INNOVATION SCHOOL
THE GLASGOW SCHOOL OF ART

CO-DESIGNING SOLUTIONS

In association with the 2020 report,
Increasing offsite housing construction in Scotland:
An evidence base to support new policy and systems.

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The Scottish construction sector contributes £21.5bn to Scotland's GDP and 10% of Scotland's GVA[1].

A target of at least 50,000 affordable homes by 2021 was set by the Scottish Government during the current parliament period and represents a 67% increase in affordable housing supply[2].

[1]The Scottish Construction Industry Strategy 2019-22. (2018) Construction Scotland.
[2] More Homes Policy. Housing and Social Justice Directorate. Scottish Government.

CONTENTS

INTRODUCTION

THE PROCESS

OUTPUTS REVIEW
PROJECTS 1 AND 2

CO-DESIGNING SOLUTIONS

OUTPUTS REVIEW
PROJECT 3

STAGE 1:
FRAME AND ENVISAGE
STAKEHOLDER WORKSHOP
MANIFESTO
HOUSE JOURNEY

KEY THEMES AND CHALLENGES

THE ELEVEN CHALLENGES: IN DETAIL

STAGE 2:
CO-DESIGNING SOLUTIONS
WORKSHOPS

STAGE 3:
TEST AND REFINE
FINAL STAKEHOLDER WORKSHOP
P.I.E.R. REVIEW

INNOVATION ACTIONS
INNOVATION AIM 1
2
3
4
5

RECOMMENDATIONS

CONCLUSIONS

INTRODUCTION

The research project, **Co-designing Solutions,** through engagement with a diverse group of stakeholders in the housing sector, aimed to collaboratively design recommendations for the Scottish Government that could improve the overall off-site construction (OSC) process, and enable wider adoption within the housing sector in Scotland.

The Innovation School at the Glasgow School of Art were commissioned to design and deliver a series of iterative co-design workshops, to identify, develop and test possible solutions and improvements to increase the level of OSC housing in Scotland.

This approach involved cross sector stakeholders following an iterative process of progressive problem solving to develop and refine options.

Utilising the knowledge, experience and perspectives of the critical stakeholders from the OSC industry, the affordable housing sector, the private housing sector and the broader supply chain; key insights were uncovered, analysed and developed. This resulted in a detailed series of "Innovation Actions" which have the potential to be taken forward as suggestions to stimulate innovation in OSC.

The outputs from the three workshops generated the recommendations from this co-design project.

THE PROCESS

OUTPUTS REVIEW PROJECT 1 & 2

The initial phases of this project explored the data and evidence of the challenges, issues and barriers faced by the affordable housing sector, Project 1, and examined the current and future OSC industry capacity, Project 2, including the capabilities and capacity of the current company base, and forecast capacity in 5 years-time.

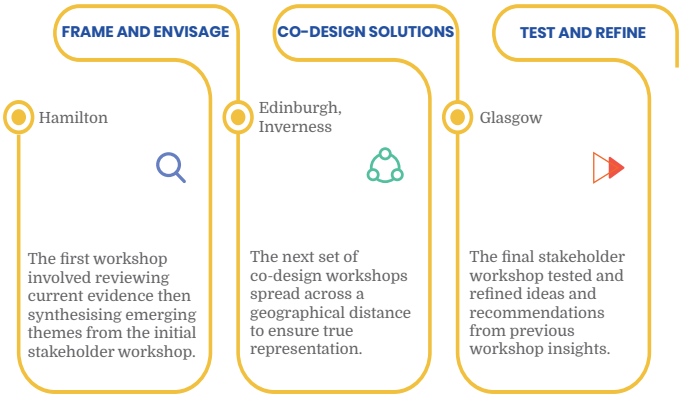
These phases included literature reviews, desk research, questionnaires, and interviews with industry and key stakeholders. The outputs from Project 1 and 2 were reviewed and informed the five initial key themes that acted as provocation areas for exploration in the first stage of the co-design process.

These five themes acted as a key input into the first stakeholder workshop, forming the basis of our discussion, and helping to shape the key areas to focus on for the next phase. The five themes were:

- **DESIGN AND PERFORMANCE**
- **CULTURE AND PERCEPTIONS**
- **COST, FUNDING AND PROCUREMENT**
- **CAPACITY AND RESOURCES**
- **SKILLS**

CO-DESIGNING SOLUTIONS

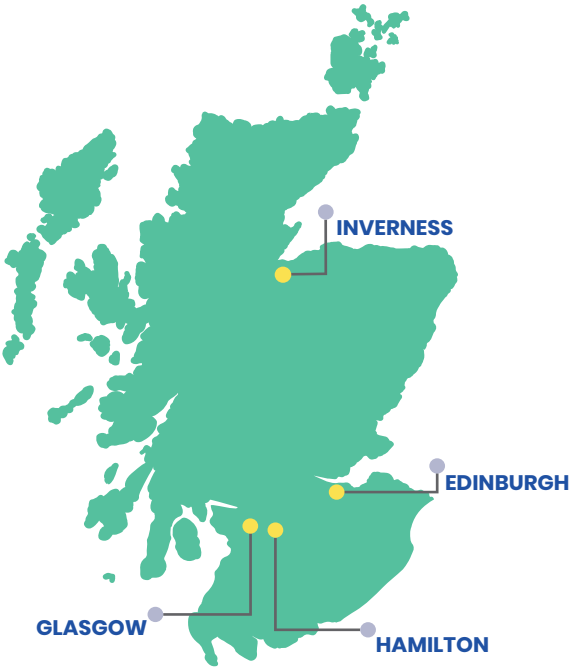
A series of four, interlinked co-design workshops explored the innovation challenges and opportunities around OSC, and co-designed, iterated and refined potential solutions and improvements, leading to a series of recommendations and actions on how all the stakeholders can take forward this agenda.



OUTPUTS REVIEW
PROJECT 3

In total, the project engaged 63 participants from 42 UK organisations.

These workshoped helped bring together perspectives from across the construction sector to explore the innovation challenges and opportunities around OSC through the practice of co-design, in collaborative events across the East, West and North of Scotland.



4
CO-DESIGN WORKSHOPS

63
PARTICIPANTS ENGAGED

42
UK ORGANISATIONS INVOLVED

STAGE 1:
FRAME AND ENVISAGE
STAKEHOLDER WORKSHOP

The first one-day workshop brought together experts from policy, the construction industry, architecture and design, academia, and government, to help inform the understanding of the current state of OSC and delve deeper into the challenges and questions to be resolved.

This launch event, held at the Construction Scotland Innovation Centre in Hamilton was introduced by Kevin Stewart, Minister for Local Government, Housing & Planning. As an initial discussion, participants shared their ambitions for OSC in Scotland. This is summarised in the form of an offsite "Manifesto". This was also revisited in the final workshop to ensure that participants felt the co-design process had focused on the key elements and important factors.

The expert group then spent time fully describing the overall process and all its elements by mapping the "House Journey", from the commissioning, design, construction, hand over, use and eventual post-use, to better understand the steps and interrelationships between the different elements.

The maps from different groups are built on by subsequent workshops and have been combined to create the first collective view of the complete end to end OSC construction journey from a multi stakeholder perspective.

Onto the "House Journey" stakeholders flagged current issues and opportunities for OSC and shared some initial visions for how this process could be improved. The following infographics illustrate both the "Manifesto" summary and the complete "House Journey" which highlights the issues, and opportunities raised by our experts.

MANIFESTO

In the first stakeholder workshop participants shared their ambitions for OSC in Scotland.

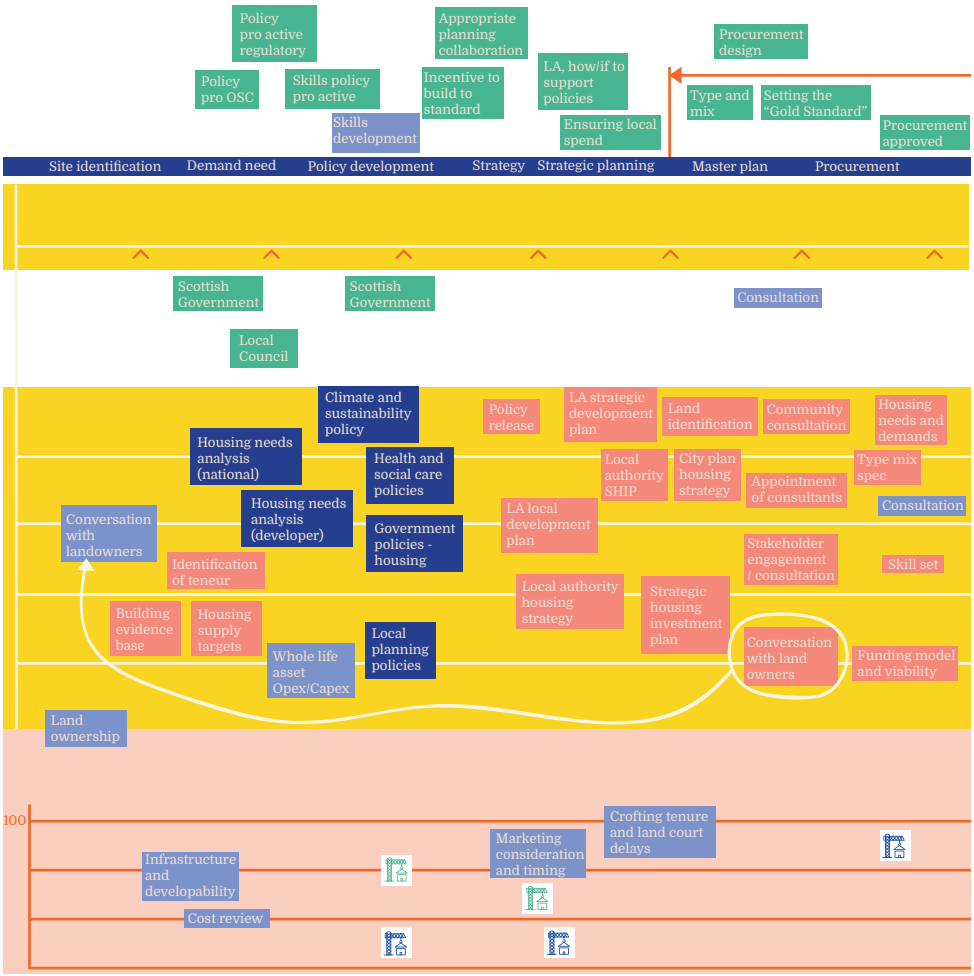
WHY INCREASE OSC IN HOUSING?

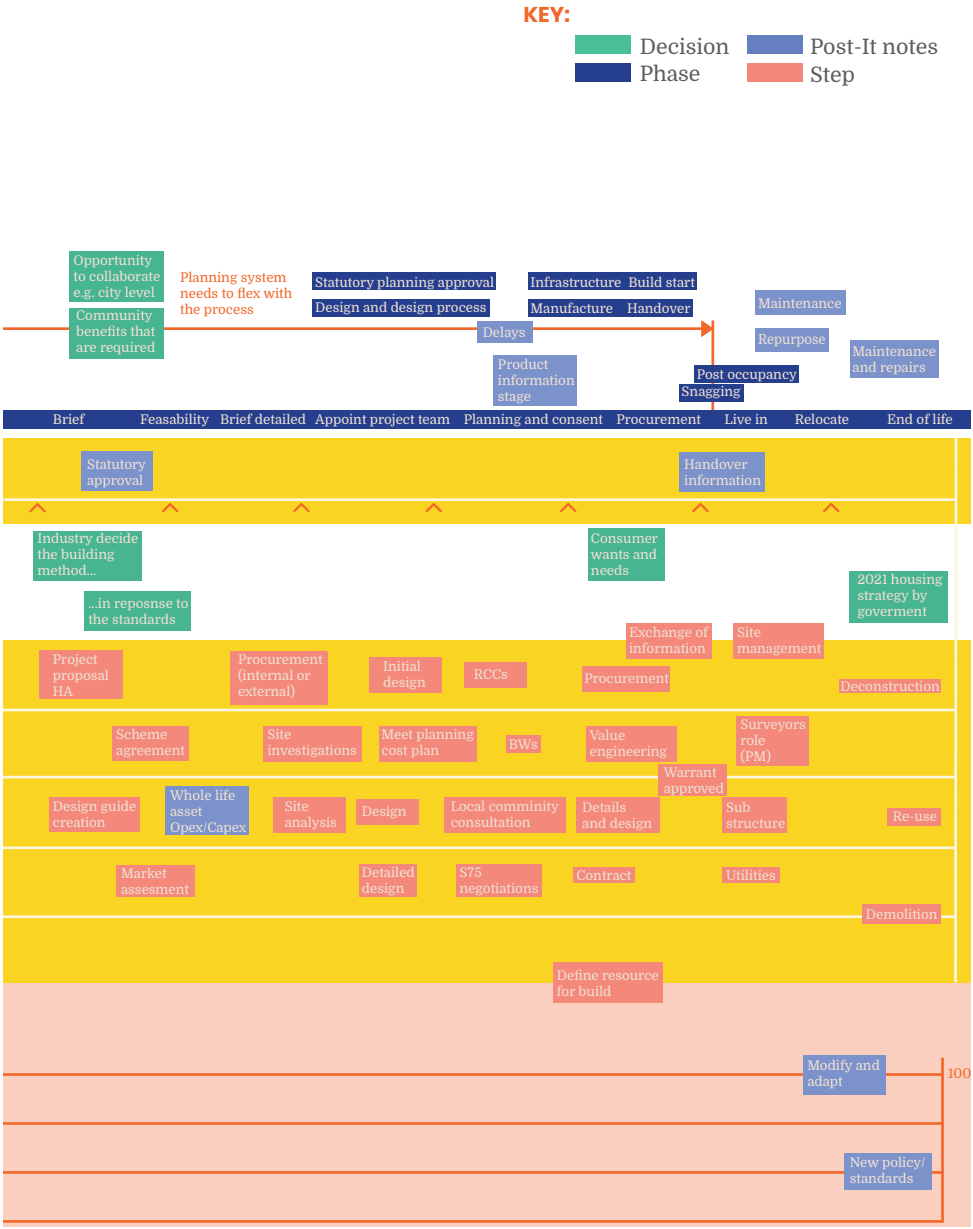
- For new business opportunities;
- To grow existing businesses and create new ones;
- To meet the future market demand;
- To create safe, compliant buildings that work;
- Because it's efficient;
- For improved quality of homes and buildings;
- To make it part of the norm;
- For the improvement of predictability;
- For the consistent standard;
- To capture the benefit for the clients and the users;
- For the whole life-cost improvement;
- To build houses that are built for a longer life and allow longer lending;
- To create a good place to live and to create a community;
- To build houses that are better than now;
- To hit house building targets;
- To build customised houses;
- To future proof the industry in terms of technology and performance;
- For the ambition to continue to innovate and grow OSC potential;
- To help balance cost, quality, and demand for affordable housing;
- To mitigate the challenges of rural.

WHAT WILL IT TAKE?

- A change in the culture and understanding of the industry;
- A better understanding of other drivers and opportunities for collaboration;
- More support for businesses to engage and take forward opportunity;
- Financial and funding models that are supportive of the process;
- Shaping demand;
- Addressing skills shortages, demographic and diversification;
- Seamless information flow;
- Implementation of digital tools;
- Evidence of benefit of OSC to help inform decision makers;
- An understanding of whole life costs;
- Ensuring the regulatory environment works seamlessly with the process.

HOUSE JOURNEY




KEY:
Decision
Phase
Post-It notes
Step
Opportunity to collaborate e.g. city level
Community benefits that are required
Planning system needs to flex with the process
Statutory planning approval
Design and design process
Delays
Infrastructure Build start
Manufacture Handover
Maintenance
Repurpose
Maintenance and repairs
Product information stage
Post occupancy
Snagging
Brief
Feasability
Brief detailed
Appoint project team
Planning and consent
Procurement
Live in
Relocate
End of life
Statutory approval
Handover information
Industry decide the building method...
...in reposnse to the standards
Consumer wants and needs
2021 housing strategy by goverment
Exchange of information
Site management
Project proposal HA
Procurement (internal or external)
Initial design
RCCs
Procurement
Deconstruction
Scheme agreement
Site investigations
Meet planning cost plan
BWs
Value engineering
Surveyors role (PM)
Warrant approved
Design guide creation
Whole life asset Opex/Capex
Site analysis
Design
Local comminity consultation
Details and design
Sub structure
Re-use
Market assesment
Detailed design
S75 negotiations
Contract
Utilities
Demolition
Define resource for build
Modify and adapt
100
New policy/ standards

KEY THEMES AND CHALLENGES

This final stage of the workshop explored in depth the challenges and opportunities identified through the five key themes, staying longer in the question and identifying the importance for OSC.

The outputs from this final stage were analysed and collated initially into ten process challenges and opportunities for OSC that should be taken forward as a potential innovation or solution. A subsequent challenge was added during one of the co-design workshops resulting in a total of eleven challenges.

5
KEY THEMES

- DESIGN AND PERFORMANCE
- CULTURE AND PERCEPTIONS
- COST, FUNDING AND PROCUREMENT
- CAPACITY AND RESOURCES

17
RECOMMENDATIONS

5
INNOVATION ACTIONS

11
CHALLENGES

DESIGN FOR THE FUTURE

IMMATURE SUPPLY CHAIN

SKILLS

PROCUREMENT

LONG-TERM COLLABORATION

QUALITY

POLICY DRIVERS

PIPELINE FOR INVESTMENT

CALCULATING THE TRUE COST

INFRASTRUCTURE AND LOGISTICS

GEOGRAPHY

THE ELEVEN CHALLENGES: IN DETAIL

PIPELINE FOR INVESTMENT
To implement a long term strategic and collaborative initiative with a sector-wide approach to maintaining value and quality.

SKILLS
To create a sense of skills identity for current and future workforce to allow greater social awareness of OSC methods.

IMMATURE SUPPLY CHAIN
To adopt flexible construction methods whilst incentivising the value of procurement by maintaining an integrated supply chain.

CALCULATING THE TRUE COST
To provide evidence of the true costs in the initial stages of the process along with a standardised method of costing to ensure a fairer distribution of costs with no compromise on quality.

DESIGN FOR FUTURE
To instil an evidence-based approach, as well as a user-focused design approach, to allow for collaborative and adaptable future outlooks.

LONG TERM COLLABORATION
To continually evaluate and maintain a consistent stream of information throughout the process to provide room for collaborative working and engagement.

POLICY DRIVERS
To establish political involvement through collaborative working with government to create targets suitable to policy criteria in effect to strive towards financial incentives.

QUALITY
To develop a skills capacity which enables OSC methods with a combination of involving the user, and engaging with a multitude of stakeholders to gain flexibility with consistent quality.

PROCUREMENT
To initiate procurement within the first stage of the process to create cross-departmental synergy and produce an integrated approach to maintaining budgets and the quality of capital cost.

INFRASTRUCTURE AND LOGISTICS
To allow for easy access requirements and transport needs which provides systematic and sustainable sequencing through efficient collaboration, communication and project management.

GEOGRAPHY
To maintain fair, and equal, geographic distribution of expertise and value of OSC which ensures an increasing proportion of productivity across the nation.

WHY INCREASE OFFSITE CONSTRUCTION IN HOUSING?

STAGE 2: CO-DESIGNING SOLUTIONS WORKSHOPS

The discussions from the first workshop were reviewed, analysed and collated to form a list of eleven more detailed challenges for OSC that could be taken forward into the next co-design phase of the project, to further develop these innovation challenges and opportunities.

Two co-design workshops were held in Edinburgh and Inverness, to ensure wide representation across Scotland and that any specific geographical issues (e.g. rural, environment issues) were fully explored and addressed. Consequently, it was in this part in the process the eleventh challenge of Geography was added.

Stakeholders were asked to prioritise their key challenges and to collectively work up initial ideas and actions to address them. There was also an opportunity to review and supplement the "House Journey".

The workshops produced seventeen co-designed recommendations for change and innovation in OSC based on the prioritised challenges. These outline recommendations were then taken forward into the final workshop. A full list of the recommendations can be seen in the "P.I.E.R. Review" infographic which details the two group summary scoring.

The outline recommendations were:

- Encourage collaboration for continuous improvement;
- Ensure early involvement of all actors;
- Involve users and the community to understand needs and desires;
- Introduce incentives to stimulate the market and promote early adoption;
- Adapt financial payment models to reflect shared risk;
- Ensure there is a long-term strategy and visibility of pipeline of investment;
- Develop and adapt current workforce for the new skills and roles that will be required;
- Plan for new and incoming skills and capability development for future workforce;
- Introduce a Scotland wide "Gold Standard" quality of build;
- Explore routes to standardisation of components for OSC without compromising flexibility;
- Evidence the true cost for whole projects and whole life using OSC approaches;
- Capture and share good practice case studies to communicate OSC benefits;
- Ensure procurement approaches include quality and whole life criteria;
- Explore the potential for optimising home-grown materials and supply;
- Implement an open source build system;
- Adapt the current planning process to the OSC approach;
- Collate and publicly share life-time performance data.

STAGE 3: TEST AND REFINE FINAL STAKEHOLDER WORKSHOP

The final one-day stakeholder workshop brought together existing project partners and additional experts from the construction industry and academia.

In the workshop, the findings from Projects 1 and 2 were presented and discussed, together with the initial findings and outline recommendations collated from the co-design workshops at Stage 2.

Two stakeholder groups were asked to review and prioritise the seventeen recommendations, and to select their top five to take forward into more detailed "Innovation Actions". This was achieved through a "P.I.E.R. Review" process, collectively assessing each recommendation against Potential; Importance; Ease; and Resources. Each idea is given a combined score based on the four categories, with the highest ranking taken forward further.

It was interesting to note some of the conflict and agreement between the two groups in terms of their ranking. Also, it was noteworthy to see that some of the ideas, while ranking as highly important with a high potential, where overall ranked low because they were perceived to be problematic and would be resource heavy.

Although five were taken forward into further action planning and development, all seventeen recommendations are important to consider as opportunities for OSC innovation.

The five prioritised recommendations were:

- **ENSURE PROCUREMENT APPROACHES INCLUDE QUALITY AND WHOLE LIFE CRITERIA**
- **ENSURE EARLY INVOLVEMENT OF ALL ACTORS**
- **CAPTURE AND SHAR GOOD PRACTICE CASE STUDIES TO COMMUNICATE OFFSITE BENEFITS**
- **INTRODUCE INCENTIVES TO STIMULATE THE MARKET AND PROMOTE EARLY ADOPTION**
- **COLLATE AND PUBLICLY SHARE LIFE-TIME PERFORMANCE DATA**

These five key recommendations were developed by self-selected working groups into five "Innovations Actions". The action plans summarise what needs to be done in order to achieve the objectives for each innovation, including individual key actions, stakeholders who should be involved and the potential challenges.

P.I.E.R REVIEW

GROUP 1

Ensure procurement approaches include quality and whole life criteria [1] [2]

Capture and share good practice case studies to communicate OSC benefits [2]

Introduce incentives to stimulate the market and promote early adoption [4]

Collate and publicly share life-time performance data [5]

GROUP 2

Ensure procurement approaches include quality and whole life criteria [1] [3]

Capture and share good practice case studies to communicate OSC benefits [2]

Introduce incentives to stimulate the market and promote early adoption [2]

Collate and publicly share life-time performance data [2]

Ensure there is a long-term strategy and visibility of pipeline of investment [2]

Plan for new and incoming skills and capability development for future workforce [2]

Ensure procurement approaches include quality and whole life criteria [2]

KEY:
GROUP 1
GROUP 2

Format shows the ranking of recommendations between the two groups.

INNOVATION ACTIONS

What follows are the detailed "Innovation Action" plans for each of the five prioritised ideas selected through the "P.I.E.R. Review" process.

The action plans summarise what needs to be done in order to achieve the objectives for each innovation, including individual key actions, stakeholders who should be involved and the potential challenges.

INNOVATION AIM 1: ENSURE PROCUREMENT APPROACHES INCLUDE QUALITY AND WHOLE LIFE CRITERIA

Collaborating efficiently across departments in hope to ensure consistent assessment of information will enable procurement approaches to develop a whole project and whole life cost model.

In order to pursue this approach evidence of the true cost is required in the initial stages of the briefing process, along with a standardised method of costing to produce a fairer distribution of costs with no compromise on quality.

OBJECTIVES:

1. Collaboration across departments to ensure consistent assessment

2. Use whole project and whole life costs

ACTIONS

1. Define and establish a standard of quality and whole life criteria

SUMMARY: the need to define and establish a high standard of quality and whole life criteria for building development teams and maintenance teams is an important stage in certifying collaborative working. With procurement teams involved and the influence of other sector involvement, an accumulation of information could be collected as an evidence base to support appropriate decision-making within OSC. With a definitive idea and greater clarity and agreement on what quality and whole life criteria means, these decisions could be the platform to instilling a higher degree of quality and efficiency in cost for OSC.

WHO NEEDS TO BE INVOLVED:

procurement, building and maintenance teams, local authorities, housing associations.

2. Structure and measure an incentivised process

SUMMARY: create and use a specifically defined construction handbook which is methodical and structured in its approach to act as a guidance to measure the OSC process and value. Mandating this handbook across the industry could bring upon incentives to ensure consistent, high quality actions take place, as well as further educate actors of the standard and quality that should be maintained for OSC. Using the connections within the Scottish Government projects teams will allow for accurate data to be collected and collated as content for the handbook. Doing so will warrant trust.

WHO NEEDS TO BE INVOLVED:

Scottish Government, procurement teams, suppliers, SME's.

3. Develop a new business model

SUMMARY: the education and awareness of procurement, building and finance teams could be developed if an appropriate weighting model was in place. This model would need to work to both extremes of the scale, very small and very large geographies and contexts, in order for it to be used effectively as a standard of quality and whole life criteria.

WHO NEEDS TO BE INVOLVED:

Scottish Government, procurement, building and finance teams.

CHALLENGES:

Key challenges will be: avoiding perverse outcomes which include 'box ticking' exercises for OSC.

Low support and use of various tools and technologies involving the generation and management of digital representations of physical and functional characteristics of places.

Finance models currently used are based on low up-front high life-time costs, which could create financial tension if they were switched without educating the process and benefits.

INNOVATION AIM 2: ENSURE EARLY INVOLVEMENT OF ALL ACTORS

Continually maintaining a collaborative working environment at the beginning of the OSC process will ensure cross-departmental synergy and will therefore aid the process of moving towards a more integrated approach to procurement, design and delivery.

In doing so it should benefit project budgets and sustain a high degree of quality in capital cost, whilst minimising the need for redesign and rework. This commitment and method of engagement within the primary stages of the process enables a stronger, greater visibility of pipeline for investment as well as a positive outlook on the criteria required to design affordable and adaptable, high quality homes for the future.

OBJECTIVES:

1. Maintain a collaborative working environment for contractors, manufacturers and architects

2. Include procurement at initial start of the process

3. Foster a growing, skilled workforce

4. Efficiently manage constraints in areas such as land ownership by effective communication and planning

ACTIONS

1. Outline the vision for the client

SUMMARY: working to a defined project scope and brief is essential to engage all actors effectively. Maintaining an up-to-date knowledge of the skill set required for offsite, and a sense of land ownership policies, at the beginning of the process is indispensable. By involving and engaging with all actors in the initial stages of the project ensures greater efficiency in both time and cost.

WHO NEEDS TO BE INVOLVED:

clients, contractors, manufacturers, local authorities, design-led team.

2. Create a transparent process to show target cost, value and risks

SUMMARY: providing a transparent outline from the off-set which details the costs, the value each topic area brings and the potentials risks involved allows for a greater understanding and acceptance to each of the partners involved. Sharing this information to all actors at the beginning of the process creates a support network whilst increasing the knowledge and acceptability of the supply chain. Making these details comprehensive and easily accessible will provide a useful tool to make informed decisions and be efficient with time management.

WHO NEEDS TO BE INVOLVED:

clients, contractors, manufacturers.

CHALLENGES:

Key challenges will be: unwillingness of actors to collaborate effectively, notwithstanding factors such as lack of confidence and trust in the capability and performance of associated partners, as well as other work responsibilities and commitments.

This approach to working could elude to the idea of increased costs being occurred and bring forward the issues and time constraints of statutory approvals and barriers in procurement.

INNOVATION AIM 3: CAPTURE AND SHARE GOOD PRACTICE CASE STUDIES TO COMMUNICATE OSC BENEFITS

Pulling together information from case studies has the potential to significantly improve the understanding of OSC for all actors involved. Communicating effectively could change, as well as improve, the attitudes and behaviours in favour of OSC.

Case studies detailing the benefits and requirements for investing collaboratively long term, will identify a wider measure of quality and performance through the methods of OSC. Capacity for investment is required to maintain open source data that produces predictive and real-time information.

OBJECTIVES:

1. Create a value of performance

2. Support the value of collaborative approaches

3. Disseminate to advocate for OSC

ACTIONS

1. Adopt new build performance and quality measurements tools

SUMMARY: a more in-depth scope of both technical data and customer research is necessary to be collated and collected in order to implement a better value of performance and quality for OSC. Currently, there are assets already available that were created by the Scottish Government, however feedback suggests these resources are not easily accessible. Enforcing a real-time data mechanism which highlights topics such as OSC energy saving, will stimulate interest from users and better communication of the benefits OSC brings to the housing process.

WHO NEEDS TO BE INVOLVED:

Scottish Government, Scotland's housing network and associations, local authorities.

2. Extend the SFHA online presence

SUMMARY: updating the SFHA website to include valuable and informative resources such as: OSC case studies, blogs, contacts and useful links; will help broaden the knowledge of OSC and encourage engagement. To make these resources known, promotion through social media channels and bulletins could be the starting link to marketing the material. The content curated would need to be agreed on as standard then effectively managed within existing resources.

WHO NEEDS TO BE INVOLVED:

Scottish Government, CSIC, housing associations – Future Thinking Leads, local authorities, developers.

CHALLENGES:

Key challenges will be: resolving any IT issues that occur through reporting and analysis.

Changing the perceptions of stakeholders associated with local authorities and housing associations to persevere within an adaptive environment.

Making the resources which deem useful to the public accessible not only to SFHA members.

INNOVATION AIM 4: INTRODUCE INCENTIVES TO STIMULATE THE MARKET AND PROMOTE EARLY ADOPTION

Long term strategies with collaboration from actors as well as political involvement is necessary in order to gather and update resources, secure commitment to projects and acquire funding through innovation partnerships.

Using incentives as a grant mechanism to encourage early adoption will in turn create value. This value is gained from testing as pilot to produce critical feedback.

OBJECTIVES:

1. Include incentives for pilots

2. Introduce a wider value of building performance certificates

3. Enhance grants support

ACTIONS

1. Agree a collective strategic approach

SUMMARY: if all key partners are addressing their investments in a long- term, strategic way which encourages partnership, this will help build consistency across the country. The strategy could be supported from UK collaboration funding through innovation partnerships which run multi-year. This long-term collaborative approach would bring the confidence needed to the market.

WHO NEEDS TO BE INVOLVED:
local authorities, councillors, manufacturers, political bodies, RSLs, UK funders and Building Scotland Fund.

2. Generate additional programme resources

SUMMARY: funding from the Scottish Government could play a crucial role in generating important material for the Affordable Housing Supply Programme. Doing so will develop meaningful and measurable data, influencing pilots for OSC.

WHO NEEDS TO BE INVOLVED:
Scottish Government.

3. Maintain collaborative commitment

SUMMARY: increasing the percentage of programme to OSC on a multi-year basis will stimulate the market and provide a better indication of what is required to make OSC successful. Spending the time and resources demonstrates a commitment to the project and in turn will build confidence in actors involved.

WHO NEEDS TO BE INVOLVED:
Scottish Government, TMDF authorities, councillors, RSLs and local authorities.

CHALLENGES:
Key challenges will be: the dearth of consistency across local authority boundaries could undermine the purpose of carrying out a strategy to entice early adoption.

The complications involved in bids for funding and procurement.

The potential risk to the profile of RSLs, councils and manufacturers. The risk including unsupported or endorsed actions.

There is a lack of visibility in the industry which can cause difficulties in the required changes in behaviour. It's also political supports, long term, of this approach is also needed. This can lead to low support and guidance from bodies such as the Scottish Government, it is not prioritised sufficiently.

Budget uncertainty can straddle the commitment and agreement to long-term policy resources and actions.

INNOVATION AIM 5: COLLATE AND PUBLICLY SHARE LIFE-TIME PERFORMANCE DATA

Collating and making available life time building performance data will help the industry to understand the true cost of OSC construction, help to shape the attitudes and perceptions of OSC, and support continuous improvement and innovation in the design, production process, and maintenance of housing.

It could also play a role in creating customer demand by providing open information that buyers can use to base their purchasing decisions on. Public information could also impact on type and availability of mortgage lenders' products.

OBJECTIVES:

1. Include information about building performance

2. Enable flexibility in mortgage options

3. Develop future running costs models

4. Raise awareness of the benefits for the home owner

5. Maintain building information management

ACTIONS

1. Define what building performance should include

SUMMARY: include a 'circular' performance report for homes that accounts for carbon rating, material waste, adaptability of building, re-use potential, health of materials; illustrate the whole life value and whole life cost benefits of the asset; and development meaningful and measurable metrics using evidence-based research.

WHO NEEDS TO BE INVOLVED:
Zero Waste Scotland, Scottish Government, public sector housing associations.

2. Engage users

SUMMARY: engaging with customers to understand their values and their motivations when choosing a place to live; speaking with people already living in OSC constructed housing to understand their experiences.

WHO NEEDS TO BE INVOLVED:
home owners, housing residents, research institutions, mortgage companies.

3. Measure and monitor

SUMMARY: the ongoing measuring and monitoring of new building performance metrics is a critical action for the success of this innovation. The key will be developing new user-friendly systems for collecting and presenting data, for example material health ratings, also developing and selecting appropriate technology led or human led solutions performance monitoring.

WHO NEEDS TO BE INVOLVED:
researchers, private technology companies.

CHALLENGES:
Key challenges will be: understanding the main driver for publicly available data, and finding who will be motivated to own the action and take it forward.

CONCLUSIONS

The co-design workshops allowed discussion around the challenges and opportunities within construction, and for OSC approaches more specifically.

Our research found that currently:

- **Life-time building performance data for OSC is not collated nor publicly shared. This hampers the industry's ability to understand the true cost of OSC as well as impeding continuous improvement and i nnovation in design. Such data could play a role in creating customer demand by, for example, providing data that buyers could use when making purchasing decisions.**

- **In the main, building quality and whole life criteria are not well understood and fail to influence established practices such as current procurement. Lack of robust whole life data positions OSC as a less cost-effective approach to traditional construction. This does not consider the true cost benefits of OSC and does not support informed appropriate decision making.**

- **There are many examples of successful OSC projects, yet these best practice cases are not well publicised and the lessons learned are not readily shared. This restricts the wider communication of the benefits of OSC and restricts the capture of valuable technical and social feedback that could help drive further innovation.**

- **The current OSC process is fragmented and lacking in early collaboration between relevant stakeholders. Continually maintaining a collaborative working environment at the beginning of the OSC process could**

ensure cross-departmental synergy and could therefore aid the process of moving towards a more integrated approach to working. In doing so it could benefit project budgets and sustain a high degree of quality in capital cost. This commitment and method of engagement within the primary stages of the process can enable a stronger, greater visibility of pipeline for investment as well as a positive outlook on the criteria required to design affordable and adaptable, high quality homes for the future.

- **A considerable barrier to accelerating OSC projects and generating sharable data is the current lack of long term and appropriate funding available. There are two key funding factors influencing OSC. Lack of long-term collaborative funding strategies, and mechanisms to stimulate early adoption.**

- **Long-term strategies with collaboration from actors as well as political involvement is necessary in order to gather and update resources, secure commitment to projects and acquire funding through innovation partnerships.**

- **Using incentives as a grant mechanism to encourage early adoption will in turn create value for OSC at large. This added value is gained from testing via pilots to produce critical feedback.**

To conclude, OSC itself is not the panacea to all of the construction industry's ailments.

For OSC manufacturing to stimulate a transformation across industry, there is an onus on clients and suppliers to quantify its longer-term asset value, and start to develop more suitable business cases that include whole-life whole-cost analysis. The industry, and clients in particular, must also look to re-develop compatible procurement and contractual strategies to enable more collaborative investments in OSC.

In order to enhance the current OSC process, to enable wider adoption and take advantage of the benefits OSC offers, there are a number of areas that have therefore been identified in Project 3 as a priority to take forward.

From this research our findings are:

- **Collation and public sharing of life-time performance data. This will involve:**
  A clear definition of building performance data;
  Customer engagement to understand buyer values;
  Continuous measuring and monitoring.

- **Early involvement of all actors in OSC projects. This will include:**
  Creating a transparent process to show target cost, value and risk.

- **Procurement approaches which include quality and whole life criteria. Key to this will be:**
  A defined and established standard of quality and whole life criteria;
  A structured and measured incentivized process;
  A new business model development.

- **Capturing and sharing good practice case studies. This will implicate:**
  Adopting new building performance quality measurement tools;

- **Introduce Incentives to stimulate the market and promote early adoption. It will be essential to:**
  Agree a collective strategic approach to encourage partnership and bring confidence;
  Generate additional programme resources to support;
  Maintain collaborative commitment and build confidence.

These findings of Project 3 suggest the evidence available to account for the performance of OSC in comparison to other, more traditional methods, needs to be fully transparent, so it can be open to proper scrutiny from members of the public.

To help with this, it proposed a number of innovations: for example; shared information, whole life-cycle costing, collaborative working and a pipeline approach which should be championed in order to accelerate the development of advanced manufacturing systems for OSC.

This co-design element of the project sought to develop a dialogue between key stakeholders in the OSC and the affordable housing sector, by way of interlinked workshops held in Hamilton, Edinburgh, Inverness, and Glasgow. These workshops aimed to explore the potential there is to co-design solutions that are fully able to overcome the barriers to any expansion of the OSC sector, and which inhibit the development of advanced manufacturing systems that are able to serve the affordable housing sector.

RECOMMENDATIONS

DECISION

While the construction industry is buoyed by predicted growth and expansion, it continues to underperform in a number of strategic areas: productivity and quality, challenges in continuity of planning and delivery pipelines, skills shortages and data transparency.

OSC - the prefabrication, modularisation and standardisation of construction processes and assets within controlled factory environments – is frequently quoted across government and industry as a potential catalyst in stimulating improvement in the sector and meeting these challenges. It also has a role to play in addressing the UK's housing shortage.

This programme of work across Project 1, Project 2, and Project 3, was commissioned to provide recommendations to the Government and the wider sector to help influence the policy for OSC for the future.

In light of Project 3's findings, the following recommendations are offered to key stakeholders in the affordable housing sector from the overall research activities:

- **Given that Scotland already successfully adopts offsite approaches to most of its housing construction, a more clearly articulated national strategy is needed in order to recognise this and to set out the future direction of travel The findings of this study suggest the current manufacturing sector has an appetite for expansion and progressive adoption of more advanced manufacturing systems and these opportunities should be captured in this strategy. This strategy should also be seen as a vehicle which contributes to the targets that Scottish Government has set for net zero carbon, zero waste and the circular economy.**

- **The current approach to affordable housing development is traditional – even when an offsite provider is appointed to build the homes.**
  This traditional approach (characterised by 'manufacture for design' rather than 'design for manufacture') is recognised as inefficient by key stakeholders and the sector should therefore develop a strategy to transform these traditional approaches in order to ensure that the potential benefits of offsite manufacturing are realised.

- **This transformation strategy should be based on;**

  a collaborative approach to procurement, rather than the traditional sequential approach;

  a whole life cost approach to evaluation rather than the traditional initial capital cost business models;

  greater standardisation of house types and components;

  development of a pipeline of demand that will allow the manufacturing sector to maximise productivity and encourage investment in more productive plant and equipment.

- **Whilst many stakeholders are keen to understand the benefits and barriers of offsite construction, they feel the evidence base currently available to justify the adoption of such an approach is insufficient to warrant this. Whilst this study should provide some reassurance, there is a need for a more systematic analysis of the available evidence, so the lessons learnt can be based on an open system of evaluation and information sharing.**

- **As part of any new strategy, it may be appropriate to introduce incentives to stimulate the market and promote the widespread adoption of modern methods of construction – for example the Scottish Government may wish to consider:**

  a. **allocating a % of all affordable housing funding for projects which demonstrate greater use of offsite construction;**

  b. **providing targeted support to SMEs in the offsite sector able to adopt modern methods of construction, by way of the Enterprise Agencies and through the Construction Scotland Innovation Centre;**

  c. **supporting capital investment in manufacturing facilities through the Building Scotland Fund and the Scottish National Investment Bank;**

  d. **reviewing how the planning process could be streamlined based on approval of certain standard systems and/or designs. Stakeholders felt this could dramatically speed up the construction process;**

  e. **examining how the current grant and payment arrangements could be modified to better support the different staged risks and outlay associated with certain modern methods of construction.**

Read the full report on the
Construction Scotland Innovation Centre
website:

https://bit.ly/39KV7TK

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