Capability	Rationale and Drivers	Development Stage	Enabling Technologies and Behaviours	Barriers to development or adoption	Applicability for case study across D-COM scope	Suggested Research Needs
Technology						
Cataloguing and prioritising of regulations that are suitable for automation.	Determining what regulations can currently be automated is a key pre-requisite. Additional automation must be prioritised.	1	-Engagement from the different domains	-Lack of engagement from policy setters and implementors. - Lack of open access to regulations.	All	Hierarchy of regulations with priorities
Development of rule processes to track decisions, feedback, and uncertainty	Development of compliance checking processes that are able to deliver the required traceability, feedback methods to allow for the requirements of checking at various points in the asset lifecycle.	2	-Existing rule engine/reasoning technologies -Link with work of uncertainty network	-Lack of a perceived market.	All – specifically when performing checking in a "pre-check" capacity.	-Adaption of existing recognised rule engines/reasoners to support built environment requirements

Detailed mapping of digitized regulation/requirement/standards processes	Development of process map of the industry consider automated compliance checking. Phased to consider steps toward adoption.	2	-Engagement from the different domains	-Resistance to change -Lack of political buy-in -Trouble engaging with policy makers/implementors	All	-Development of process through large scale consultation.
Persistent data linkages between requirements and supplied product to prevent variation on specification.	Data linkages to prevent use of replacement products within an asset (during construction or in-use) from invalidating compliance with regulations/requirements	3	-Creation of authoritative sources and data formats for product data. -Appropriate processes to allow for allow for require substitutions to be managed without jeopardising compliance	-Lack of consistent adoption of use of product data across industry. -Cultural change in challenging acceptableness of un-necessary substitutions	All	-Development of processes to manage substitutions within a framework of compliance checking.
Chain of custody of materials and data	Technologies to support the capturing of chain of custody for materials and their data	3	-Existing product data standards	-Aspects of product lifecycle do not have widespread adoption of digitisation	All	-Ability to represent chain of custody within product/asset data models in an authoritative way.
Accommodate multiple UK data models and multiple data dictionaries	Enable checking tools to support multiple dictionaries and data models	3	-Existing built environment data standards/vocabularies	-Variety and inconsistency of data models/vocabularies currently used.	All	-Creation of mappings of controlled language

Specification of a continual feedback loop process to incorporate appeals/derogations/determinations data in reviewing regulations	Defining a process to properly manage reviewing of regulations based on innovations in design	3	-Commitment to consistent processes	-Resistance to change from industry elements that rely on current appeals/derogations/determinations process	All – specifically for design stage of lifecycle	-Consultation into development of fit for purpose process
Definition of precise digitized regulation clauses.	In order to be digitizable regulations must be available for analysis and rewriting so as to reduce the need for interpretation.	4	-Engagement of policy makers and implementors.	-Lack of engagement from policy setters and implementors. -Legal issues with owners of regulations	All	-Methodology and supporting tools to support drafting of digitizable regulations. -Methodology and supporting tools to allow digitisation of human readable regulations.
Continuous checking the quality of assets using calibrated instrumentation along with other data sources	Provides the ability to determine if physical assets comply with regulations/requirements throughout their lifecycle, without the need for extensive human inspection.	4	-Data collection technologies i.e. photogrammetry, LIDAR scanning, IoT devices - Widespread deployment of these technologies -Automated analysis of data collection and comparison to virtual model of assets and regulations/requirements.	-Collection and robustness of data collection technology. -Lack of confidence in technology solutions -Resistance to change	All - specifically construction and in-use stages of asset lifecycle.	-Studying applicability and selecting appropriate data collection technologies -Developing ability to automatically process collected data and performed

						compliance checking on it.
Consistent/Structured data models and APIs (Application Programming Interface) for compliance checking	Development/improvement of APIs to allow widespread interface with compliance systems	4	-Current IFC and supporting open standards	-Inconsistencies in support of open standards in software	All	-Specification of compliance checking API
Enabling development of generative design based on regulations and requirements	Development of approaches to automate the design of assets based on regulations/requirements	4	-Existing automated design tools	-Acceptance of use of automatically generated designs in some sectors	All – specifically design phase in asset lifecycle	-Achieving explicit connection of generative design tools to building regulations and user requirements.
Investigation of relationship between regulations and identification of overlaps and gaps	Utilisation of digitised regulations to perform details analysis of regulatory landscape	4	-Digitised regulations	-Current UK regulations are not consistently digitisable.	Specifically of use for policy makers/implementors	-Methods for exploring the logical structure of regulations
Commercial						

Production of audience specific guidance on digitisation of regulations or requirements.	In order to overcome scepticism and resistance to change guidance will be produced, targeted to specific audiences, to convey the aims/objectives/ benefits of digitisation of regulations/requi rements. Additionally, will support more complete and consistent BIM usage. This will also grow wider awareness.	3	-Acceptance of Change -Change Management	-Lack of consistent messaging	All	-Change Management Principles
Detailed evidence-based business model for digitization of regulatory compliance.	Development of evidence-based business model in order to motivate and showcase benefits of adoption of automated checking. Balancing risk	3	-Documented baselines	-Lack of transparency -Multiple stakeholders with dispersed interests -Lack of KPIs	All	-Market Research/Analys is

	and opportunity. Additionally, this will expose the cost time and resource drains current processes impose.					
Explore routes to export developed toolchains to international audience and exploit international developments	Provides support for the digital compliance services market by increasing international market.	3	-Awareness of generic solutions	-Differences in regulatory landscape between UK and the rest of the world	All	Study into applicability of UK developments for other countries regulations.
Calculation method validation services	Providing service to enable software tools calculation methodologies (as utilised in checking) to be validated, providing confidence to end-users.	4	-Trust in automated systems -Validation/verification methods	-Lack of understanding of automated systems	All	-Building trust in automated systems.
Develop robust inspection methods/rules to reduce dependence on human inspectors	Processes/methods/rules to allows/support implementation of new technology	4	-Calibrated instrumentation to perform continuous checking of the quality of assets	-Collection and robustness of data collection technology. -Lack of confidence in technology solutions -Resistance to change	All	-Research and development into processes to make most efficient use of

						available technology
Professional development and training in compliance checking for all that interface with it – including clients and supply chain.	Development of training materials and delivery mechanisms for the entire industry (all stakeholders).	4	-In conjunction with work of CDBB Pedagogy Network.	-Lack of resource	All	-Competency Management
Political						
Engaging in direct consultation with Ministry of Housing, Communities and Local Government building regulation policy unit and with Building Regulation Advisory Committee.	To further engage policy makers/impleme ntors in the digitisation agenda	1	-Government Support	-Lack of engagement from policy makers/implementors	All	-Policy delivery processes in government
Developed green and white papers for presentation to government and establish funding	Presentation of the case for digitisation of compliance checking to funding to establish funding to conduct proof	1	-Government Support	-Lack of engagement from policy makers/implementors	All	-Policy delivery processes in government

	of concept prototype.					
Digitisation to be given voice with policy-implementors	Ensure that digitisation is part of the future plan for built environment regulations	2	-Government Support	-Lack of engagement from policy makers/implementors	All	-Policy delivery processes in government
Development of an understanding of parallel regulations that indirectly digitisation of compliance checking	Understand how other regulations influence the digitisation of regulations/requirements in the built environment	2	-Continuous policy review	-Rapidly changing legislation	All	-Analysis of parallel regulations
Creation of standard data and criteria for social, environment and economic impact assessments	To reduce the burden of open ended and undefined expectations	3	-Moving towards data driven policies.	-Lack of engagement from policy makers/implementors	All	-Development of a consensus of what standardised policy should be
Conducting Impact assessment of digitisation of regulations	Conduct an assessment to discover the impact of digitisation of regulations in other areas.	2	-Government Support	-Lack of a coherent view of the construction industry.	All	-Impact Assessment

-Development of recognised economic model of the sector. |