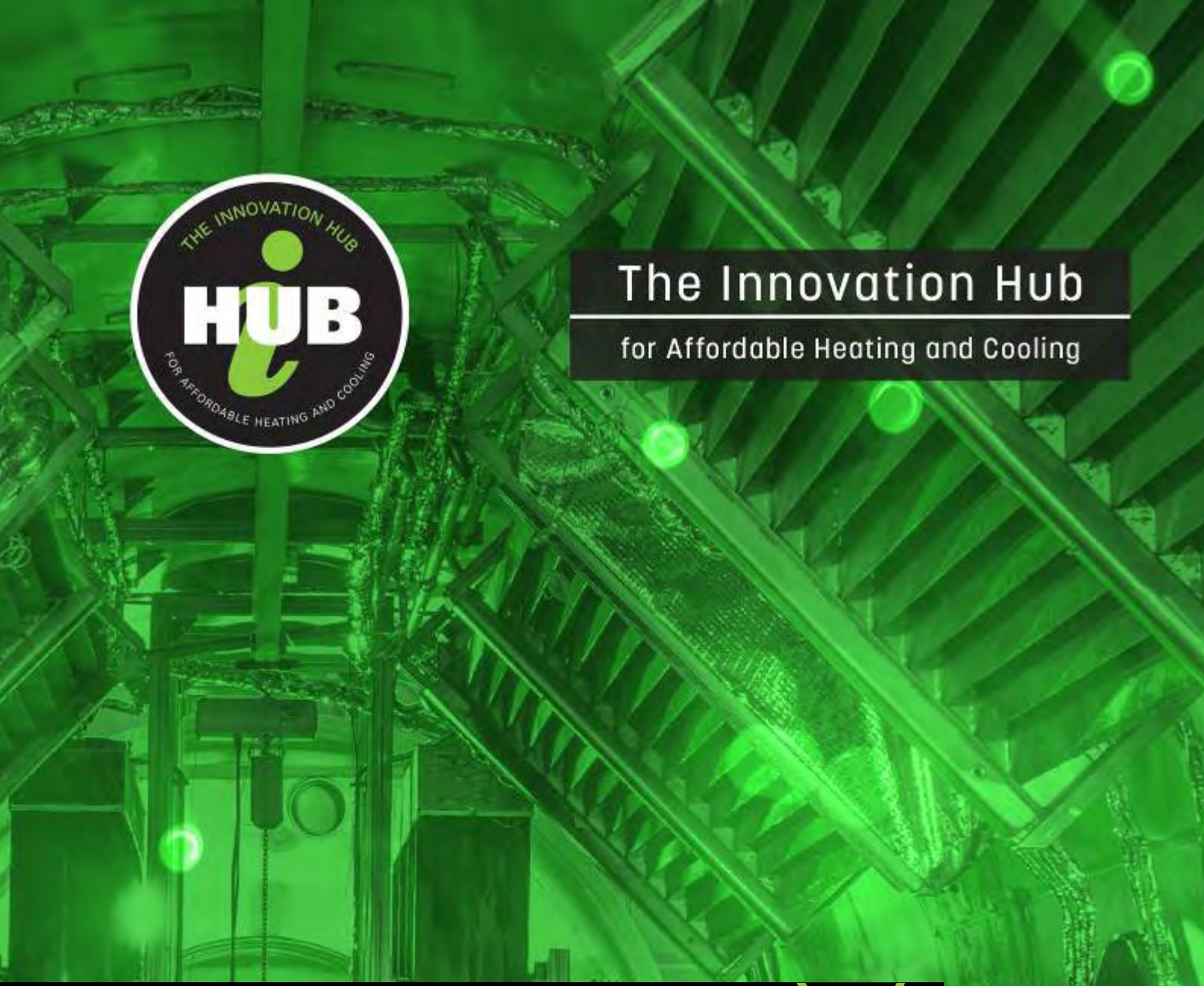

The Innovation Hub

for Affordable Heating and Cooling

Lesson Learnt Report

Fernhill RAC Living Lab

Project LLHC3

19 May 2022

Queensland University of Technology (QUT)

About i-Hub

The Innovation Hub for Affordable Heating and Cooling (i-Hub) is an initiative led by the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH) in conjunction with CSIRO, Queensland University of Technology (QUT), the University of Melbourne and the University of Wollongong and supported by Australian Renewable Energy Agency (ARENA) to facilitate the heating, ventilation, air conditioning and refrigeration (HVAC&R) industry's transition to a low emissions future, stimulate jobs growth, and showcase HVAC&R innovation in buildings.

The objective of i-Hub is to support the broader HVAC&R industry with knowledge dissemination, skills-development and capacity-building. By facilitating a collaborative approach to innovation, i-Hub brings together leading universities, researchers, consultants, building owners and equipment manufacturers to create a connected research and development community in Australia.

This Project received funding from ARENA as part of ARENA's Advancing Renewables Program.
The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.

Primary Project Partner

[logo]

i-Hub Lessons Learnt Report

Guidance notes for completion of the Lessons Learnt Report:

- This report is intended to be made public.
- Please use plain English, minimise jargon or unnecessary technical terms.
- Please use your organisation's branding for the report.
- The report should meet your organisation's publishing standards.
- Please use one template per each major lesson learnt and include as many as are relevant for your sub-Project. If what you learnt is more technical, this is the section to include technical information.
- The content of these Lessons Learnt Reports can be compiled (and updated, where necessary) for inclusion in the (public) Project Knowledge Sharing Report, for submission at the completion of your sub-Project.

Lead organisation	Queensland University of Technology		
Sub-Project number	LLHC3		
Sub-Project commencement date	01/07/2019	Completion date	30/6/2022
Report date	19/05/2022		
Contact name	Sherif Zedan		
Position in organisation	Research Associate		
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Lessons learnt

Lesson learnt #1	Complicated coordination process					
Category	Logistical					
Choose from:	*Technical*	*Commercial*	*Social*	*Regulatory*	*Logistical*	*Other (specify)*

Describe what you learnt about this aspect of the Project.

The organisational model/structure of the Living lab host comprises of multiple departments in charge of different responsibilities. These department are located in two different sites. Site 1 is the head quarters in Brisbane where the upper management, Ethics committee (HREC), and legal departments are located, and site 2 is the living lab building, where building manager/administration, maintenance, and lifestyle managers are located. In addition to the multiple departments of the LL host, there were external parties/subcontractors such as the construction contractor, technology suppliers, and BMS provider.

QUT's living lab manager had to coordinate with all these parties and get approvals from the multiple departments (e.g. non disclosure agreement or ethics approval) to implement and test the innovative technologies/ sensors. The distribution of responsibilities across various departments made the coordination process lengthy and time consuming, which was not accounted for in the initial planning.

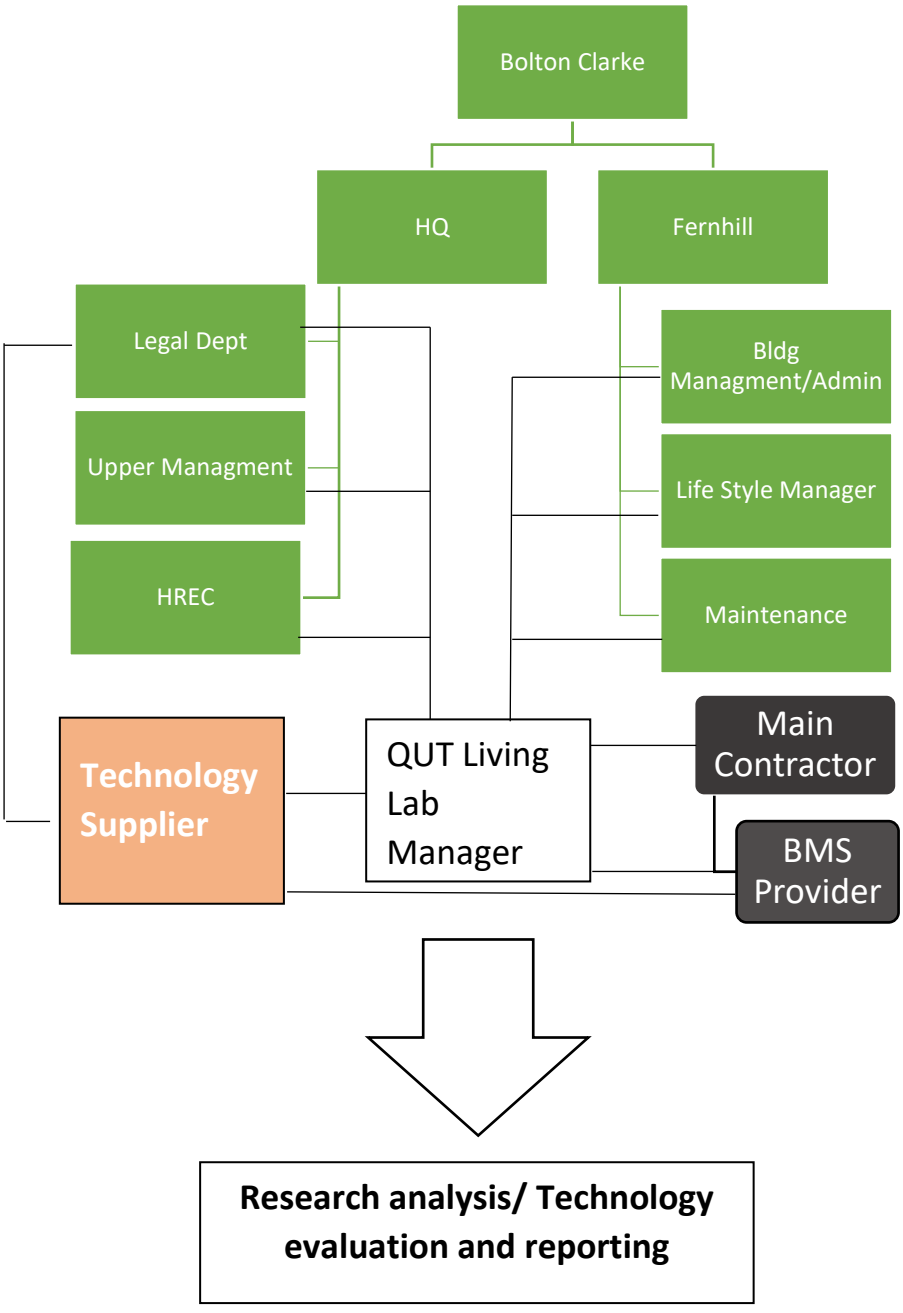
Please describe what you would do differently next time and how this would help. What are the implications for future Projects?

1- Detailed identification and allocation of responsibilities during planning phase.
2- Allocating more time/manpower for coordination in the initial planning or,
3- Giving the responsibility of coordination to one person within the LL organisation. This however might require an extensive amount of time and effort from that person. Therefore, if not compensated for that time, coordination activities might not be treated as a priority, which could risk or delay the goals of the iHUB.

If your Project learnings have identified any knowledge gaps that need to be filled, please state it below.

Please include any other information you feel is relevant or helpful in sharing the knowledge you learnt through this stage of the Project. This may be qualitative or quantitative and may include a graph, chart, infographic or table as appropriate.

Illustration of the coordination network complexity



Lesson learnt #2	Integrating technologies in construction phase					
Category	Technical/Logistical					
Choose from:	*Technical*	*Commercial*	*Social*	*Regulatory*	*Logistical*	*Other (specify)*

Describe what you learnt about this aspect of the Project.

Fully constructed living lab can add limitations on the type of technologies that can be implemented to them. Some potential technologies were supposed to be implemented into the living lab while it is being constructed. However, due to delay in the decision making from the technology provider compared to construction timeline, it became difficult to add these technologies to the fully constructed living lab.

Please describe what you would do differently next time and how this would help. What are the implications for future Projects?

For a living lab to accommodate a wider range of technologies, agreements about implementing those technologies should be reached prior to finalising construction agreements. To do so, an integrated design studio (IDS) process or early engagement of technology provider with the host and construction manager would be required.

If your Project learnings have identified any knowledge gaps that need to be filled, please state it below.

Please include any other information you feel is relevant or helpful in sharing the knowledge you learnt through this stage of the Project. This may be qualitative or quantitative and may include a graph, chart, infographic or table as appropriate.

Lesson learnt #3	Post Occupancy Evaluation					
Category	Logistical					
Choose from:	*Technical*	*Commercial*	*Social*	*Regulatory*	*Logistical*	*Other (specify)*

Describe what you learnt about this aspect of the Project.

Post Occupancy Evaluation (POE) of the built environment is a valuable process to assess occupants' satisfaction, health, safety, comfort, etc. and to implement learnings from this assessment on new projects. The research team devised three different POE activities: interviews with the residents in the specific instrumented LL rooms; focus groups with residents in general; and staff surveys. Regarding the resident activities, the interviews were conducted but the focus groups were not. For staff activities, the research team developed two surveys to be completed by staff members at Fernhill while they are onsite to evaluate their comfort and satisfaction wit the built environment. Distribution of these surveys however was more difficult than expected due to coinciding with a significant increase in COVID cases in Queensland. The stressful situation of managing an aged care under the pandemic made the building manager request postponing the surveys so as not to interrupt staff while they are under stress.

Please describe what you would do differently next time and how this would help. What are the implications for future Projects?

Surveys were perceived by the staff/building manager as an "out-of-scope" task that will consume time and will have no effect on them if it was ignored, rather than a process to improve their comfort and enhance their satisfaction with their built environment.
Working with the living lab host/upper management to educate the staff about the importance of POE and incorporating it into their tasks can facilitate the process and highlight its importance. One example of doing this is to request from the head of departments to put deadlines and follow up the status of surveys with their staff.

If your Project learnings have identified any knowledge gaps that need to be filled, please state it below.

Please include any other information you feel is relevant or helpful in sharing the knowledge you learnt through this stage of the Project. This may be qualitative or quantitative and may include a graph, chart, infographic or table as appropriate.

Lesson learnt #4	Missing parts to implement sensors into the BMS					
Category	Technical					
Choose from:	*Technical*	*Commercial*	*Social*	*Regulatory*	*Logistical*	*Other (specify)*

Describe what you learnt about this aspect of the Project.

Sensors inside buildings can impact on energy and comfort. Sensors in different locations within the same room can have different outputs, which can influence air conditioner operation. One of the planned activities was to install additional sensors into the living lab rooms and connect them to the BMS so that we could compare their temperature outputs to the temperature data that influences HVAC. The additional sensors were procured from overseas and wiring was installed during construction to incorporate them into the BMS. However, due to a missing part that allows the BMS to interact with the sensors, the implementation process took much longer than expected (due to procurement and shipping delays from the overseas supplier). Due to that delay, there wasn't enough time to gather data that is sufficient to carryout an analysis within the living lab reporting timeline.

Please describe what you would do differently next time and how this would help. What are the implications for future Projects?

Ensure that all parts are compatible with the technology installed in the living lab.
Prioritise gear that is available within Australia to limit the risk of delays due to lockdowns, etc.

If your Project learnings have identified any knowledge gaps that need to be filled, please state it below.

Please include any other information you feel is relevant or helpful in sharing the knowledge you learnt through this stage of the Project. This may be qualitative or quantitative and may include a graph, chart, infographic or table as appropriate.