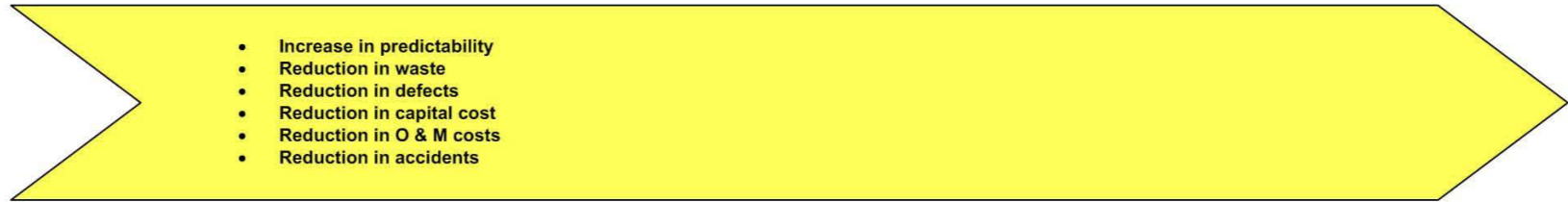


DRIVERS



PRODUCTS / SERVICES / TECHNOLOGY

Intelligent Assets
R1.1

SHORT

- ICT to determine **optimum facility operating conditions**, and maintain operations within the performance envelope (i.e. energy efficient assets)
- **Wireless and powerless sensors** that support interactive spaces - providing personalised, location and context-aware services

MEDIUM

- **Remote diagnostics** and control (real-time condition assessment, predicting problems before they arise, and enhancing performance of the asset)
- **Automated (& integrated)**, highly accurate capture of as-built data, to be fed into Asset Lifecycle Information System
- **Embedded learning** / user support, and feedback to designers and planners
- **User-aware working** / living / transport environments - access to information for optimising operations
- **Personalised** location and context aware services

LONG

- **O&M decisions** and facilities management to be based on a fully integrated consideration of all lifecycle (e.g. environmental, cost) factors, supported by accurate, current, and complete data from ALIS
- **Self-maintaining**, self-repairing facilities and systems will enable safe, secure, continuously optimised operations with near-zero downtime
- **Adaptive systems** that learn from their own use and user behaviour, and are able to adapt to new situations without manual configuration, maintenance and support i.e. self-optimising systems
- **Accurate prediction of asset performance** / improved energy efficient design

Advanced 'Next Generation' ICT Collaboration Applications
R1.2

- **Transaction management** for electronic exchange of information to ensure documents meet a pre-defined level of legal validity (e.g. within an ICT contract), security (e.g. digitally signed), and trust

- Fast access to latest (**model-based**) information, anytime, anywhere
- **Robust team interaction** e.g. information sharing and collaborative design

- **Seamless inter-enterprise integration**

Client Engagement Tools
(Involvement, end-user satisfaction, value)
R1.3

- **Requirements management tools** (to help with identifying & capturing the client's needs and allow them to transparently see how their requirements are transformed to best-in-class solutions)

- **Compliance assessment tools** (to ensure the final asset meets the customer's aspirations)
- **Streamlined client approvals**

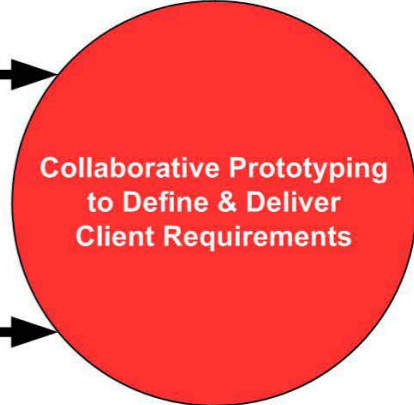
- **Decision support tools** e.g. to demonstrate to clients the performance of their asset before they decide to construct ('Try before you buy'); or to test alternative courses of action ('What if?' analysis)
- **Customer-orientated configuration design**

Whole-life Assessment Tools
(Cost, environment, society)
R1.4

- **Building MOT's** (i.e. periodic independent inspections to check assets are performing above a minimum required standard)
- **Socio-economic modelling** (to improve sustainable community development, predict effects of investment, and understand the system)

- **Whole-life costing tools** to include all environmental costs (to provide a clear business case for addressing environmental issues)
- **Comprehensive eco-efficiency evaluation tools** for all stages of the asset lifecycle (providing ready assessment of environmental performance against best practice)

- Total lifecycle is supported by **ICT tools / services for whole-life decision making, management & appraisal**, by users, owners and society



RESEARCH / ENABLERS

- Research & develop socio-economic models
- Requirements management - research ICT tools to capture the clients' requirements and transform them into technical solutions
- Research & develop use of active & passive wireless sensors, & RFID
- Investigate how to (most easily and economically) retrofit intelligent sensors / systems into existing building stock
- Research the use of transaction monitors to automatically compliance check electronic information / documentation across collaborative platforms
- Research and publish more forward-looking building regulations / design standards (currently based on retrospective data, that is becoming rapidly out-of-date due to current trends in climate change)
- Better understand, & communicate, the relationship between long-term lifecycle costs and initial facility costs
- Research & develop embedded intelligence in products & components
- Legal and contractual governance and agreements on practical procedures for ICT based collaboration e.g. model contracts
- Identify and address organisational and personal barriers to the adoption of ICT based collaboration (i.e. culture)
- Develop standardised management processes for ICT collaboration between designers, suppliers, contractors, end-users and other stakeholders

INTEROPERABILITY ENABLERS

REMOTE WORKING & CONNECTIVITY TECHNOLOGIES ENABLERS

- Compliance assessment - Research ICT-based verification tools, where technical solutions can be (automatically) verified against the set performance requirements (e.g. client's brief, design standards) ensuring there are no defects in the final product
- Use of BIM for client approval
- Research & develop ICT and methods for post-occupancy reviews
- Develop model-based process / workflow management: intelligent workflow aid; combining product model (PLM) with scheduling, resource planning (ERP) and progress monitoring
- Research & develop common platforms, networks and protocols for all systems in buildings to share
- Develop ICT to calculate energy used, and compare against design forecasts (from data model)
- Research methods for use, monitoring, operation and maintenance with intelligent embedded systems; user and context aware control; and ambient user interfaces e.g. integration of computing into the built environment to facilitate information gathering, such as visible energy use 'metering' (allowing occupiers to measure carbon footprint)
- Refocus from the purely technical to include the human element / attitude (i.e. technology is developing faster than human behaviour is changing)
- Facilitate a culture of co-operation and trust (e.g. partnering) between distributed teams, and encourage risk and reward sharing
- Create virtual communities using sophisticated applications based on WebDAV (Web-based Distributed Authoring and Versioning)
- Research & develop the design of workplaces for more efficient, collaborative and productive working

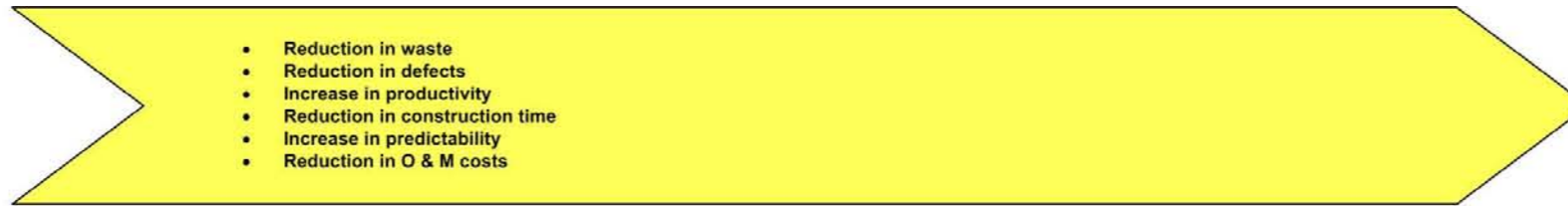
INTEROPERABILITY ENABLERS

REMOTE WORKING & CONNECTIVITY TECHNOLOGIES ENABLERS

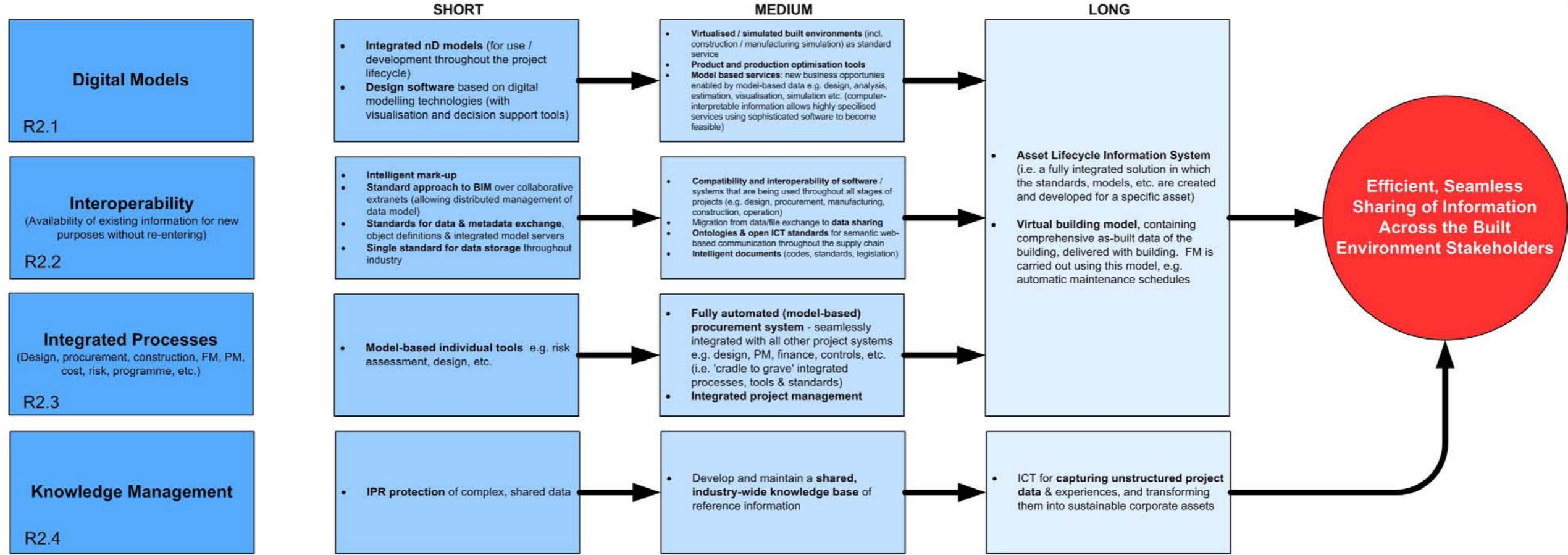
ASSET LIFECYCLE INFORMATION SYSTEM ENABLERS (i.e. data model for lifecycle of asset, with single point data capture)

- Research & development of new visualisation, virtual reality and communication tools / techniques, using shared integrated data models, enabling a 'value' & performance assessment of the asset to take place in many dimensions: e.g. energy consumption, visual impact, functionality, internal environment quality, safety, security, flexibility, operating costs and expect lifetime
- Develop optioneering capabilities e.g. climate change 'what if?' analysis (using model simulation, and based on rules and evidence)
- Research mass customised system concepts e.g. clients can order buildings like they now buy cars - selecting from a limited number of choices, creating widely different end results

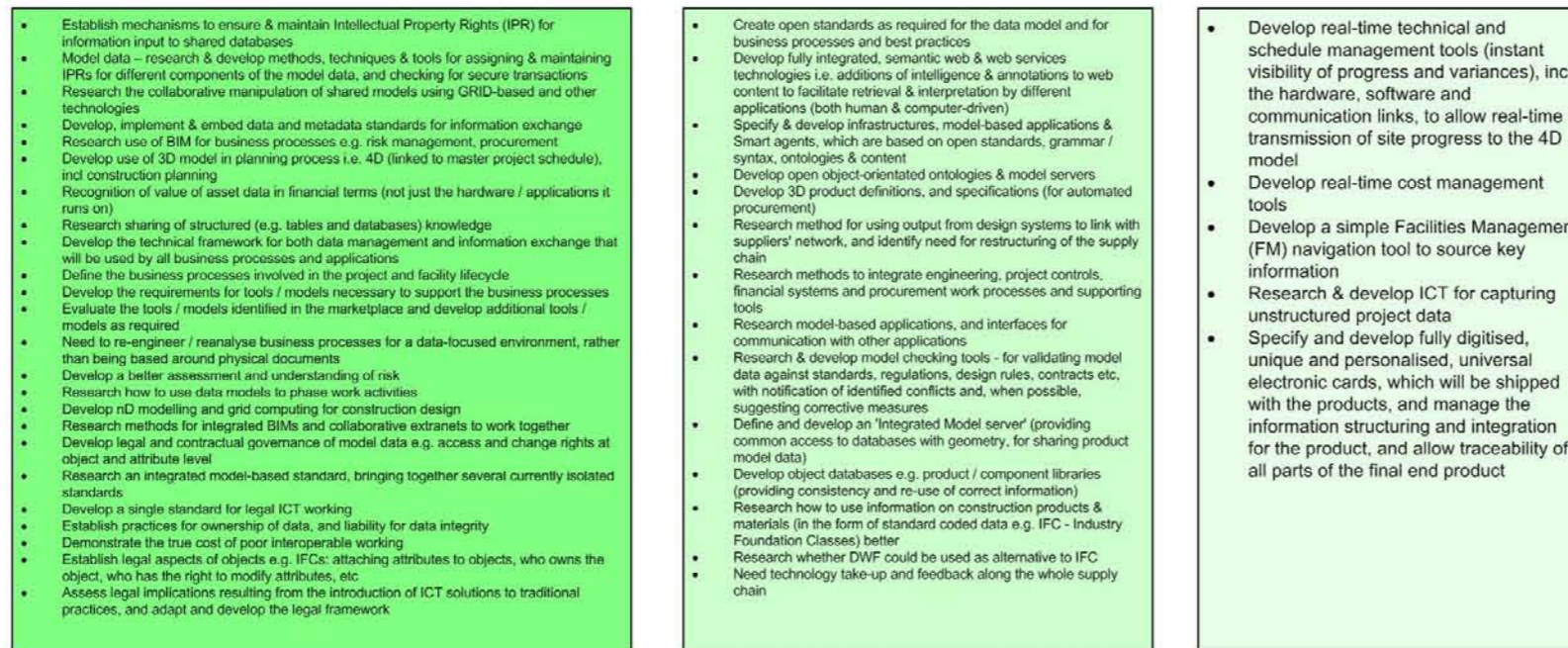
DRIVERS



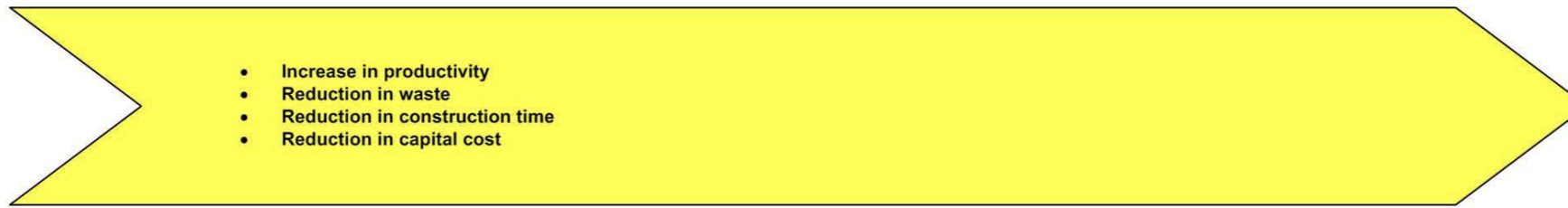
PRODUCTS / SERVICES / TECHNOLOGY



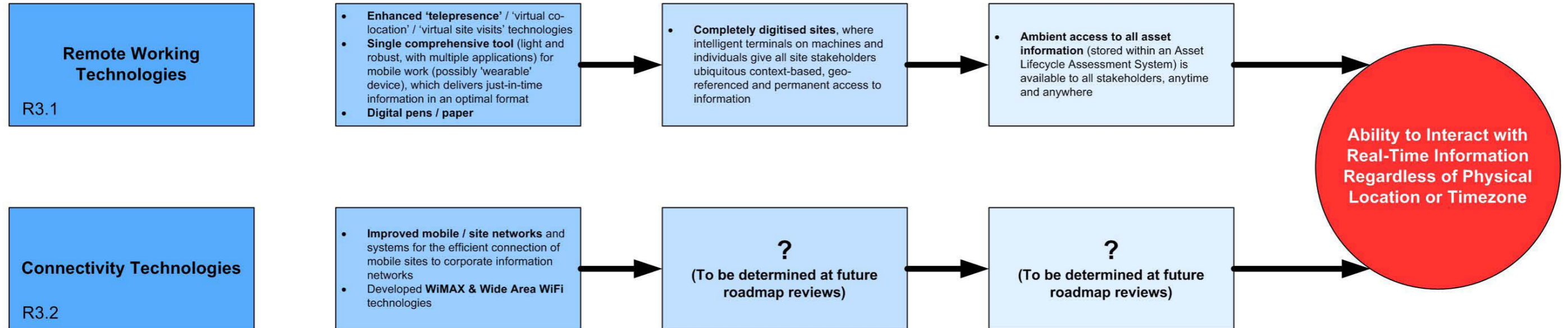
RESEARCH / ENABLERS



DRIVERS



PRODUCTS / SERVICES / TECHNOLOGY



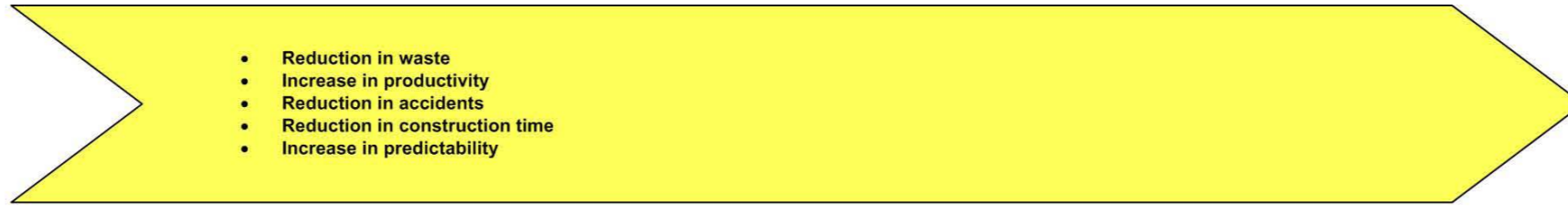
RESEARCH / ENABLERS

- Investigate advanced possibilities offered by wireless or mobile communication technology (incl. potential WiMAX and wide area WiFi)
- Research and develop enhanced 'telepresence' technologies, and implementing their wider use (both in the workplace and from home) – giving increased flexibility of working and reduced travelling
- Embed & promote the use of existing 'virtual co-location' technologies (e.g. video conferencing technology, webinars, etc.) in the industry
- Define & develop infrastructure requirements to support site working
- Research & develop better viewing capabilities for PDAs etc
- Research & develop remote management of data/process via PDAs etc

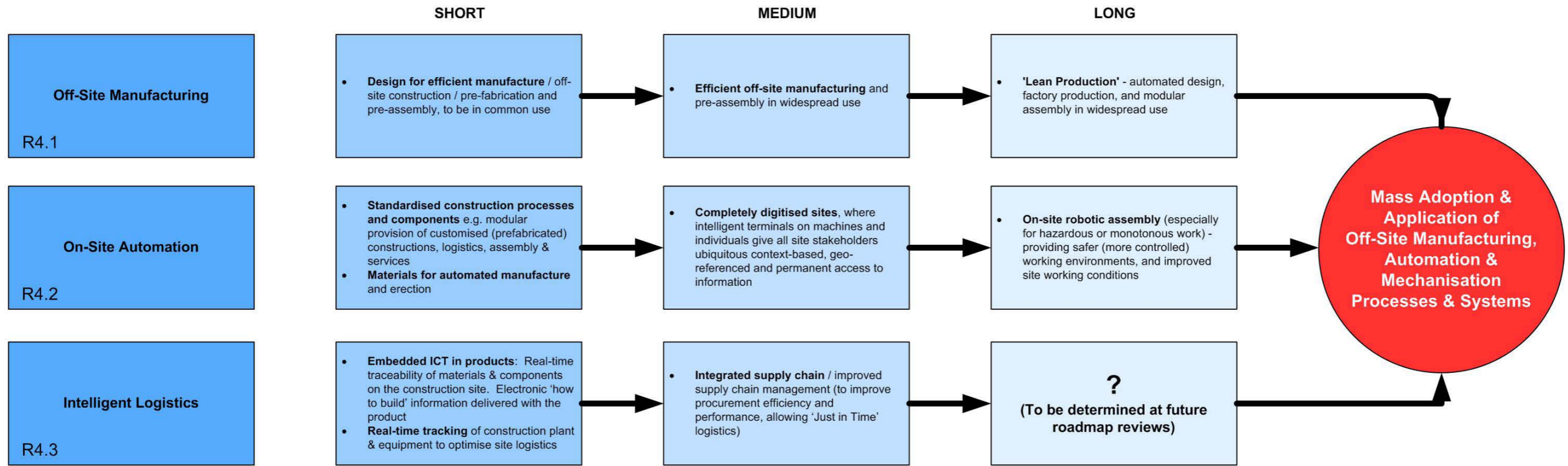
- **INTELLIGENT ASSETS ENABLERS**
- Develop GPS (or similar) to deliver data to on-site staff
- Research & develop a 'virtual site visits' capability (e.g. network of webcams linked to digital model of site, real-time BIM, etc.)
- Identification & development of 'new' human interface technologies
- **Further research / enablers to be determined at future roadmap reviews**

- **ASSET LIFECYCLE INFORMATION SYSTEM ENABLERS**
- **Further research / enablers to be determined at future roadmap reviews**

DRIVERS



PRODUCTS / SERVICES / TECHNOLOGY



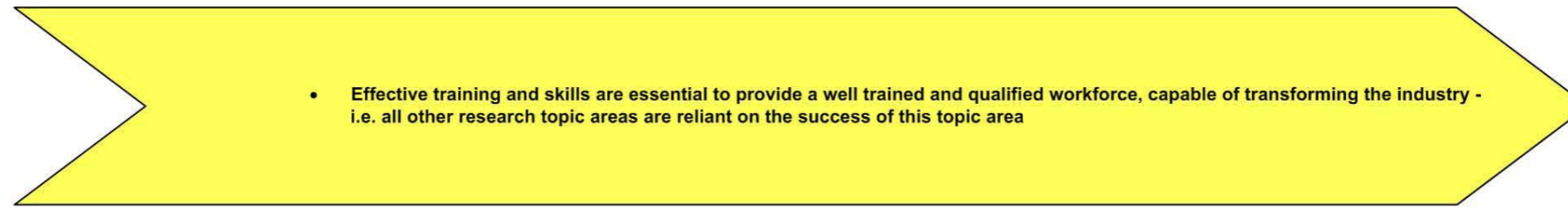
RESEARCH / ENABLERS

- **INTELLIGENT ASSETS ENABLERS**
- Adaptation of new concepts developed by other manufacturing industries (e.g. automotive & aerospace)
- Research materials to simplify, reduce cost, improve H&S, etc. for automated off-site fabrication and on-site erection
- Development & deployment of solutions (e.g. RFID) and services to identify & track on-site materials from delivery to in-situ. To include intelligent materials / products / smart coatings, capable of communicating location, orientation & condition for the lifecycle of the asset
- Define and document best practices for supply chain production, logistics, validation, and information flows to identify inefficiencies and bottlenecks and highlight improvement opportunities
- Produce construction automation guidelines
- Introduction of new services offered by satellites & GPS for site control (e.g. positioning construction equipment, and for monitoring works and their impact)
- Design new connection methods to enhance scope for automation

- **INTEROPERABILITY ENABLERS**
- **INTEGRATED PROCESSES ENABLERS**
- Develop logistics and process monitoring / management tools (incl. tagging technology) to automate tracking of actual v planned progress
- Research use of GIS to manage site data and logistics
- Investigate rationalisation of construction processes, with focus on off-site assembly of large, fully-fitted components
- Research the automation of construction plant & equipment ('Intelligent site vehicles' & robotics), and mechanisation of site activities aided by new automation and guidance technologies, including advanced embedded electronics
- Research process orchestration e.g. flow of resources for optimal build efficiency
- Integrate and automate supply chain work processes and job site delivery and tracking of materials and labour
- Research & develop distributed production management

- Research the transfer of Building Information Modelling (BIM) to manufacturing / virtual production
- Investigate the use of integrated data models (BIM) to facilitate modularisation

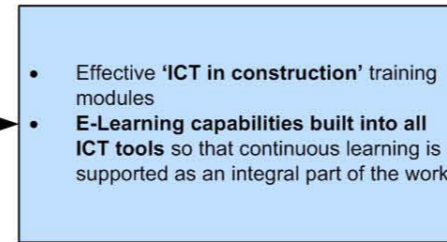
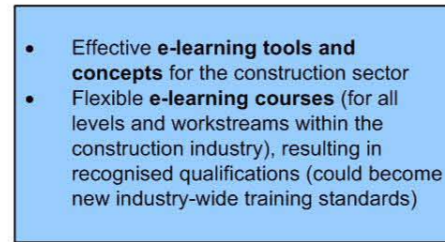
DRIVERS



SHORT

MEDIUM

LONG



RESEARCH / ENABLERS

