enough for the building type being assessed.

The distinction is particularly relevant for complex buildings. A hotel may be strongly influenced by swimming pools, kitchens, laundries, lifts, outdoor lighting and irrigation. A hospital may depend on vertical transport, backup power, specialised equipment, safety systems and medical support infrastructure. A university campus may include laboratories, ICT rooms, external lighting, irrigation and district-level interactions. A supermarket may have refrigeration as one of its dominant electricity loads. These are energy-relevant systems, but they are not yet treated as explicit SRI service domains.

2.3. Consequences of a Narrow Assessment Boundary

A narrow service boundary can lead to the underestimation of smartness in buildings with advanced non-core services. A building may have sophisticated control of refrigeration, pool operation, outdoor lighting or vertical transport, but these capabilities may not be reflected in its SRI score. Work on upscaling smartness assessment from buildings to neighbourhoods already points to the need for broader assessment boundaries when the object of evaluation becomes more complex than a single conventional building unit [18].

The opposite problem can also occur. A building may score well because its regulated energy systems are automated, monitored and partially integrated, while important facility services remain inefficient, manually operated or disconnected. In this case, the SRI score may be technically correct within its current catalogue, but it may be misunderstood as a more complete statement about the smartness of the whole facility. This risk becomes more important when SRI results are communicated to owners, users or public authorities. Work on bridging the SRI knowledge gap to European citizens has shown that communication and interpretation are central to the credibility of the scheme [19].

The narrow boundary also limits the relevance of the SRI for facility managers. Facility managers operate buildings through systems, routines and risks that are wider than the EPC service boundary. They manage access, safety, lifts, water, waste, outdoor areas, kitchens, laundries, laboratories, pools, refrigeration and ICT infrastructure. A rapid SRI assessment tool can support broader uptake of the scheme, but simplified workflows will only remain useful if the assessed service boundary is meaningful for the building being evaluated [20]. For complex buildings, the current boundary may therefore reduce the operational usefulness of the SRI as a decision-support instrument.

This issue also affects digitalisation. BIM- and IFC-based SRI evaluation can improve consistency and reduce assessor subjectivity, but automated rule checking is only as complete as the service catalogue it implements [21]. If the catalogue excludes important facility services, then digital automation may make the assessment faster without making it more comprehensive. The next methodological step is therefore not only to automate the current catalogue, but also to ask whether the catalogue itself reflects the technical systems that shape building operation.

2.4. Why This Matters for the Next Phase of SRI Implementation

The service-boundary issue becomes more important as the SRI moves towards wider policy and market use. If the SRI is connected to inspections, certification, smart renovation advice or investment decisions, then its credibility will depend on whether the score reflects the systems that matter for the assessed building. A methodology assessment based on 20 use cases showed that practical application can reveal limitations and interpretation challenges that are less visible in the abstract framework [22]. Such evidence supports the need for a more building-type-sensitive SRI.

The same applies to investment and upgrade planning. A cost-benefit methodology for SRI technologies can help compare smart upgrades across Europe, but the scope of the evaluated technologies determines which investment opportunities are visible [23]. If additional energy-relevant services remain outside the catalogue, then smartness-oriented investment may be directed mainly towards classical regulated systems, while pools, refrigeration, kitchens, laundries, outdoor lighting, irrigation or ICT rooms are left outside the SRI-based decision process.

For these reasons, the next evolution of the SRI should clarify the distinction between energy-regulated and energy-relevant services. The current nine-domain catalogue should remain the common foundation of the scheme, because it provides continuity, comparability and policy alignment. However, SRI 2.0 should introduce optional, building-type-specific modules for additional building and site services. This would allow simple buildings to remain easy to assess, while enabling complex buildings to be evaluated against a service boundary that better reflects their operational reality.

3. Missing Building and Site Services for an Expanded SRI Catalogue

The diagnosis developed above suggests that the next evolution of the SRI should not simply refine the current nine-domain catalogue, but extend it in a controlled and building-type-sensitive way. The proposed expansion should not aim to transform the SRI into a general facility management checklist. Rather, it should identify additional services that are both operationally important and compatible with the SRI logic of smart-ready functionality levels. Five service families are proposed: mobility and accessibility services, safety and security services, water and outdoor environmental services, outdoor and site infrastructure services, and special energy-intensive and facility services. These families are not intended to replace the existing SRI domains, but to complement them where they are relevant to the assessed building type. The proposed extension of the current SRI service boundary is summarised in Figure 1, where the five additional service families complement rather than replace the existing nine domains.

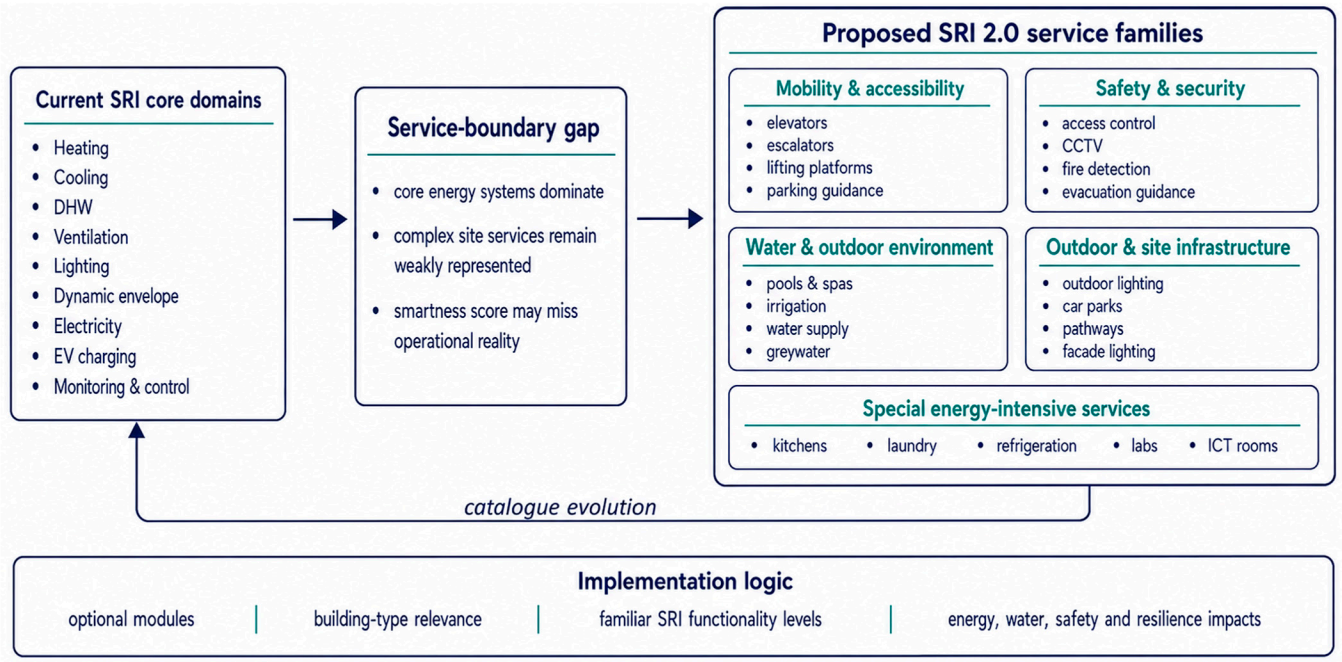

Figure 1. Expanded SRI service catalogue for complex buildings.

The proposed services were selected based on their operational relevance to complex buildings; their impact on energy, water, safety, resilience or user experience; and their ability to be expressed through progressive smart-control functionality levels. Services already adequately covered by the existing SRI domains or without a meaningful smart-readiness dimension were excluded. The selected services were grouped according to their dominant operational function, while overlaps are addressed through system integration rather than duplicate assessment.

3.1. Mobility and Accessibility Services

The first proposed service family concerns mobility and accessibility. Elevators, escalators, moving walkways, lifting platforms, automated doors and smart parking guidance systems are essential to the operation of many non-residential and high-density residential buildings. In high-rise offices, hospitals, hotels, shopping centres, airports and transport-related facilities, these services affect accessibility, convenience, operational efficiency, safety and electricity use. They also influence how occupants experience the building, especially users with reduced mobility.

These systems are suitable for SRI-type assessment because they can be described through functionality levels. A basic elevator may operate as a standalone system with limited monitoring. A more advanced installation may include standby optimisation, destination control, traffic-based dispatching, fault reporting, regenerative drives, remote diagnostics or integration with access control and emergency operation. Escalators and moving walkways may include occupancy-based activation, variable speed operation, predictive maintenance and energy-saving standby modes. Smart parking systems may include occupancy detection, guidance, lighting coordination and integration with EV charging. Such functions are consistent with the SRI logic of sensing, automation, information provision and optimisation.

The omission of mobility and accessibility services is particularly important because the SRI already includes health, well-being and accessibility as an impact criterion. However, accessibility is currently addressed mainly through the existing technical domains, not through a dedicated family of mobility-related services. This creates a mismatch between the impact criterion and the service catalogue. An expanded SRI could correct this by introducing a mobility and accessibility module for buildings where vertical or assisted movement systems are operationally significant.

3.2. Safety and Security Services

The second proposed family concerns safety and security services. Contemporary buildings increasingly rely on integrated access control, intrusion detection, CCTV, fire detection, smoke control, emergency lighting, public address systems, evacuation guidance, refuge communication and alarm management. These services are not only protective systems; they are digital, sensor-based and often connected to building management platforms. Their smartness can therefore be assessed in ways that are consistent with the SRI methodology.

A basic security system may operate through isolated devices and manual response. A more advanced system may include access zoning, occupancy-linked security modes, remote monitoring, automatic event logging, integration with lighting and HVAC operation, or cyber-secure access management. Fire and life-safety systems may progress from conventional detection and alarm towards coordinated smoke control, dynamic evacuation guidance, emergency lighting activation, fault reporting and integration with lifts, doors and building management systems. Such capabilities affect safety, resilience, maintenance and user information, all of which are already close to the impact logic of the SRI.

Safety and security services are particularly relevant as the SRI moves closer to inspections and implementation pathways. The comparative analysis of smart-readiness assessment and building inspections under the EPBD recast suggests that the SRI may increasingly interact with formal technical inspection processes [14]. If this occurs, then safety-related systems cannot remain conceptually distant from smartness assessment. Their inclusion would not mean that the SRI replaces fire safety regulation or security certification. Rather, it would allow the SRI to recognise whether safety and security services are digitally integrated, monitored, fault-aware and operationally responsive.

3.3. Water and Outdoor Environmental Services

The third proposed family concerns water and outdoor environmental services. This category includes water supply and pressure boosting, smart water metering, leak detection, rainwater management, greywater reuse, wastewater pumping, irrigation and landscaping systems, swimming pools and spas. These services are especially relevant in hotels, campuses, schools, sports centres, public buildings, healthcare facilities and residential complexes. They affect water use, energy consumption, maintenance, health, resilience and user experience.

Swimming pools and spa systems are a particularly illustrative case. They combine several technical functions: water heating, pumping, filtration, chemical dosing, water-quality monitoring, pool covers, humidity-related control in indoor pool areas, safety monitoring and maintenance diagnostics. A manually operated pool plant has very different smart readiness from a system that uses sensor-based water quality control, variable-speed pumps, occupancy-aware operation, heat recovery, cover automation, tariff-based scheduling and integration with renewable energy. These functions can be directly translated into SRI-type functionality levels.

Irrigation and landscaping systems offer a similar example. Basic irrigation may rely on timers or manual operation, while advanced systems can use soil moisture sensors, weather forecasts, zoning, rainwater availability, leak detection and evapotranspiration-based scheduling. Smart water systems can also support pressure optimisation, leak alarms, consumption analytics and greywater reuse. These services are often overlooked in building energy assessment because they sit outside the conventional EPBD service boundary, but they are increasingly important under climate adaptation and water scarcity conditions.

The relevance of this service family is reinforced by the growing effort to connect SRI assessment with sustainability-oriented decision-making. Smart readiness has already been examined as a decision-making tool for low-carbon buildings, where the value of the SRI lies not only in rating but also in guiding upgrade priorities [8]. Extending this logic to water and outdoor environmental systems would make the SRI more relevant for buildings whose environmental performance depends on both energy and water management.

3.4. Outdoor and Site Infrastructure Services

The fourth proposed service family concerns outdoor and site infrastructure. The current SRI includes lighting as a technical domain, but the focus is primarily on building lighting. Many buildings and complexes, however, include significant outdoor lighting and site systems, such as façade lighting, pathway lighting, car-park lighting, public-area lighting, signage, external circulation lighting, outdoor shading, fountains and other external infrastructure. These systems have distinct operating profiles and can be highly suitable for smart control.

Outdoor lighting can be controlled through daylight sensors, astronomical clocks, occupancy detection, adaptive dimming, security modes and fault reporting. Car-park lighting can be linked to vehicle occupancy, pedestrian movement, access control and safety requirements. Façade lighting and public-area lighting can use scheduling, zoning, dimming and event-based operation. Outdoor shading may contribute to comfort and heat-stress reduction in semi-open areas. Water features may involve pumping, filtration, water-quality monitoring and lighting control. These systems are part of the operational boundary of many real assets, even if they are outside the conditioned indoor space.

The need to address outdoor and site services becomes stronger when the assessment object expands beyond a single conventional building. Work on upscaling smartness assessment from buildings to neighbourhoods shows that the boundary of smartness becomes broader when the unit of analysis includes shared infrastructure and external spaces [18]. A similar logic applies to campuses, hotels, shopping centres and public complexes. For such assets, a purely indoor technical system boundary may not reflect the real service ecosystem that owners and facility managers operate.

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3.5. Special Energy-Intensive and Facility Services

The fifth proposed service family concerns special energy-intensive and facility services. This category includes commercial kitchens, laundry systems, refrigeration and cold rooms, laboratories, medical support systems, ICT and server rooms, uninterruptible power supplies, backup power systems and solid waste management systems. These services are not universal, but they are decisive in specific building types. A hotel cannot be fully understood without kitchens and laundries. A supermarket cannot be properly characterised without refrigeration. A hospital cannot be assessed realistically without backup power, medical support systems and safety-critical infrastructure. A university campus may include laboratories, server rooms and specialised equipment.

These services can also be expressed through SRI-type functionality levels. Commercial kitchens may include appliance monitoring, demand-controlled kitchen ventilation, heat recovery, automatic safety shut-off, load scheduling and maintenance alerts. Laundry systems may include load management, water optimisation, heat recovery, smart dosing, fault detection and alignment with tariff or PV availability. Refrigeration systems may include temperature monitoring, door-open alarms, compressor optimisation, defrost control, fault prediction, heat recovery and flexibility services. ICT rooms may include cooling coordination, UPS monitoring, load tracking and integration with building energy management systems.

The importance of this family is linked to the growing digital and operational orientation of SRI research. BIM-based SRI rule checking demonstrates that smartness assessment can be connected to structured building information and automated logic [21]. Recommendation-system approaches based on SRI data also show that smart readiness can support practical upgrade advice, rather than only classification [24]. However, both digital rule checking and recommendation systems depend on the completeness of the underlying service catalogue. If special facility services are excluded, then digital assessment tools will reproduce the same boundary limitation more efficiently, but not overcome it.

BIM/IFC-based assessment would require, at minimum, information on the presence and type of relevant equipment, its location and system assignment, associated sensors and controllers, and its connection to monitoring or building-management systems. These data would support applicability and functionality-level verification across the proposed service families. Detailed mapping to specific IFC entities and property sets is considered a subject for future methodological development.

3.6. From Missing Services to an Expanded Catalogue Logic

The five proposed service families should not be treated as mandatory additions for every building. Their value lies in creating a modular expansion layer for SRI 2.0. The current nine domains should remain the common European baseline, while the additional service families should be activated where they are present, material and relevant to the building type. Hotels, hospitals, campuses, sports facilities, supermarkets, airports, shopping centres and large residential complexes would then be assessed against a more realistic service boundary, while simple buildings would remain subject to a proportionate assessment.

This modular logic is consistent with recent work on cost–benefit evaluation of SRI technologies, where the value of smart upgrades depends on the relevance and economic effect of specific technologies [23]. It is also consistent with evidence from standardised on-site audit procedures, which shows that reliable SRI assessment depends on clear service identification and consistent data collection [11]. An expanded catalogue would therefore need to define not only new service families, but also relevance rules, functionality levels, evidence requirements and links to impact criteria.

In this sense, the proposed extension does not challenge the foundation of the SRI. It strengthens it. The current catalogue captures the smart readiness of regulated core energy systems. The proposed additional families would allow the SRI to capture the smart readiness of the wider building and site service ecosystem. This is essential if the SRI is to remain credible for complex buildings, where smartness is distributed across many technical services rather than concentrated only in HVAC, lighting, electricity and monitoring systems.

4. Towards SRI 2.0: Assessment Logic, Policy Use and Implementation Pathways

The proposed extension of the SRI service catalogue should not be understood as a simple enlargement of the current checklist. If additional building and site services are added without a clear assessment logic, the SRI could become too complex, inconsistent, or burdensome for assessors. The objective should therefore be to develop an SRI 2.0 architecture that preserves the simplicity and comparability of the existing framework, while allowing complex buildings to be assessed more realistically. This can be achieved through four principles: optional modularity, building-type relevance, continuity with existing functionality levels, and explicit linkage to broader performance impacts.

The implementation pathway proposed in this Perspective is summarised in Figure 2. The figure illustrates how SRI 2.0 could preserve the current SRI core assessment as a common European baseline, while activating additional service modules according to building type and operational relevance. These modules would then be assessed through familiar SRI functionality levels and translated into broader impact outputs and policy uses, thereby allowing the framework to remain comparable while becoming more meaningful for complex buildings.

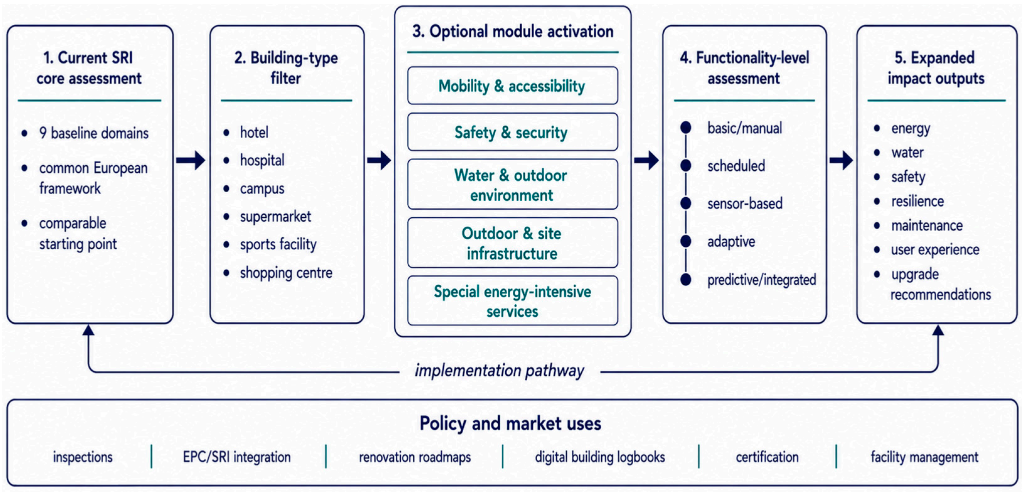

Figure 2. SRI 2.0 modular assessment and implementation pathway.

4.1. Optional Modules Rather than Universal Expansion

The first principle is that additional services should be introduced as optional modules, not as mandatory domains for all buildings. The current nine SRI domains should remain the common European baseline, because they capture the core smart-energy systems that are relevant to almost all buildings. Additional service families, such as mobility, safety, water systems, outdoor infrastructure and special facility services, should be activated only when they are present and operationally significant. This would avoid overburdening simple residential buildings and small offices, while allowing complex buildings to receive a fairer and more complete assessment.

Optional modularity is also consistent with the way smart building assessment is already evolving. The SmartLivingEPC rating system, for example, moves towards a more holistic building performance assessment logic, where energy performance, smart readiness and additional performance dimensions can be organised within an integrated framework [25]. This is important for SRI 2.0 because it shows that smart readiness does not need to remain a fixed, one-size-fits-all checklist. It can be structured as a common core supported by additional layers that become relevant depending on the building, the available data and the intended policy use.

A modular structure would also support staged implementation. In a first phase, Member States or voluntary schemes could test additional modules for selected building types, such as hotels, hospitals, campuses, sports facilities or shopping centres. In a second phase, validated modules could be integrated into national technical frameworks. In a third phase, these modules could support targeted upgrade recommendations. This would allow the SRI to evolve without destabilising the existing methodology.

4.2. Building-Type-Specific Service Activation

The second principle is building-type relevance. Additional services should be triggered by building typology, use profile, installed systems and operational materiality. A hotel may require modules for swimming pools and spas, commercial kitchens, laundries, lifts, outdoor lighting and irrigation. A hospital may require modules for vertical transport, emergency systems, medical support systems, backup power and safety-critical monitoring. A supermarket may require refrigeration and cold-room services. A university campus may require laboratories, ICT rooms, outdoor infrastructure, irrigation and district-level interactions. A sports facility may require pools, water treatment, outdoor lighting and crowd-related safety systems.

Such an approach would make the SRI more sensitive to real operational conditions. It would also reduce the risk that different buildings are compared using an incomplete or inappropriate service boundary. The study on smart data collection through call centres and the SRI is relevant in this context because it shows that SRI-related information can be collected through different channels and at different levels of detail, depending on the assessment objective and building context [26]. A future SRI 2.0 could use this logic to distinguish between core data required for all buildings and additional service-specific data required only for complex typologies.

Predefined building-type profiles could therefore be introduced. Each profile would define which additional modules are recommended, optional or not applicable. For example, the hotel profile could include pools, kitchens, laundries, vertical transport, outdoor lighting and irrigation. The hospital profile could include safety systems, backup power, vertical transport and specialised equipment. The supermarket profile could include refrigeration, cold rooms and demand flexibility. This would support consistency among assessors, reduce subjective interpretation and make the assessment more meaningful for facility managers.

4.3. Continuity with Existing Functionality Levels

The third principle is continuity with the existing SRI functionality-level logic. The added services should not require an entirely new scoring philosophy. They can be assessed using the same progression from basic operation to advanced, integrated and predictive control. For example, a smart irrigation service could move from manual control, to timer-based control, to soil-moisture-based control, to weather-forecast-based optimisation, and finally to integrated water-energy management using rainwater availability, leak detection and predictive scheduling. A swimming pool service could move from manual operation, to scheduled pump and heating control, to sensor-based water-quality control, to occupancy-aware optimisation, and finally to integrated control with renewable energy, tariffs, maintenance alerts and user information.

The same logic can be applied to elevators, security systems, outdoor lighting, kitchens, laundries, refrigeration and ICT rooms. Functionality levels should capture the extent to which a service can sense conditions, interpret data, respond automatically, communicate with other systems, support maintenance, and optimise resource use. This continuity is essential because it allows the proposed extensions to remain recognisable within the SRI methodology. It also avoids creating parallel rating logics that would make the framework difficult to communicate.

The relevance of economic and technological metrics is particularly important here. Comparative assessment of smart-ready technologies has shown that technology choices can be evaluated not only through their technical functionality, but also through economic and implementation-related criteria [23]. This supports the idea that additional SRI modules should not only define maximum smartness levels, but also help identify practical upgrade pathways. For instance, a refrigeration module could distinguish between basic monitoring, advanced control and predictive optimisation, while also supporting comparison of costs, savings and implementation complexity.

Financial interpretation is also important for functionality-level continuity. Simplified financial indicators for smart readiness can help translate technical upgrades into more understandable investment signals for building owners and decision-makers [23]. In an expanded SRI 2.0, this could be particularly useful for services such as pools, kitchens, laundries, refrigeration and outdoor lighting, where owners may require clear evidence that smart upgrades are not only technically advanced but also economically justified.

4.4. Broadening the Impact Logic

The fourth principle is to connect additional services to a broader set of impacts. The existing SRI impact criteria already include energy efficiency, maintenance and fault prediction, comfort, convenience, health, well-being and accessibility, information to occupants, and energy flexibility and storage. These criteria remain relevant, but the proposed additional services reveal the need to make some impacts more explicit. Water efficiency, safety, resilience and operational continuity are particularly important.

Water-related services would allow the SRI to address water consumption, leakage, reuse, irrigation and pool operation. Safety and security modules would connect smartness to fire detection, evacuation, access control and emergency response. Outdoor and site infrastructure services would link the SRI to the operation of the wider building plot, not only the conditioned indoor space. Special energy-intensive services would improve the assessment of buildings whose operational profile is shaped by kitchens, laundries, refrigeration, laboratories or ICT rooms. In this sense, SRI 2.0 would not only measure energy-related smartness, but also the intelligent operation of building services that affect water, safety, resilience, maintenance and user experience.

The link with green building certification is relevant here. Work on the relationship between smart readiness and green building certification schemes shows that SRI-related assessment can contribute to broader carbon neutrality and sustainability objectives, rather than remaining limited to technical automation [27]. This is precisely why the additional service families matter. In complex buildings, sustainability performance is not shaped only by HVAC and lighting, but also by water systems, outdoor infrastructure, refrigeration, kitchens, laundries and specialised facility services.

This broader impact logic could also strengthen the policy relevance of the SRI. If the SRI is to support renovation roadmaps, smart building certification, EPC integration, inspections and digital building logbooks, it must provide information that is useful beyond a single score. Optional service modules could generate targeted recommendations for building owners and facility managers. A hotel could receive recommendations on pool control, kitchen ventilation, laundry scheduling and outdoor lighting. A hospital could receive recommendations on safety integration, backup power monitoring and vertical transport resilience. A campus could receive recommendations on irrigation, laboratories, server rooms and site lighting. This would make the SRI more actionable as a decision-support tool, not only a rating scheme.

5. Conclusions

This Perspective identifies a service-boundary limitation in the current SRI and proposes five complementary service families for complex buildings. Their implementation through optional, building-type-specific modules would preserve the existing SRI core while extending smart-readiness assessment to important energy-, water-, safety- and facility-related services. The proposal remains conceptual and has not yet been validated through building case studies or integrated into the formal SRI scoring methodology. Future research should therefore test the proposed modules in representative complex buildings, define and validate their functionality levels and weighting rules, and examine assessor consistency and practical applicability. The next stage of the SRI should combine stability and evolution. The existing nine-domain framework should remain the backbone of the methodology, because it provides a harmonised basis for assessing smart-ready energy systems. However, complex buildings require a wider service boundary. SRI 2.0 should introduce optional, building-type-specific modules for missing building and site services, assessed through familiar functionality levels and linked to energy, water, safety, resilience, maintenance and user experience.

The overall aim should be to move from a framework that assesses smart readiness mainly in regulated energy systems towards one that also recognises the wider service ecosystem of real buildings. This does not mean that every building should be assessed against every possible service. It means that the SRI should become capable of activating the right service modules for the right building types. In this way, the SRI can remain comparable and practical, while becoming more credible for complex buildings.

This expanded interpretation would also support a more mature view of smart readiness as part of sustainability governance. The SRI has already been discussed as a conceptual framework for building decarbonisation and digitalisation governance [28]. The proposed SRI 2.0 service catalogue would extend that logic by ensuring that digitalisation and smart readiness are not limited to the classical energy-regulated systems, but also address the broader energy-relevant services that increasingly define the operation of contemporary buildings. Further work should also investigate BIM/IFC-based automated assessment and its integration with EPCs, inspections and digital building logbooks.

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