Guiding Systemic Change: A cross-case analysis of 'transition labs' in Canada and Sweden

Johan Larsson[1]*, Stephen Williams[2]* and John Holmberg[1]

[1]Division Physical Resource Theory, Chalmers University of Technology, Gothenburg Sweden
[2]Institute for Resources, Environment and Sustainability, The University of British Columbia, Vancouver, Canada

*corresponding authors: johan.larsson@chalmers.se, stephengarywilliams@gmail.com

Abstract
Agenda 2030 presents a global ambition to transform our world into sustainability. In this study we seek to advance knowledge on how sustainable systemic change can be guided in practice, and how the keywords of Agenda 2030 can provide value in such work. We argue that the conception of sustainability and desire for positive change may form strong coalitions and motivators for realizing transitions challenging the status quo. This study seeks to make a practical contribution into some of the methodologies, processes, tools and techniques that may be useful in guiding systemic change: with an emphasis on backcasting and a multi-level model for transitions. The study is exploratory in its approach, building on a description, comparison and cross-case analysis of two lab methodologies and insights from their application in concrete cases: the Energy Futures Lab in Alberta, Canada and the Challenge Lab in West Sweden. The analysis is guided by a novel analytical framework operationalizing keywords of Agenda 2030 to shed light on how sustainability transition processes (including transition labs) may contribute to sustainability transitions. The framework itself, and the explorative comparison and analysis pose some questions that may inspire further development of transition lab methodologies to have a transformative impact across systems.

Keywords: sustainability, transitions, governance, Agenda 2030, labs, backcasting

1 Introduction

Much policy and practice are expected to be guided by Agenda 2030 and its 17 Sustainable Development Goals during the coming decade. The Agenda recognizes the demand for transformations on various levels in society as necessary processes to realize sustainability (United Nations, 2015). In this study we focus on the phenomena of sustainability transitions to conceptualize systemic, fundamental change in society. In particular, we seek to provide insights into how keywords of Agenda 2030 can inform lab methodologies for guiding sustainable systemic change in practice.

Sustainability transitions are to a high degree journeys into the unknown. Transitions are co-evolutionary, long-term, open-ended, multi-actor change processes on a level of systems in society (Grin, Rotmans & Schot, 2010). Sustainability, when recognized as an "essentially

contested concept", is surrounded by ambiguity and tension (Jacobs, 1999; Robinson, 2004), further adding to the inherent complexity and uncertainty accompanying sustainability transitions.

A central question in governing transitions is how an 'unsustainable system' in the present, can be replaced by a future 'sustainable system', which happens through a complex system innovation process (Geels, 2002; 2011; Elzen et al., 2004; Smith, Voss & Grin, 2010; Geels et al., 2016). Building on the reasoning on 'wickedness' by Rittel and Webber (1973) it is often concluded that transitions cannot be planned in a traditional sense, but rather influenced. This concern has, amongst others, been incorporated in transition governance approaches (Rotmans, Kemp & van Asselt, 2001; Smith et al., 2005; Voss, Bauknecht & Kemp, 2006; Loorbach, 2007). Such approaches build on experimentation, learning-by-doing and reflexivity as strategies to cope with complexity and uncertainty. Here, backcasting is often used as an approach to handle complex issues in a structured (and transformative) way. Backcasting approaches seeks to articulate desired futures, navigate systems in the present and develop measures for realising the desired futures – acknowledging that the long-term future is open-ended and something to be created, rather than fixed and pre-determined (e.g. Robinson, 1990; Dreborg, 1996; Holmberg, 1998; Quist, 2007; Carlsson-Kanyama et al., 2008; Wangel, 2011; Robinson et al., 2011).

Recently, lab-based initiatives have been suggested and applied to guide sustainable systemic change in a diverse range of settings as (urban) living labs, transition labs, social labs, (social) innovation labs, laboratories (Nevens et al., 2013; Evans and Karvonen 2014; Hassan, 2014; Bulkeley et al., 2016). Labs provide a protected space for exploring unknowns, learning-by-doing and experimentation. Naturally, labs that seek to contribute to sustainability transitions often contain elements of various transition governance approaches, such as the 'transition management' framework building on a 'transition arena' (Loorbach, 2007; 2010), but are more methodologically pluralistic. In this paper, we refer to transition labs and arenas as 'transition labs' without referring to any specific conceptualisation.

The aim of this study is to further understand how lab settings can guide systemic change towards sustainability. This explorative study seeks to make a practical contribution into some of the methodologies, processes, tools and techniques that may be useful in guiding systemic change: with an emphasis on backcasting and a multi-level model for transitions. The study takes its starting point in two lab methodologies and insights from their application in concrete cases: the Energy Futures Lab (EFL) in Alberta, Canada and the Challenge Lab (C-Lab) in West Sweden. First a cross-case comparison was made to illuminate similarities and differences between the methodologies, followed by an analysis in relation to a developed framework for operationalizing Agenda 2030.

2 Guiding systemic change towards sustainability

Of interest in transitions governance are sustainability challenges in socio-technical, socio-institutional and/or socio-ecological systems (Loorbach et al., 2017). An assumption is that an understanding of transition dynamics in present systems can provide opportunities to identify ways of influencing how the future development patterns of such systems unfold. Sustainability transitions governance seek to purposefully navigate transitions into desirable pathways. Smith et al. (2005, p. 1498):

> *"The art of governing transitions becomes one of recognizing which context for transformation prevails, and which drivers offer the best leverage for guiding change in a desirable direction"*

In short: the essence of sustainability transitions governance is to identify points of leverage for 'acupuncture interventions', illuminated when operating in what Senge (1990) would refer to as the 'creative tension' generated when vision (what one wants) is juxtaposed with current reality (where one is relative to where one wants to be).

2.1 Agenda 2030 as motivator and opportunity

Agenda 2030 (United Nations, 2015) can provide a starting point and motivator for engaging with sustainability transitions. Sustainability is here represented by 17 Sustainable Development Goals, that are integrated and interrelated emphasising three dimensions of sustainable development: the social, the economic and the environmental. The process thereto is outlined in the very title of the Agenda: *"Transforming our world"* and it is emphasised that *"no one should be left behind".*

The transformative nature of Agenda 2030 may not lie in in the rational (mainstream) procedure of translating international goals into national regulations and policies, to be implemented and followed-up in a bureaucratic manner. Here the Agenda and the SDGs risk become a 'checklist'. Rather, the transformative potential of the Agenda may lie in its keywords: *transformation*, *integration* and *universality*. These keywords can be engaged with on any level and scale in the realisation of sustainable futures.

Transformative in this context has two components:

1. Does the process have an aim towards sustainability as defined in Agenda 2030 or another framing? For example, is there a long-term rather than a one-off project orientation?
2. Does the process recognize the need to change a current unsustainable system on a more fundamental level or is the focus on incremental change?

In order to achieve this type of societal transformation: fundamental changes on a systemic level, one must work differently - a key concept covered in the **Integration** keyword. Integration refers to the breadth of transition efforts in integrating different perspectives on sustainability and, at the same time, integrating different actors across silos, sectors, and worldviews which is often a central concern of transdisciplinarity (Klein, 2004; Hirsch Hadorn, 2008; Lang, 2012). Agenda 2030 specifically calls out the need for integrating

economic, social and environmental perspectives of sustainability. Processes aiming for integration should also consider the diversity of perspectives and worldviews represented in participants.

Finally, if (sustainable) transformations are to be achieved at a global level, the keyword of **universality** is central. The implication of universality is that process designers should consider how their work will or might contribute to global sustainability. Process designers should consider potential impacts at multiple jurisdictional, spatial and temporal scales when designing and delivering projects (Termeer et al., 2010). This is also emphasised in transdisciplinary research and (environmental) justice literature (e.g. Swilling & Annecke, 2012).

Exactly how these keywords can be realized in practice depend on context, which is why a search for blueprints and best practices is both unattainable and counterproductive. Instead, their realization is to a large extent dependent on our abilities to create and hold safe spaces for exploring unknowns through modes of experimentation and learning – processes that may unfold very differently across contexts.

2.2 Society-based laboratories as a safe space for experimentation and learning

In complex systems where external factors such as political and economic conditions are shifting rapidly, there are many unknowns, there is often a lack of trust and understanding between stakeholders, coordination is weak and there is little coherence regarding strategic orientation among actors. Unconventional but emergent governance approaches seeking to handle these challenges are transition labs and experiments (Evans & Karvonen, 2014; Hassan, 2014; Luederitz et al., 2016; Caniglia et al., 2017). Framed as a laboratory, one typically seeks to explore unknowns through modes of experimentation and learning-by-doing. This is motivated as a strategy for coping with the uncertainty, complexity and ambiguity prevalent in attempts of making sense, navigating and guiding transitions into desirable pathways and realize sustainable futures. Put concretely, transition labs create space for trust-building in multi-stakeholder settings, systems analysis, future envisioning, intervention development and reflection.

Emphasising the importance learning in transitions (Kemp, Schot & Hoogma, 1998; van de Kerkhof & Wieczorek, 2005; Smith & Raven, 2012), procedural aspects of transition labs become a central concern. It is simply not enough to bring together a group of actors around authentic and unscripted problems and expect (transformative) learning to happen (Budwig, 2015).

Although examples exist of case-based studies and practical insights on the “how” of guiding change, knowledge gains in this area are to a large extent tacit among practitioners. When knowledge gains on this topic are reported, they tend to be referred to anecdotally, or as experiences and lessons learnt (e.g. Rotmans & Loorbach, 2010). This leaves an opportunity and demand for rich empirical and systematic studies, comparisons and (cross-case) evaluations to attain deeper insights into “how” systemic change can be guided in practice.

2.3 Study Background

In this study we seek to advance knowledge on how sustainable systemic change can be guided in practice, and how the keywords of Agenda 2030 can provide value in such work. We argue that the conception of sustainability and desire for positive change may form strong coalitions and motivators for realizing transitions challenging the status quo. The study is exploratory in its approach, building on a description, comparison and cross-case analysis of two lab methodologies and insights from their application in their respective contexts. The analysis is partly guided by a novel analytical framework operationalizing keywords of Agenda 2030, to shed light on how sustainability transition processes (including transition labs) may contribute to sustainability transitions.

We explore the cases of two transition labs and their methodologies - the Energy Futures Lab (EFL) in Canada and the Challenge Lab in Sweden - in order to better understand the challenges and opportunities in guiding systemic change.

The EFL is a multi-stakeholder process in Alberta, Canada comprised of participants from across the energy system who are participating in a collaborative 5-year leadership development and rapid prototyping program designed to answer the question “how can Alberta’s leadership position in today’s energy system serve as a platform for the energy system the future requires of us?” The Challenge Lab approach was recently applied in the formation of a regional sustainable/low-carbon transition strategy in West Sweden engaging 120 actors related to energy, agri-food, and transportation systems. The overarching question was “how can we guarantee a good life for the region’s inhabitants in a climate neutral region?” The strategic work is now entering further stages into more specific areas of intervention, one of which is sustainable electromobility transitions in Gothenburg city, guided by the same Lab-based approach.

Both cases provide examples of methodologies and their real-world applications in guiding systemic change. They both seek to handle sustainability transitions, are of multi-stakeholder character, and use both backcasting and MLP. The authors of this study have in-depth experience from hands-on engagement in the cases studied. We do not claim that the cases are exemplary cases of transitions governance in practice, but they share elements in common that open up an opportunity to learn, reflect and explore across cases and contexts.

The following research questions are asked:

- How are transition labs ‘practically’ guiding systemic change towards sustainability?
    - What process characteristics and elements are used?
    - How can processes designed to guide sustainability transitions be assessed in relation to Agenda 2030 keywords?

3 Cases from Canada and Sweden

While similar in aim and focus, the two methodologies and their application in concrete cases take place in different contexts.

When the EFL was being planned, the price of oil was over $100USD/barrel, the Province of Alberta was governed by the Conservative Party who had been in power for 40 years and were supporters of the oil industry and minimized climate action, and the country was governed by the Conservative Party led by Prime Minister Stephen Harper who championed oil and gas and was reluctant to take action on climate change action. Since then, the price of oil dipped to a low of $22USD/barrel before rebounding to $69USD/barrel at time of writing. A newly elected provincial New Democratic Party and federal Liberal government have implemented wide sweeping environmental actions including provincial and national carbon pricing. However, the economic price paid by Canada and Alberta in particular has been staggering on both government and business. Oil royalties that account for a large proportion of government revenue fell by 75% from 2014/15 to 2016/17 (Government of Alberta, 2018). Over 60,000 energy sector employees have lost their jobs and recovery has been slow. Most recently, the province of British Columbia is in a fight with Alberta and the Federal government trying to block the construction of a pipeline that will carry Albertan bitumen from the oilsands to the B.C. coast. The Energy Futures Lab arrived at a time when the future of energy, system transition, and meanings of sustainability are top of mind for citizens, business, NGOs, and governments across the country.

West Sweden is an industrialized region of Sweden and an important transport hub with the largest port in Scandinavia. The region has a political goal of being fossil independent by 2030, and climate neutral by 2045 while securing a good life for all inhabitants of the region. Fossil independency is defined by the region as having an 80% reduction of greenhouse gas (GHG) emissions compared to the 1990 levels within the regional boundaries. It is also accompanied by a consumption target, aiming at reaching a 30% reduction of GHG emissions by 2030 compared to 2010 years' levels. Since 1990, the emissions have seen a reduction of 15% and the Regional Council has initiated a variety of activities to step up the efforts of reaching the targets. The low-carbon transition policy formation process was a focused effort to identify concrete areas of intervention for realizing the ambitions. The process was guided by the C-Lab methodology – initially developed for Chalmers University of Technology in Gothenburg, West Sweden (Holmberg, 2014).

Chalmers University of Technology has by tradition engaged in societal challenges, and played a key role in the establishments of five knowledge clusters in the region. The clusters seek to contribute to sustainability transitions both globally and in the region, in the areas of Urban futures, the Marine Environment and the Maritime Sector, Transport solutions, Green Chemistry and Bio-based products, and Life Science. Chalmers has further transformed its own institution into a matrix-organization with a number of Areas of Advance, that cross-cut the traditional university departments. The structure is supposed to make the University even more relevant for society by stimulating inter- and transdisciplinary research that address societal challenges (Holmberg et al., 2012). In this context, Challenge Lab was established to create space for students to be part of the transitional processes (Holmberg, 2014).

3.1 Energy Futures Lab in Alberta, Canada

The EFL consists of 60 energy system leaders (known as Fellows) from across the energy system including oil and gas companies, renewable energy firms, municipal, provincial and federal government agencies, academics, First Nations and NGOs. Convening partners of the EFL are the Natural Step Canada, the Suncor Energy Foundation (one of Canada's largest oil companies), the Pembina Institute (an environmental NGO), the Banff Centre (leadership and development organization), and the Government of Alberta. The majority of the funding for EFL comes from the Suncor Energy Foundation. The EFL was designed with three phases:

1. Commit to collaborating and begin to co-create a new, shared narrative about Alberta's energy system.
2. Map the desired transition in the system, prioritize collaborative projects, and engage stakeholders beyond the lab.
3. Co-ordinate action across a broad range of organizations, which in turn begins to shift the public narrative about energy issues. (Energy Futures Lab, 2018a)

This framework emerged from TNSC's experience with backcasting (Holmberg & Robert, 2000) and their desire to apply their sustainability principles along with design and facilitation techniques to systems transitions challenges. In practice, the EFL diverged slightly from Holmberg and Robert's conception of backcasting for a number of reasons. First, the widely diverse membership required a lot of time to be spent building mutual trust. Oil companies, environmentalists and government officials were initially quite skeptical of the collaboration. Second, these different stakeholders had very different view of the current state of the energy system in Alberta and the challenges it faced. Partly this was due to ideological differences but also due to the complexity of the system itself. For example, electricity generation and distribution uses different industry and regulatory structures than oil & gas extraction, processing and transportation which is different again from the renewable energy industry. These two design challenges led to additional time being spent on system sensing.

The EFL has evolved through a number of steps including:

1. System sensing - understanding the present system and prototyping to learn
2. Developing future vision - using backcasting process to co-develop a vision of the energy system of the future
3. Identify gaps - Identify the gaps between the current system and desired future and define intervention points
4. Prototype development and scaling - develop and scale prototypes for systems intervention

The goal of the EFL was to achieve "breakthrough results" defined as "New Partnerships, New Standards, Game-changing Business Models, Shifts in Public Narrative, and Changes in Public Policy" (Energy Futures Lab, 2018). The EFL design attempted to achieve these results through 3 streams of work. The first is a cohort of Fellows that meet for 2-3 day long workshops 3-4 times per year. These workshops were organized around different themes such as prototyping, backcasting, and initiative development. Through the workshops, EFL participants have learned about sustainability and systems change through different lenses including the MLP, the Natural Step's Framework for Strategic Sustainable Development

(FSSD) (Broman & Robèrt, 2017), innovation processes, systems thinking, strategic foresight, the role of narratives and a number of facilitation and process methods such as open space (used to generate and explore new ideas) and fishbowl conversations (used to facilitate emotionally charged conversations in a safe space). This learning has been facilitated by lecture style presentations, hands on workshop activities and interactive games. The second stream is an organizational engagement process that conducts workshops inside participant organizations such as Suncor and the National Energy Board delivering customized versions of EFL content. The final stream is public engagement that connects EFL to the public through media, events and public workshops.

3.2 Challenge Labs in West Sweden

In this section, the Challenge Lab (C-Lab) methodology will first be outlined, followed by process descriptions and outcomes from its application in two cases in West Sweden. The cases are the 'Challenge Lab' at Chalmers University of Technology for which the methodology was originally developed, and a regional low-carbon transition policy process in West Sweden in which an adapted version of the methodology was applied.

The C-Lab methodology (Holmberg, 2014) follows a backcasting approach that emphasises the formulation and use of guiding sustainability principles in the development of measures to induce, guide and accelerate transitions (system innovation) into desirable pathways. The methodology is positioned as 'sustainability-driven'. It complements idea-driven innovation logics that emphasise the development and push of ideas into society, and demand-driven innovation (pull) logics that emphasise the development of solutions to meet present needs in society.

The C-Lab methodology is guided by the four backcasting steps (adapted from Holmberg (1998)):

1. Framing a sustainable future on a level of principles and values
2. Analysing the current situation in relation to the principles: identifying gaps/challenges
3. Finding leverage points and conceptual solutions that can bridge the gaps
4. Identifying feasible ways/strategies to realize the solutions.

The process often plays out in facilitated participative settings where all four steps lead to results that potentially can be useful in inducing, guiding and/or accelerating transitions. Each step is accompanied by a set of techniques and tools, chosen on a basis of factors such as context, scope and intent of the lab. Often a smaller group works between the sessions to conduct syntheses and analysis work from previous sessions, as well as prepare and plan future sessions.

At Chalmers University of Technology the methodology is applied at 'Challenge Lab'. The Lab supports and creates space for students to engage with sustainability challenges in society. The Lab has a double aim: to provide meaningful learning experiences for the students involved, and create value in support of society's sustainability transitions. Each year approximately 20 master students from different cultural and educational backgrounds write their master thesis at the Lab. In a first phase the students seek to identify leverage

points to address sustainability challenges together with stakeholders on a local/regional level. Often leverage points are identified in areas in spaces in-between what each actor can or does govern by its own activity. In a second phase the students work in dialogue with the stakeholders to address the leverage point. Previous studies have identified that the students develop transformative leadership capabilities through their engagement at Challenge Lab, while also challenging underlying assumptions and build trust in society (Larsson & Holmberg, 2018).

In West Sweden the C-Lab methodology was applied to formulate a regional low-carbon transition strategy. The strategy was commissioned by the political assembly for Region West Sweden as a reaction to the slow decarbonisation pace of the regional economy, which has the goals of being fossil independent by 2030 and climate neutral by 2045. The process was led by the Regional Council and the County Administrative board, guided by the overarching question "how can we ensure a good life for the region's inhabitants in a climate neutral region?" The process aimed to produce outcomes as 'areas of effort' in which work should be coordinated and intensified to have an increased leverage in bringing the regional vision into reality. The process was structured in five parallel groups with a socio-technical framing as 'themes' being (a) energy, (b) transportation, (c) bioeconomy, (d) consumption of goods/services, and (e) lifestyles. In total 125 stakeholders were part of the sessions identified through snowballing to have a representation from private, public, academia and NGOs. Criteria for selection were primarily on their basis of possessing power (cf. Avelino, 2011) being reinforcive, innovative and/or transformative.

The process resulted in an identification of 80 proposed interventions that could shift the region into sustainable low-carbon pathways. The areas were further organized in 12 themes and 4 focus areas. Another outcome from the process was achieved on the level of the project team, shifting the focus on questions asked in the climate strategic work from "what to do" into "how to do it" (Larsson & Holmberg, 2016). The strategic work is now entering further stages into more specific areas of intervention. To achieve leverage in the areas, four ways of working and the essence of their integration were identified as key for the region's continued work: forerunning (including public procurement), planning, experimentation, and citizen engagement. One area identified with big leverage was opportunities for sustainable mobility transitions. A process on transition towards sustainable electromobility has been initiated in Gothenburg city, guided by the same methodology.

4 Methods

To gain insights in how to guide systemic (desirable) change through lab-based approaches, a case study-approach was chosen. It takes its starting point in the EFL and C-Lab methodologies informed by data from its application in practical cases. Case studies *"[investigate] a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and context are not clear"* (Yin, 1994, 13). The choice of multiple cases was based on the belief that contextual factors and circumstances external to the methodologies to a larger extent could be isolated out. Further, multiple cases allow for learning and dialogue between cases as well as researchers.

A cross-case comparison and analysis (Khan & VanWynsberghe, 2008) was conducted. First, similarities and differences were identified by comparing process characteristics and elements from the two methodologies. The similarities and differences between the methodologies were then analysed and discussed in relation to their intents. Finally, to reach recommendations for future lab-based initiatives seeking to guide systemic change towards sustainability, the case methodologies were assessed and discussed in relation to the keywords of Agenda 2030: *transformation*, *integration* and *universality*. The recommendations are to a large extent derived from experiences, data and the analysis of two methodologies and their application in particular cases. Hence, it is stressed that the knowledge gains here are partial but cumulative.

4.1 Data sources

Table 1: Data sources used for this study

Data sources	EFL methodology	C-Lab methodology
Interviews & surveys	Semi structured December 2016-January 2017 (n=18) April 2017 (n=24) January 2018 (n=34)	Region West Sweden: Semi-structured interviews with core project team December 2016 (n=3) Pre-post survey with participants (n=80) Chalmers: Course evaluation surveys 2014-2017
Documents	Internal planning, design and evaluation documents	Region West Sweden: Meeting protocols, process-related documents and evaluations Chalmers: Process-related documents and written articles on the methodology
Observations	Weekly team meetings from	Region West Sweden:

	January 2016-April 2018 8 Fellow workshops[1]	Team meetings before, during and after the workshops (10) 13 workshops Chalmers: Teaching and facilitating most Lab activities

After the Comparison and Analytical frameworks were developed (see below) the data sets were analyzed to find supporting evidence in the characteristics and elements as well as their intentions were identified.

4.2 Comparison Framework

A framework to guide the comparison was created. Its categories[2] consist of prevalent practical process characteristics and elements from backcasting and transition management. **Characteristics** refer to pre-conditions and qualities of the process, such as how the space is created and held, facilitation philosophies and reflexivity. **Elements** refer to activities occurring as discrete steps in the process: working with the future, working with the present, identifying gaps/doing interventions, and scaling. In the framework these categories are presented as 'Future', 'Present', 'Gaps & Interventions', 'Scaling'.

4.3 Agenda 2030 Analytical Framework

The analytical framework highlights potential operationalization characteristics drawn from Agenda 2030. For the **Transformative** keyword, we focus on two key questions: how did the process conceptualize and engage with the concept of sustainability? And, to what extent was the process focused on transformational and systemic change as opposed to incremental? We have divided the **Integration** keyword into two components: perspectives - referring to integration of multiple aspects of sustainability, different knowledges and perceptions and silos - referring to integration across functional, organizational or jurisdictional boundaries. Finally, we examined how cases had engaged with the questions of jurisdictional, spatial and temporal scales (**Universality**).

Through our cross-case analysis, we looked for presence - or absence - of these indicators in order to make an assessment of how each case is engaging with these keywords in both intent (i.e. design phase) and realization (i.e. implementation and project outcomes). Note that we propose a preliminary method of operationalizing the Agenda 2030 keywords as a

[1] EFL workshops observed: Banff (November 2015), Edmonton (January 2016), Kananaskis (May 2016), Calgary (October 2016), Red Deer (February 2017), Canmore (May 2017), Waterton (October 2017), Olds (January 2018)

[2] These categories do not claim to cover all aspects of transition labs, but were selected on the basis of the purpose of this study. The categories partly emerged from a conversation among the authors when comparing the respective processes.

means of demonstrating the feasibility and usefulness of this approach. A more robust framework including sets of indicators drawn from literature on evaluation of social innovation labs, transition experiments and transition management (cf. Schäpke et al., 2017; Williams, 2017, United Nations, 2015) is underway by the authors and will be published in a future paper.

5 Results and Analysis

The two cases share many similarities in their goals, focus on systemic transition rather than technological innovations, and the use of methods such as backcasting and the MLP. However, there are important differences in the context in which the labs take place, such as process, which tools and methods were utilized, and the beliefs and values of participants. These similarities and differences between cases provide a basis for fruitful comparison, analysis and learning about processes that may guide systemic change.

First, a comparison is made between the two methodologies to illuminate similarities and differences between the cases. The comparison is then followed by an analysis in relation to the Agenda 2030 framework.

5.1 Illuminating similarities and differences in the methodologies

Table 2: Comparing Process Characteristics and Elements

	C-Lab	**EFL**
Process Characteristics		
(Pre-)conditions Qualities	Backcasting approach to "stay in the question" Holding and maintaining space of openness and trust	Creating safe space for dialogue and innovation Facilitating networks and connections
Process Elements[3]		
Future	Guiding principles Values clarification	Backcasting Scenarios Three Horizons
Present	Systems dynamics/mapping, MLP Multi-stakeholder dialogue	System mapping through multiple lenses Energy trends analysis
Gaps & Interventions	Design thinking Co-creation	Prototyping Portfolio mapping
Scaling	MLP/transitions Scenarios Diffusion of Innovation Effectuation	MLP

[3] See Appendix 1. Tools & Techniques Descriptions for descriptions and background concepts/theories for each of the tool and techniques referenced here

While there are many similarities between the two cases, there are a number of key differences that are elaborated upon in the following subsections. The comparison seeks to illuminate where the respective methodology has something to learn, and the rigour of how the various process characteristics and elements are realised in practice.

5.1.1 Backcasting as approach vs. tool

First, in C-Lab, backcasting is used as an overarching approach in which different tools and techniques are subordinated and sequenced. In the EFL, backcasting is understood as a technique that is used at a point in the process to generate a shared vision of the future, compare that to today and identify points of leverage for prototype development. These two ways[4] of referring to backcasting as an overarching framing and approach or as a certain tool and technique have been considered one aspect distinguishing "participatory backcasting" from "transition management" (van de Kerkhof & Wiezcorek, 2005; Quist et al., 2013).

5.1.2 MLP as approach vs. tool

A similar difference in interpretation of backcasting exists with the use of the MLP. The EFL use MLP throughout the design process to assess the current state of the system, identity intervention points, map the portfolio against MLP to check the alignment to transition, and informed a number of process design elements such as building niche-regime networks, creating space for innovation, supporting mutually reinforcing dynamics between niche innovations and embedding landscape context monitoring and adaptation into the EFL itself (Williams, Forthcoming). The MLP also informs plans for "EFL 2.0" which will focus more explicitly on bridging the niche and regime to scale niche innovations and shift regime players in a more sustainable direction. The EFL 2.0 strategy is to "influence [the energy transition] by niche activities, by practice and policies, [and] influence markets through cultural landscape." (Energy Futures Lab, 2017)[5]. Within the C-Lab methodology, the MLP is used as a tool to identify and analyze opportunities, unsustainabilities and trends in present niches, regimes and landscapes. The analysis is done in relation to the sustainability principles formulated in the first step to give a sense of gaps/challenges. MLP then comes in again in the last phase of the process to analyse and establish transition pathways once measures for bridging the gaps have been identified and iterated upon.

5.1.3 Use of scenarios

Scenarios are used in both processes but at different stages. The EFL used scenarios generated by the Government of Alberta to help gain a clearer picture of possible futures and assess how the portfolio of interventions may perform in different scenarios. The C-Lab used scenarios as part of the scaling phase. When suggested solutions have been developed, their performance are evaluated against critical external uncertainties in alternative futures. This evaluation is used to trigger further development of solutions to increase their robustness in alternative futures.

[4]There are several ways in how backcasting is referred to and applied (cf. Vergragt & Quist, 2011 for an elaboration)

[5] Williams is conducting ongoing research on the societal effects of EFL. The authors plan a future paper that compares outcomes of the two cases in more detail.

5.1.4 Gap identification and leverage points

Both processes used gap analysis to identify leverage points for lab projects. However, the EFL continued to use gap analysis through the life of the project to assess the portfolio of interventions. This analysis was conducted at multiple points throughout the project and used MLP, 3 Horizons (Sharpe et al., 2016), and an energy system value chain as frameworks for gap identification. This analysis led the EFL team to adjust its portfolio and invite new Fellows into the Lab from, for example, agriculture, the financial sector, and natural gas industry (Williams, Forthcoming).

In C-Lab, leverage points are identified in the gaps and challenges spanned up by on the one hand the guiding principles and values, and on the other hand a representation of socio-technical systems and their dynamics in the present. Leverage points are described (where, what, when, how) to intervene, as well as motivated (why).

5.2 Agenda 2030 Framework analysis

Both cases provide insights into how the transformative, integrative and universality keywords appear in practice. In our analysis, we first describe how the EFL and C-lab processes engaged with the transformative, integrative and universality keywords - in other words what the processes intend to do. We then discuss the experience of the Lab processes - in other words, what actually happened - and reflect on how the processes may better engage with Agenda 2030 keywords.

5.2.1 Transformative

5.2.1.1 Engaging with sustainability

Both cases have an explicit goal of sustainability and the need for systems transformation. The C-lab embeds principles referring to a “sustainable future” considering sustainability in its broad meaning, not solely “low-carbon” transitions and focuses on change in socio-technical systems. The EFL has built this principle into its convening question to “transition to the energy system the future needs” (Energy Futures Lab, 2018) and the EFL vision has a timeframe of 2050 which encourages long-term thinking and allows space for experimentation.

Assessing the transformative impact of sustainability transition labs is not a simple task and is the focus of much current research (cf. Luederitz et al., 2016; Wiek et al., 2014, Williams, 2017). For example, it is difficult to capture transformative outcomes for an ongoing process and the time scales at which these impacts may show up are longer than this study allows. However, we can make claims about the actions the cases have taken to realize their transformative intent. EFL Fellows have co-created a new alternative vision of the future of energy in Alberta that is shared by the wide diversity of Fellows. However, acceptance of this vision beyond the EFL itself has not yet taken place.

In West Sweden, the C-Lab methodology encouraged the process team to extend the time-span for the principles-envisioning process from 2030 to 2050. The time shift gave space to conduct broader conversations on infrastructure futures, refinery transitions etc. that

typically have longer investment cycles and payback periods. Without the shift to 2050, such perspectives would most likely have been left out of the conversation. Further, a shift was made from focusing on low-carbon futures in the climate strategy, to focusing on the realisation of sustainable futures, including social, economic and well-being aspects.

5.2.1.2 Engaging with systemic shifts

EFL goals are defined in terms of systems transition including new partnerships, standards, business models, shifts in public narrative and changes in public policy along with technological innovations (Energy Futures Lab, 2018a). The C-Lab methodology intends to provide transformative learning experiences, build trust in multi-stakeholder environments and identify leverage points that can induce change in socio-technical systems.

As described above, the EFL used MLP and other models to assess the transformative potential of their portfolio of interventions at multiple times during the process. Participants have reported increases in knowledge about the energy system along with greater confidence to take action in transition, participant networks have grown and strengthened leading to new partnerships and collaborations, and new social and technological innovations have been delivered. Projects initiated by Fellows have contributed to policy development at the municipal and provincial levels and there have been shifts in how partner organizations talk about sustainability transition internally and externally. However, there have been concerns expressed by participants that the vision and projects of the EFL are not transformative enough. The role of regime incumbents within transition processes and resources available to scale prototype projects may have been factors and deserve further exploration.

At Chalmers University, it has been concluded that the students in C-Lab develop transformative leadership capabilities while also creating value in support of sustainability transitions in society (Larsson & Holmberg, 2018). In the low-carbon policy process in West Sweden, the C-Lab methodology guided a shift from a production-perspective on carbon emissions into a socio-technical problem framing. This meant that the object of focus in the sessions were not sectoral emissions from agriculture, industry, transport etc. Instead, focus was on transitioning systems providing societal functions, i.e. agri-food systems, energy systems, transportation systems, and systems related to various consumption of goods and services among the region's inhabitants. The participants in the process identifying areas of interventions experienced an increase in systems- and transformation knowledge[6] having gone through the backcasting process (Larsson & Holmberg, 2016). It is however too early to say what eventual implications this have had for the interventions the Region lead and support.

[6] cf. Walter et al. (2007) for an elaboration on the different kind of knowledges used in this study

5.2.2 Integrative

5.2.2.1 Integrating Perspectives

The first element of the **Integrative** keyword is integrating multiple perspectives including broad conceptions of sustainability (i.e. social, environmental and economic) as well as broadening the perspectives and understanding of participants. Again, both the C-lab and EFL demonstrated this approach. The EFL vision of the future reflects social, economic and environmental concerns. "Partnership leading to reconciliation with Indigenous peoples" is explicitly in the EFL vision which represents both an inclusion of different perspectives from a political standpoint but also respecting Traditional Ecological Knowledge. In the C-lab, Sustainability is engaged with in the dimensions of "ecological", "social", "economic", and "well-being". C-Lab also focuses on building openness, trust and perspective awareness through dialoguing, creating conditions for fruitful experimentation where one dares to make mistakes, intended to enhance the capability of handling complex sustainability challenges together.

The use of multiple lenses for systems analysis fostered an integrative perspective amongst EFL participants from the early days of the lab. The inclusion of learning journeys to industrial facilities, renewable energy projects and First Nations sites of historical significance also added multiple perspectives to the EFL. EFL Fellows now feel they have deeper insights into the dynamics of 'transition' to a carbon constrained future while some report increased insight and empathy into the perspectives, narratives of other actors in the system (e.g. *"I did not know that energy companies were so interested in sustainability*") (Energy Futures Lab, 2017).

The C-Lab methodology has experienced value in staying with the question of what sustainability entails before moving into analysing problems in the present and immediately developing solutions. Participants report from framework-creation sessions on sustainability principles as e.g. *"supporting the possibility of lifting the view*", and report that it has broadened their views of sustainability. Participants also reported the importance of the framework when identifying and framing challenges at further stages in the process.

5.2.2.2 Working Across Silos

The second element of the **integrative** keyword is working across silos. Here the focus is on working across disciplines and sectors and developing boundary-crossing collaborations and partnerships. This requires fostering trust amongst a diverse set of participants in order to reach, if not consensus, at least common agreement on a way forward. The C-Lab includes representation across sectors, public, private, academia (including students), and NGOs. C-Lab is often identifying and operating in multi-stakeholder contexts, in between what the respective actor can govern individually. Much of the EFL's work in system sensing was focused on building trust and relationships amongst the 60 Fellows from across the energy system - Oil & gas, Electricity distribution, Renewable energy producers, First Nations, Federal, Provincial & Municipal governments, Academia, NGOs, Industry (Energy Futures Lab, 2018b).

About 2/3 of Fellows are connecting on EFL activities outside the Lab (e.g. information sharing, education/training, joint projects, brokering relationships) demonstrating a high-

level of network connection that span jurisdictional and institutional boundaries. Fellows also report a sense of connection to other Fellows and respect for commitment & diversity but expressed concern that the full energy system was not represented, especially First Nations.

The C-Lab methodology at Chalmers has reported facilitation across societal sectors in a range set of initiatives. An example is the initiation of an electromobility transition strategy for the city of Gothenburg, an activity that involved traffic and city planners, car manufacturers, carpooling organizations and mobility researchers.

5.2.3 Universality

The keyword of **universality** suggests that processes should assess transferability and scalability (i.e. the ability of outcomes/processes to be transferred or scaled) when designing and delivering projects (Schäpke et al., 2018). Within the EFL, this manifested as an early debate within the EFL design team and Fellows was the appropriate scale of intervention. The EFL wrestled with questions such as: would it even matter if we shut the oilsands down (0.1% of global GHG emissions)? Would it not be a bigger global impact if we focused instead on producing natural gas that can displace Chinese coal consumption impacting 24.5% of global GHG emissions (Government of Canada, 2018)? For the C-Lab methodology the universality keyword is reflected in the way system boundaries are set – typically, sustainability is engaged with as a global concept, and any progress made locally is reflected in its eventual implications elsewhere.

The EFL team decided to focus on Alberta working on what was within their sphere of influence. However, questions of universality and appropriate scale of intervention are alive in academic, policy circles, and in the public debate in Canada on oilsands and pipeline development. Internal EFL discussions are now underway for a national scale EFL in Canada to specifically address these issues of scale within the country, not just the province. In the West Sweden low-carbon transition process, a consumption perspective was acknowledged and particularly emphasised in one of the groups, considering environmental (and sustainability) effects caused by individual consumption and lifestyles, regardless of where in the world the emissions occur. For example, from a consumption perspective in Sweden most carbon emissions are caused by long distance travelling and meat consumption. There are little mandates for a local municipality or a region to handle these issues, yet they have the largest implications for climate and sustainability. By bringing this perspective in and having explicit conversations on the issue brings in some aspects of universality. This perspective has later been spread to other municipalities and regions in Sweden.

5.2.4 Summary

Both cases have demonstrated intent, action and outcomes engaging with the Integration keyword. Both the EFL and C-lab have an explicit design intent to foster diverse networks. Interestingly, both cases highlight the importance of trust-building amongst networks as an enabling factor for transformative change. In addition, both cases demonstrate integration of different perspectives of sustainability and a focus on co-production of knowledge and transformative learning. However, we do not claim universal importance of all process design elements from our cases for every lab. This study represents our experience and key

findings from this study, and we anticipate future work and comparative cases studies in order to make more generalizable claims.

6 Key findings

Below a number of key findings are presented, which are then related back to the ambition of the study followed by suggestions for further work and implications for research and practice.

We have identified it as a valuable practice to engage with the keywords of Agenda 2030 as a complement to the 17 SDGs in designing and reflecting upon methodology design and outcomes. If one is to achieve transformative change, the SDGs risk becoming a checklist focusing on "what to do" without any critical reflection and challenging of existing practices and assumptions. As argued for by transition scholars (Rotmans et al., 2001; Smith et al., 2005; Voss et al., 2006; Loorbach, 2007) experimentation, learning and reflexivity lie at the centre when entering uncertain terrain. Here, the "how" question is of central importance, and the three keywords *transformation*, *integration* and *universality* may play a role in guiding such activities. Through a continuous reflection upon how our practices align (or not) with *transformation*, *integration* and *universality,* the future called for by Agenda 2030 can be experimented with already in the present.

For a lab methodology to be transformative, this study has identified two components of particular importance. C-Lab and EFL stress one component each, and each has much to learn from the other. C-Lab emphasises the essence of staying with the question: *where are we going, and why?* What are some guiding principles of the future that we want to create? What do we mean with sustainability? The time frame is here important to leave considerable room for transformation, adjustment and deliberate choice. The scope is also of importance: how many perspectives are brought in? Is sustainability solely about a low-carbon future, or does it also entail social aspects, economic aspects and aspects related to well-being?

EFL emphasises the need to get a rich picture of the systems you seek to engage with and understand them at different levels, scales and perspectives. Here a variety of approaches are used: MLP as an overarching framing of systems change complemented with value chain analysis, socio-ecological aspects and three horizons. It has been important to iterate this systems understanding, as the context in which EFL is situated is contested and rapidly evolving.

Further, the creation of a safe space is emphasised in both methodologies. The idea is to foster trust-building, to experiment (and dare to make mistakes together) and reflect. Here the facilitation and a clear process has been of critical importance. This removes unnecessary uncertainties and when facilitated skilfully, the process is carefully scaffolded to stay focussed without imposing constraints. The integrative keyword provides a lens through which process designers can challenge their own designs especially around inclusivity and diversity of participants, perspectives, and worldviews.

A last note on the integration keyword that may be of special importance for "lab" activities that are meant to be performed 'outside' mainstream systems and practices, is that there is a risk that labs merely become creative "post-it" activities conducted as isolated islands without connection or learning across systems. There is an inherent tension in small-group

processes that represent a broader system (cf. Kahane et al., 2013). It is just as important for process designers to facilitate connections between the transition lab and the broader system along with brokering connections between lab participants.

6.1 Areas for further research

This single study is not adequate to answer all the questions our approach raises, but a step in the direction to understanding the why and how of guiding systemic change. We foresee future research in three main areas.

First is the need for further elaborating the operationalization of the Agenda 2030 framework with a comprehensive set of indicators and development of additional cross-case comparisons. In parallel to this contribution, also submitted to the IST-18 conference, is an attempt to use the same keywords to contrast experimental arenas through the lens of Agenda 2030 building on a broad literature review (McCrory et al., forthcoming).

The second area of needed research is on how Agenda 2030 framing could be used as a conceptual framework for evaluating contribution of labs processes to transformation. The authors are developing this approach and Williams plans to apply this framework to evaluate the EFL's contribution to system transition. The authors plan to further develop these cases to include a cross-case comparison of EFL and C-Lab outcomes and attempt to link tools/processes to outcomes.

Third, we see the need for further research on the variety of process design elements that can support the Agenda 2030 keywords of *transformation*, *integration* and *universality*. For example, it was identified in the comparison that C-Lab and EFL engage with backcasting and MLP in slightly different ways. C-Lab frames its entire process in a backcasting approach where MLP is applied as a tool in a certain step. EFL instead frames its process through a MLP lens whereas backcasting is engaged with at a certain step in the process. An experience from the C-Lab methodology is that its backcasting framing supports the engagement of sustainability as a challenge, opportunity or even responsibility; rather than a problem, risk or obstacle. With a backcasting framing, one takes a clear stance in not letting the past and present dictate the future (Robinson, 1988), a shift denoted by Ringland (2002) as stepping out of *"the tyranny of the present"*, and Stewart (1993) as not letting *"what is"* hinder *"what could be"*. This shift also resembles Senge's (2003) emphasis of moving *from reactive problem solving to creating desirable futures.* In the EFL, the framing has instead been to make sense of complex dynamics of present systems and design interventions to guide system developments into sustainable directions, a process to a large extent framed by MLP. Both cases however stress that process sequencing has an implication for how the labs unfold, but at this this stage, it can only be established that both framings matter in a sustainability transition context. Further work needs to be done to understand its eventual implications and how the framings potentially could be combined.

7 Conclusions

In this paper, we have argued that transition labs can have a transformative impact across systems and that the Agenda 2030 keywords of *transformation*, *integration* and *universality* provide guideposts for practitioners designing and facilitating transition labs. Processes seeking to facilitate transformative change are sometimes conducted with a sense of urgency and rush for solutions, rather than through thoughtful reflection by "staying with the question". The process characteristics and elements utilized by the Energy Futures Lab and Challenge Lab illustrate an approach to guiding systemic change that engages with broad conceptions of sustainability, integrates different perspectives and focuses on the link between context-specific local interventions and global sustainability. Backcasting and the multi-level perspective are process elements that have helped our two cases engage with the Agenda 2030 keywords in an effort to foster sustainable systemic change.

As researchers and practitioners around the world work to foster sustainability transformation at a global scale, we navigate the complexities and unknowns of transition. We propose that engaging with Agenda 2030 keywords will help ensure these processes are most effective at guiding systemic change and support a transformation from an unsustainable present to a sustainable future.

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10 Appendix 1. Tools and Techniques Description[7]

Tool/Method Name	Background concept/theory	Practical uses
Backcasting	Philosophical framing by Robinson (1988; 1990) and Dreborg (1996). Backcasting from principles by Holmberg & Robèrt (2000).	Approach and technique to: - envision sustainable futures and how they might be achieved - guide innovation based on future sustainability rather than ideas and needs in the present - consider the future as something to be created
Guiding principles	Thinking based on Holmberg, Robért & Eriksson (1996)	Conceptual tool to: - Guide thinking beyond today's unsustainable and locked-in systems - Integrate the sustainability dimensions - Support co-creation through fostering of shared mental models
Values clarification	SelfLeaders (selfleaders.com and valuesonline)	Tool to: - Clarify one's own values and motivations - Build openness and trust in a group
Three Horizons	Sharpe et al. (2016)	Assess portfolio of innovations within a process. If innovations tend to be skewed to Horizon 1 and 2, challenge whether process should be thinking more transformationally.
Multi-level Perspective (MLP)	Element of socio-technical transitions theory articulated by Geels (2007; 2011), Berkhout et al. (2004) and Loorback & Rotmans (2010	Analyze current state of system to identify what niche innovations are present, the key regime actors (and their motivations), and landscape pressures.
System mapping through multiple lenses	-	Different lenses (e.g. value chain, MLP, Three Horizons) all provide different insights to Lab participants. Multiple lense analysis can facilitate discussion and surface gaps that might exist in single lens analysis.

[7] Organizing principles for Appendix 1 adapted from Kapitulčinová et al., 2018.

Energy trends analysis	Proprietary process developed by Government of Alberta Department of Energy	Collection of observed energy system trends locally, nationally and internationally. Used to facilitate discussion on importance and relevance to local context. Also useful in establishing a common understanding of the current system.
Systems dynamics/mapping	Forrester (1995), Meadows (1997), Haraldsson (2004)	To map out causal relationships between components of a system, to make sense of complexity and identify points of leverage
Multi-stakeholder dialogue	Isaacs (1993), Bohm (2013)	A procedure to voice different opinions and think together by "agreeing to disagree", i.e. moving into dialogue rather than consensus.
Portfolio mapping	-	Similar to system mapping through multiple lenses, this method maps a portfolio of innovations against multiple lenses for completeness. This leads to strategic choice as to where a Lab will focus e.g. a specific link in the value chain or an end-to-end approach
Design thinking	Lawson (2006)	The fundamental ideas of design thinking is to rapidly develop prototypes and iterate upon those, considering prototypes not necessarily being close to a finished product or process, but as an object around which conversations can be conducted and information about e.g. preferences be gathered
Prototyping	Method to test new ideas. (cf. Design Thinking) Practical applications for Labs through groups such as Nesta (www.nesta.org.uk) and IDEO (www.designkit.org) and Cabaj (2017)	May be used to: "Surface new ideas, make ideas tangible, test the "manifestations" of an idea in the field, provide a full, robust,longer term test of the idea, or used to make a decision to adopt,scale, or let go of an idea" (Cabaj, 2017)
Co-creation	-	Emphasis on working in each other's strengths rather than weaknesses'
Transition theory	Articulates a view of how socio-technical transitions take place. Main components are MLP (e.g. Geels 2007), Transition Management (e.g. Loorbach	Useful to help Lab participants understand system change dynamics, gain insight into current system actors and find system intervention points. Particularly useful when system contexts

	2010), and Strategic Niche Management (Kemp et al. 1998)	are changing rapidly.
Scenarios	Descriptions of potential futures. First developed by Shell Oil for strategic planning purposes. Conceptualized for use in transition processes by Robinson et al. (2011); Lyons et al. (2013); Loorbach & Rotmans (2010)	Used to make concrete possible futures and used for decision making. Key is to propose "multiple incommensurable futures" and clarify we cannot accurately predict which future will emerge. However, we can assess proposed interventions based on how well they will perform in multiple possible futures.
Diffusion of Innovation	Robinson (2009)	An overview of what qualities make innovations spread
Effectuation	Sarasvathy (2001)	A prescriptive model for creating value emphasising on taking action, building around the questions what I can do, what I want to do, who I know and should interact with, seeking commitment and then iterating upon the questions in the process of acquiring new means and goals.

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