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ADAPTING THROUGH ORGANIZATIONAL CHANGE IN CAPITAL PROJECTS ORGANIZATIONS

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ADAPTING THROUGH ORGANIZATIONAL CHANGE IN CAPITAL PROJECTS
ORGANIZATIONS

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THESIS
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A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in Civil Engineering in the
College of Engineering
at the University of Kentucky

By

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Lexington, Kentucky

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2022

ABSTRACT OF THESIS

ADAPTING THROUGH ORGANIZATIONAL CHANGE IN CAPITAL PROJECTS
ORGANIZATIONS

Organizational change can be defined as an alteration of a core aspect of an organization's operation, structure, or culture. Previous research on organizational change mainly has focused on different types of technical changes, such as alternative project delivery methods and strategies to adopt the design-build approach successfully. Also, previous studies have focused on the project level changes instead of organizational level responses. Here I show using a proposed change model and performing thematic, and analysis, that there exist common responses, and challenges across different types of capital projects organizations studied. The results show that responses to change will differ as a function of the type of change, and the organization's capabilities and resources. Furthermore, when performing organizational changes, the impact on "people" within the organization should be closely studied and monitored, while taking into account other challenges that might impact the organization.

For drivers of change, the main themes were related to Market shift. Clients/owners' needs, and Sustainability. On the other hand, the organizational responses' main themes were related to Restructuring, Communication, Partnerships, Training, Recruitment, Internal capabilities, organizational design, and supportive leadership. While for challenges, the main themes were mainly related to Resistance to change, the nature of the industry, and retaining the workforce.

One of the major challenges faced during the research was motivating the organizations to participate. Various organizations showed interest and then decided not to join, while others that participated had to review their responses multiple times, and were concerned about revealing their "Trade secrets".

Future work should build on this effort and consider the responses and analyze them as a function of types of change, Moreover, future research should consider asking the interviewees to "weight" the responses to avoid wrong conclusions due to the low number of in-text mentions. This research will help capital project organizations to be aware of the main areas of concern during the journey of change and help them to learn from previous experiences from other organizations.

KEYWORDS: Organizational Change, Drivers of Change, Capital projects organizations, Project-based Organizations, Social Networks, Thematic analysis, Concept Maps

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TABLE OF CONTENTS

1.1 List of tables

1.2 List of Figures

CHAPTER 1. INTRODUCTION

1.1   Capital projects organizations

Capital projects organizations can be defined as project-based organizations that create temporary systems for carrying out their work (Michel, 2007). These organizations could include different industries such as construction, energy, and manufacturing. Moreover, capital projects organizations handle complex, high-value projects, such as airports, data centers, refineries, powerplants (traditional or renewables), and with the aim to either improve operating-level capabilities or create a new product, service, assets for an expected profit (Accenture, 2020; Barone, 2020; Caldas et al., 2015; Scott-Young & Samson, 2008).

In recent years, organizational change within the capital projects industry has been a central concern for various practitioners and researchers due to the continuously changing markets and new emerging challenges which are facing the industry as a whole (CII, 2020). Various studies have highlighted some of these challenges that are affecting capital projects. For example, Forrest et al., (2020) showcased that at least 60% are seeing cost overruns in their organizations due to various challenges including oil and gas prices, and limited government spending.

In addition, there are various drivers and challenges impacting capital projects, including sustainability requirements and regulations, limited funding, skilled workers scarcity, digitization, industrialization, and internationalization (McKinsey, 2021a). In addition, the COVID-19 pandemic has already accelerated various changes, such as remote work, and digitization in various industries including capital projects (Orzeł & Wolniak, 2022). Furthermore, (McKinsey, 2021a) has performed a survey to analyze the expected changes to the capital projects industry. The results show that more than 75% of organizations' executives believe that major changes are likely to occur in the industry within the next five years. Also, (McKinsey, 2021a) showed that there is a large pool of profit waiting organizations that adapt through future changes, and it is estimated to be $265 billion.

Therefore, studying organizational change is important because it will allow capital projects organizations to learn from their own experiences, grow, and survive the continuously changing environment (Stobierski, 2020).

1.2   Research background and Gap

Organizational change was defined in the literature in many ways; it can be defined as an alteration of a core aspect of an organization's operation, structure, or culture (Stobierski, 2020), Or the process by which the organizations move from a current state to a desired future state to increase their operational effectiveness (Ameh & Karette, 2015). Many studies have discussed different types of organizational change in the capital projects industry, such as alternative project delivery methods, new workflow implementations, the application of various technological tools, new safety programs (VardiReddy, 2017), or knowledge transfer (Caldas et al., 2015). However, various studies have focused on the technical aspects and benefits of different changes on a project level

within capital projects organizations with a limited focus on changes on the organizational level (Erdogan et al., 2005). For example, (Gerdin et al., 2010) thoroughly discussed the application of change management models in capital projects organizations, and highlighted the challenges faced by a capital project organization during the process of implementing a new project management visual tool. One of the main challenges that faced the organization was the "lack of motivation" to properly implement the tool due to poor "communication" from the managers. Also, discussed how change management can be applied during the lifecycle of a construction project and proposed a change management model which can be used by other capital projects.

Even though there exist various studies that discuss the organizational change in capital projects organizations, however, previous work only discussed changes on a project level and didn't analyze organization level changes, for example studying strategic responses by capital projects as a result of certain drivers of change.

1.3   Research question, objective, and scope

Studying organizational change at the organization level is important because only organizations with proper change strategies, structures, processes, and technologies can transition more efficiently and, as a result, reduce resource utilization, adapt to shifting market trends, and maintain their competitiveness (Burke, 2018). In addition, The results of organizational change performed by different organizations are not consistent within the capital projects industry, where some organizations fail while others succeed (Isaksson et al., 2011). The main objective of this research is to provide an overview of the past and present changes facing capital project organizations, and to understand what drove these changes, and how they responded to them. The main focus of this research will be organizational level, which differs from previous works on capital project organizations. Moreover, the scope will focus on capital projects in different industries while targeting owners and contractor organizations. This is due to the fact the value chain of capital projects is mainly composed of them (McKinsey, 2021b). Therefore, studying them will provide a more general overview of the organizational change in the capital project industry

The aim is to provide a general overview of organizational change in the capital projects industry and understand the main drivers, responses, and challenges that are common during the process of change. Therefore, the main research question that will drive this effort is

1. How did capital project organizations respond to change? What are the main responses performed? What are the main challenges faced by the organization?

1.4   Structure of thesis

The thesis is composed of seven chapters, Chapter 1, provides a brief introduction to the study. Chapter 2 provides a broad overview of organizations, organizational change diagnoses, drivers of change, and organizational design, which will help in creating the

research change model. Chapter 3 discusses the methodology and provides a detailed overview of the research process, including interviews, coding, and social network analysis. In addition, Chapter 4 presents case studies' narratives which provide an overview of the drivers of change, responses, and challenges. Moreover, Chapter 5 presents the results of the analysis of the data collected and presents the concept maps for different case studies. Chapter 6 provides a discussion of the results of the case studies and the social networks. Finally, chapter 7 presents the main conclusions of the study.

CHAPTER 2. LITERATURE REVIEW

2.1 Overview of organizations:

Organizations can be defined as social and physical structures created by individuals to achieve a set of common goals (Leana & Van Buren, 1999). However, in literature there exist various definitions for Organizations. Senior and Fleming (2016) defined it as physical spaces where a group of people work and interact and are motivated by a common goal. Moreover, (Senior & Fleming, 2016) viewed it as a system of interacting subsystems in a constantly changing environment that receives input and processes it to create an output, the input could be composed of materials, or resources (including services), while the output includes services or products as shown in Figure 2-1. Moreover, the organization is composed of formal and informal subsystems, these subsystems were discussed by (Nadler & Tushman, 1999; Stacey, 2007; Child, 2012); the formal subsystem is dictated by the organization's strategy and it includes technology, processes, and structure; while the informal subsystem is related to intangible elements such as communication, power, and influence, values and norms, which represent the culture of the organization.
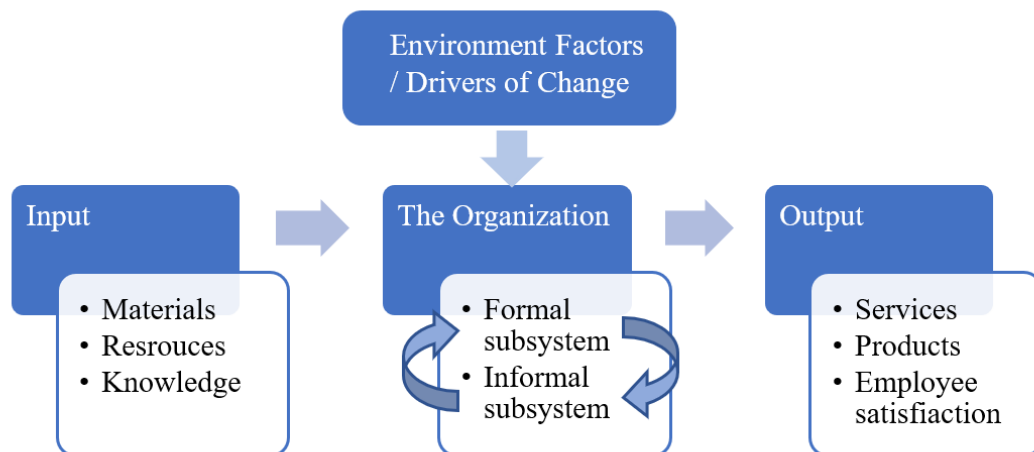
Figure 2-1 Organizations model summarized from (Senior & Fleming, 2016)

In addition, they discussed how these subsystems interact with each and how they are influenced by different environmental factors (drivers of change), which can be economic, technological, political, or socio-cultural. Moreover, the drivers of change will dictate the type of change within the organization and that will be discussed further within this section. Finally, the output in this model can represent the primary goal of the organization's existence, however, other outputs that are particularly relevant to the informal subsystem such as employee satisfaction (Vermeeren et al., 2014). Having understood the basics of organizations, the next step would be understanding the importance of studying them.

2.2   Importance of analyzing Organizations

When studying organizational change many factors should be considered. Jacobs et al. (2013) highlighted the importance of analyzing organizations from a micro and macro perspective, meaning analyzing the drivers of change impacting the organization, while understanding the organization's responses, and how different elements of an organization are affected, such as structure, or processes. In addition, (Armenakis & Harris, 2009) discussed the importance of properly diagnosing organizational change, since it will allow the organization to survive the future changes. Moreover, (Armenakis & Harris, 2009) advised performing various change audits to identify the problems (for example low profits), and analyze the causes behind them, which can help mitigate the future challenges. Therefore, an accurate and effective diagnosis is critical to preparing the organization for future and current changes.

To study organizations, (M. Beer, 1971) advised three different data collection methods, such as observations, interviews, and surveys. In addition, (McFillen et al., 2013) provided various prompts on how to properly study organizational changes, and one of these methods includes creating a "model" that will help analyze organizational change, drivers, and the rate of change. Therefore, the coming sections will discuss different aspects of organizational change will help in creating the change model, such as drivers of change, and organizational design which can help to pave the way and create a new change model.

2.3   Drivers of change and Futures Triangle

Whelan-Berry (2003) defines change drivers as events, activities, or behaviors that facilitate the implementation of change. While (Dick, 1995) referred to them as "change accelerators", or "catalysts" (Whelan ,1997).

Various examples from literature showcased how drivers of change can be analyzed. Oakland and Tanner (2007) interviewed senior management from 28 different organizations (including engineering and manufacturing) and identified eight drivers of change that can be categorized into external and internal drivers of change. Moreover, they identified the "dynamics of internal drivers", which can be considered as a manifestation of the external drivers (Oakland & Tanner, 2007). For example, if there is an increase in customer demand, then internally, the organization will be forced to enhance products/services quality and improve the innovation process to keep up with the demand.

Moreover, (Oakland & Tanner, 2007) provided examples of external drivers of change such as government regulations; and internal drivers such as improving operational efficiency, and processes improvement.

The previous CII RT-360 project identified 16 drivers of change for capital projects and mapped those drivers using a technique known as the "Futures triangle" (CII, 2020). In addition, early work by (Inayatullah, 2008, 2013; Russo, 2019) has shown how this method could be used to help organizations analyze their current state and draw a plausible image of the future they aim to achieve.

"Futures triangle" was first introduced by (Inayatullah, 2008), which is a new approach to studying the future. The purpose of the future triangle is to map today's future views by integrating three dimensions. The "pull of the future" represents the image of the future that pulls us forward toward it. "Push of the present" are the drivers and trends that are currently pushing us to change and achieve the future image. Finally, the "weight of the past" represents the barriers that inhibit the change.

Below is an example of how this technique works low carbon future example:
- Pull of the future: it represents possible scenarios of the future, for example, An organization will achieve low carbon transformation in 2050
- Push of the present: it represents things happening currently and supporting the shift to the future image, for example, government incentives for companies working on decreasing their emissions
- Weight of the past: it represents current or past barriers challenging the organization to change, for example, the lack of experts in low carbon projects

Various research work has shown the effectiveness of this approach in creating a plausible image of the future. Russo (2019) showcased the future triangle workshop within an Australian health care organization. The main aim was to look for gaps between healthcare providers and community members and analyze and create an efficient and effective operation of health services.

During the workshop, different elements of the futures triangle were discussed. It was concluded that by 2030, the connection between personal, household, and local to global health systems would be helping more Australians access the services they need at the correct times. It was proposed that every health activity have its digital health platform to help engage people regularly to prepare for the anticipated future.

Therefore, this method could be used to analyze the drivers of change affecting an organization, and it can help in predicting a plausible future for them.
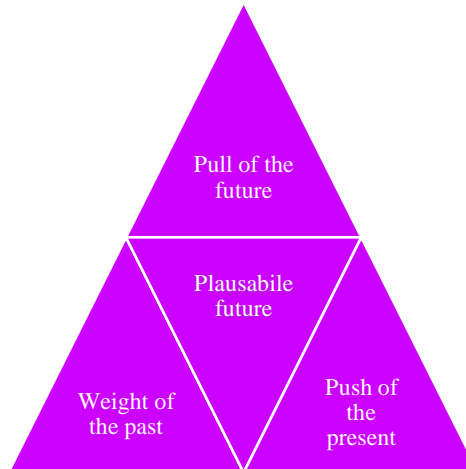
Figure 2-2 Futures triangle recreated from (Inayatullah, 2008)

2.4 Organizational design

Before reading this section, it should be noted that this research doesn't attempt to "design" an organization, instead, it will use the existing design models to create a new change model which will help in analyzing the organizational change in capital projects organizations.

Literature provided an overview of organizational design and provided different examples of how they were used (Córdova & González, 2017; Kates & Galbraith, 2007a; McCoy, 2021). Even though current models presented tend to be simplistic to reflect the complexity of modern organizations, they can be useful as analytical frameworks to identify relevant design choices and analyze organizational change (Doty et al., 1993).

Córdova and González (2017) used Glabraith's star model to analyze organizational change within NASA during the mars mission. They used a systematic approach using a set of questions mentioned in (Kates & Galbraith, 2007b), for example, when analyzing the strategy these questions should be asked, "what to do? where to play? and "how to win?". The book by (Kates & Galbraith, 2007b), provided templates that can be used to ask the right questions and evaluate the current state of the organization. Also, these templates can be modified to fit the organizational-specific needs and industry. Moreover, other work by (Miterev et al., 2017) discussed how the Galbraith's star model can be a better fit to analyze project-based organizations. In addition, the research provided an overview of how different organizational design models include similar individual components, for example, related to people, structures, and processes.

Briefly, Jay Galbraith's "Star Model™" framework was created in the 1960s to design and analyze organizations. It represents the foundation on which an organization bases its design choices.

The model consists of a series of design choices that are controllable by corporate leadership. The policies act as a set of tools with which management should implement to shape the decisions and behaviors of their organizations effectively. The model is composed of five categories as shown in Figure 2-3.

Strategy, which determines the long-term path that organizations will follow, dictates which activities are necessary for the organization. The other element of the model is Structure, which determines the placement of power and authority in the organization.

Processes are related to the flow of information across the organization's structure. Rewards provide motivation and incentives for desired behavior to align the goals of the employee with the goals of the organization.

Finally, People are related to human resource policies which include recruiting, selection, rotation, training, and development.

Galbraith Star Model
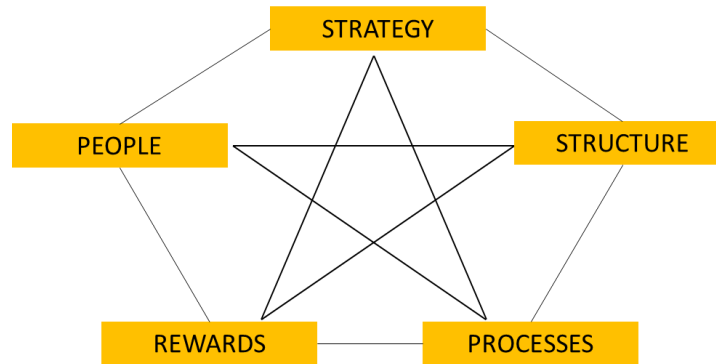
Figure 2-3 Galbraith's Star Model

On the other hand, Miterev et al. (2017) explained the limitations of other models, for example, Mckinsey 7s has been criticized for not being specific in identifying gaps in organizational strategy, while Weisbord's Six Box Model, is not balanced which may result in the risk of focusing too much on some organizational dimension at the expense of others.

Consequently, taking into consideration the research objectives and the focus on capital projects organizations, Glabraith's star model was chosen to build the change model. Even though culture is not included amongst the factors of the Star Model, because (Kates & Galbraith, 2007b) explains that managers cannot directly control the culture. However, they further elaborate in their book that controlling culture could be achieved through the alignment of the five elements of the change model. Therefore, culture will be included in the proposed change model which will be discussed in the next section.

CHAPTER 3. METHODOLOGY

3.1.1   Qualitative vs Quantitative

To understand how capital project organizations responded(ing) to change, a hybrid qualitative-quantitative approach was used to answer the research questions. Organizational change literature provided various examples of this approach, such as the

work of (Janicijevic, 2011) that discussed how a hybrid research approach could help to provide a better understanding of the research topic, especially in organizational change studies. Moreover, (Creswell & Creswell, 2017) discussed the benefits of having a hybrid research approach, which allows the researcher to understand a topic that hasn't been addressed before in literature. In addition, (Creswell & Creswell, 2017) advised starting with qualitative analysis first, and then expanding the scope by utilizing quantitative methods.

First, a comprehensive literature review had to be performed using terms like "Organizational change examples", "Organizational change", "Futures Triangle", "levers of change", "Drivers of change", "Successful organizational change", "Effective implementation of change", "Capital projects organizations", "Project Based organizations" and "organizational design". After that, a series of papers were selected, analyzed, and the current gap in organizational change literature was identified. Finally, the research questions were created.

3.1.2   Proposed Change model
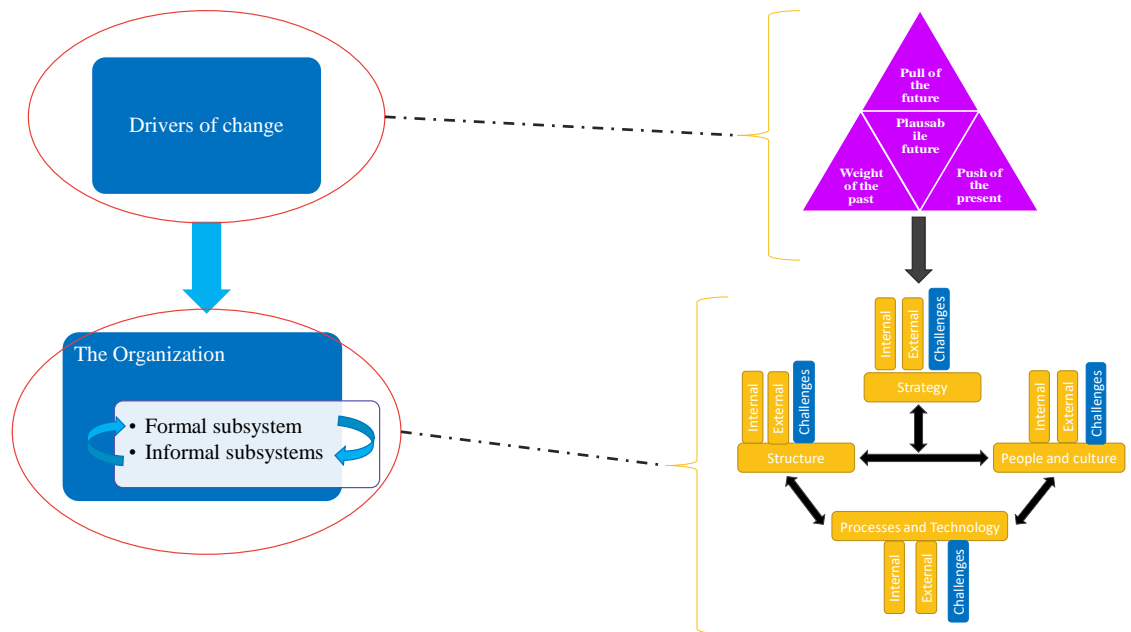
Figure 3-1 proposed change model Inspired by (Senior & Fleming, 2016)

The next step was creating the new change model as shown in Figure 3-1, which was inspired by the previous work of (Senior & Fleming, 2016), (McFillen et al., 2013), (Inayatullah, 2008), CII RT-360 (CII, 2020), and (Kates & Galbraith, 2007b). The new change model will be composed of two main parts, the futures triangle and Galbraith's star model. The drivers of change from (Senior & Fleming, 2016) model were represented by the futures triangle, while the organization was represented by a modified Galbraith's

20

organizational design model (Strategy, Structure, Processes and technology, people and culture).

In addition, other aspects were added to the model including, internal, external, and challenges for each dimension. The reason behind this can be explained by the work of (Barnett & Carroll, 1995), which distinguished between internal and external change responses within the organizations, and emphasized that they must be analyzed separately when studying organizational changes in an organization. In addition, other work by (Hiatt et al., 2015), showcased the differences between internal and external change responses in oil and gas organizations as a result of changes in public-private sector policies and climate change laws. Also, the research discussed how each change resulted in internal and external responses for the organizations.

Finally, the new proposed change model was used to lay the basis for the creation of semi-structured interview questions that were asked during the interviews to understand how capital projects organizations responded to change.

3.1.3   Semi-structured interviews protocol

Having created the change model, the next step was creating a Semi-structured case study protocol as shown in the appendix section 7.1.2 . The semi-structured approach was used because it offers flexibility to the researcher especially when similar work has not been done previously (Carruthers, 1990). Also, it is considered an appropriate technique to gain insight and develop a deeper understanding of the participants' perspectives. It also offers the researcher a leeway to understand new conversation trajectories in the interviews, which can help to gain additional insights (Cronin, 2014; Magaldi & Berler, 2018). The reason behind not choosing a structured interview can be summarized by the work of (Mathers et al., 2010), which explains that the questions in a structured interview may be phrased in a way that may result in a limited range of responses. In addition, the organizations participating in this research effort are from different industries, and the interviewees have different positions within their organizations. Moreover, having a structured interview would pose a problem, since it will limit the number of responses or drive the research in a narrow direction (Grossoehme, 2014). Therefore, to achieve the research objective, a semi-structured interview was used.

3.1.4   Organization selection, reach out efforts, and interviewees

3.1.4.1   Organization selection and definitions

After creating, the change model and the interview template, the reach out efforts started, to invite capital projects to participate in the research project. The first step was to create a pool of candidate organizations from different sectors using the help of multiple industry professionals.

This candidate list focused on Owner and Contractor capital projects organizations because the value chain of capital projects is mainly composed of them (McKinsey, 2021b). Therefore studying them will provide a more general overview of the

organizational change responses in the capital projects industry. Owner and contractor organizations can be defined following (Leana & Van Buren, 1999; Senior & Fleming, 2016) organization definition.

Owner capital project organizations are social structures that 1) pursue and manage a collection of capital projects that supports the company strategy and 2) have the autonomy and authority to make decisions and enact change.

Contractor capital project organizations are social structures that 1) pursue and manage a collection of capital projects that supports both the company and owner strategies and 2) have the autonomy and authority to make decisions and enact change.

3.1.4.2   Reach out efforts

After facing some challenges in getting responses from organizations, a one page document that summarized the purpose and the objective of the research was created and shared with the potential participants. The aim was to remove any ambiguity regarding the outcome and to reaffirm the non-disclosure agreements that were signed to ensure the privacy of the participating organizations.

3.1.4.3   Interviewees

After getting their preliminary notice to participate, organizations were asked to suggest the name of people who participated and/or had enough knowledge of the organizational changes happening within their organizations. These candidates could be managers or non-managers, but their relationship to change was the criterion of selection. The aim was to create a credible set of results and to give the research team more in depth insights into the changes/responses happening in the studied organizations.

3.1.5   Interviews (Data collection)

As the reach out efforts continued and organizations started to join, video interviews were performed. Each interview ranged from 60–90 minutes, and the interview template (appendix section 7.1.2) guided the flow of the conversations. In addition, during each interview, the interviewer reminded the participant(s) that the interview would be recorded, and described the procedures used to protect the confidentiality and anonymity of the participant's identity and his organization.

3.1.6   Thematic analysis and coding

After performing the interviews, they were transcribed using Nvivo 12, which is a computer-assisted qualitative data analysis software. To analyze the transcripts, thematic analysis was used as suggested by (Kashif Imran, 2021), which showcased how it can help in deriving valuable insights from the interviews.

According to (Braun & Clarke, 2006), thematic analysis is defined as a method used for analyzing qualitative data. It entails searching across a collected data set (interviews, questionnaires) to identify, analyze, and report repeated patterns. Moreover,

it helps to describe the data, but it also involves interpretation by the researcher, especially in the process of constructing themes.

Thematic analysis has many advantages and it is relatively simple to learn and apply (Braun & Clarke, 2006). It does not require the use of a pre-created theory to perform the analysis since it can be "inductive", by using the text to generate the theme (Braun & Clarke, 2006).

Before discussing the coding steps, a couple of terms used widely in the process of thematic analysis must be presented using the works of (Braun & Clarke, 2006; Krippendorff, 2004; Stough & Lee, 2021).

- Code: it's a word/phrase which represents a single idea
- Theme: word/phrase to describe a group of codes. Themes could be broken down into first-order and second-order themes.
- First-order themes: word/phrase to describe a group of codes but is more granular compared to second-order themes
- Second-order themes: word/phrase to describe a group of first-order themes
- Category: word/phrase to categorize a set of codes or themes by their membership in a class
- Inductive Thematic analysis: is the process of creating codes and themes from the data itself, which can help in creating theories.

The following example will help to understand the definitions of these terms:

- Statement from a transcript: " *we decided as a corporation to acquire two organizations in country X due to the increasing challenges in our sector"*
- Code: "acquiring organizations in X"
- Frist order theme: " Acquisition"
- Second-order theme: "Restructuring"
- Category: "Change Responses in country X"

It is worth mentioning that the categories in this research are the change model elements.

3.1.7 Codes/themes creation steps

Braun and Clarke (2006) outlined six steps to perform the coding process. The first step involves getting familiar with the data, such as reading and re-reading the interview transcripts to explore the trends and highlight important sections.

Step two involves generating initial codes from the highlighted sections/phrases. To achieve this, data must be organized in a meaningful and systematic way to condense the data into smaller pieces of meaning. Therefore, various highlighted statements were coded with specific phrases.

The third step is the process of searching for themes by examining how the codes could be combined to form an overarching theme in the data. So codes created from step two were organized to create first-order themes. In this research, the first-order themes were reviewed multiple times with the help of the interviewees.

In the fourth step, the first-order themes were reviewed and grouped into a higher-level set of themes (second-order themes).

As a result of the coding process, the initial number of first-order themes was more than a hundred (step 2). However, after multiple rounds of edits and reviews, the number decreased to 61 themes (step 4). Moreover, the second-order themes created in this research represent responses, drivers of change, and challenges.

The fifth step involves creating the high-level categories, and in our case, they are related to the change model, for example, push of the present, structure internal.

Therefore, in this research, every theme mentioned is a second-order theme. Each of these created themes was defined from literature, and they are provided in the APPENDIX GLOSSARY.

3.1.8   Number of case studies and theoretical data saturation

According to (Saunders et al., 2018), theoretical data saturation can be defined as the point at which the research data doesn't provide any additional insights or conclusions. In addition, data analysis and collection occur iteratively until theoretical saturation is reached. Moreover, data saturation can be defined in the context of thematic analysis as the point at which the data doesn't generate any new additional themes (Urquhart, 2012).

As shown in Figure 3-2, as more case studies were performed, the number of new additional second-order themes didn't increase drastically. Therefore in this research, the final number of case studies performed is 11.
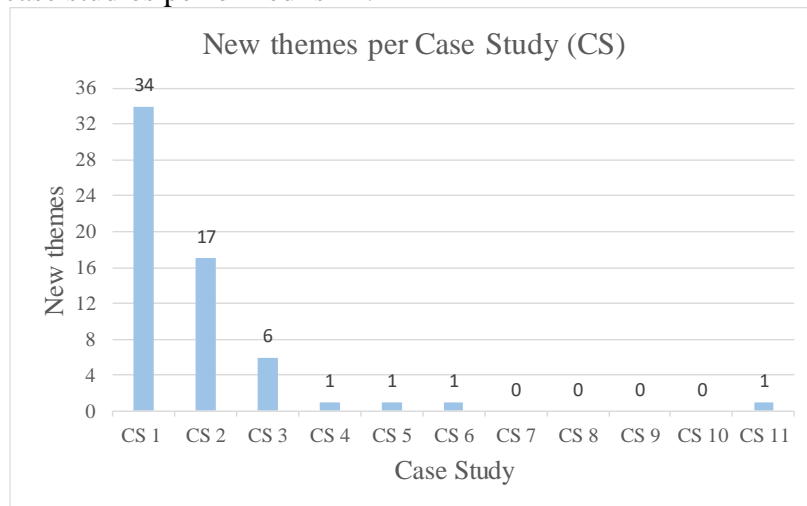
Figure 3-2 New additional themes per case study

3.1.9   Framework data presentation

To make it easier for the reader to access the information, and allow the interviewees to review the data, each case study was summarized into the framework template that is built using the change model (APPENDIX. FRAMEWORK TEMPLATE).
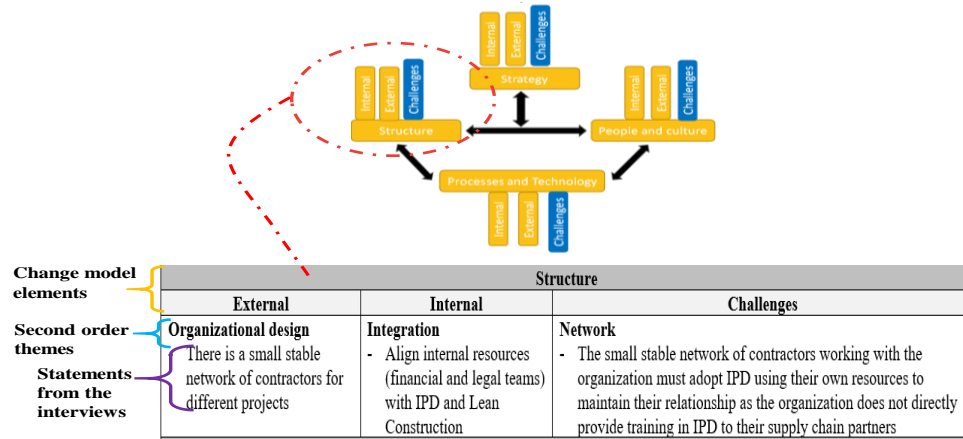
Figure 3-3 Framework presentation

Figure 3-3 showcases a sample framework, and how the template is constructed to reflect the different parts of the change model.

3.1.10 Nvivo data presentation

After coding on Nvivo (APPENDIX. ORGANIZATION NVIVO EXTRACTS), reports that contain a "tree map" summary of themes for the different organizations were created. According to (NVivo, 2010), a tree map is a diagram that shows hierarchical data as a set of nested rectangles of varying sizes, where a node with a large number of coding references would display as a large rectangle from left to right. Moreover, rectangles are scaled to best fit the available space, so the sizes of the rectangles should be considered in relation to each other, rather than as an absolute number.

Figure 3-4 Part of Org A Nvivo tree map

Figure 3-4 shows that the Push of the present and People and culture challenges are bigger than People Internal and Structure Internal. The colors at the corner of each box represent different elements in the change model. Neon Pink represents the drivers of change (ex: push of the present), Dark Blue represents the challenges (ex: People and Culture challenges), neon light blue represents the themes (ex: Market shift), while orange represents the responses in the change model (ex: Structure -Internal). Finally, it is worth mentioning that some of the theme labels are not fully shown, it's because the software had to fit all of them which resulted in the truncation of some of the labels. Unfortunately,

25

up to this date, there is no workaround to reorient or change the size or the font of the labels (Nvivo, 2022).

After coding was performed for each case study, the data was exported to excel to create different tables and prepare to import the data to UCInet which will be used to perform social network analysis.

3.1.11 Social network analysis

In this thesis, Social Network Analysis (SNA) will be used to analyze organizations' change model networks for different organizations. SNA is the process of investigating social structures and interactions by using networks and graph theory. These networks are made of nodes representing firms, people, and/or ideas; and edges representing either relationships or interactions between the nodes (S. Borgatti, 2016). According to (S. P. Borgatti & Halgin, 2014), in social network analysis, the term "affiliations" usually refers to membership or an association with a group or an event. However, in this research, "membership" is related to location in the change model, for example, Sustainability and Market shift were mentioned under pull of the future, so they share the same "membership/affiliation", and as a result, they will be connected together with a line.

One of the main benefits of using network visualizations is that it allows researchers to analyze networks qualitatively by changing the visual representation of the nodes and edges to reflect certain attributes of interest. On the other hand, it can be used quantitatively by using different network measures, such as centrality (Grunspan et al., 2014). In this research, this method will help to highlight the important "themes" for different organizations and to analyze the relationships between themes that cannot be analyzed using frequencies alone. For example, if two themes were having the same frequency, one will not be able to differentiate which one is more important than the other. However, with the aid of social network analysis, it can solve this challenge using different measures and modeling procedures (McLinden, 2013).

Two types of networks will be created, one that represents the change model, and it is referred to as a 2 mode network (which contains nodes of multiple types). The other type of network that will be created is a "themes only" network which is referred to as a 1 mode network (which contains one type of node). The process of creating a theme by theme network is known as "projection". This method operates by selecting node sets and linking them if they were connected to at least one common node (S. Borgatti et al., 2018). Therefore, the networks that will be discussed in sections 5.3.1 - 5.3.11, are 2 mode networks that showcase nodes of different types, such as themes, and drivers of change. On the other hand, the networks in sections 5.3.12 and 5.4 are 1 mode networks composed of themes only.

The following section provides a basic overview of social networks that are presented in this research, along with metrics and sample calculations.

Social networks created in this research are composed of the following elements:
- **Change model nodes** represent the "category" of the change according to the proposed change model in the research, such as strategic response internal,

culture, and people external. These nodes will be colored in orange (change responses), neon pink (futures triangle), and dark blue (challenges).

- **Themes nodes** represent the second-order themes, in other words, the actions taken by the organizations such as restructuring, and recruitment. These nodes will be colored in neon light blue.

- **Edges/Ties** represent the relations or mentions. For example, if the interviewee provided insights regarding a specific category of change, and then discussed action taken by the organization (second-order themes), that relation will be represented as shown in Figure 3-5.
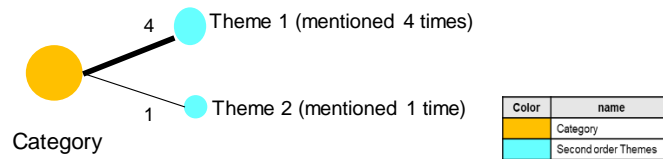
Figure 3-5 sample illustration of the network

- **Tie strength** represents the strength of the connection between two different nodes. Here in this research, it represents the number of times a theme was repeated under another category in the interview. Figure 3-5 provides an example of how that relationship will be represented visually, the thicker connection means it has a higher tie strength

- **Node size** represents the number of connections (degree) to the nodes and the sum of tie strength. Figure 3-5 showcases how the theme 1 node is larger than theme 2, which means it was mentioned more often in the interview.

Therefore, the concept maps will help to visually represent the case studies interviews and will help to highlight the important parts of the concept maps for different organizations.

3.1.12 Network measures:

Various network measures were used in this research, which could highlight different aspects of the concept maps.

3.1.12.1 Degree centrality and Weighted degree centrality (The higher the better):

Degree centrality measures in concept maps help to showcase the concepts that are highly impacting the network. So, it will highlight the major responses discussed and taken by organizations in response to drivers of change.

Degree Centrality: it represents the number of edges connected to a node. In the case of a directed graph, Inflow and Outflow Centrality measures could be calculated, however in our research the concept maps are undirected, so only one measure will be used. The formula for degree centrality is:

$$Degree\ centrality\ (DC) = \sum_{j=1}^{n} Aij$$

Where $\sum Aij$ represents the summation of a number of connections to/from node A at row i, and column j to other nodes of the network. For example, in Figure 3-6 the degree centrality for the category is equal to 3.
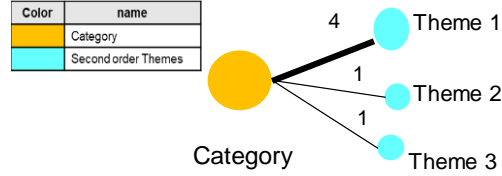
Figure 3-6 Degree centrality

Weighted Degree Centrality: It represents the summation of tie strengths to/from a node to other nodes in the networks. It was decided to use this measure, because the networks in our research are valued networks, meaning the ties strengths have values of more than 1, in addition, this measure acts as a "total count" for the themes in the network. The formula for weighted degree centrality is:

$$Weighted\ Degree\ Centrality(WDC) = \sum_{j=1}^{n} WAij$$

Where $\sum WAij$ represents the summation of weights of the connection to/from node A at row i, and column j to other nodes of the network. For example, in Figure 3-6 WDC for theme 1 is equal to 4, while WDC for the category is equal to 6.

Both degree centrality measures could be normalized to be comparable to other networks. This process can be achieved by dividing the values by (n-1), where n is the number of nodes of networks. As a result, the normalized DC values will be between 0 (lowest value - not connected to any nodes) and 1 (highest values - connected to all other nodes), while WDC would be greater than 0 (S. Borgatti et al., 2018).

3.1.12.2 Betweenness centrality (The higher the better):

It represents the number of times a node is present on the shortest path between 2 other nodes, divided by the number of shortest paths between different pairs (S. Borgatti et al., 2018). It can be calculated using the formula below:

$$Betweeness\ Centrality\ (BC) = \sum_{j \neq v \neq k} \frac{g_{jk}(v)}{g_{jk}}$$

Where g_{jk} represents the number/count of shortest paths connecting jk, and $g_{jk}(v)$ is the number of times node v was on that shortest path between jk. Below is an example

that showcases how to use BC formula on a sample undirected network shown in Figure 3-7
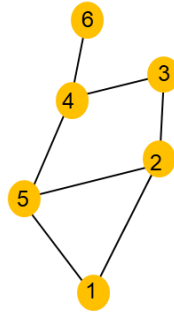
Figure 3-7 Betweenness sample network

$$BC(2) = \frac{g_{13}(2)}{g_{13}} + \frac{g_{14}(2)}{g_{14}} + \frac{g_{15}(2)}{g_{15}} + \frac{g_{16}(2)}{g_{16}} + \frac{g_{34}(2)}{g_{34}} + \frac{g_{35}(2)}{g_{35}} + \frac{g_{36}(2)}{g_{36}} + \frac{g_{45}(2)}{g_{45}}$$
$$+ \frac{g_{46}(2)}{g_{46}} + \frac{g_{56}(2)}{g_{56}} == \frac{1}{1} + \frac{0}{1} + \frac{0}{1} + \frac{0}{1} + \frac{0}{1} + \frac{1}{2} + \frac{0}{1} + \frac{0}{1} + \frac{0}{1} + \frac{0}{1} = 1.5$$

This measure helps in detecting nodes that act as a "broker" between other nodes in a network. However, the concept maps, will represent nodes that are responsible for the activation of other concepts (Grebitus & Bruhn, 2008; Rondoni et al., 2021). For example, in Figure 3-8 theme 2 have a high betweenness centrality, meaning if theme 1 and theme 3 were discussed, there is a high probability theme 2 will be present in the discussion. Also, it means it is a "central/bridge" theme in the discussion, meaning it is of high importance (McLinden, 2013).
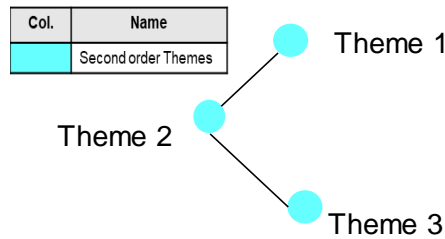
Figure 3-8 Betweenness example

This measure could be normalized by dividing the values by (n-1)(n-2)/2 which represents the total number of pairs within a network (S. Borgatti et al., 2018).

Betweenness centrality differs from the other centrality measures, for instance, A node could have a low degree, and be far from other nodes on average, while having a high betweenness value. For example, this could happen when the node is on a single "bridge" that connects two groups within a network.

3.1.12.3 Closeness centrality (The higher the better) :

It is the inverse average length of the shortest distance from the node of interest to all other nodes in the network. In other words, if the sum of the distances is large, then the closeness is small, and it is far from other nodes in the network, and this means that the node is independent of other nodes in the network (Freeman, 1978). On the other hand, if closeness centrality is high, it means that it has close relation with other nodes (Metcalf & Casey, 2016).

$$Clossness\ Centrality\ CC(n_i) = \sum_{j=1}^{n} \frac{1}{d(n_i, n_j)}$$

Where $d(n_i, n_j)$ represents the shortest path connecting node n_i and node n_j. Below is an example that showcases how to use the CC formula on a sample undirected network
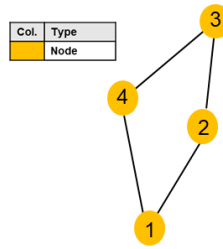
Figure 3-9 Closeness centrality example

$$CC(1) = \sum_{j=1}^{n} \frac{1}{d(1, n_n)} = \frac{1}{d(1,2) + d(1,3) + d(1,4)} = \frac{1}{1 + 2 + 1} = \frac{1}{4} = 0.25$$

This measure could be normalized by multiplying the values by (n-1) where n is the number of network nodes (S. Borgatti et al., 2018).

Usually, this measure is used to identify nodes in a favorable position to control and acquire information and resources within an organization. However, in our research closeness will be used to measure how close one concept is to all other concepts which could infer some information. A high closeness centrality will infer that the concept is close enough to others, which helps to activate them (Grebitus & Bruhn, 2008).

3.1.12.4 Non metric multidimensional scaling:

No-metric multidimensional (MDS) scaling is an ordination technique, that aims to scale a multi-dimensional problem into a smaller number of dimensions while preserving the pairwise distances between the variables (Holland, 2008). It is an iterative algorithm that seeks a solution and stops when the best solution has been found. Non-metric MDS

helped position different elements of the concept maps next to each other showcasing the importance in addition to the similarity between a set of nodes.

The way MDS works could be summarized in the following steps:

- Pairwise distances among samples are calculated, which could be Euclidean distance (Metric MDS), or geodesic distance (Non-metric MDS)
- The MDS algorithm begins by constructing an initial random configuration in the "m" dimensions
- It will iteratively reconfigure the ordination, and the number of dimensions, recalculate the distances and recalculate the stress. The stress that is calculated is based on the goodness-of-fit of the differences between the actual distances and their predicted values (from the algorithm)
- The algorithm will stop when no further optimization can be achieved on the stress.

$$Stress = \sqrt{\frac{\sum_{h,i}(d_{hi} - \hat{d}_{hi})^2}{\sum_{h,i} d_{hi}}}$$

where d_{hi} is the actual distance between points h and i calculated from the original data set, and $\hat{d}_{hi}$ is the distance predicted from the algorithm.

The Stress Goodness-of-fit values and their interpretation are provided in Table 3.1 (NCSS, 2021)

Table 3.1 Stress values and results

Value	Results
0.200	poor
0.100	fair
0.050	good
0.025	excellent
0.000	perfect

In this research, all the stress values for all the non-metric MDS concept maps created ranged from 0.001 to 0.003

3.1.13 Low carbon case study

In addition to the 11 case studies, an additional standalone case study that discussed a specific type of change was chosen by the researcher based on collective feedback from the participating organizations. The chosen topic of this case study was the low carbon future due to the current importance of this topic in the capital projects industry (McKinsey, 2020).

 This case study served two main objectives; the first objective was to act as a pilot case study that will help to create a preliminary data set using the framework template to highlight any shortcomings or modifications to the data collection process and analysis. While the second objective was to discuss a topic of high interest to the capital projects industry while providing a better understanding of the drivers, responses, and challenges.

Unlike the data collection method used in the single case studies, this case study used focused group discussions to collect the data and fill the framework. The focused groups were composed of different candidates from the participating organizations, and each group focused on one aspect of the organizational model (ex: structure (Internal, external, challenges)). After the focused group discussions, the teams reconvened and discussed the findings as a bigger group. Finally, the rest of the analysis process continued using the same approach used in the 11 case studies (Thematic analysis, SNA).

CHAPTER 4. CASE STUDIES NARRATIVE

In this chapter, all the case study narrative summaries were presented. The purpose of these narratives is to offer a general overview of the organizational changes in the different case studies including internal and external changes. However, they do not contain every response performed by the organizations. These must be read in lieu of the frameworks to provide an overall picture of the ongoing changes in different organizations. The frameworks for these case studies are included in the APPENDIX. ORGANIZATION FRAMEWORKS section contains all the responses collected from organizations.

4.1   Owner Chemical organization A (2015 - current)

4.1.1   Drivers of change

This case study discusses the implications of lithium market growth on an owner chemical organization. Currently, different drivers are pulling/pushing the organization, these include the shift towards renewables and grid electrification which are increasing the demand for lithium batteries. Electric vehicles car manufacturers, known as Original Equipment Manufacturers (OEMs) are seeking to localize and regionalize the supply chain, especially after the severe disruptions that happened recently due to the COVID-19 pandemic. Furthermore, the demand is expected to boom due to the latest set of governmental incentives packages which will offer discounts to those who buy electric vehicles that are manufactured within the U.S. Moreover, Biden Administration is planning to replace the government's vehicle fleet with electric vehicles assembled in the U.S.

4.1.2   Strategy (Internal and external)

To respond to the drivers, increase its internal capabilities, and competitive advantage, the organization acquired a chemical industry company specialized in lithium and divested all non-lithium business units. The acquisition has placed some pressure on the organization, causing some integration issues on people, structure, and processes.

Also, "internationalization" was another response used by the organization in response to the different drivers. Internationalization helped the organization to expand lithium carbonate and lithium hydroxide projects. Also, it helped the organization gain a foothold in new countries and secure raw materials used to manufacture the batteries.

Moreover, the organization had to perform partnerships and sign master service agreements with strategic partners, such as OEMs and service providers to perform different projects, and accelerate technological developments. Even though these partnerships helped the organizations, however in some instances they imposed some challenges on the organization, especially when the owner organization fits within two business units within the construction service provider, which could impose challenges if mission-critical goals to the organization are not mission-centric to them.

4.1.3 Structure (Internal and external)

On an internal structural level, the organization had to restructure by creating new lithium units to support the lithium business and had to change its internal reporting procedures due to these changes.

4.1.4 People and culture (Internal)

From a people and culture perspective, the organization had to change the leadership, especially those from a manufacturing background, since they imposed various challenges and resistance within different units. Therefore the organization started hiring generalist project professionals to run the business units and critical projects for the organization.

Different changes by the organization, have placed them in the high ranks amongst lithium companies globally. To sustain that advantage, the organization had to be forward-looking, commit to finishing projects even if delayed, enhance its operating model with a focus on execution and processes discipline rather than traditional "firefighting"

4.1.5 Processes and technology (Internal and external)

From a processes and technology perspective, the organization had to invest in research and development to fortify its market position. Also, it developed various stage-gate processes and implemented ERP systems to enhance the organization's internal processes.

4.1.6 Challenges

Many challenges faced by the organization throughout the change process can be summarized in post-acquisition integration challenges due to the differences in project implementation approaches. Also, the organization has faced strong resistance from manufacturing-based unit leadership. In addition, the regional/unit requirements differed by country, meaning different countries had different procedures, which stressed the organization. Moreover, the personality of different units varies, thus, creating challenges for deploying talent across the organization. Finally, commitment to sustainability increased the pressure on the organization and stretched its resources. Furthermore, the need to do better at recording and tracking environmental impact by the organization is currently adding another level of complexity in tracking sustainability progress.

4.2 EPC organization B (2017 - current)

4.2.1 Drivers of change

This case study showcases the implications of digitization on an EPC organization. Different drivers are pushing the organization to change, these include the shift in customer demand towards digitization and sustainability, in addition to the pressure from owners

who are developing and shifting towards digital solutions, which pushed the need for the use of the latest data analysis tools and techniques. Moreover, software tools and data interoperability are continuously growing which provides EPC organizations with a variety of options that can enhance and digitize the construction workflow.

4.2.2 Strategy (Internal and external)

To respond to these various drivers, the organization allocated a yearly budget to support the digital transformation efforts and invested in different handhelds technologies to enhance communication across different levels within the organization. Also, the organization started developing various in-house tools to fulfill the evolving digitization requirements. To Develop these applications, the organization had to outsource, and hire specialized technology experts when needed to develop various software packages and support various digitization efforts across the organization. Furthermore, the organization had to implement different training programs (virtual and physical) to train employees on different tools. Moreover, the organization performed training programs targeting unionized workers locally and internationally to help in creating technology-friendly workers who could be hired in the future.

Additionally, the organization worked closely with subcontractors and suppliers to adopt digital workflows, promote green practices, and lower carbon emissions. Also, it partnered with universities to train future graduates to be proficient in technology and data analytics, and prepare them for the job market of the future.

4.2.3 Structure (Internal)

Achieving these responses would have never been possible without having a strong network within the organization that crosses different global business units, projects, and different functions which supported change buy-in efforts. Also, feedback collection was part of these efforts which eventually pushed the organization.

4.2.4 People and culture(Internal and external)

From a people perspective, various responses were taken to support the change efforts. Leadership supported the change efforts across the organization, in addition, they promoted and effectively communicated the importance of different changes across the organization. On a cultural level, the organization focused on organizational commitment and nurtured a can-do culture that supports the lookout for innovations and progress.

4.2.5 Processes and technology(Internal)

Finally, from a processes and technology perspective, the organization focused on improving project execution and implemented advanced work packaging (AWP). In addition, different processes and procedures were well structured, written, and shared with employees to support buy-in efforts.

4.2.6 Challenges

Even though the change efforts are going well, multiple challenges are facing the organization. First, the available software tools in the market do not always fulfill the organization's specific requirements, which forces the organization to invest more in in-house solutions, that require specialized experts that are not always available. Also, The organization's digital transformation initiative depends on clients' requirements and type of projects, which means there is a great emphasis on customization, which costs more and takes more time. Moreover, engineering and procurement are faster to embrace the digital transformation compared to construction, not to mention the resistance to change from craft leadership and a unionized workforce. Furthermore, the fast-paced and fragmented nature of the construction industry poses various challenges in the face of new technologies implementation or change initiatives.

In addition, cyber threats have slowed down the shift towards remote work tools. Also, virtual training and simulation are dependent on the type of project, and cannot be easily implemented in complex projects. Finally, there was a notable resistance to return to the office work environment which was instigated by the fear of going back to old processes and procedures which were not acceptable or supported by the employees.

4.3 Owner energy organization C (2019- Current)

4.3.1 Drivers of change

This case study showcases the implications of a new capital projects' operating model implemented during overall project portfolio transformation. The organization was consistently growing throughout the years, performing various projects across different countries, however, in recent years, the organization started suffering from inconsistent performance across large capital projects. As the result, the organization started to shift its business objective from growth to returns and started to shift its portfolio away from megaprojects, with a focus on low carbon energy transition projects (carbon capture plants).

4.3.2 Strategy (Internal and external)

The organization has performed various strategic responses to take on change. To reassess its position, it started performing internal and external benchmarking studies, to understand the root causes of inconsistent performance across different projects, and to understand its competitive position in comparison to other competitors.

To perform these studies, the organization developed various metrics to track the progress of organizational performance. Furthermore, it strengthened the linkage between the technical functions and business units in the early phases of capital projects and centralized the execution of the early phase of capital projects. To perform these changes on the operating model, the organization focused on communicating key strategic changes to those who were involved, including project practitioners and business leaders.

4.3.3 Structure (Internal)

From a structure perspective, the organization restructured existing legacy functions into one technical center dedicated to supporting the enterprise, and the execution of capital projects (upstream and downstream)

4.3.4 people and culture (Internal)

From a people and culture perspective, the organization had to identify the right people that will fit the job. Also, it focused on communicating the change efforts and clearly articulating the importance of these changes on the performance and long-term strategy of the organization. In addition, the newly restructured technical function unit provided internal training and competency development to various business units project professionals. Also, the organization eliminated the "loaning" of employees to different business units.

4.3.5 Processes and technology(Internal)

From a processes and technology perspective, the organization focused its efforts on centralizing early phase work, increased its focus to define competitiveness, enhanced its stage-gate processes by applying an agile mindset, and continuously improved the ongoing changes by reinforcing various changes that happened or are still ongoing.

4.3.6 Challenges

The organization has faced various challenges throughout the change process. These challenges include the portfolio shift towards medium-sized projects, as well as the shift to low carbon energy projects. In addition to the complexity of existing processes within the organization in comparison to other organizations. Furthermore, the existing operating model centralized management of the workforce which created process, behavioral, and accountability challenges. Moreover, the operating model was overly prescriptive and resulted in teams following the process in a "check the box" manner, as opposed to meeting the intents of the process.

4.4 Airport Authority organization D (2018- Current)

4.4.1 Drivers of change

This case study showcases the implications of remote work for an airport authority. Before Covid-19, the organization was in the process of updating its organizational emergency plans which identified operational risks and response actions. That move was motivated by various reasons including the continuous effort to improve the internal capabilities of the organization and increase the work environment adaptability. Also, another reason behind that move is the disruptions that happened previously by the Severe Acute Respiratory Syndrome (SARS) virus.

Before 2019, the organization started implementing virtual meeting software tools to minimize work-related travel for some business units, due to the size of the airport, which made in-person meetings time-consuming. However, after the pandemic hit, it pushed the organization to adopt virtual meetings globally within the organization.

4.4.2   Strategy (Internal and external)

After shifting to the virtual work mode, the organization focused on strengthening its partnerships and reaching out to key personnel regularly. In addition, it performed informal training related to virtual meeting tools. Moreover, unit leaders performed daily morning virtual meetings to increase accountability, assign tasks, discuss any challenges, and communicate with management to give feedback and discuss any problems.

4.4.3   People and culture (Internal)

From a people and culture perspective, the leadership prepared for worst-case scenarios and continuously upskilled the employees via internal training. Due to these consistent interactions, the airport's employees developed a pride-based culture.

4.4.4   Processes and technology (Internal)

From a processes and technology perspective, the organization moved to a segregated cloud service to mitigate cyber-attack threats, which are considered one of the major challenges facing remote work environments. Also, the organization used a centralized common data environment to store and use different project models to enhance collaboration.

4.4.5   Challenges

Various challenges have faced the organization, especially when it shifted to a remote work environment. Resistance to the virtual model of work was mainly fueled by the "oversight culture" which requires employees to be physically present to perform the work. In addition, remote work has caused a loss of social interactions in the workplace. Also, it resulted in some risks associated with levels of permanence of some communication methods, which might cause contractual conflicts. Furthermore, employees faced various technical challenges while connecting to the local airport network via VPN due to a sudden increase in the number of users. Moreover, the remote work model has caused uncertainties related to project execution and governance, since some projects were canceled while others were accelerated because the airport was not busy as usual.

4.5 EPC Organization E (2017 – 2021)

4.5.1 Drivers of change

This case study showcases the implications of a new market segment shift on an EPC organization. The drop in oil and gas prices affected the organization since the market started to shift away from oil and gas projects which are considered the main source of income for the organization. In addition, other factors are affecting the organization, such as the shift to renewable energy projects due to commitment signed by different countries to achieve the United Nations (UN) Sustainable Development Goals (SDGs) and achieve low carbon 2050 goals. In addition to these, there is an increased reliance on data centers due to the shift toward remote work environments and the latest technological innovations in cloud computing.

4.5.2 Strategy (Internal and external)

To respond to these various drivers, the organization had to perform multiple responses, including leadership changes by assigning a new CEO after sustaining multiple financial losses. Also, the organization started shifting from megaprojects to medium and small projects. In addition, it leveraged its relations to get into new types of projects like data centers, by taking on Front-End Engineering Design (FEED) and consulting roles to build stronger relationships with potential clients and to grow these small projects into the long term program efforts. In doing so, the organization is building long-term opportunities to grow and diversify its portfolio.

4.5.3 Structure (Internal and external)

From a structure standpoint, the organization had to restructure into three business units with independent reporting and an equal projects pool. Moreover, the organization signed multiple Master Services Agreement (MSA) agreements with different companies to enhance collaboration and serve the organization's long-term goals. Finally, the organization had to divest some units that do not serve the organization's long-term strategy.

4.5.4 People and Culture (Internal and external)

From a people perspective, the organization invested in training programs to upskill the workforce, in addition, they created various incentive programs to retain them. Also, it redistributed expensive labor force to megaprojects, to cut down on the overall cost while retaining the expertise. Moreover, the organization partnered with technical colleges to create tailored training programs and courses that meet the business needs, and prepare the workforce of the future for the job market. On a cultural level, the organization focused on fostering a high-performance culture, which can be seen by the various actions taken such as investing in current and future employees, and the various MSA agreements signed.

4.5.5   Process and technology (Internal and external)

On a process and technology level, the organization had to acquire and learn different software tools requested by different owners, created centralized tools to connect to different projects; and developed data standardization processes to improve project benchmarking and progress reporting. Also, the organization is currently investing in engineering schools and supporting various STEM programs with a large population of minority students.

4.5.6   Challenges

During the course of change, various challenges have faced the organization such as market shift, resistance to change, retaining workforce, and many others.

Currently, the organization is facing strong competition, due to the decrease in the availability of mega projects which is attributed to the shift towards small and medium-sized projects. Also, competitive projects' bids are costing the organization to prepare and submit the bids, however, many of these projects' bids were not won. Moreover, due to the structure of the organization, a client could fit within more than one business unit depending on the project, which is causing challenges in selecting the unit in charge of the project, and creating internal competition between different units within the organization. On the other hand, from a people perspective, resistance to change and retaining the workforce is one of the main issues facing the organization, especially when shifting to a new market segment, or new types of projects such as data centers. Furthermore, the organization is facing challenges in keeping key professionals with the required experience and skill set while lowering the pay scale, especially for managerial positions. Also, craft workers will shift to different organizations with a slight salary increase.

From a processes and technology perspective, different owners' requirements for different software tools have caused interoperability challenges that affected the project cost reporting process. In addition, these requirements required the organization to perform extensive training and integration within the existing workflows. Finally, the set of projects and requirements required the organization to work in a cloud-based environment, which grants the participants (different organizations) access to financial project documents which is not desirable.

4.6   Manufacturing Organization F (2015-current)

4.6.1   Drivers of change

This case study showcases the implications of the adoption of Integrated Project Delivery (IPD) on a manufacturing organization. What is driving the organization to change is the pursuit to increase operational efficiency, decrease project timing, increase innovation, and reduce cost and risk. The organization attempted to change the project delivery method to design-build which helped to decrease risks, and improve project timing. However, the continuous growing pressure from the market to finish projects quicker pushed the organization to adopt a new delivery method IPD in a couple of

projects, as a result of the successful implementation, the organization attempted to scale up the implementation to different projects.

4.6.2 Strategy (Internal and external)

During the process of change, the organization communicated key benefits of IPD to different business units via different methods including seminars, meetings, trips, and case studies. Also, it used facts, and success stories of other industries to promote IPD. Moreover, IPD promoted integration, since it allowed different stakeholders to participate in the pre-engineering phase to help in formulating the scope of work. Furthermore, it promoted different practices such as sharing profit numbers with different trade partners in the project to incentivize and increase collaboration and transparency (Shared Risk/Reward). In addition, the organization partnered with specialized suppliers to exchange IPD knowledge. Also, to increase the adaptability of the organization's subcontractors and suppliers network, the change efforts were communicated early to give them the time to learn the new approach and change their processes.

4.6.3 Structure (Internal and external)

From a structure perspective, the organization had to align its different units (financial and legal) on IPD, and highlight the differences between the new approach vs the old one. In addition to establishing a small network of contractors for different projects.

4.6.4 People and culture (Internal and external)

To transition from a legacy project delivery model to a more collaborative one, the organization focused its efforts to train project managers and engineers on IPD and hired experienced specialists to support the training efforts. Also, the organization hired specialized accountants with IPD experience to ensure the financial viability of the change process. Moreover, the organization recognized the importance of culture and trust in IPD implementation, so the organization held in-person meetings and co-located project teams in the early phases of the project to develop the interpersonal relationships that allowed the formulation of a shared culture and feelings of trust among the participants. Furthermore, the organization's leadership supported the change efforts throughout the process.

4.6.5 Processes and technology (Internal and external)

From a processes and technology perspective, the organization was involved in multiple professional organizations such as CURT and LCI which helped in finding the proper resources needed to achieve buy-in and support. In addition, literature case studies collected by the organization helped to convince stakeholders and support buy-in efforts for IPD implementation. Furthermore, the organization used experienced IPD coaches to help them with project setup and kickoff.

4.6.6   Challenges

Various challenges have faced the organization throughout the change process. First, project managers, engineers, and financial teams faced difficulties in understanding how IPD contracts work even with the formal training, which caused resistance within the organization. Furthermore, there is a resistance to IPD adoption and implementation by different owners in the industry. Also, there is limited availability of experienced IPD employees which is limiting the organization from implementing IPD in new projects. In addition, the small stable network of contractors working with the organization is pressured to adapt to IPD using their resources to maintain their relationship as the organization does not directly provide IPD training to their supply chain partners. Moreover, The organization was not accustomed to sharing its budget under the previous project delivery systems, and project teams were not used to the new collaborative and shared risk model. Finally, there is a lack of regimented processes to achieve the IPD transformation across the organization and the network.

4.7   Government Organization G (2010-current)

This case study provides an overview of the implications of the adoption of a new support model, and public-private partnerships (PPPs). The organizational changes that happened were a response to various drivers including changes to the nature of space operations, operational efficiency, and the need to lower the cost of space exploration and the development of space technologies via PPPs.

4.7.1   New support model

4.7.1.1   Drivers of change

In previous years, space operations were segmented and lasted for weeks, which gave senior employees frequent rest periods that allowed them to recharge and focus on other tasks within the organization. However, changes in the type of space operations and the continuous human presence in space required the organization to shift from a segmented to a continuous all-year operational model in the space control center. As a result, the nonstop work model had increased the operational cost, limited the employees' availability to perform other tasks, and exhausted them.

The challenge is not only limited to the nonstop working model, but it is related to the type of employees working in the main control center, who are mainly specialized seniors that went through a rigorous career progression model to reach their current positions. These seniors started in apprentice roles and accumulated five to seven years of specialized experience, after which they went through a certification exam to be able to work in the control center. The fact these seniors are highly specialized makes them a valuable resource to the organization and occupying them with nonstop continuous monitoring space missions is limiting their potential. Therefore, the organization's senior leadership decided to adopt a new requirement and support model which relies on hiring

fresh college students with no experience and enrolling them in 18 month training program to get them certified. This model aims to ease the reliance on the old lengthy recruitment and progression model, and to allow the seniors to focus on other important tasks/missions within the organization, for example, PPPs.

4.7.1.2   Strategy (Internal)

To initiate the change process, senior leadership communicated the change to all employees via middle management, then later decided to communicate the change directly to employees via small groups without the middle management intervention. After understanding the leadership's vision, employees realized the long-term benefits of the program to the organization, and as a result, trust was built, and buy-in was achieved.

4.7.1.3   Structure (Internal)

From a structural perspective, the organization's leadership realized a great potential in two internal business units which supported the same missions. To leverage their strong potential, it was decided to merge them into a single unit to drive operational efficiency.

4.7.1.4   People and culture (Internal)

When the new program was adopted, the organization taught fresh graduates their roles and interdependencies within the organization. It also focused on growing leadership skills by placing them in a challenging environment. In addition, the program allowed them to progress from operators to instructors positions which created a continuous knowledge sharing cycle (train-specialize-instruct).

4.7.1.5   Challenges

The change initiative was faced with various cultural and people-related challenges. First, the goal behind the change was not properly communicated to different unit leaders and employees, which caused strong resistance. In addition, units' leaders opposed each other which also contributed to the resistance as well. As a result, the organization's leadership decided to change the units' leaders and assigned a new charismatic neutral leader to oversee the merged units and the change efforts.

Moreover, employees had concerns and didn't know the purpose behind the adoption of a new operating model. Furthermore, some employees resisted that program since it allowed fresh graduates to progress and achieve senior roles in a shorter period which older employees spent years to achieve, and that raised many operational safety concerns.

The merger has caused career path challenges to the employees since they had to shift to new positions within the organization, for example, shifting from specialized to broader roles. Also, the merger caused a loss of specific work tasks they had before, for example, working with astronauts. As result, employees resisted change and lost motivation to work. On the other hand, senior leadership also suffered from change when their credibility was shaken in the eyes of employees, because of the way they handled the

old units' leaders. The unit's leaders were sidelined and not given any new jobs within the new unit which forced them to leave the organization after long years of work.

4.7.2   Public-Private Partnerships

4.7.2.1   Drivers of change

To lower the cost of space exploration and the development of space technologies, the organization decided to engage in PPPs.

4.7.2.2   Strategy (Internal and external)

To achieve it, various actions were taken by the organization, such as, canceling programs to lower the cost and shift resources to support PPP, and shifting from a self-sufficient to a partnering model. In addition, the organization partnered with the industry to achieve common goals that will benefit the organization and the country as a whole.

4.7.2.1   Structure (Internal and external)

From a structure perspective, the organization provided the private space providers with funds and technology to perform heavy demanding operations such as the launching of crews, and cargo into space. In doing so, the organization transferred the knowledge and expertise to private space providers while giving them the ability to offer the same services to other external companies/entities which will create a large number of local jobs that will benefit the economy.

4.7.2.2   Processes and technology (Internal and external)

On a process level, the organization shifted resources to support the current changes and worked closely with new partners to ensure the new set of processes adhered to the agency safety standards

4.7.2.3   Challenges

However, the actions taken by the organization resulted in various challenges, such as bureaucracy, which caused frustration among employees. Also, the change process was not properly communicated with the employees which caused ambiguity among them, especially when canceling promising space programs.

4.8 Power generation Organization H (2017- Current)

4.8.1 Drivers of change

This case study showcases the implications of acquisitions on a power generation organization. What is driving the organizational change is the low carbon neutrality UN SDG 2050 goals, and the market shift towards renewables. In addition, many nuclear power plants operated by the organization are reaching their end of life. As a result, the organization started to seek options to expand its hydro and gas-powered plants projects.

4.8.2 Strategy (Internal and external)

In response to different drivers, the organization created a strategic growth plan that considers available resources to expand the portfolio and initiated a team to analyze the impact of acquisitions on the workforce and the possible shift in skillsets.

To expand its renewable segment, the organization decided to acquire other organizations with experience in hydro and gas generation to bridge the knowledge, and capability gap, support low carbon transformation and prepare for future project opportunities.

Furthermore, the organization improved various internal processes, such as communication and approval, to support acquisition and integration efforts. Moreover, it updated its financial reporting processes to ensure a proper information flow between the subsidiaries and the organization. In addition, change efforts and challenges were communicated to both the leadership and employees.

4.8.3 Structure (Internal and external)

From a structure perspective, the organization created an internal integration team to coordinate between the organization and various subsidiaries. In addition, the organization decided to integrate some subsidiaries and allowed others to operate independently based on multiple factors such as the location of operation and culture.

4.8.4 People and culture (Internal)

From a people and culture respective, the leadership supported the change efforts and effectively communicated the change message within the organization. Also, the organization identified internal capabilities by looking closely at the staff skills and experiences regarding future growth, to devise a labor strategy plan. Moreover, the organization supported innovation, agility, and transparency. Also, it communicated good news and challenges to employees.

4.8.5 Processes and technology (Internal)

From a processes and technology perspective, the organization updated its reporting processes to accommodate the new changes, re-engineered existing processes, and developed a mergers and acquisition playbook to guide future efforts and highlight areas of diligence.

4.8.6 Challenges

On the other hand, the organization faced various challenges because it did not have prior acquisition experience. In addition, the acquired organization operates in another country and thus the legal and socio-political environments are different. Also, the acquisition was time-compressed, and the strategy was executed quickly which stretched the organization's resources. Moreover, the organization is still identifying the proper information flow procedures with subsidiaries. Furthermore, it faced challenges of resource allocation, especially for unionized workforce since they are under an agreement with the organization and the government, and termination will result in legal hurdles.

4.9 Service organization within a capital project energy company I (2016- Current)

4.9.1 Drivers of change

This case study showcases the implications of market shift on a service organization within an owner capital project company. Currently, there is great emphasis on environmental regulations and investments supporting low carbon initiatives in various countries to achieve carbon neutrality UN SDG goals by 2050. In addition, the drop in gas prices and the slow growth of coal energy customers is pushing many owners toward renewable energy projects.

4.9.2 Strategy (Internal and external)

Before initiating the change process, the organization's leadership started anticipating the signs of shift early, by looking at current and the projected future market trends. In addition, the organization knew that the processes of change will take time, so it started communicating these strategic changes to customers, employees, and stakeholders to eliminate ambiguity and ensure buy-in and support. Also, the organization created a strategic plan that took into account available and the future projected needed resources to achieve portfolio transformation.

Furthermore, the organization identified skillsets that will no longer be required and those that have transferrable skills. It also offered affected employees voluntary transition packages to ensure their smooth transition. On the other hand, it also provided training to contractors working with the organization to fulfill the gap caused by downsizing and the shift in the organization's portfolio.

4.9.3 Structure (Internal and external)

From a structure perspective, the organization partnered with external organizations to perform services or works that were no longer provided by the organization. Also, the organization accelerated its retooling/restructuring efforts to optimize resources and talents to meet the anticipated shift in customer demand and organization portfolio.

4.9.4 People and Culture (Internal and external)

From a people and culture perspective, the leadership supported the change efforts and balanced between their business and compassionate decisions. In addition, they planned the longevity of the employees throughout the change initiative. Furthermore, the organization adjusted the communication of the change efforts according to the audience. Moreover, the organization continuously provided internal specialty training by third parties when needed. The organization also strived to anticipate the future, with a mindset of working towards the present and future of the organization. Also, it strengthened its relationships with clients by maintaining a continuous line of communication to ensure buy-in and support for change efforts.

4.9.5 processes and technology (Internal)

From a processes and technology perspective, the organization shifted towards new technologies that will support the low carbon transformation. In addition, it adjusted the Integrated Technical Strategy according to the continuously changing conditions.

4.9.6 Challenges

The organization faced various challenges such as the disapproval caused by the changes in the required skillset. Moreover, some project delays happened due to retooling, hiring, relocating, or releasing of existing employees. Finally, to achieve the portfolio shift, the organization had to understand how current processes and technologies needed to change, and how to achieve these changes with current human capital resources at hand.

4.10 Owner EPC Organization J (2019- Current)

4.10.1 Drivers of change

This case study showcases the implications of low carbon future on a service provider EPC organization. What is driving the change of the organization is the carbon neutrality goals 2050 UN SDGs. In addition, the market is shifting towards renewables (Hydrogen plants, Solar), and diverting away from Nuclear projects. Moreover, there is an increase in environmental rules, regulations, and investments supporting low carbon initiatives in various countries such as European Union, Brazil, and Canada.

4.10.2 Strategy (Internal and external)

In response to different drivers, the organization announced its new strategy with a focus on the chemical business segment and green projects. To achieve the new strategy, the capital projects portfolio was realigned to serve the corporate core strategy and stay ahead of competitors. Also, the change process was phased, gradual, and communicated via emails, Questions & Answers sessions (Q&A) by different organizational leaders. Furthermore, the organization had to modify its organizational governance system to

increase accountability and streamline decision making, which allows units to work independently, but actively communicate and decide decisions affecting the organization collectively, especially for large-scale and strategic projects.

4.10.3 Structure (Internal and external)

In addition, the organization partnered with specialized local and international entities to exchange low carbon transformation technologies and implementation knowledge mainly in green chemical projects. Besides the internal restructuring, the organization considered the acquisition of organizations specialized in low carbon to bridge the knowledge and capability gap. Moreover, the organization was restructured by merging, splitting, and divesting some units that do not align with the long-term corporate strategic goals.

4.10.4 People and culture (Internal and external)

From a people and culture perspective, the organization empowered employees and increased their sense of accountability by ensuring that their voices are being heard and promoting their contributions even if they are small. In addition, it focused on feedback collection, via Q&As and providing employees with feedback regarding their suggestions. Also, the organization acknowledged the shift in the required skills and identified the right people for the right place. Due to these various responses, the organization was able to increase commitment and create a strong culture and allegiance to the organization since it was operating for hundreds of years and, has strong traditions. Also, it incorporated corporate goals into the organization's cultural events to support buy-in efforts.

4.10.5 Processes and technology (Internal)

From a processes and technology perspective, the organization identified its internal capabilities, knowledge, and competencies such as the green chemicals projects. Additionally, it invested extensively in the research and development (R&D) efforts, with a strong focus on green chemicals and decarbonization.

4.10.6 Challenges

Various challenges have faced the organization, which varied by country and the type of projects. Different regions required different approaches and technologies, for example, implementing green projects is easier in countries where energy is generated via renewable sources. Moreover, chemical plant projects are complex and require a specific set of skills, knowledge, and technologies that varies from project to project which stresses the organization to fill the knowledge gap. Also, scaling and marketing green chemicals projects is challenging for the organization due to its relatively higher cost. Also, research and development for various green projects are very costly.

Internally, post-merger caused various challenges to the organization since the approval procedures for the new processes complicated the overall workflow and caused the loss of employees' motivation, and accountability calls. Also, it caused financial

challenges due to the complexity of the newly created structure. Furthermore, different merged segments had different cultures and expertise, which caused various challenges when merged - some employees embraced their status quo and resisted change. In addition, employee accountability decreased, which affected their motivation. As a result, the organization reverted to its old structure.

4.11 Low carbon future

4.11.1 Drivers of change

This case study provides an overview of the Implications of low carbon future on owner and service provider capital project organizations. The organizational changes that happened were a response to various drivers, including the increased legislation to reduce greenhouse gases, pressure from owners, investors, NGOs, and society. In addition to the shift in the energy market toward renewables, and the U.S. government's ambitious targets. The ultimate goal behind low carbon transformation is to achieve carbon neutrality by 2050 as set by the UN Sustainability Development Goals (SDGs).

Currently, multiple factors are supporting the low carbon change efforts within different capital project organizations. First, there is an increase in environmental rules and regulations enforcing or supporting low carbon initiatives, which is supported by governments' renewing commitments toward SDGs implementation, for example, the U.S. government's latest policies targets installing 500,000 electric vehicle charging stations by 2030 and transforming at least 20% of school busses to EV. Also, the plan includes providing consumer incentives to promote EVs by offering $100 Billion in consumer rebates.

Also, there is a notable shift in the energy market worldwide towards renewables, such as wind and solar. The market shift had been supported by pressure from the public, media, and stockholders who are promoting renewables and raising awareness of climate change challenges. The market shift has pushed various major yacht companies to start introducing hydrogen-powered vessels which will affect the maritime transportation industry in the long run by offering maritime eco-friendly solutions.

Finally, the COVID-19 pandemic had its share in promoting low carbon transformation efforts by driving companies to shift to the virtual work environment and the use of cloud platforms. The pandemic has helped in changing work operations, such as minimizing work air travel, and it offered companies more flexibility in acquiring new international talents that can support low carbon efforts.

4.11.2 Strategy (External and internal)

To achieve low carbon goals, organizations have strategically responded by setting strict carbon-neutral targets that take into account the organizations' internal capabilities. After that, organizations are changing their portfolio to achieve the pre-set goals and to stay ahead of market competitors, for example, shifting from mega plant projects (coal/gas) to multiple small renewable projects or converting existing facilities to renewable ones (renewable diesel facility). In addition, Organizations are incorporating

climate change plans and processes into the whole project lifecycle while identifying the proper set of technologies that will be used to achieve low carbon goals

Changing an organization's portfolio requires an adequate set of skills, and for that organizations are identifying required vs available resource for low carbon transformation and devise a resourcing plan to address the gap, which can take many forms including partnering with government agencies and universities to bridge the skillset capability gap either through laws, programs, and grants. In addition, partnering with local transport companies to promote electrification, or acquiring organizations/startups specializing in low carbon to bridge the knowledge/capability gap. Furthermore, the resourcing plan will also consider market analysis efforts performed to analyze (2-5) years of market trends, and detect the available/potential workforce including the number of graduates, their specializations, and available skill sets.

4.11.3 Structure (Internal and external)

From a structure prespective, organizations are undergoing restructuring by creating new groups, merging others, or by creating subunits that will be responsible for overseeing the execution of low carbon initiatives (such as creating an enterprise risk management group). In addition, organizations are shifting to smaller office buildings, redesigning their facilities, or moving the headquarters to a new location to attract needed low carbon talents which will support low carbon transformation goals.

4.11.4 People and culture (Internal and external)

From a people perspective, the capital projects organizations will communicate their strategic decisions to potentially affected internal business units to give them time to prepare adequate responses, after the leadership will share these low carbon change plans with employees to build trust and support internal buy-in efforts. The acknowledgment of trust provides a strong connection to the organization, which strengthens corporate culture and facilitates organizational change efforts. In addition to achieving internal buy-in, organizations are identifying skill sets and projects that don't align with the low carbon strategies and providing employees with cut-off dates to allow them to reskill or apply for new internal positions. Therefore, removing the organizations' transition phase stress and anxiety associated with low carbon transformation.

In addition, organizations are using different training techniques and programs to shift the skillset of the current workforce and attract new ones, especially specialists, via partnerships with universities, government agencies, and clients. In addition, they are creating new intern programs within their organizations to bring awareness to renewables and prepare interns for the new market.

4.11.5 Processes and technology (Internal and external)

From a processes and technology perspective, the organizations are performing business incubation initiatives and investing in green technologies such as carbon capture, biomass, hydrogen, and renewables to be the future provider of these technologies.

On the other hand, organizations are developing strong relationships with clients to identify areas where the current workforce can be mobilized, for example, teams who had worked on nuclear and gas projects may have transferable construction skills to renewable projects. Also, the organizations will modify their operation to fulfill low carbon objectives, for example, decreasing work air travel, shifting to a virtual work environment, changing corporate fleets to EV and hybrid. In addition, organizations are lowering carbon emissions without minimizing production by adjusting some processes, such as gas flaring.

In addition, capital projects organizations are standardizing and centralizing the engineering information to make it accessible and searchable throughout the organization which helps in achieving digital transformation objectives that serve low carbon goals. Also, some organizations are utilizing advanced data analytics tools to modify their processes and decrease carbon emissions, for example, a mega software company is utilizing data analytics in their data centers to minimize cooling emissions.

4.11.6 Challenges

Even though organizations are taking various actions to achieve a low carbon future, many challenges are being faced. From a strategic and process preceptive, there exists some ambiguity regarding how capital project organizations set their low carbon goals and the metrics they use to align their actions with their goals, which in some cases, allows the organizations to minimize their carbon footprint by offloading it to other organizations in the supply chain, or by not taking responsibility for the emissions throughout the value chain, for example, shifting from inhouse to cloud computing to offload emissions. In addition, organizations are facing challenges in articulating long-term and short-term strategies, which is attributed to the variable severity of the low carbon shift among different organizations, especially service providers, whose low carbon goals depend on their clients' requirements. Another factor attributing to the strategic challenges is the fact that UN sustainability goals are cascaded differently in projects depending on the organization. Also, it is being affected by the challenging legislative and lobbying factors which can affect current projects and low carbon goals, for instance, governments not supporting carbon capture initiatives by major Oil and Gas companies, and NGOs are lobbying to reject carbon capture initiatives.

Furthermore, the capital projects industry does not have a major player or even a group of major players taking on global initiatives and changing the market, unlike the manufacturing industry. Furthermore, the complete departure from traditional energy sources is not yet possible on a global scale, especially when considering the profitability vs. investment cost of green technologies which poses an obstacle to their wide adoption. Moreover, shifting to smaller projects caused various problems such as underestimating and underbidding. Finally, small organizations do not have the capacity to invest in technology and innovation related to low carbon future.

From a people perspective, organizations are experiencing knowledge and skillset gap, especially for organizations that have no prior experience in low carbon projects. Also, organizations are facing internal resistance from leadership and employees especially when the change will result in career path changes and terminations. Other, factors contributing to resistance can be attributed to challenges in communicating change plans to different employees, which is causing confusion and ambiguity, which is pushing SMEs to leave the organizations. Also, there exists ambiguity regarding how the

organizations should develop labor strategies (develop talent vs hire). Furthermore, organizations are facing challenges in transferring highly paid SMEs to a new positions in medium and small-sized projects. Moreover, the changes in the organizations' portfolio to incorporate low carbon projects will create uncertainty, especially for the unionized labor force, and will result in legal hurdles in case the organization decided to terminate large numbers due to the skillset requirement shift.

CHAPTER 5. RESULTS

In the pursuit to answer the research question, semi-structured interviews, and case study analysis were performed on 10 capital project organizations from different industries, in addition to a pilot case study related to low carbon future which represents the possible future of capital project organizations. As a result, a total of 590 responses were recorded, analyzed, and coded in a total of 61 themes. Some of these themes were related to drivers of change (ex: Sustainability), challenges, responses performed by the organizations (ex: Restructuring), or challenges (ex: Resistance to change). The main objective of the analysis is to provide an overview of the past and present changes facing capital project organizations and understand what drove these changes, and how they responded to them. The main focus of this research was on the organizational level, unlike previous works on capital project organizations which mainly focused on "change management" and project level changes.

5.1   Case studies data summaries and analysis

In summary, the total number of case study frameworks created is 11. In addition, the total number of interviews performed is 14. These interviews generated 590 responses which can be categorized into actions or challenges, and the total number of themes is 61.
Table 5.1 provides an overview summary of the different case studies performed. It includes the organization name, industry type, change period, drivers of change, main responses performed by the organizations, and the total number of interviews performed.

Table 5.1 Case study summary table

Organization description	Industry type	Change period	Drivers of change	Main response	Interviews
Owner Chemical organization A	Chemicals	2015 - current	Low carbon future	Acquisition and internationalization	4
EPC organization B	Construction	2017 - current	Digitization and Low carbon future	Digitization	2
Owner energy organization C	Energy	2019 - current	Low carbon future	New operating model	1
Airport Authority organization D	Airport	2018 - current	Adaptable work environment	Remote work	1
EPC organization F	Construction	2017 - 2021	Low carbon future and drop in oil prices	Renewables , and data centers	1
Manufacturing organization G	Manufacturing	2015 - current	Need to increase the Organization's operational efficiency	Integrated Project Delivery	1
Government Agency N - External	Government	2010 - current	Achieve future development needs	Public Private Partnership	1
Government Agency N - Internal	Government	2010 - current	Decrease operational cost	New support model	
Power generation government organization O	Government	2017 - current	Low carbon future	Acquisitions	1
Service org. within an energy organization S	Energy	2016 - current	Low carbon future	Strategy realignment ,anticipation, and retooling	1
Owner EPC organization T	Construction	2019 - current	Low carbon future and market shift	Restructuring and renewables	1
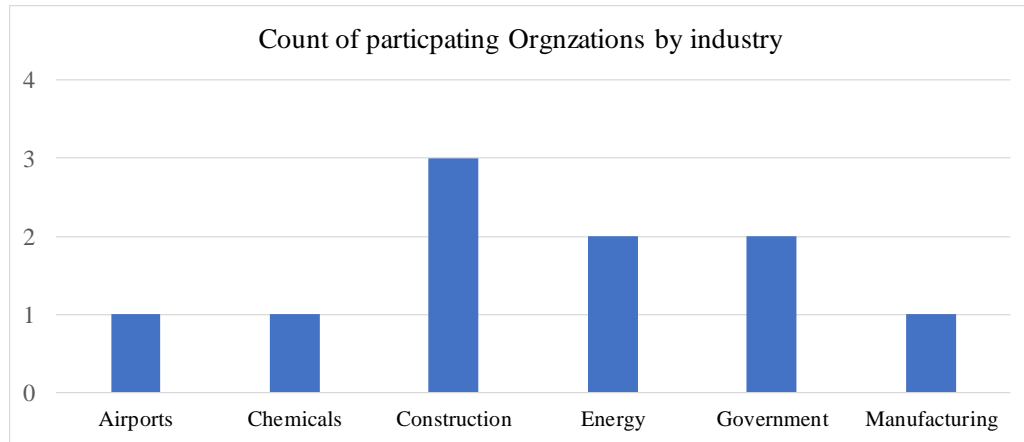
Figure 5-1 Count of Industries of participating Organizations

Figure 5-1 provides an overview of the total number of participating organizations by their industry. Three of the participating organizations were construction contractors, and another two organizations specialized in energy. In addition, one of the organizations is specialized in airport management and another one in manufacturing. Finally, two government organizations participated.
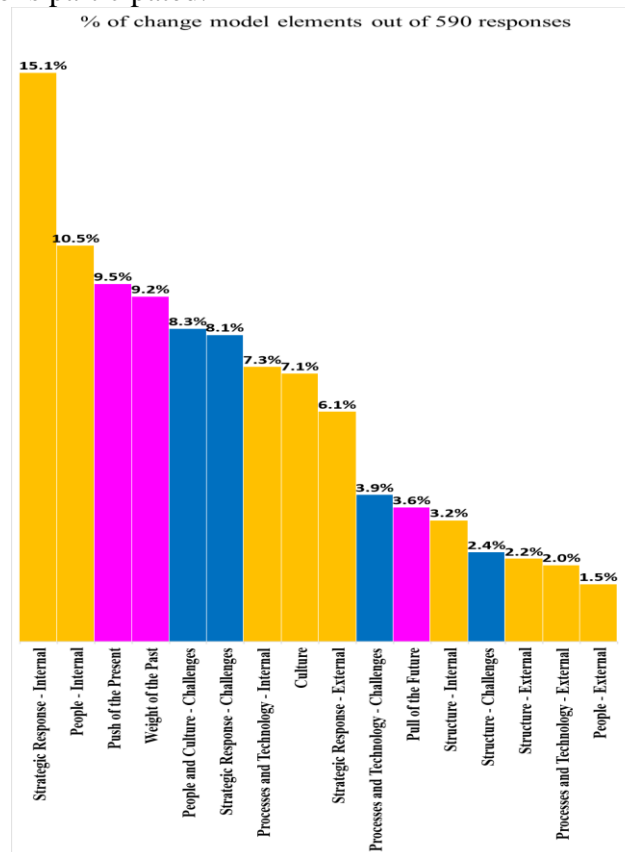
Figure 5-2 Percentage of change model elements

Figure 5-2 showcases the total percentage of change model elements for all case studies combined. The Bars colored in orange represent change model responses, neon pink represents the futures triangles, while those colored in dark blue represent the challenges in the change model, In addition, bars colored in pink represent the futures triangle elements from the model. The responses provided derived from the interviews were mainly related to internal strategy (15.1%), people internal (10.5%), the weight of the past (9.2%), the push of present (9.5%), people and culture challenges (8.3%), strategic response challenges (8.1 %), culture (7.1%), processes and technology internal (7.3%), strategic response external (6.1%). In total, the percentage of challenges combined is 31.9 %, while 68.1% is the for the rest of the change model elements. These percentages offer an overview of important elements discussed in the interviews, especially strategic responses. Different changes provided in the case studies required the organization to perform internal strategic, and people internal responses. In addition, many of the changes in the case studies were driven by the push of the present drivers of change.

However, due to the qualitative nature of the study, referring back to the frameworks and understanding the effect of change model elements is important. For example, the pull of the future represents 3.6 % of the total responses, however, it is an important element of the model since it represents the main driver of change for different organizations.

Table 5.2 Summary of the % of themes occurrence for all case studies combined

Second-order themes	% of occurrence	Sum of % by group
Restructuring	4.92%	
Resistance to change	4.92%	
Communication	4.75%	
Training	4.24%	
Market shift	3.90%	
Partnerships	3.90%	44.41% for 12 themes Group 1
Nature of industry	3.22%	
Supportive leadership	3.22%	
Organizational design	2.88%	
Recruitment	2.88%	
Internal capabilities	2.88%	
Organizational commitment	2.71%	
Market expansion	2.71%	
Retaining workforce	2.54%	
Resources	2.54%	
Remote work	2.20%	
Integration	2.20%	38.64% for 22 themes Group 2
Portfolio	2.20%	
Clients/owners' needs	2.20%	
Shift in the required skillset	2.03%	
Technology	2.03%	

Strategic objective	2.03%	
Human resource allocation	1.86%	
Anticipation	1.86%	
Project execution	1.53%	
Operating model	1.53%	
Sustainability	1.36%	
Reporting	1.36%	
Regional/unit requirements	1.19%	
External interactions	1.19%	
Process re-engineering	1.19%	
Feedback collection	1.02%	
Network	1.02%	
Leadership changes	0.85%	
Gov't participation/control/support	0.85%	
Workforce	0.85%	
Effective leadership	0.85%	
Diversity and inclusion	0.85%	
External/internal benchmarking	0.85%	
Competitive advantage	0.85%	
Digitization	0.85%	
Relationships with private and public entities	0.85%	
Resource efficiency	0.85%	
Knowledge management	0.85%	
Termination	0.85%	
Owner/client requirements	0.68%	16.5% for 27 themes
Subs and suppliers adaptability	0.68%	Group 3
Accountability	0.68%	
Competitive bids	0.51%	
Pandemic	0.51%	
Research and development	0.51%	
Career progression	0.51%	
Stage-gate processes	0.51%	
Innovation	0.51%	
Continuous improvement	0.51%	
Scaling	0.51%	
External growth opportunities	0.34%	
Budget	0.34%	
Adaptive changes	0.34%	
Investment	0.34%	

Metrics	0.17%	
Grand Total	**100.00%**	**100.00%**

Table 5.2 provides a summary of % theme occurrence out of 590 responses for all the case studies combined. The most recurring theme was restructuring (4.92%) along with resistance to change (4.92%), and the least used theme was Metrics (0.17%).

Group 1 is composed of 12 themes and represents 44.1% of the occurrence, group 2 is composed of 22 themes representing 38.64 % of occurrence, while group 3 is composed of 27 themes representing 16.5 % of the occurrence.

The themes in group 1 are related to different categories of the change model, for instance, restructuring is related to strategic response, and structure internal. While training, recruitment, and supportive leadership are related to people internal. On the other hand, resistance to change is related to the weight of the past, people, and culture challenges. The market shift is mainly related to the push of the present, and the pull of the future. In addition, the partnership is related to structure and strategic response external. Furthermore, communication is related to people and culture, strategic responses internal. organizational commitments are related to culture, the weight of the past, and people's challenges. Moreover, organizational design and internal capabilities are related to multiple elements in the change model. Finally, the nature of the industry is related to strategic challenges and the weight of the past.

Therefore, different themes have different allocations within the change models, some themes will appear under challenges, while others will appear in different parts of the change model.

Also, it is important to understand the themes in the context of the frameworks, for instance, Gov't participation/control/support only occurred 0.9%, however, it was one of the themes that had a greater impact on the organizations and sometimes it pushed the change process, for example: "The US administration is supporting the shift of government vehicles to EV". On the other hand, sometimes that theme prevented the organization from performing a response, for example: "Merging with companies outside the local regions is lobbied and not accepted by the government".

5.2   Change model analysis with the second-order themes:

Table 5.3 represents the total count of second-order themes within different parts of the change model. The table is read in this manner: Accountability was mentioned a total of 4 times, 2 times in strategic response internal, and 2 times in people internal. Also, the cells were colored in shades of green as a function of count to highlight high and low mentions. For instance, second-order themes with 0 count will not be colored, and that means that theme was not discussed. On the other hand, 1 will be lightly shaded, and the highest number will have the darkest color which means that theme was mentioned more frequently in the text. This visual representation is also known as a heat map, which allows the reader to spot the highly discussed themes across the different case studies, and highlight the change model elements with a lot of themes. As shown in the table, restructuring is the highest discussed theme, and resistance to change is the highly discussed challenge for all the case studies combined.

Table 5.3 Summary of Second-order themes within the change model for all case studies

Second-order themes	Weight of the Past	Push of the Present	Pull of the Future	Strategic Response - External	Strategic Response - Internal	Structure - External	Structure - Internal	People - Internal	People - External	Culture	Processes and Technology - External	Processes and Technology - Internal	Strategic Response - Challenges	Structure - Challenges	People and Culture - Challenges	Processes and Technology - Challenges	Grand Total
Resistance to change	12	0	0	0	0	0	0	0	0	0	0	0	3	0	14	0	29
Restructuring	1	1	0	1	8	2	8	1	0	0	0	0	5	1	1	0	29
Communication	3	0	0	1	9	0	0	5	0	5	0	0	2	0	1	2	28
Training	1	0	0	2	5	0	0	10	0	0	0	1	2	0	2	2	25
Market shift	1	14	4	0	1	0	0	0	0	0	0	0	2	0	0	1	23
Partnerships	0	2	0	9	0	6	0	0	1	0	1	0	1	3	0	0	23
Supportive leadership	1	1	0	0	2	0	0	8	0	3	0	0	0	0	3	1	19
Nature of industry	6	3	0	1	0	0	0	0	0	0	0	0	6	0	1	2	19
Internal capabilities	1	2	1	1	2	0	2	1	0	2	1	3	0	0	1	0	17
Organizational design	0	2	2	0	1	2	0	1	0	3	0	1	3	1	0	1	17
Recruitment	0	0	0	3	1	0	0	5	4	1	1	1	0	0	1	0	17
Organizational commitment	5	0	0	0	0	0	0	0	0	8	0	0	1	0	2	0	16
Market expansion	2	2	2	2	6	1	0	0	0	0	0	0	0	1	0	0	16
Resources	3	0	0	1	1	0	0	0	0	1	2	2	1	2	1	1	15
Retaining workforce	0	0	0	0	1	0	0	1	0	0	0	0	5	2	6	0	15
Integration	0	0	0	2	5	0	3	0	0	0	0	1	0	0	2	0	13
Portfolio	1	3	1	2	4	0	0	0	0	0	0	0	2	0	0	0	13
Remote work	1	3	0	0	3	0	0	0	0	0	1	2	1	0	0	2	13
Clients/owners needs	0	7	0	0	0	0	1	0	1	0	0	0	2	1	0	1	13
Strategic objective	1	1	0	1	2	0	0	1	0	3	0	1	2	0	0	0	12
Technology	1	1	0	0	2	0	0	0	0	0	0	8	0	0	0	0	12

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Shift in the required skillset	3	0	0	0	0	0	0	5	0	0	0	0	1	0	3	0	12
Anticipation	0	0	1	0	1	0	0	0	0	7	0	2	0	0	0	0	11
Human resource allocation	0	0	0	0	4	0	0	2	0	0	1	1	0	0	3	0	11
Project execution	0	0	0	1	2	0	0	1	0	0	0	3	2	0	0	0	9
Operating model	1	0	3	0	1	0	0	0	0	1	0	0	0	0	2	1	9
Sustainability	1	2	4	0	0	0	0	0	0	0	0	0	0	0	0	1	8
Reporting	0	0	0	0	2	0	3	0	0	0	0	2	0	0	1	0	8
External interactions	1	0	0	3	0	1	0	0	0	1	0	0	0	1	0	0	7
Process re-engineering	0	0	0	0	1	0	0	0	0	1	0	2	0	0	0	3	7
Regional/unit requirements	1	0	1	0	0	0	0	0	0	0	0	0	0	0	5	0	7
Network	0	0	0	0	0	0	1	1	1	1	0	0	1	1	0	0	6
Feedback collection	0	0	0	0	1	0	1	3	0	0	1	0	0	0	0	0	6
Competitive advantage	0	2	1	0	1	0	0	0	0	0	0	1	0	0	0	0	5
Leadership changes	1	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	5
Resource efficiency	0	0	0	0	2	0	0	1	0	0	0	2	0	0	0	0	5
Effective leadership	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	0	5
Workforce	0	1	0	0	0	0	0	0	0	1	0	0	3	0	0	0	5
Digitization	1	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	5
Gov't participation/control/support	1	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5
External/internal benchmarking	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	5
Knowledge management	0	0	0	0	1	0	0	0	0	0	0	4	0	0	0	0	5
Diversity and inclusion	0	0	0	0	3	0	0	1	0	1	0	0	0	0	0	0	5
Termination	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	5
Relationships with private and public entities	0	0	0	1	0	0	0	0	1	0	3	0	0	0	0	0	5
Subs and suppliers adaptability	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4
Accountability	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	4
Owner/client requirements	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	4
Pandemic	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Innovation	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
Career progression	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	3
Stage-gate processes	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	3

Scaling	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	3
Competitive bids	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3
Continuous improvement	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	3
Research and development	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	3
Budget	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	2
External growth opportunities	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Adaptive changes	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2
Investment	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
Metrics	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Grand Total	**54**	**56**	**21**	**36**	**89**	**13**	**19**	**62**	**9**	**42**	**12**	**43**	**48**	**14**	**49**	**23**	**590**

To further analyze the theme trends, a new set of tables were created for different parts of the change models, the percentages in each set are based on the column total. For example, themes in Weight of the Past will be calculated as a percentage of 54.

Table 5.4 Push of present & Pull of future theme % breakdown

Push of present		Pull of future	
Market shift	25.0%	Sustainability	19.0%
Clients/owners needs	12.5%	Market shift	19.0%
Remote work	5.4%	Operating model	14.3%
Portfolio	5.4%	Organizational design	9.5%
Subs and suppliers adaptability	5.4%	Market expansion	9.5%
Gov't participation/control/support	5.4%	Competitive advantage	4.8%
Nature of industry	5.4%	Portfolio	4.8%
Market expansion	3.6%	Regional/unit requirements	4.8%
Sustainability	3.6%	Anticipation	4.8%
Competitive advantage	3.6%	Internal capabilities	4.8%
Internal capabilities	3.6%	Digitization	4.8%
Organizational design	3.6%		
Partnerships	3.6%		
Pandemic	3.6%		
Restructuring	1.8%		
Workforce	1.8%		
Technology	1.8%		
Digitization	1.8%		
Strategic objective	1.8%		
Supportive leadership	1.8%		

As shown in Table 5.4, these parts of the change model represent the drivers of change, Market shift, and Sustainability are dominating themes, since low carbon future

(sustainability) is causing a shift toward renewables. Another theme that is also related to low carbon is Gov't participation/control/support. For example: *"There is an increase in environmental rules and regulations and investments supporting low carbon initiatives in various countries (such as European Union, Brazil, and Canada", "There is an increase in environmental regulations and investments supporting low carbon initiatives in various countries"*

Organizational design is a theme mainly related to organizational efficiency and how the organization is set up, as mentioned in the interviews, for example: *"the organization developed a Mergers and Acquisitions playbook to guide future efforts and highlight areas of diligence", "Shift from a design-bid-build to Design-Build, and later to IPD project delivery approach to reduce time, cost, and risk".*

Table 5.5 Strategic response theme % breakdown

Strategic Response - External		Strategic Response - Internal	
Partnerships	25.0%	Communication	10.1%
External interactions	8.3%	Restructuring	9.0%
Recruitment	8.3%	Market expansion	6.7%
External growth opportunities	5.6%	Training	5.6%
Market expansion	5.6%	Integration	5.6%
Training	5.6%	Human resource allocation	4.5%
External/internal benchmarking	5.6%	Portfolio	4.5%
Integration	5.6%	Remote work	3.4%
Portfolio	5.6%	External/internal benchmarking	3.4%
Subs and suppliers adaptability	2.8%	Diversity and inclusion	3.4%
Restructuring	2.8%	Project execution	2.2%
Internal capabilities	2.8%	Technology	2.2%
Project execution	2.8%	Strategic objective	2.2%
Strategic objective	2.8%	Career progression	2.2%
Nature of industry	2.8%	Reporting	2.2%
Communication	2.8%	Resource efficiency	2.2%
Relationships with private and public entities	2.8%	Internal capabilities	2.2%
Resources	2.8%	Supportive leadership	2.2%
		Leadership changes	2.2%
		Accountability	2.2%
		Feedback collection	1.1%
		Anticipation	1.1%
		Competitive advantage	1.1%
		Operating model	1.1%
		Scaling	1.1%
		Organizational design	1.1%
		Budget	1.1%
		Adaptive changes	1.1%
		Resources	1.1%
		Process re-engineering	1.1%

Retaining workforce	1.1%
Effective leadership	1.1%
Stage-gate processes	1.1%
Recruitment	1.1%
Digitization	1.1%
Investment	1.1%
Knowledge management	1.1%
Metrics	1.1%
Market shift	1.1%

As shown in Table 5.5, the main themes in strategy were partnerships and recruitment, which were common responses taken by organizations. In addition to communication, restructuring, training, and integration

Table 5.6 Structure theme % breakdown

Structure - External	Structure - External	Structure - Internal	Structure - Internal
Partnerships	46.2%	Restructuring	42.1%
Restructuring	15.4%	Reporting	15.8%
Organizational design	15.4%	Integration	15.8%
Investment	7.7%	Internal capabilities	10.5%
External interactions	7.7%	Network	5.3%
Market expansion	7.7%	Clients/owners needs	5.3%
		Feedback collection	5.3%

As shown in Table 5.6, partnering, restructuring, reporting and integration are the main recurring themes in the change model for structures. During various changes, to bridge the knowledge/capability gap, the various organization had to perform partnerships. Besides, the organization had to restructure either by merging, splitting, or divesting units to serve its strategic goals

Table 5.7 people and culture theme % breakdown

People internal People - Internal		People external People - External		Culture Culture	
Training	16.1%	Recruitment	44.4%	Organizational commitment	19.05%
Supportive leadership	12.9%	Relationships with private and public entities	11.1%	Anticipation	16.67%
Shift in the required skillset	8.1%	Partnerships	11.1%	Communication	11.9%
Recruitment	8.1%	Network	11.1%	Organizational design	7.1%
Communication	8.1%	Clients/owners needs	11.1%	Supportive leadership	7.1%
Termination	8.1%	Owner/client requirements	11.1%	Innovation	7.14%

61

Effective leadership	6.5%	Strategic objective	7.14%
Feedback collection	4.8%	Internal capabilities	4.76%
Leadership changes	3.2%	Recruitment	2.38%
Human resource allocation	3.2%	Process re-engineering	2.4%
Accountability	3.2%	Resources	2.4%
Strategic objective	1.6%	Network	2.38%
Retaining workforce	1.6%	Workforce	2.38%
Adaptive changes	1.6%	External interactions	2.38%
Project execution	1.6%	Diversity and inclusion	2.38%
Internal capabilities	1.6%	Operating model	2.4%
Diversity and inclusion	1.6%		
Career progression	1.6%		
Resource efficiency	1.6%		
Organizational design	1.6%		
Restructuring	1.6%		
Network	1.6%		

As shown in Table 5.7, the main themes in people and culture are training, supportive leadership, partnerships, recruitment, organizational commitment, and anticipations

Table 5.8 Processes and Technology theme % breakdown

Processes and Technology - External		Processes and Technology - Internal	
Relationships with private and public entities	25.0%	Technology	18.6%
Resources	16.7%	Knowledge management	9.3%
Human resource allocation	8.3%	Internal capabilities	7.0%
Internal capabilities	8.3%	Project execution	7.0%
Remote work	8.3%	Stage-gate processes	4.7%
Research and development	8.3%	Resource efficiency	4.7%
Feedback collection	8.3%	Reporting	4.7%
Partnerships	8.3%	Continuous improvement	4.7%
Recruitment	8.3%	Resources	4.7%
		Process re-engineering	4.7%
		Anticipation	4.7%

Remote work	4.7%
Digitization	2.3%
Recruitment	2.3%
Human resource allocation	2.3%
Organizational design	2.3%
Strategic objective	2.3%
Research and development	2.3%
Training	2.3%
Competitive advantage	2.3%
Integration	2.3%

As shown in Table 5.8, processes and technology rely on Relationships with private and public entities, which will allow the organization to fulfill the knowledge gap. While resources are related to the organization seeking involvement in a professional organization which helped in getting the proper knowledge required to do the change.

Also, it relies on Technology, which is related to the implementation of various technologies such as cloud service, centralized work environment, and digital twins. On the other hand, Knowledge management is related to the creation of a set of tools to transfer and retain knowledge, or using the available CII knowledge base

Furthermore, Internal capabilities are related to technical knowledge available within the organization. Some organizations developed in-house tools to fulfill the gap, while others developed strong processes. On the other hand, some organization grew their internal capability efforts by performing acquisitions

Table 5.9 Weight of the past and strategic challenges theme % breakdown

Weight of the Past		Strategic Response - Challenges	
Resistance to change	22.2%	Nature of industry	12.5%
Nature of industry	11.1%	Restructuring	10.4%
Organizational commitment	9.3%	Retaining workforce	10.4%
Resources	5.6%	Resistance to change	6.3%
Shift in the required skillset	5.6%	Workforce	6.3%
Communication	5.6%	Organizational design	6.3%
Market expansion	3.7%	Project execution	4.2%
Regional/unit requirements	1.9%	Communication	4.2%
Internal capabilities	1.9%	Clients/owners needs	4.2%
Digitization	1.9%	Market shift	4.2%
Restructuring	1.9%	Strategic objective	4.2%
Market shift	1.9%	Portfolio	4.2%
Supportive leadership	1.9%	Training	4.2%
Competitive bids	1.9%	Competitive bids	2.1%
Remote work	1.9%	Shift in the required skillset	2.1%
Operating model	1.9%	Network	2.1%

Gov't participation/control/support	1.9%	Organizational commitment	2.1%
Sustainability	1.9%	Remote work	2.1%
Scaling	1.9%	Resources	2.1%
Technology	1.9%	Owner/client requirements	2.1%
Strategic objective	1.9%	Budget	2.1%
External interactions	1.9%	Partnerships	2.1%
Leadership changes	1.9%		
Portfolio	1.9%		
Training	1.9%		
Owner/client requirements	1.9%		
Pandemic	1.9%		

Table 5.10 Structure, People, Processes, and technology challenges theme % breakdown

Structure - Challenges		People and Culture - Challenges		Processes and Technology - Challenges	
Partnerships	21.4%	Resistance to change	28.6%	Process re-engineering	13.0%
Retaining workforce	14.3%	Retaining workforce	12.2%	Nature of industry	8.7%
Resources	14.3%	Regional/unit requirements	10.2%	Remote work	8.7%
External interactions	7.1%	Shift in the required skillset	6.1%	Communication	8.7%
Organizational design	7.1%	Human resource allocation	6.1%	Training	8.7%
Gov't participation/control/support	7.1%	Supportive leadership	6.1%	Resources	4.3%
Restructuring	7.1%	Integration	4.1%	Market shift	4.3%
Market expansion	7.1%	Operating model	4.1%	Supportive leadership	4.3%
Clients/owners needs	7.1%	Organizational commitment	4.1%	Operating model	4.3%
Network	7.1%	Training	4.1%	Research and development	4.3%
		Recruitment	2.0%	Sustainability	4.3%
		Restructuring	2.0%	Scaling	4.3%
		Nature of industry	2.0%	Clients/owners needs	4.3%
		Resources	2.0%	Competitive bids	4.3%
		Communication	2.0%	Continuous improvement	4.3%
		Internal capabilities	2.0%	Organizational design	4.3%
		Reporting	2.0%	Owner/client requirements	4.3%

The main challenge themes in Weight of the past are Resistance to change, the nature of the industry, and organizational commitment. While the main challenges in strategic response are the nature of industry, restructuring, and retaining the workforce. On the other hand, structure challenges are related to Partnerships and retaining the workforce. Moreover, the main themes for people and culture are Resistance to change and retaining the workforce. Finally, for processes and technology challenges, the main themes are process re-engineering, nature of the industry, remote work, communication, and training.

5.3   Concept Maps analysis (second-order themes and Categories)

In this section, concept maps were analyzed to detect the main changes and themes affecting the organizations using UCInet 6 software (S. Borgatti et al., 2002). In addition, betweenness centrality will not be used, since the network is "star" structured, meaning the center will always have a higher betweenness centrality, while the peripheries will have a lower or a zero value. In terms of closeness, since themes are always one step away from the change model categories nodes (strategy, structure), multiple themes might have the same Closeness values. However, in some instances when a theme is mentioned multiple times under different categories, its value will be higher, because it has shorter routes to other nodes in the network.

5.3.1   Organization A

Various observations could be noted from the concept maps of organization A shown in Figure 5-3 and Figure 5-4, for example, the main changes faced by the organization are related to people - internal (WDC=0.26) and strategic response internal (WDC=0.18). Moreover, the main challenges facing the organization are People and Culture - Challenges (WDC=0.26), which is expected especially since the changes happening to the organization are related to the acquisition of a new organization, and expansion to international markets which caused various people related issues ranging from a shift in the skillset to leadership changes. What is driving the organization to change is the market shift towards renewables (Bigger circle and thick edge to push of the present), that market shift is pushing the organization to "Market expansion", which required the organization to partner and restructure to grow its "Internal capabilities". Internal capabilities had a higher score of closeness (CC= 0.39) compared to other themes due to the fact it was mentioned under different categories, which highlights some importance, that could be explained by the fact that the purpose behind the organizational change is to be ready for the market shift, which requires the organization to grow internal capabilities to help the organization to expand.

Moreover, various themes are located next to each other in a concept map, such as restructuring and partnerships which shows how the organization performed these responses together.

Finally, the main themes of the responses taken by the organization are summarized in Table 3.1.

Table 5.11 Org A. main themes

Second-order theme	Mainly related to
Market shift	– Push of the present - Drivers
Market expansion	– Strategic response external
Partnerships	– Structure responses external
	– Strategic response external
Internal capabilities	– Structure Internal
	– Culture
	– Process and technology external and internal
Recruitment	– People internal
External interactions	– Strategic response external
Restructuring	– Structure responses external
	– Strategic response external
Regional/unit requirements	– People and Culture challenges
Supportive leadership	– People and Culture challenges

Table 5.12 Org A normalized network measures

Node	Degree	Closeness
People and Culture - Challenges	0.26	0.35
People - Internal	0.20	0.40
Push of the Present	0.20	0.39
Strategic Response - Internal	0.18	0.40
Culture	0.16	0.41
Strategic Response - External	0.16	0.38
Pro and Tech - Internal	0.14	0.39
Structure - External	0.14	0.38
Market shift	0.14	0.32
Pro and Tech - External	0.12	0.40
Structure - Internal	0.12	0.40
Weight of the Past	0.12	0.39
Pro and Tech - Challenges	0.12	0.34
Market expansion	0.12	0.34
Partnerships	0.12	0.31
Internal capabilities	0.10	0.39

Recruitment	0.10	0.35
Pull of the Future	0.10	0.38
Structure - Challenges	0.10	0.33
Strategic Response - Challenges	0.10	0.32
External interactions	0.10	0.31
Restructuring	0.10	0.32
Regional/unit requirements	0.08	0.31
Supportive leadership	0.08	0.31
Clients/owners needs	0.06	0.34
Shift in the required skillset	0.06	0.31
Leadership changes	0.04	0.32
Operating model	0.04	0.32
Sustainability	0.04	0.31
Competitive advantage	0.04	0.30
Reporting	0.04	0.31
Knowledge management	0.04	0.28
Integration	0.04	0.26
Anticipation	0.02	0.29
Organizational commitment	0.02	0.29
Strategic objective	0.02	0.29
Termination	0.02	0.29
Training	0.02	0.29
Feedback collection	0.02	0.29
Research and development	0.02	0.29
Stage-gate processes	0.02	0.28
Technology	0.02	0.28
Gov't participation/control/support	0.02	0.28
Resistance to change	0.02	0.28
External growth opportunities	0.02	0.28
Organizational design	0.02	0.28
Human resource allocation	0.02	0.26
Continuous improvement	0.02	0.26
Process re-engineering	0.02	0.26
Portfolio	0.02	0.24

Figure 5-3 Org A concept map

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Org. A

Integration
Shift in the required skillset
Human resource allocation
Organizational commitment
Strategic objective
Anticipation
Supportive leadership
Training
Termination
Regional/unit requirements
Recruitment
Research and development
Feedback collection
Competitive advantage
Leadership changes
Operating model
Market shift
Internal capabilities
Reporting
Restructuring
Clients/owners needs
Sustainability
Stage-gate processes
Technology
Knowledge management
Continuous improvement
Process re-engineering
External growth opportunities
Partnerships
Market expansion
External interactions
Portfolio
Resistance to change
Gov't participation/control/support

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-4 Org A Themes concept map

5.3.2   Organization B

Various observations could be noted from the concept maps of organization B as shown in

Figure 5-5, Figure 5-6, and Table 5.14. "Digitization" is the main driver causing the organization to change.

Various actions have been taken by the organization on an internal level, and they are mainly related to strategy (WDC=0.35), people (WDC=0.30), processes and technology (WDC=0.28). In addition, Push of the present (WDC=0.26) helped the organization to proceed with change efforts due to the growing need for "remote work", "Subs/suppliers adaptability", and "client owner needs". Furthermore, the main challenges faced by the organization are related to Strategic response (WDC=0.24), People and Culture (WDC=0.22), and Weight of the past (WDC=0.20). For people, as shown in

Figure 5-5, the main theme is "resistance to change" which had the highest value among the change response themes (WDC= 0.15). On the hand, strategic challenges are mainly attributed to the "nature of the industry" such as fragmentation, and pandemic recovery. Moreover, the weight of the past is mainly attributed to "Remote work", "Resources", "Digitization", "Resistance to change", and the "Nature of industry".

Training had a higher score of closeness (CC=0.46) compared to other themes due to the fact it was mentioned under different categories. Meaning it was an important action taken by the organization. Also, this can be explained by the fact digitization requires a lot of training to be achieved successfully (McKinsey, 2018).

Also, the concept map plotted remote work, digitization, and technology next to each other, which showcases how these themes are related to each other (Digitization requires technology, and remote work supports digitization). Moreover, recruitment and training are located next to each other, which showcases how these actions are related and were performed by the organization during the change initiative. Table 5.13 provides a summary of the main themes of the responses taken by organization B.

Table 5.13 Org B. main themes

Second-order theme	Mainly related to
	– Strategic response Internal and external
Training	– People internal
Resistance to change	– People and Culture challenges
	– Processes and technology internal
Remote work	– Push of the present
Recruitment	– People internal and external
Supportive leadership	– People internal

	–	Strategic response internal
	–	Processes and technology internal
Digitization	–	Push of the present
	–	Processes and technology internal
Technology	–	Push of the present
	–	Weight of the Past
Nature of industry	–	Push of the Present

Table 5.14 Org B normalized network measures

Node	Degree	Closeness
Strategic Response - Internal	0.35	0.51
People - Internal	0.30	0.45
Pro and Tech - Internal	0.28	0.41
Push of the Present	0.26	0.41
Strategic Response - Challenges	0.24	0.46
People and Culture - Challenges	0.22	0.41
Weight of the Past	0.20	0.42
Strategic Response - External	0.17	0.43
Culture	0.15	0.41
Training	0.15	0.46
Resistance to change	0.15	0.40
Remote work	0.13	0.41
Recruitment	0.13	0.40
Supportive leadership	0.11	0.42
Digitization	0.11	0.42
Technology	0.11	0.41
People - External	0.11	0.38
Nature of industry	0.10	0.34
Network	0.09	0.36
Project execution	0.09	0.36
Pro and Tech - Challenges	0.07	0.38
Feedback collection	0.07	0.37
Internal capabilities	0.07	0.39
Structure - Internal	0.07	0.37
Subs and suppliers adaptability	0.07	0.29
Workforce	0.04	0.36
Resources	0.04	0.33
Anticipation	0.04	0.32
Diversity and inclusion	0.04	0.37
Process re-engineering	0.04	0.32
Resource efficiency	0.04	0.36
Pull of the Future	0.04	0.36
Budget	0.04	0.37
Partnerships	0.04	0.30

Clients/owners needs	0.04	0.29
Investment	0.02	0.34
Scaling	0.02	0.34
Market shift	0.02	0.32
Owner/client requirements	0.02	0.32
Effective leadership	0.02	0.31
Termination	0.02	0.31
Relationships with private and public entities	0.02	0.30
Market expansion	0.02	0.30
Pandemic	0.02	0.30
Operating model	0.02	0.29
Organizational commitment	0.02	0.29

Org. B

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-5 Org B concept map

73

Org. B

Organizational commitment

Process re-engineering
Anticipation

Operating model

Network

Termination

Effective leadership

Clients/owners needs
Subs and suppliers adaptability

Internal capabilities

Supportive leadership

Feedback collection

Diversity and inclusion

Training

Digitization
Technology
Remote work
Recruitment

Resource efficiency
Project execution

Investment
Scaling

Workforce

Resistance to change

Budget

Nature of industry

Resources

Pandemic

Market expansion

Owner/client requirements

Market shift

Relationships with private and public entities
Partnerships

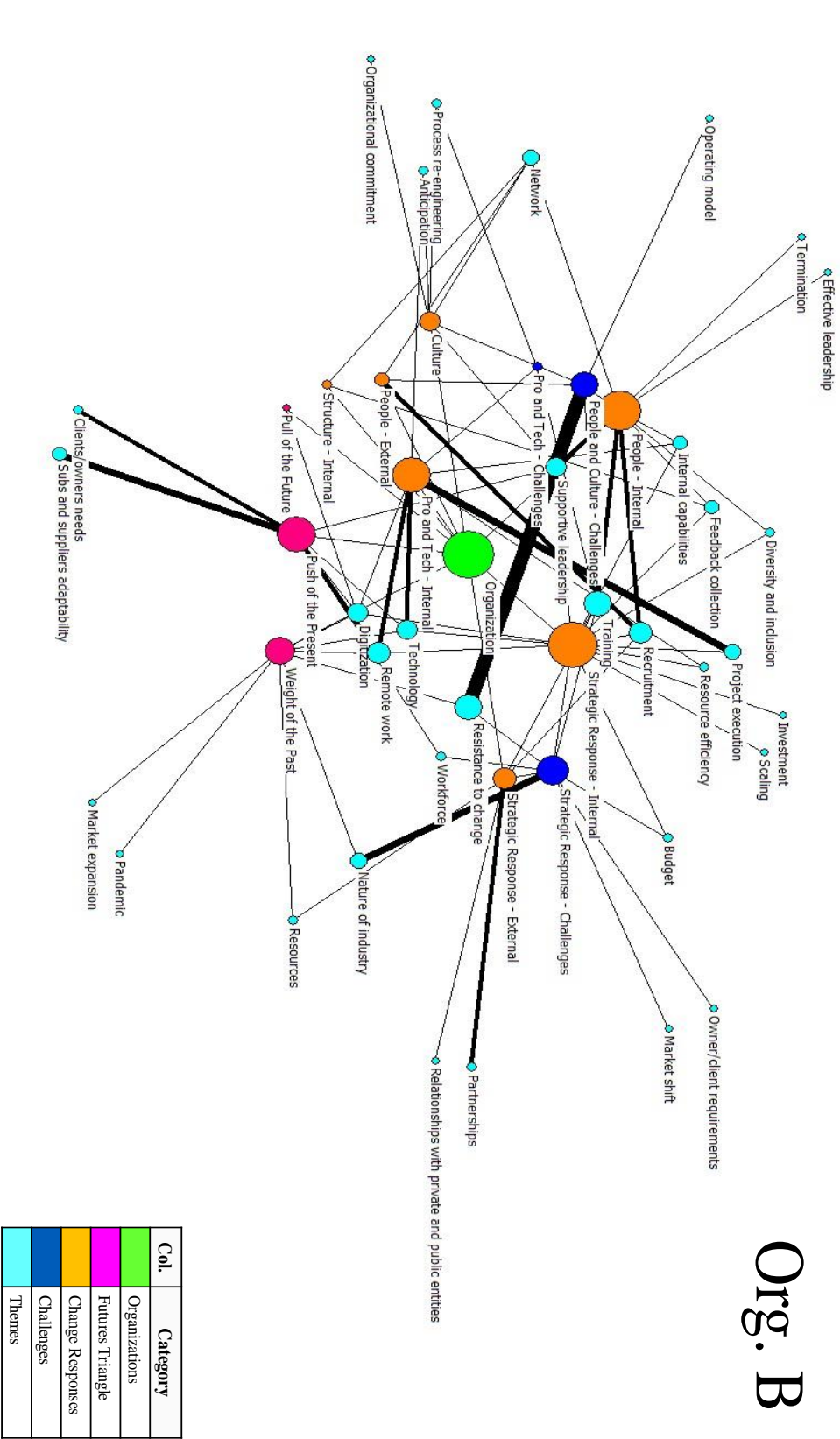| Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-6 Org B Themes concept map

74

5.3.3 Organization C

Various observations could be noted from the concept maps of organization C as shown in

Figure 5-5, Figure 5-6, Table 5.15, and Table 5.16. The main organizational responses are internal mainly related to strategic response internal (WDC=0.45) and people (WDC=0.30), in addition to Processes and technology (WDC=0.18), and culture (WDC=0.18). The main theme utilized by the organization during the change process is communication scoring the highest (WDC=0.18, CC=0.42) among other themes. In addition, as shown in the concept map, it is connected to strategic response internal, people internal, and culture with thicker edges. In the course of the interview, it discussed how the organization was shifting its portfolio from mega capital projects to low carbon energy transition projects which required the organization to perform various internal actions and to communicate these changes to employees at different levels within the organization. Communication is important.

On the other hand, "External/internal benchmarking" is second-ranked response taken by the organization with WDC=0.18, it mainly contributes to strategy response external and internal. This action was taken by the organization to assess how well are they positioned compared to external competitors and to assess how well are they performing internally.

The concept map plots remote work, communication, training, and project execution. These three are mentioned under the strategy and people internal and could be explained together. To train employees, change must be communicated to achieve the training purpose. In addition, to achieve proper project execution and "Strengthening the linkage between the technical functions and business units in the early phases of capital projects" as mentioned in the framework for organization C, this was achieved by strong communication.

Table 5.15 Org C main themes

Second-order theme	Mainly related to
	– Strategic response Internal
	– People internal
Communication	– Culture
External/internal benchmarking	– Strategic response Internal and external
	– People internal
	– Culture
Strategic objective	– Push of the present
	– Strategic response Internal
Project execution	– People internal

Table 5.16 Org C normalized network measures

Node	Degree	Closeness
Strategic Response - Internal	0.45	0.52
People - Internal	0.30	0.47
Communication	0.18	0.42
Culture	0.18	0.41
Pro and Tech - Internal	0.18	0.41
Strategic Response - Challenges	0.15	0.42
External/internal benchmarking	0.12	0.35
People and Culture - Challenges	0.12	0.35
Push of the Present	0.12	0.39
Strategic Response - External	0.12	0.40
Strategic objective	0.12	0.35
Project execution	0.09	0.41
Weight of the Past	0.09	0.40
Competitive advantage	0.06	0.37
Integration	0.06	0.37
Nature of industry	0.06	0.34
Operating model	0.06	0.32
Portfolio	0.06	0.33
Pull of the Future	0.06	0.38
Recruitment	0.06	0.36
Restructuring	0.06	0.35
Stage-gate processes	0.06	0.37
Structure - Internal	0.06	0.38
Training	0.06	0.41
Accountability	0.03	0.34
Career progression	0.03	0.34
Continuous improvement	0.03	0.29
Internal capabilities	0.03	0.26
Market expansion	0.03	0.28
Metrics	0.03	0.34
Organizational design	0.03	0.32
Pandemic	0.03	0.28
Shift in the required skillset	0.03	0.32

Org. C

Career progression
Accountability
Metrics
Restructuring
Integration
Competitive advantage
Stage-gate processes
External/internal benchmarking
Strategic Response - Challenges
Portfolio
Continuous improvement
Pro and Tech - Internal
Strategic Response - Internal
Pull of the Future
Project execution
Nature of industry
Structure - Internal
Strategic Response - External
Training
Communication
Organization
Push of the Present
Recruitment
Weight of the Past
People - Internal
Market expansion
Culture
Shift in the required skillset
Pandemic
Strategic objective
Organizational design
Operating model
People and Culture - Challenges
Internal capabilities

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-7 Org C concept map

77

Org. C

Nature of industry

Project execution
Training
Communication

Metrics
Accountability
External/internal benchmarking

Career progression
Restructuring
Integration
Competitive advantage
Stage-gate processes

Portfolio

Continuous improvement

Recruitment

Market expansion

Pandemic

Strategic objective

Shift in the required skillset

Organizational design

Operating model

Internal capabilities

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-8 Org C themes

5.3.4   Organization D

As shown in Figure 5-9, Figure 5-10, Table 5.17, and Table 5.18, the main changes affecting the organization are internal, and they are related to strategy internal (WDC= 0.23), people internal (WDC= 0.19), and technology (WDC= 0.19). In addition, the organization is facing two main challenges mainly strategic (WDC=0.23) and people related (WDC=0.19). These are expected since the changes are related to the shift to remote work (WDC=0.12) environment which required communication (WDC=0.12 and CC=0.38), and Training (WDC=0.12, CC=0.38) on the new workflows while using proper technology (WDC= 0.08). These changes happened while ensuring employees' accountability (WDC=0.08) by performing various meetings. Furthermore, the transition to remote work was possible because of "Anticipation" (WDC=0.08), where the organization identified a couple of years ago the risks that might face the airport including the shift to a remote work environment. Furthermore, the Nature of the industry (WDC=0.08) is mainly related to the drivers pushing the organization "Airport's facilities are large" which requires remote tools, or barriers such as "oversight culture that is against remote work and requires employees to be present in the workplace. Moreover, communication and remote work contributed to strategic response challenges, while training contributed to people and culture challenges.

Table 5.17 provides a summary of the main themes of the responses taken by organization D.

Table 5.17 Org D main themes

Second-order theme	Mainly related to
	– Strategic Response - Challenges
	– People and Culture - Challenges
Communication	– Strategy
	– Push of the present
	– Strategic Response - Challenges
	– Processes and technology - Challenges
Remote work	– Strategic Response - Internal
	– People - Internal
	– People and Culture - Challenges
Training	– Strategic Response - Internal
Accountability	– People - Internal
	– Strategic Response - Internal
Anticipation	

	–	Processes and Technology - Internal
	–	Weight of the Past
Nature of industry	–	Push of the Present
	–	Processes and Technology - Internal
Technology	–	Processes and Technology - Internal

Table 5.18 Org D normalized network measures

Node	Degree	Closeness
Strategic Response - Challenges	0.23	0.41
Strategic Response - Internal	0.23	0.47
People - Internal	0.19	0.43
People and Culture - Challenges	0.19	0.37
Pro and Tech - Internal	0.19	0.41
Push of the Present	0.15	0.41
Communication	0.12	0.38
Culture	0.12	0.41
Pro and Tech - Challenges	0.12	0.35
Remote work	0.12	0.37
Strategic Response - External	0.12	0.41
Training	0.12	0.38
Weight of the Past	0.12	0.41
Accountability	0.08	0.36
Anticipation	0.08	0.35
Nature of industry	0.08	0.31
Pull of the Future	0.08	0.37
Technology	0.08	0.29
Effective leadership	0.04	0.31
Internal capabilities	0.04	0.27
Organizational commitment	0.04	0.30
Pandemic	0.04	0.30
Partnerships	0.04	0.29
Project execution	0.04	0.29
Regional/unit requirements	0.04	0.27
Retaining workforce	0.04	0.27

Figure 5-9 Org D concept map

Org. D

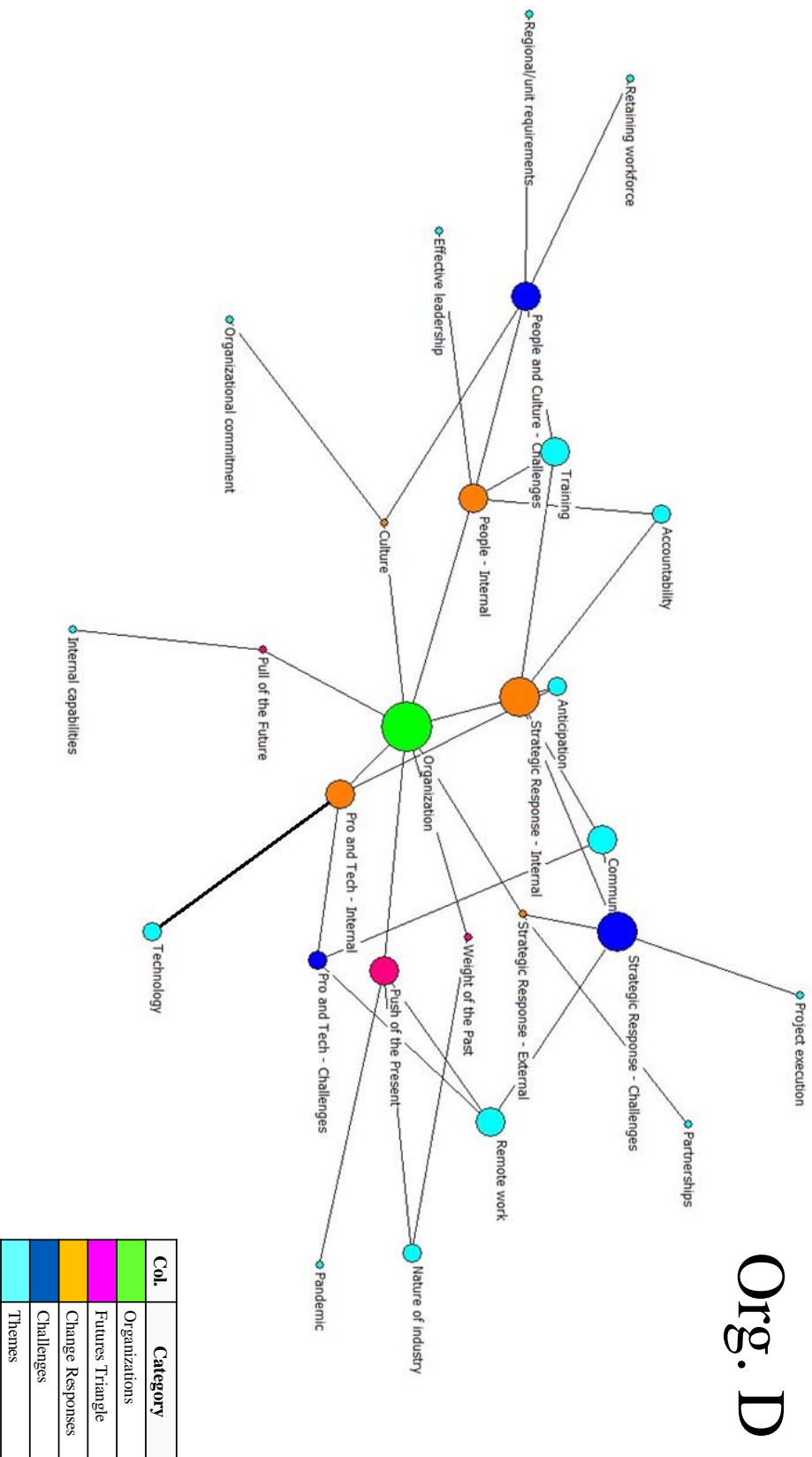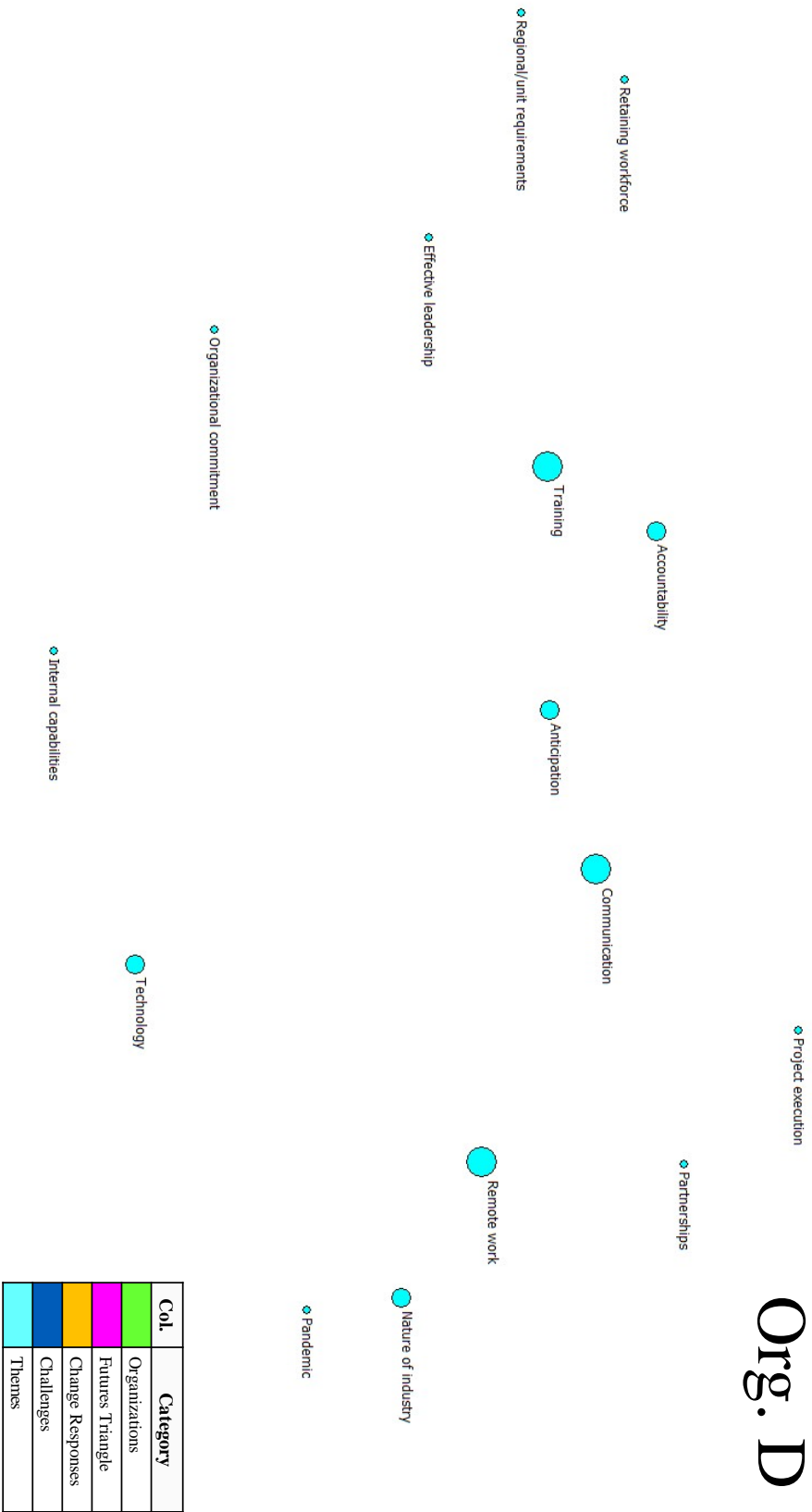| Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-10 Org D themes

5.3.5   Organization E

For Organization E, the organization responses were related to strategy internal (WDC=0.32), People internal (WDC=0.17). However the organization was facing various challenges related to the weight of the past (WDC=0.26), strategic response internal (WDC=0.23), People and culture (WDC=0.19), processes and technology (WDC=0.17). The main theme affecting the organization is "market shift" with the highest WDC=0.19 and CC=0.41 among other themes, which can be explained from the interviews by the fact there is a strong market shift from oil and gas projects towards low carbon, and technology projects. As a result of the market shift, the organization changed its portfolio (WDC=0.09), suspended the gas-fired projects, and shifted towards medium/small projects.

"Retaining workforce" is the second-ranking theme (WDC=0.17), and it is mainly related to challenges facing the organization. The current market shift towards a new portfolio of projects is challenging the organization in retaining the workforce, due to competitive offers by other firms to workers, cyclicality of projects (pharmaceuticals), and limited availability of skilled workers who support the portfolio shift. "Resistance to change" (WDC=0.11) is another challenge facing the organization mainly attributed to portfolio shift which caused resistance, especially among seniors who are specialized in oil and gas projects.

To proceed with the change, the organization had to "Train" (WDC=0.09) to improve the workers' skillsets and re-allocate "Human resources" (WDC=0.09) to lower the cost of projects. Also, the organization relied on remote work (WDC=0.09) to improve various processes within the organization.

Table 5.19 provides a summary of the main themes of the responses taken by Organization E

Table 5.19 Org E main themes

Second-order theme	Mainly related to
Market shift	– Push of the present
	– Pull of the future
	– Strategic Response - Challenges
Retaining workforce	– Strategic Response - Challenges
	– People and culture challenges
Resistance to change	– Weight of the Past
	– People and Culture - Challenges
Portfolio	– Weight of the Past
	– Strategic Response - External
Training	– Strategic Response - Internal
	– People - Internal

Nature of industry	– Weight of the Past
	– People and Culture - Challenges
Remote work	– Strategic Response - Internal
	– Processes and Technology - External
Human resource allocation	– Strategic Response - Internal
	– People - Internal

Table 5.20 Org E normalized network measures

Node	Degree	Closeness
Strategic Response - Internal	0.32	0.48
Weight of the Past	0.26	0.43
Strategic Response - Challenges	0.23	0.42
Market shift	0.19	0.41
People and Culture - Challenges	0.19	0.39
People - Internal	0.17	0.42
Pro and Tech - Challenges	0.17	0.39
Retaining workforce	0.17	0.40
Strategic Response - External	0.17	0.43
Culture	0.15	0.41
Pro and Tech - External	0.15	0.40
Pro and Tech - Internal	0.15	0.41
Push of the Present	0.15	0.39
Pull of the Future	0.11	0.39
Resistance to change	0.11	0.34
Structure - External	0.11	0.39
Human resource allocation	0.09	0.35
Nature of industry	0.09	0.36
Portfolio	0.09	0.37
Remote work	0.09	0.36
Training	0.09	0.37
Competitive bids	0.06	0.38
Diversity and inclusion	0.06	0.36
Internal capabilities	0.06	0.31
Leadership changes	0.06	0.36
People - External	0.06	0.38
Relationships with private and public entities	0.06	0.29
Resource efficiency	0.06	0.36
Resources	0.06	0.38
Restructuring	0.06	0.35
Structure - Challenges	0.06	0.31
Structure - Internal	0.06	0.38

Clients/owners needs	0.04	0.32
Knowledge management	0.04	0.35
Market expansion	0.04	0.30
Organizational design	0.04	0.34
Owner/client requirements	0.04	0.33
Partnerships	0.04	0.30
Technology	0.04	0.29
Anticipation	0.02	0.29
External Interactions	0.02	0.29
External growth opportunities	0.02	0.30
Investment	0.02	0.28
Organizational commitment	0.02	0.29
Reporting	0.02	0.29
Sustainability	0.02	0.28
Workforce	0.02	0.30

Figure 5-11 Org E concept map

Org. E

Workforce

External growth opportunities

Market expansion

Owner/client requirements

Competitive bids

Resources

Portfolio

Leadership changes

Remote work

Knowledge management

Training

Clients/owners needs

Organizational design

Nature of industry

Market shift

Retaining workforce

Sustainability

Human resource allocation

Resource efficiency

Technology

Reporting

Restructuring

Resistance to change

Diversity and inclusion

Relationships with private and public entities

Partnerships

Investment

Internal capabilities

External interactions

Organizational commitment

Anticipation

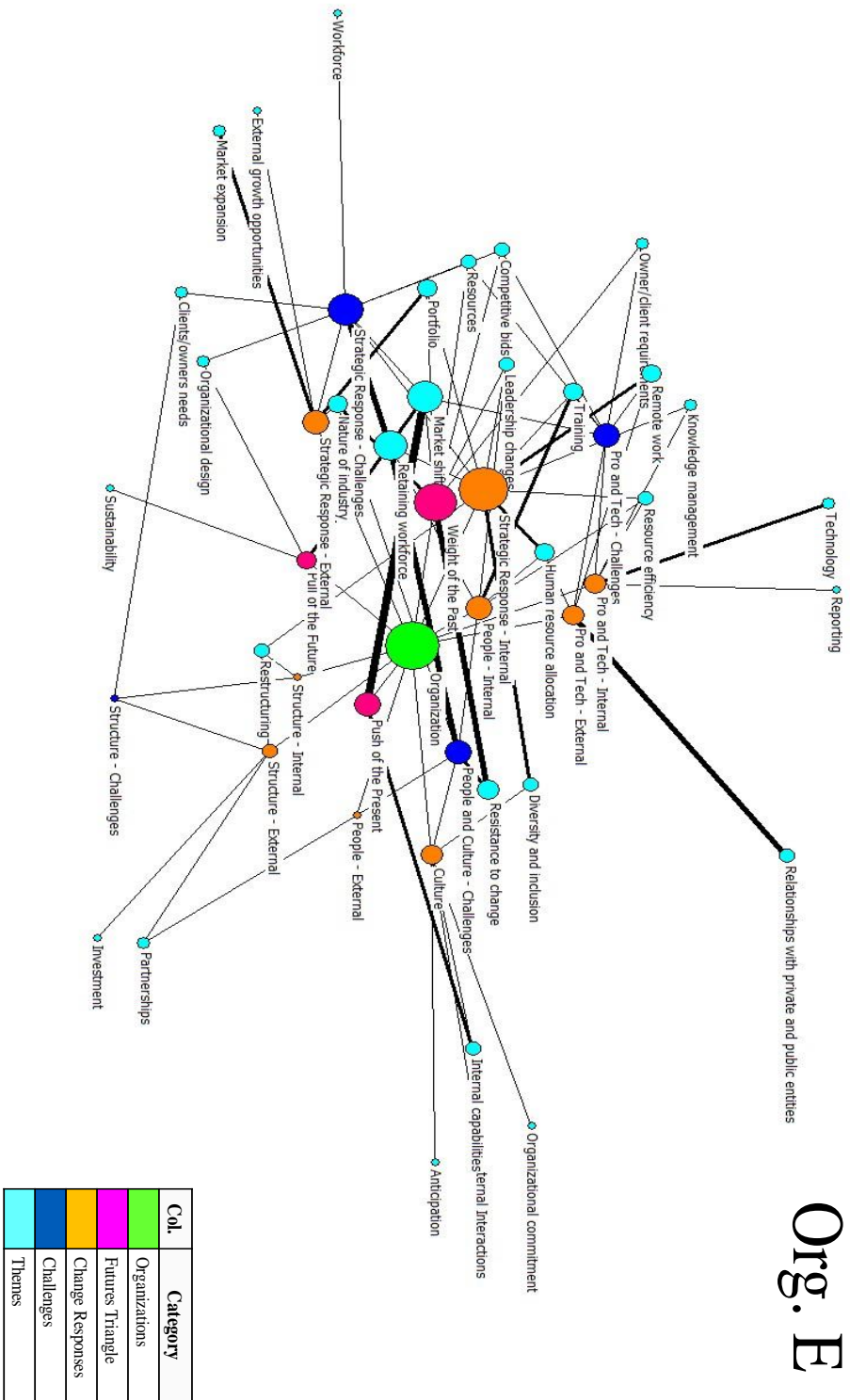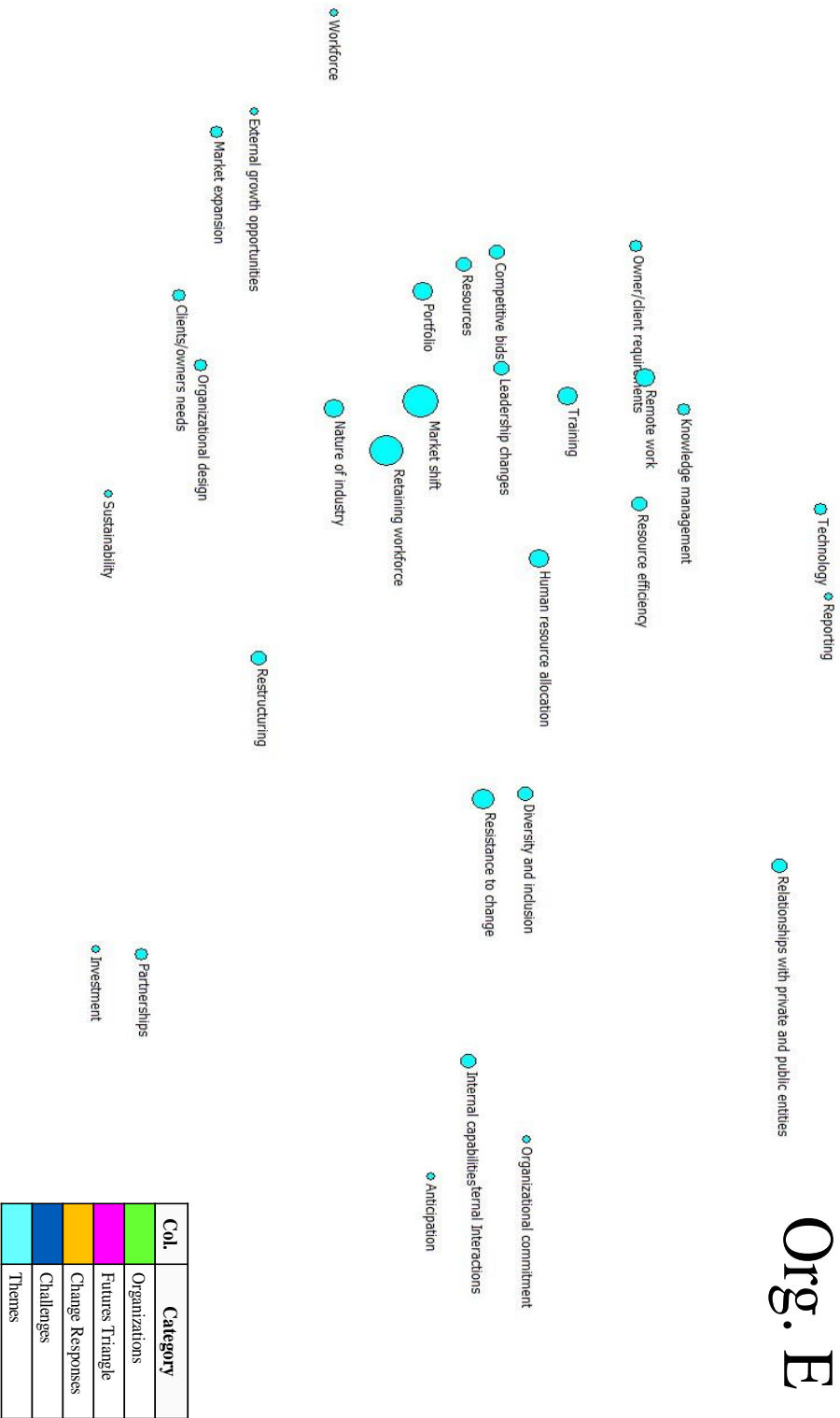| Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-12 Org E Themes

87

5.3.6   Organization F

The change in Organization F is mainly motivated by the organization's need to improve its operational efficiency.

Using Figure 5-13, Figure 5-14, Table 5.21, and Table 5.22, it can be noticed that the change is mainly related to culture (WDC=0.29), strategic response external (WDC=0.24), and processes and technology (WDC=0.15). Also, various challenges have faced the organization mainly related to people and culture (WDC=0.26), and strategic response (WDC=0.24). Furthermore, "organizational design" is the highest-ranked theme with WDC=0.26 and CC=0.46. This theme is mainly related to the cultural shift the organization had to go through, such as the implementation of in-person meetings in the early phases of projects to help develop interpersonal relationships and trust which are necessary to achieve the IPD shift. Moreover, "organizational design" is related to the push of the present, as mentioned in the framework, "successful implementation of multiple IPD projects helped to ensure buy-in from the organization and unit leadership". The second dominating theme is "resources" (WDC=0.21), and it is mainly related to actions taken by the organization to gain the IPD knowledge, such as involvement in professional organizations, and using experienced IPD coaches. To gain the IPD knowledge, the organization responded by "recruitment" (WDC= 0.12) and "training" (WDC=0.12). The main challenges are mainly related to People (WDC=0.26) and strategy (WDC=0.24). From a people perspective, the main challenge is "resistance to change" (WDC=0.15), while for the strategy it is related to the "Nature of industry" (WDC=0.12). The nature of industry challenges is related to difficulties in project estimation, and a lack of a clear career progression track for planning engineers.

Table 5.21 Org F main themes

Second-order theme	Mainly related to
Organizational design	– Culture – Push of the present – Processes and Technology - External and Internal
Resources	– Culture – Weight of the past
Resistance to change	– People and Culture - challenges – Strategic Response - Challenges
Nature of industry	– Processes and Technology - Challenges – Strategic Response - External
Recruitment	– People - External – Strategic Response - Challenges
Training	– People - Internal

Table 5.22 Org F normalized network measures

Node	Degree	Closeness
Culture	0.29	0.48
Organizational design	0.26	0.46
People and Culture - Challenges	0.26	0.40
Strategic Response - Challenges	0.24	0.47
Strategic Response - External	0.24	0.46
Resources	0.21	0.39
Pro and Tech - Internal	0.15	0.43
Resistance to change	0.15	0.39
Nature of industry	0.12	0.36
People - External	0.12	0.41
People - Internal	0.12	0.43
Pro and Tech - Challenges	0.12	0.36
Pro and Tech - External	0.12	0.41
Push of the Present	0.12	0.40
Recruitment	0.12	0.34
Training	0.12	0.38
Weight of the Past	0.12	0.41
Strategic Response - Internal	0.09	0.41
Structure - Challenges	0.09	0.31
Structure - External	0.09	0.41
Structure - Internal	0.09	0.40
Integration	0.06	0.34
Pull of the Future	0.06	0.39
Retaining workforce	0.06	0.37
Supportive leadership	0.06	0.34
Anticipation	0.03	0.33
Communication	0.03	0.30
Innovation	0.03	0.33
Network	0.03	0.24
Partnerships	0.03	0.32
Project execution	0.03	0.32
Reporting	0.03	0.29
Subs and suppliers adaptability	0.03	0.32
Workforce	0.03	0.33

Col.	Category
(green)	Organizations
(magenta)	Futures Triangle
(orange)	Change Responses
(dark blue)	Challenges
(cyan)	Themes
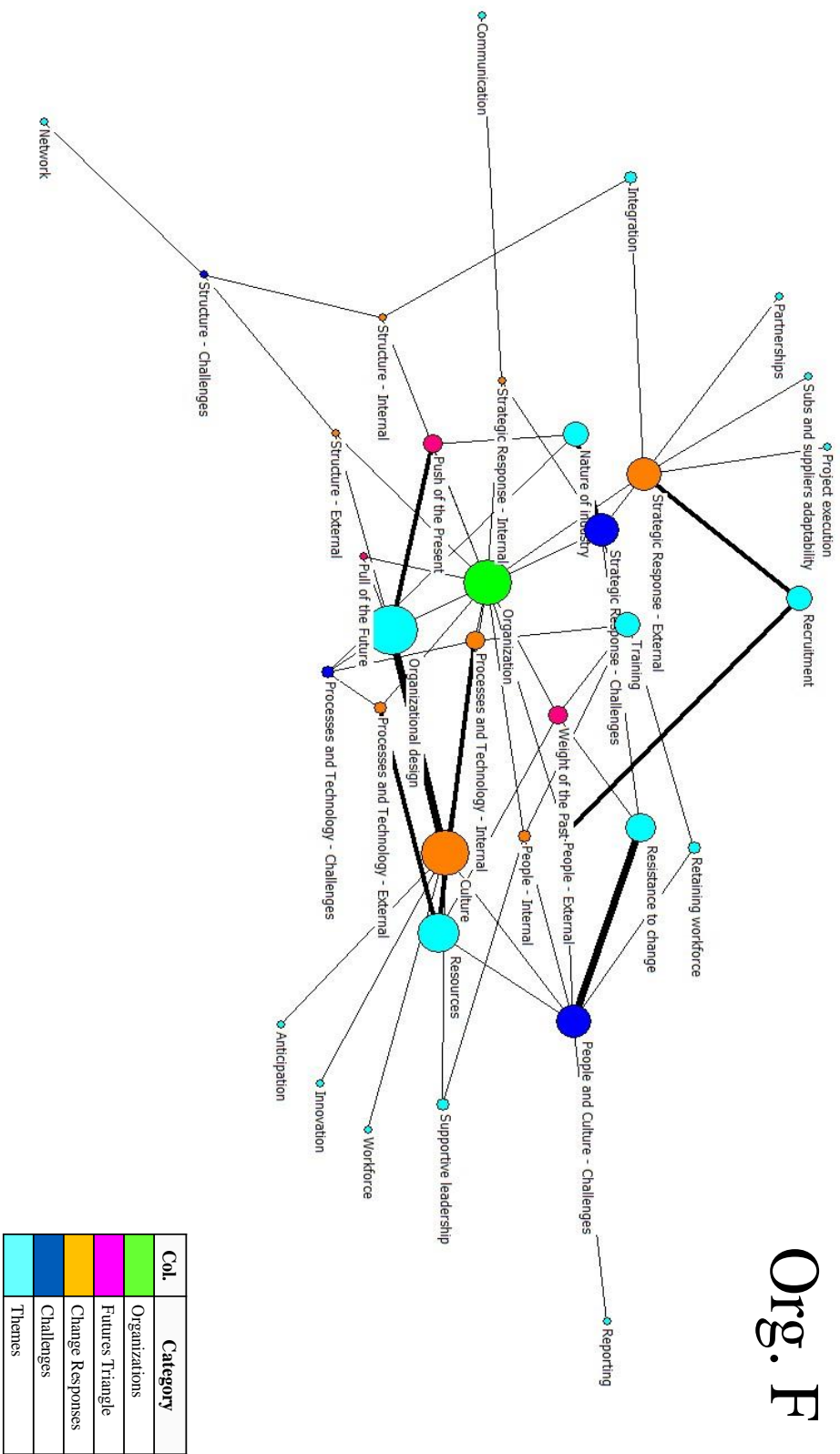
Figure 5-13 Org F concept map

Org. F

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Communication

Network

Integration

Partnerships

Subs and suppliers adaptability

Project execution

Nature of industry

Training

Recruitment

Organizational design

Resistance to change

Retaining workforce

Resources

Anticipation

Innovation

Workforce

Supportive leadership

Reporting

Figure 5-14 Org F themes

5.3.7   Organization G-External

The change is mainly external, and it is related to public-private partnerships. As shown in Figure 5-15, Figure 5-16, Table 5.23, and Table 5.24, "partnerships" is the main theme with the highest (WDC=0.18) across all other nodes in the network. In the push of the present, it represents the drivers behind "PPP", such as creating jobs and improving the economy or achieving common goals. While in the rest of the case study, partnerships are related to actions taken by the organization, such as "partnering with other organizations and seeding with money and technology to perform project operations". Moreover, The organization had to "Restructure" (WDC=0.07) by canceling programs that do not support PPP efforts, in addition, it had to change from performing development to oversight development. Furthermore, "Portfolio" (WDC=0.07) changed from performing missions in-house, to partnerships while ensuring their oversight.

The organization has faced various challenges, mainly Weight of the past (WDC=0.18), Processes and technology challenges (WDC=0.14), and strategic response challenges (WDC=0.14). "Strategic objective" (WDC=0.11) was the main challenge, and it is related to "Ambiguity regarding organizational change purpose". The lack of proper strategic objective definition and poor "communication" (WDC=0.07) of change efforts resulted in various challenges including resistance to change, and "human resource allocation" challenges (WDC=0.07).

Table 5.23 Org G Ext main themes

Second-order theme	Mainly related to
	– Push of the present
	– Strategic Response - External
	– Structure - External
	– Processes and Technology - External
Partnerships	– Weight of the past
Strategic objective	– Strategic response challenges
	– Weight of the past
Communication	– Processes and technology - challenges
	– People and Culture - Challenges
Human resource allocation	– Processes and Technology - Internal
	– Strategic Response - Internal
Restructuring	– Structure - Internal
Portfolio	– Push of the Present

− Strategic Response - Internal

Table 5.24 Org G Ext normalized network measures

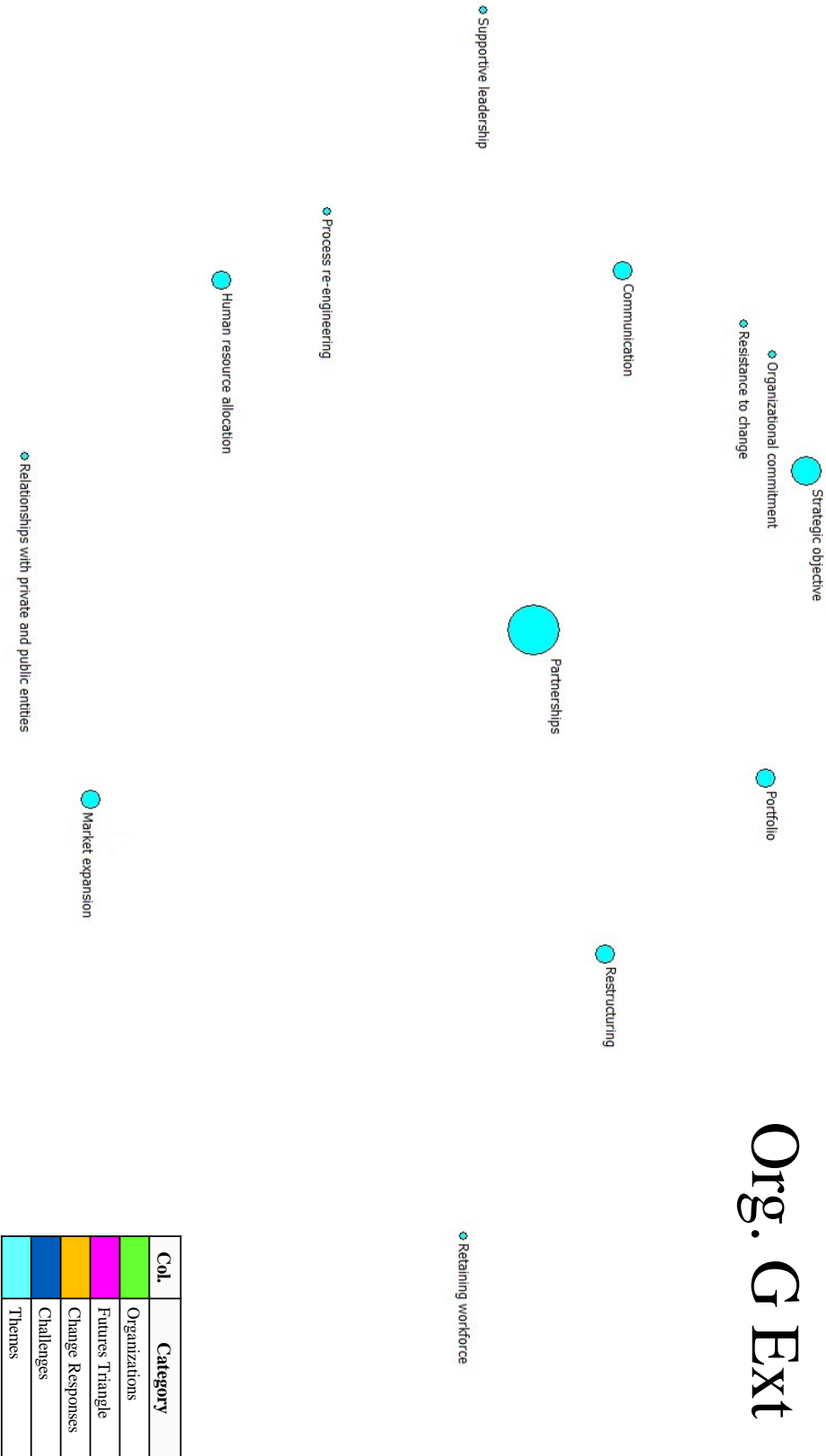| Node	Degree	Closeness
Partnerships	0.18	0.35
Weight of the Past	0.18	0.44
Pro and Tech - Challenges	0.14	0.35
Pro and Tech - Internal	0.14	0.43
Push of the Present	0.14	0.39
Strategic Response - Challenges	0.14	0.33
Strategic Response - Internal	0.14	0.41
People - External	0.11	0.40
Pro and Tech - External	0.11	0.41
Pull of the Future	0.11	0.39
Strategic Response - External	0.11	0.40
Strategic objective	0.11	0.33
Structure - Challenges	0.11	0.31
Structure - External	0.11	0.41
Structure - Internal	0.11	0.41
Communication	0.07	0.34
Human resource allocation	0.07	0.32
People and Culture - Challenges	0.07	0.31
Portfolio	0.07	0.31
Restructuring	0.07	0.31
Market expansion	0.04	0.29
Organizational commitment	0.04	0.31
Process re-engineering	0.04	0.30
Relationships with private and public entities	0.04	0.29
Resistance to change	0.04	0.31
Retaining workforce	0.04	0.24
Supportive leadership	0.04	0.26
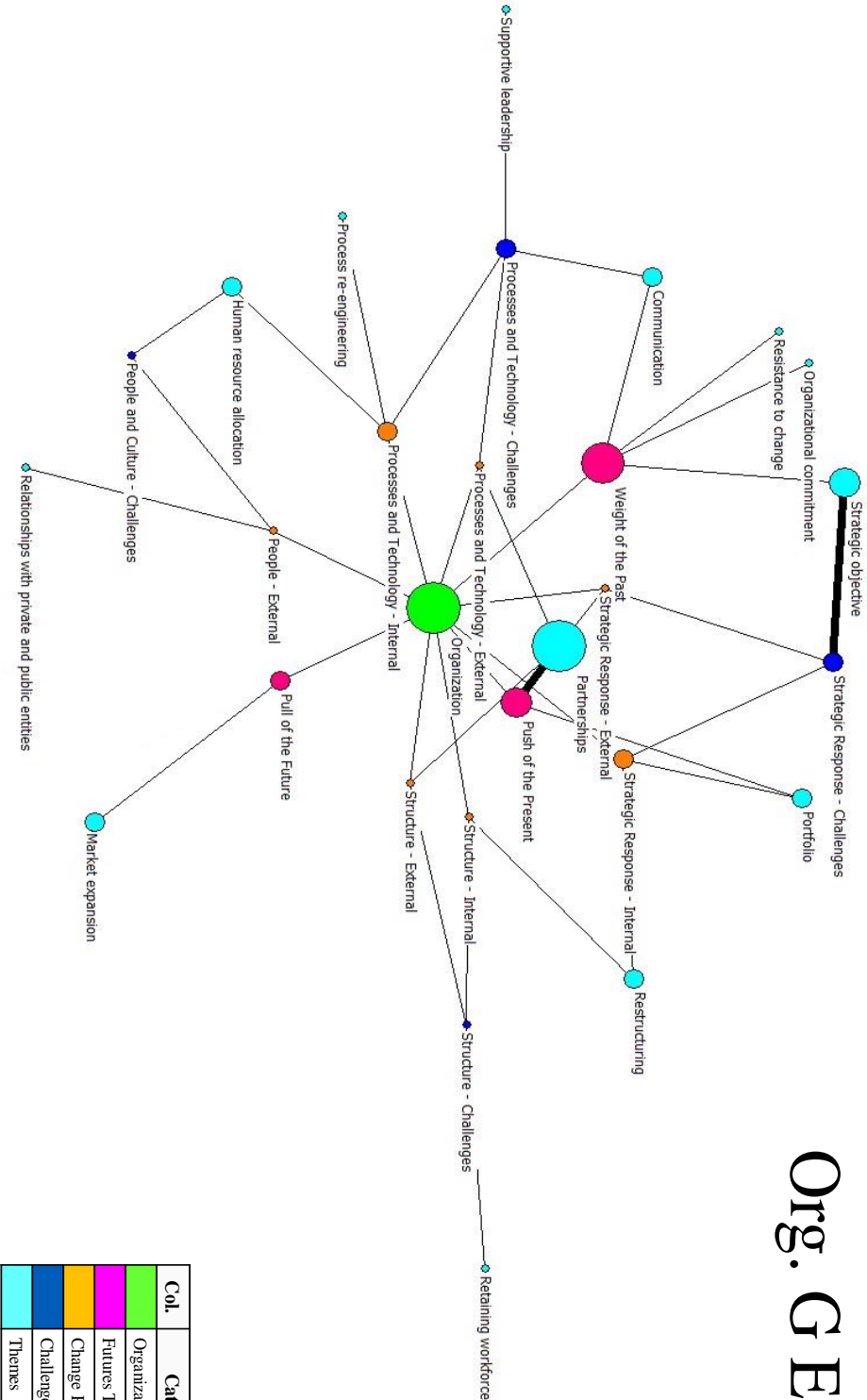
Figure 5-15 Org G Ext concept map

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

94

Org. G Ext

Supportive leadership

Process re-engineering

Human resource allocation

Communication

Resistance to change

Organizational commitment

Strategic objective

Relationships with private and public entities

Partnerships

Portfolio

Market expansion

Restructuring

Retaining workforce

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-16 Or N Ext themes

5.3.8 Organization G-Internal

The change is mainly internal, and it is related to the implementation of a new support model. As shown in Figure 5-17, Figure 5-18, Table 5.25, and Table 5.26, the organization faced various challenges, mainly related to the weight of the past (WDC=0.56), and people and culture challenges (WDC=0.32). The organization was shifting to a new support model that provided newly entered employees with a faster progression track which seniors didn't have access to. That shift caused challenges which are represented by "Organizational commitment" (WDC=0.32) mainly related to how the "credibility of leadership was shaken", and how the culture was so ingrained in the middle managers who did not support the new model. In addition, the new support model caused strong "resistance to change" within the organization (WDC=0.28), "Communication" (WDC=0.24) challenges, and a "Shift in the required skillset" (WDC=0.12). The old seniors were sidelined, and the change message was not delivered by middle management. However, the organization.

In response to various challenges, the organization performed various internal changes, related to strategy (WDC=0.28), people (WDC=0.28), and culture (WDC=0.16). Also, the organization "restructured" units and career progression system, improved "communication", by building trust between management and employees, and delivering the change message to employees. In addition, middle management that didn't support the change efforts were "Terminated". Furthermore, the organization focused on enhancing "organizational commitment" by "Operating as one and treating everyone the same".

Table 5.25 Org G int main themes

Second-order theme	Mainly related to
Organizational commitment	– Weight of the past – Culture
Resistance to change	– Weight of the past – Strategic response challenges – People and culture challenges
Communication	– Weight of the past – Strategic response – People internal
Restructuring	– Weight of the past – People and culture challenges
Shift in the required skillset	– Weight of the Past – People and Culture - Challenges

Table 5.26 Org G int normalized network measures

Node	Degree	Closeness

Weight of the Past	0.56	0.45
People and Culture - Challenges	0.32	0.42
Organizational commitment	0.32	0.39
People - Internal	0.28	0.46
Resistance to change	0.28	0.38
Strategic Response - Internal	0.28	0.45
Communication	0.24	0.42
Culture	0.16	0.43
Strategic Response - Challenges	0.16	0.36
Push of the Present	0.12	0.37
Restructuring	0.12	0.34
Shift in the required skillset	0.12	0.35
Structure - Internal	0.12	0.40
Portfolio	0.08	0.27
Pull of the Future	0.08	0.37
Structure - Challenges	0.08	0.29
Supportive leadership	0.08	0.32
Career progression	0.04	0.31
Effective leadership	0.04	0.32
Human resource allocation	0.04	0.32
Operating model	0.04	0.27
Resources	0.04	0.23
Termination	0.04	0.32
Training	0.04	0.32
Workforce	0.04	0.27
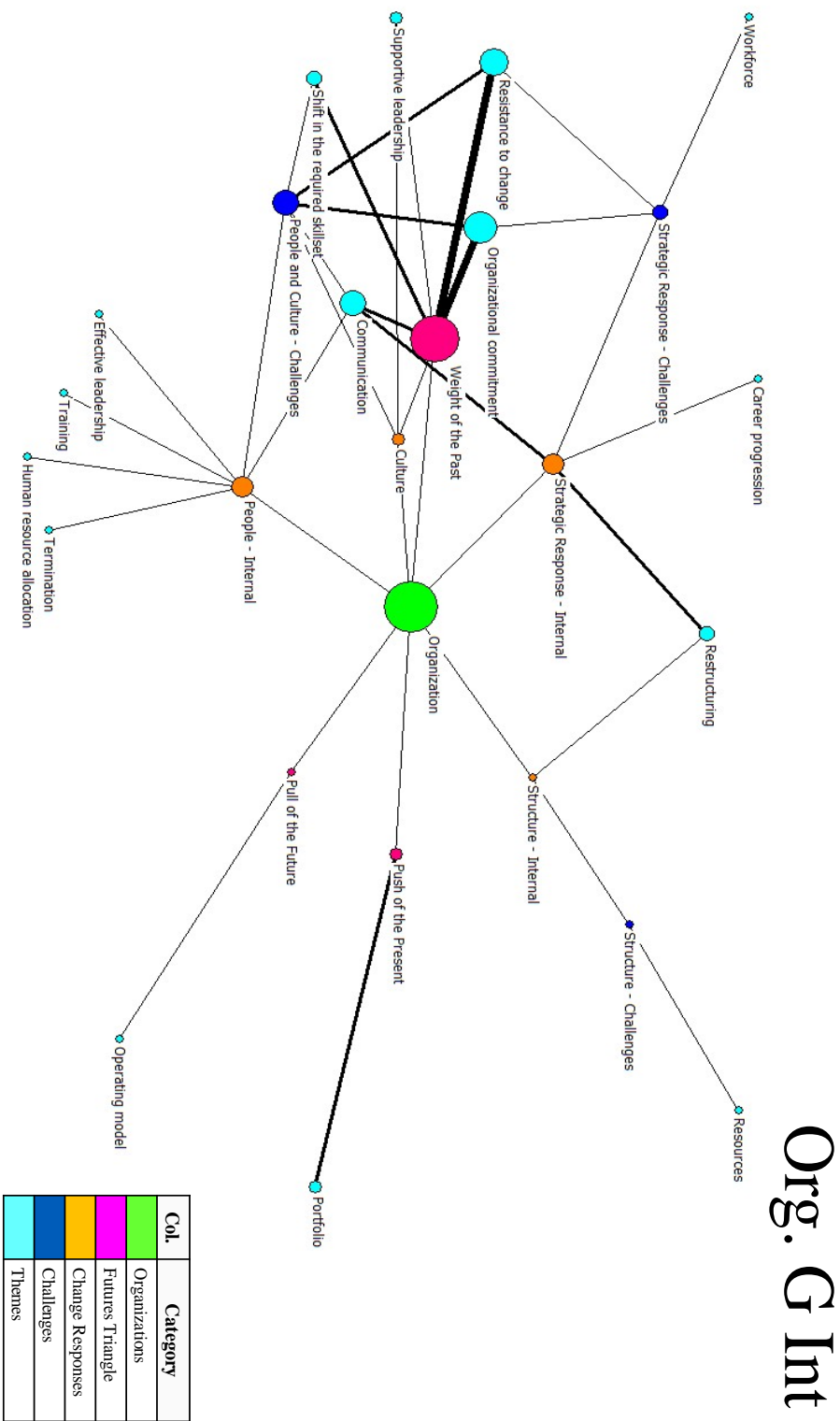
Figure 5-17 Org G int concept map

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

98

Org. G Int

Workforce · Career progression · Restructuring · Resources · Portfolio · Operating model · Supportive leadership · Shift in the required skillset · Resistance to change · Organizational commitment · Communication · Effective leadership · Training · Termination · Human resource allocation

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-18 Org G int themes

5.3.9   Organization H

The change is related to an acquisition by the organization which was motivated, by the low carbon shift. As shown in Figure 5-19, Figure 5-20, Table 5.27, and Table 5.28, the main responses are related to internal changes such as strategy (WDC=0.48), Culture (WDC=0.19), and People (WDC=0.16). The main strategy responses are related to "Integration" (WDC=0.19) of the newly acquired unit, setting up integration teams, and allowing some subsidiaries to operate independently while integrating others. "Communication" (WDC=0.19) is another response that is related to culture and strategy internal, whereby the organization communicated the change efforts for the upcoming acquisitions. Moreover, the organization established a culture of transparency (delivering good and bad news), and open communication. In addition, "Organizational design" (WDC=0.10) was another action taken by the organization and its mainly related to structure external and processes and technology external. The organization developed a legal structure for its subsidiaries and developed a mergers and acquisitions playbook to guide future efforts and highlight areas of due diligence.

The main challenges facing the organization are related to strategy (WDC=0.16). "Restructuring" (WDC=0.10) is the main theme contributing to the weight of the past and strategic challenges facing the organization such as the lack of experience in acquisitions, and the short time of the overall process.

Table 5.27 Org H main themes

Second-order theme	Mainly related to
Integration	– Strategic response internal – Structure – Culture
Communication	– Strategic response internal – Structure - External
Organizational design	– Processes and Technology - Internal
Restructuring	– Weight of the Past – Strategic Response - Challenges

Table 5.28 Org H normalized network measures

Node	Degree	Closeness
Strategic Response - Internal	0.48	0.53
Culture	0.19	0.42
Integration	0.19	0.37
People - Internal	0.16	0.42
Strategic Response - Challenges	0.16	0.40
Communication	0.13	0.39
Pro and Tech - Internal	0.13	0.41

Structure - Internal	0.13	0.40
Organizational design	0.10	0.31
People and Culture - Challenges	0.10	0.36
Push of the Present	0.10	0.40
Restructuring	0.10	0.34
Strategic Response - External	0.10	0.41
Structure - Challenges	0.10	0.31
Structure - External	0.10	0.40
Weight of the Past	0.10	0.40
Effective leadership	0.06	0.37
Human resource allocation	0.06	0.38
Innovation	0.06	0.30
Market expansion	0.06	0.37
Process re-engineering	0.06	0.37
Pull of the Future	0.06	0.39
Reporting	0.06	0.37
Supportive leadership	0.06	0.37
External/internal benchmarking	0.03	0.35
Gov't participation/control/support	0.03	0.29
Internal capabilities	0.03	0.29
Nature of industry	0.03	0.29
Shift in the required skillset	0.03	0.30
Strategic objective	0.03	0.35
Sustainability	0.03	0.28
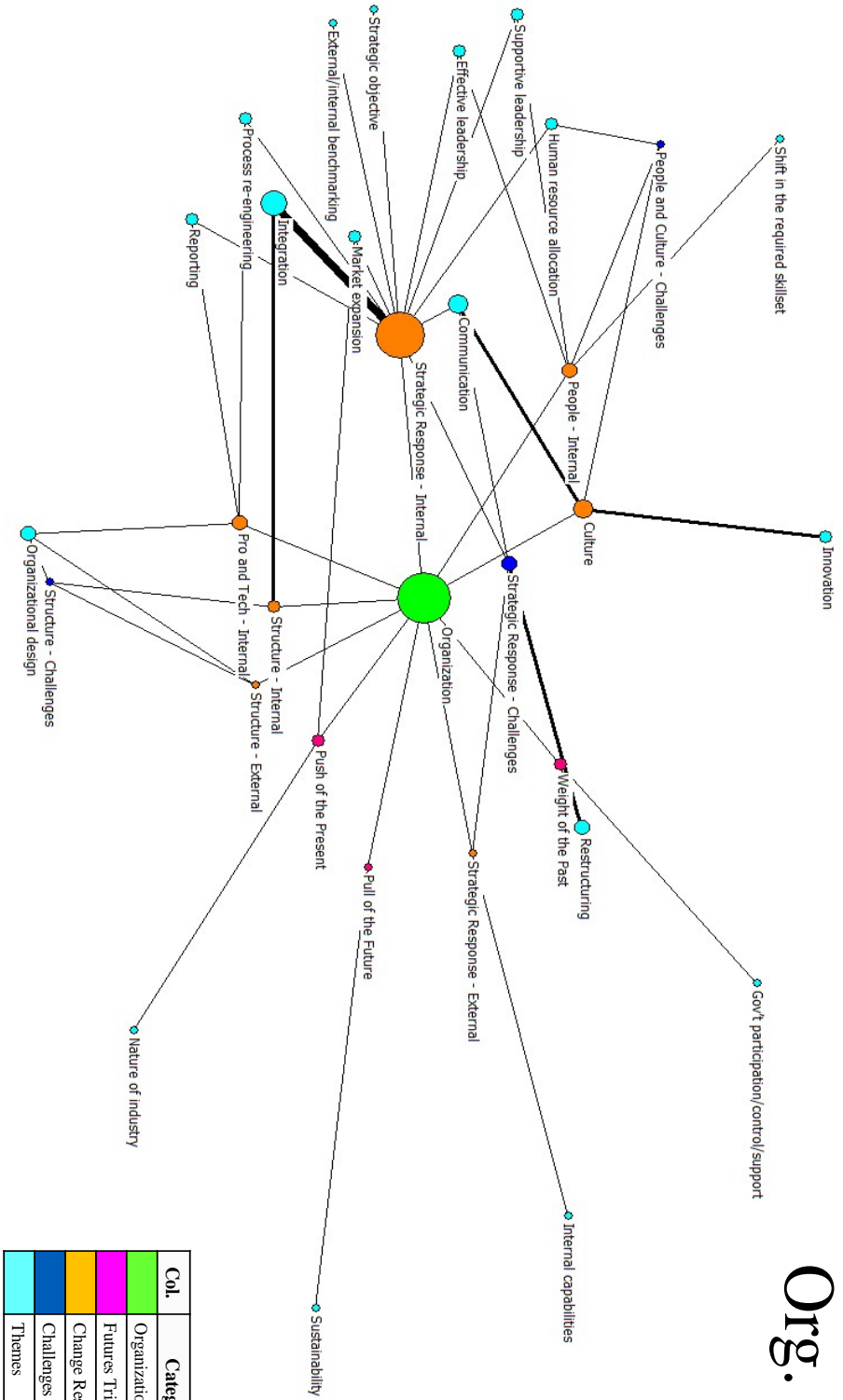
Figure 5-19 Org H concept map

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Org. H

102

Org. H

Shift in the required skillset

Supportive leadership

Strategic objective

External/internal benchmarking

Effective leadership

Human resource allocation

Process re-engineering

Integration

Reporting

Market expansion

Communication

Organizational design

Innovation

Restructuring

Gov't participation/control/support

Nature of industry

Internal capabilities

Sustainability

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-20 Org H themes

5.3.10 Organization I

This framework discussed the implications of market shift on a service organization within an owner capital project organization.

As shown in Figure 5-21, Figure 5-22, Table 5.29, and Table 5.30, various changes are happening in the organization, but the main ones are related to strategy internal (WDC=0.30), people internal (WDC=0.18), and strategy external (WDC=0.19).   In addition, the push of the present (WDC=0.61) is also supporting the various organizational changes.

The highest mentioned theme in this case study was related to "communication" (WDC=0.14 and CC=0.45), which the organization had to perform consistently, especially during the process of low carbon market shift and the aim was to ensure buy and support from customers, employees, stakeholders, and to eliminate ambiguity and ensure buy-in and support. Moreover, "Restructuring" (WDC=0.12 and CC=0.36), was also an important theme discussed in the case study. This theme is mainly related to the various retooling procedures performed by the organization within the technical services division to ensure a proper transition of talent, especially with the ongoing "Shift in the required skillset" (WDC=0.11 and CC=0.36). Various actions were performed by the organization as a result of the culture of "anticipation" (WDC=0.11 and CC=0.30) which made the organization forward-looking and continuously seeking future trends to ensure its present state supports its future one.

Various challenges have faced the organization during the process of change, and these were related to "shift in the required skillset", and "retaining the workforce". These themes are mainly related to disapproval caused by the changes in the required skillset shift as a result of the portfolio shift.

Table 5.29 Org I main themes

Second-order theme	Mainly related to
	– Strategic Response - External
	– Strategic Response - Internal
Communication	– People - Internal
	– Strategic Response - Internal
Restructuring	– Structure - Internal
	– People internal
Shift in the required skillset	– Strategic Response - Challenges
	– Culture
Anticipation	– Pull of the future
	– Strategic Response - Challenges
	– Structure- Challenges
	– People and Culture - Challenges
Retaining workforce	

Table 5.30 Org I normalized network measures

Node	Degree	Closeness
Strategic Response - Internal	0.30	0.45
People - Internal	0.30	0.45
Strategic Response - External	0.19	0.43
Culture	0.19	0.40
Push of the Present	0.16	0.39
Pro and Tech - Internal	0.14	0.40
Strategic Response - Challenges	0.14	0.40
Communication	0.14	0.37
People and Culture - Challenges	0.14	0.36
Restructuring	0.12	0.36
Shift in the required skillset	0.11	0.36
Anticipation	0.11	0.30
Retaining workforce	0.08	0.34
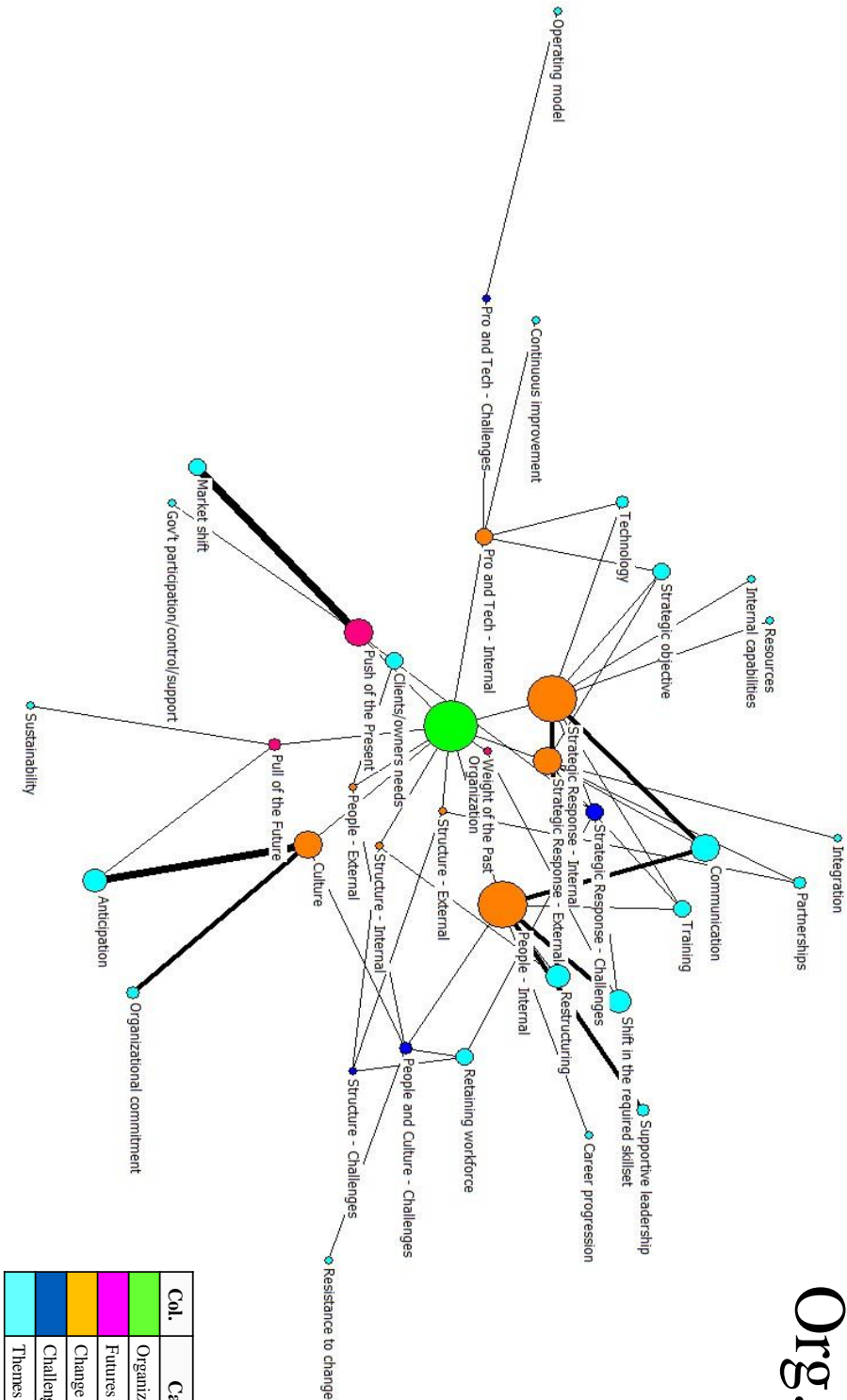
Figure 5-21 Org I concept map

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Org. I

Org. I

Operating model

Continuous improvement

Market shift
Gov't participation/control/support

Technology

Resources
Internal capabilities

Strategic objective

Clients/owners needs

Sustainability

Integration

Communication
Partnerships

Anticipation

Training

Organizational commitment

Restructuring
Shift in the required skillset

Retaining workforce

Career progression
Supportive leadership

Resistance to change

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Figure 5-22 Org I themes

5.3.11 Organization J

This framework discussed the implication of low carbon shift on an EPC organization.

As shown in Figure 5-23, Figure 5-24, Table 5.32, and Table 5.31, various changes are happening in the organization, but the main changes are related to strategy internal (WDC=0.21), and people internal (WDC=0.18). In addition, the push of the present (WDC=0.21) is supporting the organizational change. The main response theme is "restructuring" (WDC=0.21 and CC=0.42) which is related to the merging, splitting, and divesting of some units within the organization that does not serve the organization's long term low carbon shift. Also, Restructuring has caused some strategy-related challenges to the organization and they are mainly related to disruption caused by the processes, such as governance, and financial challenges. Also, "Restructuring" caused "resistance to change" (WDC=0.05) within the organization.

"Sustainability" is another important theme, and it is the driver pushing the organizational change, for example, Hydrogen production is currently gaining traction, which will benefit many industries to reduce emissions. Moreover, the current "Market shift" (WDC=0.05) from nuclear projects toward renewables is also supporting the overall organizational change. On the other hand, the shift to low carbon also caused people challenges mainly related to the "Shift in the required skillset" (WDC=0.05). Another challenge that faced the organization is related to "Regional/unit requirements" (WDC=0.05) because various regions of operation require different approaches, technologies, and different cultures.

Table 5.31 Org J main themes

Second-order theme	Mainly related to
Restructuring	– Structure internal
	– Strategic response internal
	– Strategy challenges
	– Structure challenges
Sustainability	– Push of the present
	– Pull of the future
Regional/unit requirements	– Weight of the past
	– Processes and technology challenges
Resistance to change	– Weight of the past
	– People and culture challenges
Adaptive changes	– Strategic response internal
	– People internal
Shift in the required skillset	– People internal

		–	People and culture challenges
Gov't participation/control/support		–	Push of the present
		–	Structure challenges
Organizational design		–	Strategic response internal
		–	Strategy challenges
Market shift		–	Push of the present

Table 5.32 Org J normalized network measures

Node	Degree	Closeness
Push of the Present	0.21	0.42
Restructuring	0.21	0.42
Strategic Response - Internal	0.21	0.43
People - Internal	0.18	0.42
People and Culture - Challenges	0.18	0.41
Strategic Response - Challenges	0.13	0.35
Structure - Challenges	0.13	0.35
Weight of the Past	0.13	0.41
Culture	0.10	0.41
Pro and Tech - Challenges	0.10	0.30
Pro and Tech - Internal	0.10	0.40
Structure - External	0.10	0.41
Structure - Internal	0.10	0.40
People - External	0.08	0.40
Strategic Response - External	0.08	0.39
Sustainability	0.08	0.30
Regional/unit requirements	0.05	0.34
Resistance to change	0.05	0.34
Adaptive changes	0.05	0.33
Shift in the required skillset	0.05	0.33
Gov't participation/control/support	0.05	0.32
Organizational design	0.05	0.31
Nature of industry	0.05	0.30
Scaling	0.05	0.30
Pull of the Future	0.05	0.38
Partnerships	0.05	0.30
Portfolio	0.05	0.30
Market shift	0.05	0.30
Feedback collection	0.05	0.30
Research and development	0.05	0.29
Human resource allocation	0.03	0.30
Competitive advantage	0.03	0.30
Accountability	0.03	0.30
Communication	0.03	0.29
Market expansion	0.03	0.29

Organizational commitment	0.03	0.29
Internal capabilities	0.03	0.29
Owner/client requirements	0.03	0.29
Resources	0.03	0.26
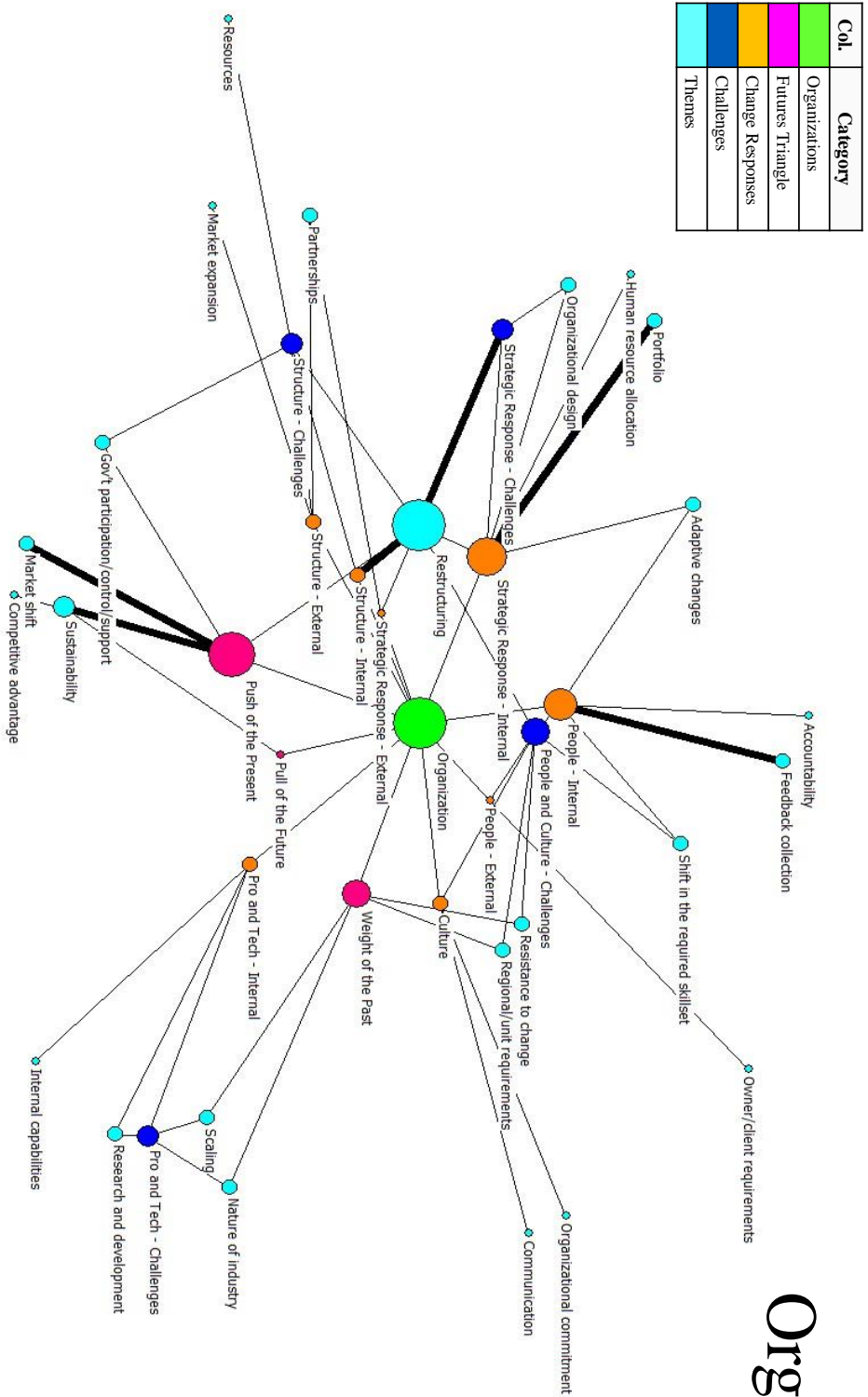
Figure 5-23 Org J concept map

Col.	Category
	Organizations
	Futures Triangle
	Change Responses
	Challenges
	Themes

Org. J

Resources

Market expansion

Partnerships

Organizational design

Human resource allocation

Portfolio

Adaptive changes

Restructuring

Gov't participation/control/support

Market shift

Competitive advantage

Sustainability

Internal capabilities

Research and development

Scaling

Nature of industry

Accountability

Feedback collection

Shift in the required skillset

Resistance to change

Regional/unit requirements

Owner/client requirements

Organizational commitment

Communication

Figure 5-24 Org J themes

5.3.12 Combined network

As shown in Figure 5-25, when all the case studies are combined, it becomes difficult to identify important nodes. To further understand the relations between different themes, a theme by theme concept map was created for all the case studies and the low-carbon future. The newly created networks shown in Figure 5-26 (change response) and Figure 5-27 (challenges) were created using UCInet and following (S. P. Borgatti & Halgin, 2014) procedure. Similarly, the same procedure was used to create the low carbon case study 1 mode concept maps shown in Figure 5-29 and Figure 5-30. The new 1-mode network that was created is composed of "themes" only, unlike the previous 2 mode networks which had nodes of different types (themes, categories). Also, two types of converted concept maps were created in this section, one that contains themes that are not related to challenges, and another one for themes related to challenges only.

The metric used in these concept maps is betweenness because previous work by (S. P. Borgatti & Halgin, 2014) has shown that a higher betweenness, corresponds to higher importance/influence of the node. In our case, a theme with higher betweenness means that it has more spread. In other words, it was mentioned in different parts of the change model and has more common connections with other themes. It is worth mentioning that higher betweenness doesn't necessarily mean a higher degree (count). For example, if theme 1 was only mentioned in a single category in the change model, while theme 2 was mentioned in different places in the change model, theme 2 will have a higher betweenness compared to theme 1.

As shown in Figure 5-26 and **Error! Reference source not found.** the themes with the highest betweenness (excluding challenges) are internal capabilities, recruitment, organizational design, strategic objective, restructuring, and market expansion. On the other hand, Figure 5-27 and Table 5.34 showcase that the themes with the highest betweenness are communication, nature of industry, resources, training, organizational commitment, and resistance to change.

Table 5.33 All organizations' themes betweenness (excluding challenges)

Theme	Betweenness
Internal capabilities	0.029
Recruitment	0.027
Organizational design	0.024
Strategic objective	0.020
Restructuring	0.016
Market expansion	0.015

Table 5.34 All organizations' themes of challenges (betweenness)

Theme	Betweenness
Nature of industry	0.024
Communication	0.024
Training	0.024
Resources	0.024
Resistance to change	0.015

Figure 5-25 Capital project organizations combined concept map

114
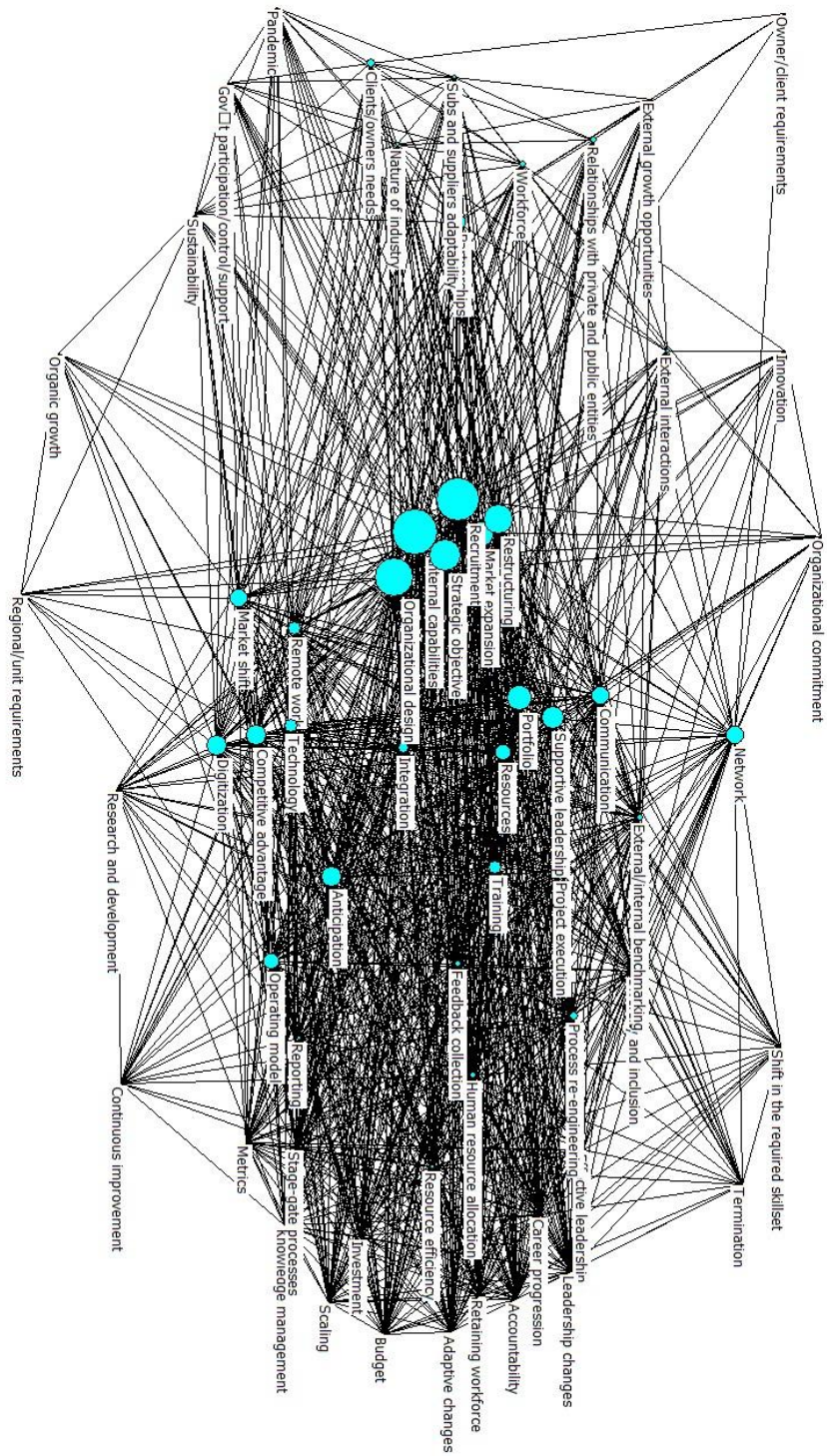
Figure 5-26 Responses themes concept map (Betweenness)
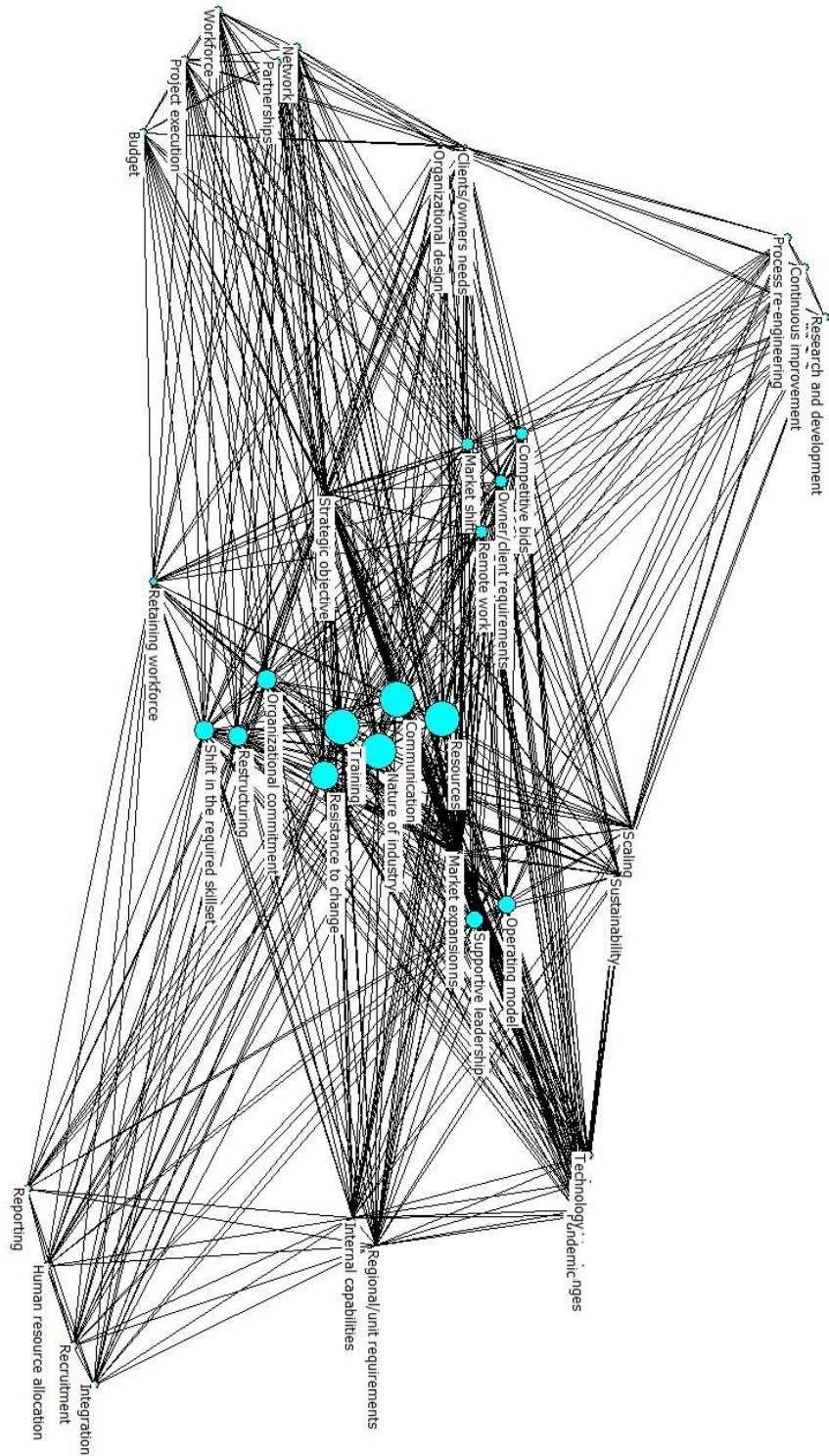
Figure 5-27 Challenges themes concept map (Betweenness)

5.4   Low Carbon

For the low carbon case study, Figure 5-29 and Table 5.35 show that the themes with the highest betweenness (excluding challenges) are internal capabilities, recruitment, organizational design, strategic objective, restructuring, and market expansion. On the other hand, Figure 5-30 and Table 5.36 showcase that the themes with the highest betweenness are resistance to change while other themes had 0 betweenness, which can be explained by the structure of the low carbon challenge themes network. In Figure 5-30, the three subnetworks have no connections with each other's, the first one is integration, sustainability, and digitization, which are related to processes and technology challenges. The second subnetwork is related to the weight of the past and people and culture challenges. The third subnetwork is related to strategy and structure challenges. Going back to the definition of betweenness, it can be concluded that when a theme doesn't lie on the shortest path between other themes, then betweenness is 0. In this current scenario, it can be concluded that the themes of challenges are different in the different categories of the change model, in comparison to all organizations' networks.

Table 5.35 low carbon themes betweenness (excluding challenges)

Theme	Betweenness
Internal capabilities	0.393
Technology	0.217
Communication	0.135
Supportive leadership	0.103
Investment	0.069

Table 5.36 low carbon themes of challenges (betweenness)

Theme	Betweenness
Resistance to change	0.043

Figure 5-28 Low carbon concept map
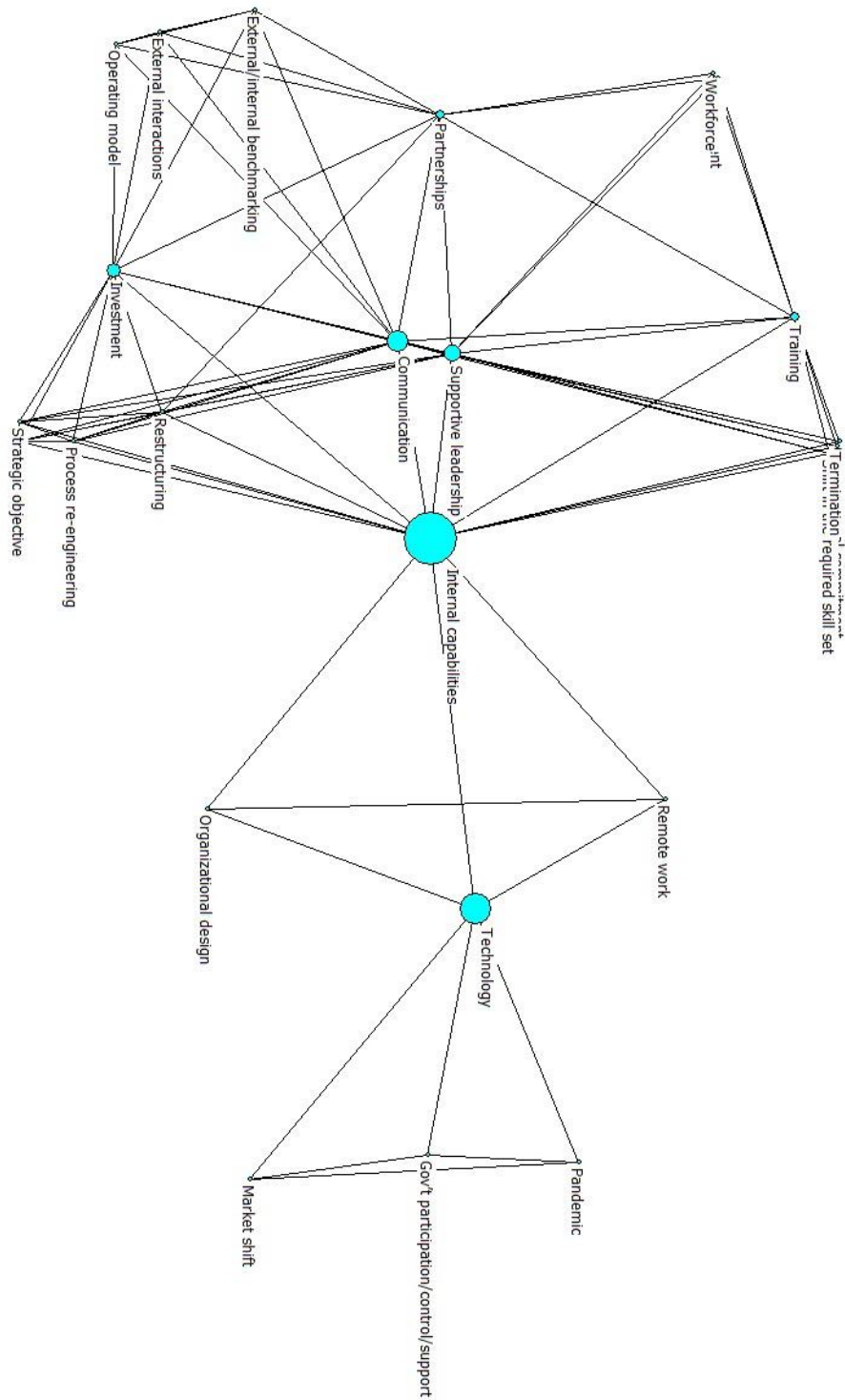
Figure 5-29 low carbon themes (betweenness)
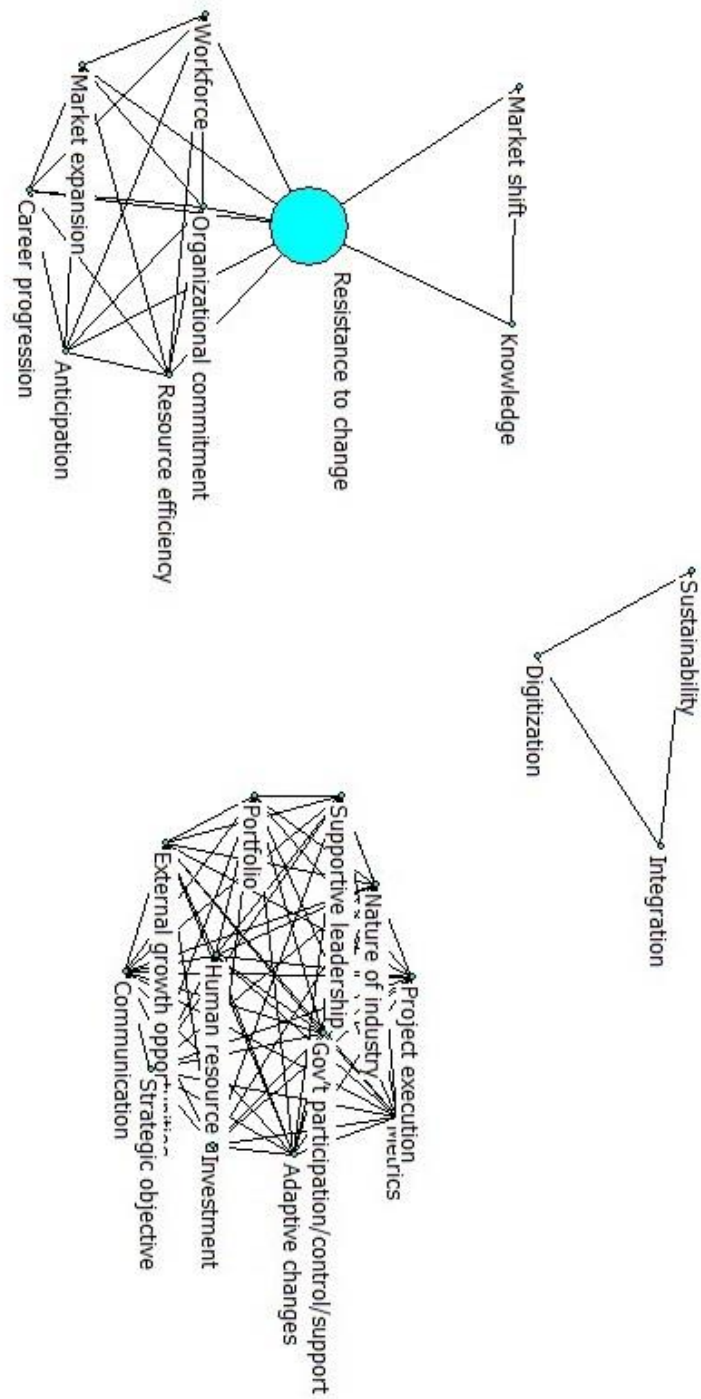
Figure 5-30 low carbon challenges themes concept map (betweenness)

CHAPTER 6. DISCUSSION

In the pursuit to answer the research question, semi-structured interviews, and case study analyses were performed on 10 capital project organizations from different industries, in addition to a case study related to low carbon future. As a result, a total of 590 responses were recorded, analyzed, and coded in a total of 61 themes. Some of these themes were related to drivers of change (ex: Sustainability), challenges, responses performed by the organizations (ex: Restructuring), or challenges (ex: Resistance to change). The main objective of the analysis is to provide an overview of the past and present changes facing capital project organizations and understand how capital projects are responding to them. The main focus of this research was on the organizational level, unlike previous works on capital project organizations which focused on "change management" and project level changes.

Table 6.1 Summary of the highest organizations' themes(frequency and WDC) and purpose of change

ID	Driver of change	Responses theme	challenges theme	The motivation behind the change
Org A	Market shift	Internal capabilities	Partnerships	Achieve Low carbon
Org B	Digitization	Recruitment	Resistance to change	Increase operational efficiency
Org C	Portfolio	Communication	Nature of industry	Achieve Low carbon and Increase operational efficiency
Org D	Internal capabilities	Technology	Communication	Increase operational efficiency
Org E	Market Shift	Human resource allocation	Retaining workforce	Achieve Low carbon
Org F	Organizational design	Resources	Resistance to change	Increase operational efficiency
Org G-Ext	Market expansion	Partnerships	Strategic objective	Achieve future development needs
Org G-Int	Operating model	Restructuring	Organizational commitment	Decrease operational cost
Org H	Sustainability	Integration	Restructuring	Achieve Low carbon
Org I	Sustainability	Communication	Retaining workforce	Achieve Low carbon
Org J	Sustainability	Restructuring	Restructuring	Achieve Low carbon

6.1.1 Overview of the case studies

Various insights could be derived from the case studies and concept maps analysis. Strategy internal, people internal push of present, the weight of the past, people and culture challenges, strategic response challenges had the highest number of responses as shown in Figure 5-2, which means that the changes that were discussed were related to "internal" changes, moreover, it can mean that the interviewees focused their attention on the internal changes within their organizations and didn't focus on the external changes, or they didn't have more information on them. The same thing can be said for the low carbon future case study, which shows that the main changes are internal, and are related to the strategy of the organizations as shown in Figure 5-28.

Looking at the challenges, the weight of the past is the highest challenge compared to others, meaning the organizations are facing challenges from their past, since many of the organizations interviewed were legacy organizations, and have been implementing their strategy, and processes in a "traditional" way, which caused various challenges when taking on an organizational change journey. On the other hand, People and culture challenges were the second-highest challenge category, meaning that the challenges are people-oriented, and are not "technical challenges". In other words, the challenges facing the organizations are not related to a technology or a process that will help the organizational change. On the other hand, for low carbon, the main challenges were strategic challenges, and processes and technology-related.

Table 6.1 provides an overview of the change themes per case study, these were the highly discussed themes for each organization. It can be noted that the reason/motivation behind various changes was mainly related to low carbon, and increasing operational efficiency. Looking at different response themes, it can be noted that different organizations had different "main" responses even though the motivation for many organizations was the same (Org A, Org C, Org E, Org H, Org I, Org J). This is normal considering that neither of these organizations has the same capabilities and resources even though many are from the same industry. So it can be concluded that the responses to change will differ as a function of the type of change, and the organization's capabilities and resources. In terms of challenges (Org G-Int, Org I, Org J, Org B, Org E, Org F) had more similar challenges, and many of these were "people" related, such as resistance to change, retaining the workforce, communication, and organizational commitment. On the other hand, Org A, Org C, Org D, Org G-Ext, Org H, Org J, had challenges mainly related to the "structure", and "strategy" of the organization. Therefore, when performing organizational changes organization should consider the impact of these changes on "people" within the organization, while taking into account the other challenges that might be faced.

6.1.2 Analysis of combined case studies

6.1.2.1 Main themes for all organizations

After combining all the case studies and analyzing various social networks, and, the main recurring themes are as follows:

In terms of drivers of change, the main themes were related to Market shift. Clients/owners' needs, Sustainability. On the other hand, the responses' main themes were related to Restructuring, Communication, Partnerships, Training, Recruitment, Internal capabilities, organizational design, and supportive leadership. While in terms of challenges, the themes were mainly related to Resistance to change, the nature of the industry, and retaining the workforce.

Also, the themes could be broken down by the change model, the main themes in strategy were partnerships, recruitment, communication, restructuring, and training. In structure responses, the main themes are partnering, and restructuring. While for the pull of future and push of present, Market shift and Sustainability are dominating themes.

For the Weight of the past, the main themes are Resistance to change and the nature of the industry. While strategic response challenges are the nature of industry, restructuring, and retaining the workforce. On the other hand, structure challenges are related to resources and retaining the workforce. Moreover, the main themes for people and culture are Resistance to change and retaining the workforce. Finally, for processes and technology challenges, the main themes are the nature of the industry, communication, and training.

When combining the case studies and analyzing them as a single case study, the themes could be explained together to provide an overview of the aspects of the organizational change facing capital projects organizations.

6.1.2.2 Drivers

Low carbon future or Sustainability (pull of future) is causing a market shift across the industry, towards environment-friendly energy generation, EV cars, or the development of new technologies. Moreover, Client/owner needs also play an important role in promoting the shift toward sustainability, which pushed different organizations to change.

6.1.2.3 Responses

To fulfill the knowledge/capability gaps, the organization had to perform various actions to improve its internal capabilities, some created in-house software tools to improve its operations, while other organizations identified skillsets that are no longer requested and those that are transferrable to help support the long term strategy. As a result, many organizations resorted to Training as one of the ways to build internal capabilities, and according to the different frameworks, it was the first action performed before seeking new recruitment.

Moreover, to fulfill the capability gaps, Restructuring was performed by creating new internal units, divesting existing ones, or acquiring new organizations. When such an option was not available, partnerships were performed. Some organizations, worked with subcontractors and suppliers to promote green practices, while others signed master service agreements with other organizations to serve the corporate long-term goals. Moreover, some have partnered with technical colleges to create tailored training programs and courses that meet business needs.

The organizational design was one of the actions performed by the organization during the process of change. For example, one of the organizations developed a mergers

and acquisitions playbook to guide future efforts and highlight areas of diligence to evade any future challenges. While another organization modified its governance system to allow accountability and streamlined decision-making to allow units to work independently to improve the overall operations of the organization.

Communication and supportive leadership are closely related themes because, without proper communication, buy-in and support from leadership and other employees cannot be achieved. To support and buy-in, some organizations communicated the change efforts and challenges early on. Other organizations adjusted the communication efforts according to the audience.

6.1.2.4   Challenges

As a result of the various changes, many challenges faced the organizations, The main challenge was resistance to change. In different frameworks, the resistance was related to the major changes happening within the organization, such as restructuring, market shift, or the shift in the required skillset. in some frameworks, it was a result of bad communication between leadership and the employees. As a result of that resistance, many organizations have faced challenges in retaining the existing workforce. Finally, the nature of the industry was another challenge facing the organizations, and its mainly related to complexity, cyclical nature of projects, and fragmentation across the industry.

The results from sections 5.3.12 and 5.4 confirm the importance of the previously mentioned themes such as internal capabilities, Restructuring, and the challenges, such as Resistance to change, Nature of industry, and Communication.

6.1.3   Support from literature

Even though similar work hasn't been performed on capital projects organizations yet the responses and challenges themes were discussed in previous literature in general for all organizations and it wasn't solely related to capital projects organizations.

For example, Market shift, Supportive leadership, and Internal capabilities resonate with the work of (Burke, 2018), which discussed the current state of organizational changes in mega organizations that are related to manufacturing, engineering, and technology. The research showcased how current and future changes are occurring so rapidly and how it places organizational executives under pressure to monitor and be prepared for different organizational changes.

In addition, the organizational design was a common response during times of change as discussed by (Dyduch, 2019) when reviewing manufacturing and technology organizations. Dyduch (2019) discussed how it can affect the Organizational structures of an organization which in return can shape the way the organizations operate.

Moreover, According to (Imamoglu et al., 2019) human factor plays a crucial role in maintaining the continuity of organizations. Therefore, to achieve buy in and support can be achieved with the help of supportive leadership (Imamoglu et al., 2019)

6.1.4 Contributions, Limitations & challenges, and future work

To the best of the author's knowledge, similar work hasn't been done on capital projects organizations. This study offers a valuable addition to the organizational change literature and it offers an overview of the past, present, and future changes facing different capital projects organizations. In addition, it applied a hybrid approach by integrating interview data with social networks to highlight the important themes and challenges faced by different organizations. Even though changes and responses are specific to different organizations, however, organizations could learn from the responses and challenges faced, and how each organization faced these challenges. The provided frameworks in this thesis can be used as a toolbox that other organizations could learn from. Moreover, other organizations should be prepared for a low carbon future and seek ways to change since these changes are complex and take time. Moreover, "people" are a key during different changes, and the various actions provided in the frameworks could help other organizations during the process of change.

One of the limitations of this research is the small sample size which doesn't allow the findings to be generally standardized. Moreover, most of the responses recorded were mainly related to internal changes within the organization, other external changes were not thoroughly discussed which doesn't allow to create a broader image of how the changes affected external organizations. In analyzing the change in social networks, the factor of time was not considered. In real life, some responses precede others and having a network that changes would have been beneficial to understand how things changed gradually, which can help to understand the causality between responses, drivers, and challenges. Also, future research should provide some sort of weightage before performing any analysis. As shown in some sections, the "sustainability" theme was not mentioned in comparison to other themes, however, it had more "weight" and caused the various changes discussed in many case studies. To work around that challenge, the case study interviews helped to re-assess some of the findings of social network results, but that method could be tedious when the data set becomes larger (for example 30 case studies).

One of the major challenges faced during the research was motivating the organizations to participate. Various organizations showed interest, and then decided not to join, some had concerns about revealing their "trade secrets". Even the participating organizations had to review their frameworks, and were concerned about revealing some important pieces of information which can take away their "market advantage".

Future work should build on this effort and consider the responses and analyze them as a function of types of change, meaning, responses for low carbon transformation, wouldn't be the same as responses for entering a new market. Moreover, future efforts should consider asking the interviewees to "weight" the responses to avoid wrong conclusions due to a low number of "mentions".

CHAPTER 7. CONCLUSION

In the pursuit to answer the research question, semi-structured interviews, and case study analysis were performed on 10 capital project organizations from different industries, in addition to the pilot low carbon case study. As a result, a total of 590 responses were recorded, analyzed, and coded in a total of 61 themes. Some of these themes were related to drivers of change (ex: Sustainability), challenges, responses performed by the organizations (ex: Restructuring), or challenges (ex: Resistance to change). The main objective of the analysis was to provide an overview of the past, present, and future changes facing capital project organizations, and to understand what drove these changes, and how they responded to them. The main focus of this research was on the organizational level, unlike previous works on capital project organizations which mainly focused on "change management" project-level changes.

To achieve the research objective, a change model was created using previous literature. Then semi-structured case studies were performed. Later the interviews were transcribed and coded into themes which were analyzed using social networks. This approach helped to identify themes related to drivers of change, responses, and challenges.

In terms of drivers of change, the main themes were related to Market shift. Clients/owners' needs, and Sustainability. On the hand, the responses' main themes were related to Restructuring, Communication, Partnerships, Training, Recruitment, Internal capabilities, organizational design, and supportive leadership. While in terms of challenges, the themes were mainly related to Resistance to change, the nature of the industry, and retaining the workforce.

Furthermore, various conclusions were derived from this research. Responses to change will differ as a function of the type of change, and the organization's capabilities and resources. In addition, when performing organizational changes, the impact on "people" within the organization should be closely studied and monitored, while taking into account other challenges that might impact the organization. In addition, Looking at the challenges, the weight of the past is the highest challenge compared to others, meaning the organizations are facing challenges from their past, since many of the organizations interviewed were legacy organizations, and have been implementing their strategy, and processes in a "traditional" way, which caused various challenges during the journey of change. On the other hand, People and culture challenges were the second-highest challenge category, meaning that the challenges are people-oriented, and are not "technical". In other words, the challenges facing the organizations are not related to a technology or a process that will help the organizational change.

One of the major challenges faced during the research was motivating the organizations to participate. Various organizations showed interest and then decided not to join, while others that participated had to review their responses multiple times, and were concerned about revealing their "Trade secrets".

Future work should build on this effort and consider the responses and analyze them as a function of types of change, Moreover, future research should consider asking the interviewees to "weight" the responses to avoid wrong conclusions due to the low number of in text mentions. This research will help capital project organizations to be aware of the main areas of concern during the journey of change and help them to learn from previous experiences from other organizations.

APPENDICES

APPENDIX. GLOSSARY

Table 0.1 Themes Definitions

Theme	Definition	Citation
Accountability	Can be defined as the extent to which one's actions are evaluated by some external constituency who has relevant rewards or punishment (Ferris et al., 2009) Can be defined as the process that activates when a negative (or positive) state is reached by employee(s), and the authoritative entity within the organization wishes to hold them accounted for (Baldoni et al., 2017)	(Ferris et al., 2009) (Baldoni et al., 2017)
Adaptive changes	Can be defined as small, incremental changes that organizations and managers create to adapt to various business challenges. These aim to improve existing processes and don't aim to change the organization as a whole (HBS, 2020)	(HBS, 2020)
Anticipation	Can be defined as the attempts taken by the organization to manage its future activities and shape its surroundings. It involves more than the unfolding of events but rather anticipatory activities that serve to gauge and guide different organizational future actions (Flyverbom & Garsten, 2021)	(Flyverbom & Garsten, 2021)
Budget	Can be defined as a financial plan for a defined period that includes costs and expenses, assets, liabilities, and cash flows of an organization (Ross, 2008) Can be defined as the sum of finances allocated for a particular purpose (Ross, 2008)	(Ross, 2008)
Career progression	Can be defined as the advancement in the level of position and level of the reward of an employee within an organization (Stroh et al., 1992)	(Stroh et al., 1992)

Theme	Definition	Citation
Communication	Can be defined as the sending and receiving of information through different formats (oral, written, electronic). Communication can occur at different levels (unit, department, enterprise), in different forms (formal, informal), and can happen within or outside the organization (internally and externally) (Baker, 2000)	(Baker, 2000)
Clients/owners' needs	Can be defined as a high-level representation of the Clients/Owners' requirements needed to solve a problem or achieve an objective (Sammy, 2013)	(Sammy, 2013)
Competitive advantage	Can be defined as factors that allow an organization to deliver its services better and cost-effectively than its rivals. It is related to the financial, strategic, and technological capabilities of the organization (Ulrich & Lake, 1991)	(Ulrich & Lake, 1991)
Competitive bids	Can be defined as the process through which a group of organizations competes to win a bid with a client to deliver a project at a particular point in time and for a specified cost. (Crowley & Hancher, 1995)	(Crowley & Hancher, 1995)
Continuous improvement	Can be defined as the ongoing efforts to improve services or processes within an organization (LCI, 2017)	(LCI, 2017)
Digitization	Can be defined as the process of connecting different systems with the value chain or an organization. It is about working with digital tools and different technologies to improve organizational workflow (Schober, 2016) (Evans-Greenwood et al., 2019)	(Schober, 2016) (Evans-Greenwood et al., 2019)
Diversity and inclusion	Can be defined as the achievement of a work environment in which all individuals with different/similar values, race, beliefs are treated fairly, respectfully, have equal access to opportunities and resources, and can contribute to the organization's success	(SHRM, 2008)

Theme	Definition	Citation
Effective leadership	Can be defined as strong leaders that clearly communicate the change initiative message throughout the organization (Palmer et al., 2001) (Cooper, & Nirenberg, 2012)	(Palmer et al., 2001) (Cooper, & Nirenberg, 2012)
External interactions	Can be defined as an organization's decision to partner and interact with external entities (local, international, governmental) to achieve its organizational strategy	
External/internal benchmarking	Can be defined as a systematic process of measuring an organization's performance against recognized organizations to evaluate current status, and determine best practices that can lead to superior performance when utilized (CII, 2018)	(CII, 2018)
Feedback collection	Can be defined as the action performed by organizations to collect feedback regarding current/future organizational changes (Ashford & Cummings, 1983)	(Ashford & Cummings, 1983)
Gov't participation/control/support	Can be defined as the exposure to policy changes and a wide range of government involvement which can happen through enforced laws or collaboration (CII, 2013)	(CII, 2013)
Innovation	Can be defined as the search for, the discovery, development, improvement, adoption, and commercialization of new processes, new products, and new organizational structures and procedures to achieve short and long term goals, improve productivity, and increase profitability (Damanpour, 2017; Liao, 2005)	(Liao, 2005)(Damanpour, 2017)
Integration	Can be defined as the extent to which distinct and interdependent organizational components constitute a unified whole (Barki & Pinsonneault, 2005)	(Barki & Pinsonneault, 2005)

Theme	Definition	Citation
Internal capabilities	Can be defined as organizational characteristics that enable an organization to conceive, choose, and implement strategies. Capabilities could include product innovations, and responsiveness to market trends and marketing (Collis, 1994)	(Collis, 1994)
Investment	Can be defined as the allocation of resources of any kind and purpose that is relevant to the organization (Beer & Casti, 1975)	(S. Beer & Casti, 1975)
Knowledge management	Can be defined as protected and unprotected knowledge creation and transfer through various means such as face-to-face interactions (planned or ad hoc), mentoring job rotation, and staff development (Alavi & Leidner, 1999; Henao-Calad et al., 2017)	(Alavi & Leidner, 1999)(Henao-Calad et al., 2017)
Leadership changes	Can be defined as the changes that occur to a leadership position (unit or corporate level) within an organization as a result of an organizational restructuring process, financial losses, attrition, or layoffs.	
Market expansion	Can be defined as the entrance to a new market (i.e. geographic, demographic, etc.) to sell existing products or services (Kotler & Singh, 1981)(Kotler & Keller, 2009)	(Kotler & Singh, 1981) (Kotler & Keller, 2009)
Market Shift	Can be defined as the significant and permanent changes in market needs and behaviors (Barnes, 2020)	(Barnes, 2020)
Metrics	Can be defined as quantifiable measures that are used to track and assess the status of specific organizational processes or performance (Bladt & Filbin, 2013)	(Bladt & Filbin, 2013)

Theme	Definition	Citation
Nature of industry	Can be defined as essential qualities or characteristics for which industry is known, for example, fragmentation in the AEC industry	
Network	Can be defined as a social structure made up of a set of social actors (people or organizations) that interact with each other's (Can & Alatas, 2019)	(Can & Alatas, 2019)
Operating model	Can be defined as a model that described how an organization delivers and achieves value to owners/customers and to itself (McKinsey, 2017) (Zott et al., 2011)	(McKinsey, 2017) (Zott et al., 2011)
Organic growth	Can be defined as the process by which an organization expands/grows using its capacity, resources, and relations with clients/owners (CFI, 2020)	(CFI, 2020)
Organizational commitment	Can be defined as the act of pledging or promising to fulfill an obligation to the organization, and having a strong belief in the organization's goals and values (Zangaro, 2001)	(Zangaro, 2001)
Organizational design	Can be defined as the set of actions taken by an organization for shaping the way it operates. It aims to integrate people, strategy, structure, and technology (Hossain et al., 2019)	(Hossain et al., 2019)
Owner/client requirements	Can be defined as the condition or capability required by Clients/Owners to solve a problem or achieve an objective (the need) (Elgendy, 2016)	

Theme	Definition	Citation
Pandemic	Can be defined as an event in which a disease spreads across several countries and affects a large number of people (CDC, 2020)	(CDC, 2020)
Partnerships	Can be defined as the ongoing collaborative relationship between two or more legally separated organizations based upon a commitment to share the costs, risks, and rewards derived from working together (Chicksand, 2015)	(Chicksand, 2015)
Portfolio	Can be defined as an organization's group of projects/services that is managed together to coordinate the interfaces and prioritize resources between the projects/services and thereby reducing the uncertainty in the execution and allowing it to achieve its strategic goals (Müller & Blomquist, 2004)	(Müller & Blomquist, 2004)
Process re-engineering	Can be defined as the analysis and re-design of workflows and processes within an organization, to enhance and streamline the business structures, processes, management systems, and external relationships to deliver value (Dey, 1999)	(Dey, 1999)
Project execution	Can be defined as performing the project activities and scope of work in accordance with project plans and specs	
Recruitment	Can be defined as the process that provides the organization with a pool of qualified job candidates from which to choose (Oldham, 1976)	(Oldham, 1976)

Theme	Definition	Citation
Regional/unit requirements	Can be defined as a set of requirements needed within an organization's unit or by certain regions in which the organizations operate in	
Relationships with private and public entities	Can be defined as the collaboration between two organizations (private or public) to achieve business goals	
Remote work	Can be defined as the ability of employees within an organization to perform their jobs from a location other than the central office via different means	
Reporting	Can be defined as the process of compiling and reviewing the information within a specific functional area in an organization such as operations, where performance is monitored and measured (Usenko & Zenkina, 2016)	(Usenko & Zenkina, 2016)
Research and development	Can be defined as investments made in research and development made by organizations to gain a technological and competitive advantage	
Resistance to change	Can be defined as the opposition by the workforce and employees to organizational change initiatives that will change and disrupt the current status quo (Dent & Goldberg, 1999)	(Dent & Goldberg, 1999)
Human resource allocation	Can be defined as the process of assigning and managing resources (people) to support an organization's strategic goals (Maritan & Lee, 2017)	(Maritan & Lee, 2017)

Theme	Definition	Citation
Resource efficiency	Can be defined as the enhancing organizational resource utilization (people, assists, financials) to minimize waste such as idle time (EPA, 2020)	(EPA, 2020)
Resources	Can be defined as the tangible and intangible entities available to the organization that enable it to produce efficiently and/or effectively a market offering that has value for some market segment or segments (Homburg et al., 2000)	(Homburg et al., 2000)
Restructuring	Can be defined as divestments, acquisitions, and/or mergers involving two or more major businesses. It includes both asset restructuring and internal management changes (Liao, 2005) Can be defined as the reconfiguration of internal administrative structure that is associated with an intentional management change program. There are three types of restructuring: organizational, portfolio, and financial (Mckinley & Scherer, 2000)	(Liao, 2005) (Mckinley & Scherer, 2000)
Retaining workforce	Can be defined as the actions performed by an organization to retain the workforce. It can include fostering a positive work atmosphere, providing competitive pay and incentives, and promoting employee engagement (Mohd Kasmuri et al., 2020)	(Mohd Kasmuri et al., 2020)
Scaling	Can be defined as the growth (scale-up) of an organizational initiative/process. It can be horizontal, i.e., growth within their area of operation, or region. In addition, it can be vertical, i.e., within the organization itself (van Doren et al., 2018)	(van Doren et al., 2018)
Shift in the required skill set	Can be defined as the changes in the workers' knowledge and skills requirements driven by changes in the environment, technology, and market demand (Salleh et al., 2010)	(Salleh et al., 2010)

Theme	Definition	Citation
Stage-gate processes	Can be defined as a systematic process in which a change initiative is divided into distinct stages or phases to drive the change from idea to execution (Cooper et al., 2002)	(Cooper et al., 2002)
Strategic objective	Can be defined as purpose statements that create a vision and set goals with measurable steps to help an organization achieve the desired outcome (Indeed, 2021)	(Indeed, 2021)
Subs and suppliers' adaptability	Can be defined as the ability of subcontractors or suppliers to adjust their structure and processes and successfully achieve their goals (Weerakkody et al., 2019)	(Weerakkody et al., 2019)
Supportive leadership	Can be defined as leadership that encourages various change initiatives at different levels within an organization	
Sustainability	Can be defined as activities taken by an organization, voluntary or governed by law, to demonstrate the ability of the organization to maintain viable business operations (including financial viability as appropriate) whilst not negatively impacting any social or ecological systems (Smith & Sharicz, 2011) Can be defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs (Ketata et al., 2015)	(Smith & Sharicz, 2011) (Ketata et al., 2015)
Technology	Can be defined as the total sum of man-made gadgets or processes that alter, refine, or create new goods and services delivered by organizations. It includes electronics, software, documents, new techniques, or any combination thereof used in the delivery of services (Neuby, 2016)	(Neuby, 2016)

Theme	Definition	Citation
Termination	Can be defined as the end of an employee's work with an organization, which can be voluntary, or involuntary. Involuntary Termination can be defined as an employer-initiated decision to terminate an individual's employment at an organization based on a particular cause (such as downsizing, performance problems, or insubordination) (Rubenstein et al., 2019)	(Rubenstein et al., 2019)
Training	Can be defined as an intervention aimed at increasing the knowledge and capacities of individuals to cope better personally, work more effectively with others, and perform better at their job to help an organization achieve its goals (Budhwar et al., 2002)	(Budhwar et al., 2002)
Workforce	People are engaged in or available for work, either in a country or area or in a particular organization or industry. They could be unionized or non-unionized	

APPENDIX. SEMI-STRUCTURED INTERVIEW TEMPLATE

7.1.1   AGENDA

- Welcome participants
- Introductions
- Provide a quick overview of the project
    - The Construction Industry Institute has commissioned this research team to understand how capital project organizations can position themselves for change in an agile way.
- Identify the purpose of the study and interviews (we could provide the diagram in an Appendix)
    - Study how capital project organizations responded to past change and positioned themselves for success.
    - Study what capital project organizations consider as success.
    - Identify capabilities that enable capital project organizations to be agile.
- Provide definitions of fundamental terms
    - Owner capital project organizations are social structures that 1) pursue and manage a collection of capital projects that supports the company strategy and 2) have the autonomy and authority to make decisions and enact change.
    - Contractor capital project organizations are social structures that 1) pursue and manage a collection of capital projects which supports both the company and owner strategies and 2) have the autonomy and authority to make decisions and enact change.

7.1.2   SEMI-STRUCTURED INTERVIEW QUESTIONS:

Background Information
1. Please tell us about your role at COMPANY and what your group does.

2. Please describe the historical evolution of COMPANY (focus on capital-projects organizations for construction companies).

3. Please elaborate on the structure of your organization.

7.1.3   Response to change

4. Please tell us about a successful organizational change that was implemented at COMPANY?
    a. Type of response

     b. Timeline

     c. Why is it considered a successful response

5. What were the drivers of this organizational change?

6. What structure-related issues did this change impose on your organization?
   a. How did your organization respond to these issues?
   b. Which aspects were successful?
   c. Which aspects were problematic?
7. What **people-related issues** did this change impose on your organization?
   a. How did your organization respond to these issues?
   b. Which aspects were successful?
   c. Which were problematic?
8. What **process-related issues** did this change impose on your organization?
   a. How did your organization respond to these issues?
   b. Which aspects were successful?
   c. Which were problematic?

7.1.4   Current Capabilities

9. What strengths did your organization have before and while undergoing this organizational change?
   a. Culture-related strengths
   b. Structure-related strengths
   c. People-related strengths
   d. Process/technology-related strengths
10. What obstacles did your organization face throughout the change process?
11. How were your conditions different from your competitors?

7.1.5   Future Direction

12. What are the drivers of change for your organization now?
13. Which lessons learned from this change process can shape future organizational changes?

APPENDIX . FRAMEWORK TEMPLATE

Case Study:		
Timeline:		
One Interviewee:		
Key Enablers (Inputs):		
Measures of Success (Outputs):		
Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Strategic Response		
External	**Internal**	**Challenges**
Structure		
External	**Internal**	**Challenges**
People and Culture		
People and Culture		**Challenges**
People – Internal **People – External** **Culture**		
Processes and Technology		
External	**Internal**	**Challenges**

APPENDIX . ORGANIZATION FRAMEWORKS

7.1.6   Organization A Framework

Case Study: Implications of Lithium growth opportunities on an Owner Chemical Company		
Timeline: 2015 – Present		
Six Interviewees: VP Business Transformation | Corporate Project Services Director | VP of Lithium Process Technology and Quality | VP Lithium Capital Projects, | Chief Technology Officer – Lithium | VP Bromine & Catalyst Capital Projects		
Key Enablers (Inputs): supportive leadership, strategic M&A, organizational re-design, training, disciplined operating model		
Measures of Success (Outputs): financial performance (stock, profit) and capital project portfolio (right projects selected, executed well)		
Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Internal capabilities - Capabilities to execute large and/or megaprojects limited within the organization; Lack of industry knowledge and benchmark data on large conversion plant lithium capital projects **Market expansion** - Limited M&A opportunities requiring greater focus on organic growth **Resistance to change** - Resistance to change to a more disciplined approach within the legacy (acquired) organization **External interactions**	**Market shift** - The market is shifting toward green energy solutions – there is a significant expansion in the lithium market which is primarily driven by electric vehicle (EV) manufacturers - All major automakers have announced plans to shift their fleets to all or significant EV production Some announcing conversion of entire fleets within 5-10 years - Demand and prices of lithium are increasing faster than previously thought	**Market shift** - Electrification of the grid - Desire for clean energy in response to climate change **Competitive advantage** - Staying ahead of the natural resources curve (exploration, R&D, recycling) **Operating model** - Continued need for greater capital efficiency - "Speed to market" is critical to maintain market share **Regional/unit requirements** - Regionalization/localization of the supply chain to match battery manufacturers and OEMs

- Customer interface was owned by the commercial team which inhibits communication between customers and the manufacturing & technology teams **Sustainability** - Commitment to sustainability increases the pressure on the organization which can stretch its resources	- The market is shifting, and the technology specifications are rapidly evolving - Tech companies like Apple and Xiaomi are investing billions of dollars toward EV **Gov't participation/control/support** - Recently approved US infrastructure bill contained funding for EV market and supporting charging infrastructure **Competitive advantage** - Entrants have an advantage over incumbents due to organizational size and agility; Some are leaner than the legacy organization **Clients/owners needs** - Customers' needs are not homogeneous are driven by technology considerations - Hydroxide and carbonate markets are dynamic based on battery type - Evolving markets for lithium specialties business - Need to participate in battery recycling	
Strategic Response		
External	**Internal**	**Challenges**
Restructuring - Acquired a company specialized in lithium and divested all non-lithium business units of the acquired company **Partnerships**	**Leadership changes** - Changes in senior leadership of the company, lithium business unit, and capital project organization **Reporting**	**Restructuring** - Implications of post-acquisition integration (structure, people, process) **Partnerships**

External	Internal	Challenges
- Established Master Service Agreements (MSAs) with strategic partners for global and regional traditional EPC services as well as technology - Partnering with OEMs and others to accelerate developments **External growth opportunities** - Leveraging international relations to enter and gain a foothold in new countries **External interactions** - Promoting electrification and greener practices by creating local organizations - New operating model created greater focus on the customer; Achieving or exceeding the customer's needs is not the responsibility of one group but the entire organization - Greater focus on quality with the Lithium GBU	- Restructured organizational reporting **Market shift** - Adopted a real options approach to deal with uncertainty in the market **Market expansion** - Expanding the lithium carbonate portfolio - Expanding the lithium hydroxide project portfolio globally - Capturing greater market shares for lithium specialties - Focusing on natural resources and recycling opportunities in the near-term - Ensuring Wave 4 production includes considerations for regional/localized production of lithium **Operating model** - Enhanced operating model to establish greater consistency across the business and more disciplined execution	- Implications of establishing an MSA with separate entities **Portfolio** - Diversification of lithium and catalysts businesses coexisting within the same portfolio & strategy

Structure		
External	**Internal**	**Challenges**
Restructuring - Acquired a company with lithium capabilities **Partnerships** - Developed appropriate regional service agreements to augment global MSAs	**Restructuring** - Created a new, separate lithium global business unit (GBU) and using the revenue from other business units to support the growth of lithium business unit (organic growth) **Reporting**	**Partnerships** - Implications of establishing an MSA with an EPC firm to ensure that local capabilities and "know how" can be leveraged for greater capital efficiency and speed

- Establishing an MSA with traditional EPC services provider as well as technology partner **External interactions** - Broadening the interface with customers – move from commodity to 'value-added' services	- Restructured organizational reporting - Improved cross-functional collaboration across the organization - Improved process to align individual goals to the strategic objectives **Internal capabilities** - Built a data science team within the technology department - Reorganized structure to ensure owners for lithium growth platforms and commercial organization **Clients/owners needs** - Broadening the interface with customers – moving from a sales-only approach to bringing the technical team and commercial team together	- Finding the right regional project partners to augment global agreements - Rapidly growing the capital project organization to keep pace with the GBU growth ambitions **Market expansion** - International Footprint versus Regional Supply Chain **External interactions** - Challenges with broadening the interface with customers – moving from a sales-only approach to bringing the technical team and commercial team together

People and Culture	

People and Culture	Challenges
People – Internal **Leadership changes** - A new CEO from an EPC background was hired (previous CEO came from a manufacturing background) enabling greater focus during a period of high growth and capital intensity **Supportive leadership** - Corporate leadership supported change initiatives (internal and external) - Enrolled key leaders in the initiatives to better enable cascading of new ways of working to the company **Termination** - Upskilling of capital project organization in key roles to ensure right-fit skill sets - Leveraging local talent and capability to capture regional advantages in project planning & delivery	**Integration** - Integration issues emerged post-acquisition - Differences in project implementation approaches in post-acquisition time period **Supportive leadership** - Old project leadership did not effectively communicate with the project team members - Difficulties in post-acquisition time period in achieving consensus among executives

- Relentless focus on talent to recruit, retain, train, and deploy the best capital project expertise to global mega projects **Training** - Training modules are provided for capital project managers through a global project services group **Recruitment** - Recruit of talent in areas of strategic growth (e.g., China, Chile) - Recruit people with process technology & engineering capabilities **People – External** - <> **Culture** **Internal capabilities** - The company is among the top five lithium companies **Anticipation** - The company is forward-looking **Organizational commitment** - Organization has a strong commitment to finish capital projects even if they were delayed **Strategic objective** - Creating a customer-centric focus across the organization **Operating model** - Greater focus on execution and process discipline rather than traditional 'firefighting' **Recruitment** - Leveraging a global workforce through remote opportunities identified during covid-19 pandemic	- Leadership overseeing the lithium expansion projects were initially manufacturing specialists which caused various problems **Human resource allocation** - Difficulties balancing internal resources post-acquisition **Shift in the required skillset** - People working on small to medium projects cannot easily transfer the knowledge to major/mega capital projects **Regional/unit requirements** - Different cultural considerations with the push to be international - Different people issues with the push to be international - Personality of GBUs varies creating challenges for deploying talent across the organization **Recruitment** - Fast moving nature of projects and business make recruitment of project professionals from traditional project owners difficult (cultural fits)

Processes and Technology		
External	**Internal**	**Challenges**
Internal capabilities - The acquisition provided the organization lithium natural resources	**Stage-gate processes**	**Sustainability** - The need to do better at recording and tracking environmental impact as the

and capabilities to do lithium conversion **Research and development** - Technology and R&D teams working on creating new lithium products that capture future market opportunities and create a competitive advantage **Feedback collection** - Created a customer feedback loop to stay connected with the customer and to refine the lithium products **Recruitment** - Recruiting talent to be part of the growth platform and not to fill a gap	- Developed detailed stage-gate processes to organize the work and enhance organizational discipline **Knowledge management** - Creation of a centralized project controls organization and improved application of project controls on projects (IPA-best practice) - Using the CII knowledge base (PDRI, constructability index) - Ongoing lessons learned approach and training to deploy new knowledge to the organization **Technology** - Implemented an enterprise-wide ERP system **Internal capabilities** - Developed strong process technology capabilities which gave them the ability to continuously modify existing plants to stay competitive	company is being pushed to be more sustainable **Continuous improvement** - Room for improvement of capital procurement (also an IPA best practice) despite several reorganizations and initiatives **Clients/owners needs** - The invisible 'push' to go faster than the process allows is creating additional risk for projects and the business **Process re-engineering** - Continuing to modify existing processes through lean sigma to ensure that processes & technology is right fit and adds value - Balancing governance with speed of execution to capture current and future market opportunities

Case Study: Implications of digitization on an EPC company **Timeline:** 2017- Current **One Interviewee:** **Key Enablers (Inputs):** Supportive leadership, organizational re-design, training, modular pilot testing, digital workflows, repeatability **Measures of Success (Outputs):** Productivity, project cost and time, customer satisfaction, financial performance (stock, profit)		
Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Market expansion - The competitive industrial and construction market where resources are very limited and challenging to find **Pandemic** - The pandemic placed budget pressure on the organization and resulted in budget cuts **Technology** - Available software packages in the market do not always fulfill the organization's specific requirements **Remote work**	**Clients/owners needs** - Established owners who are developing their digital landscape have pushed the need to consistently produced and use data - There is a shift in customer demand towards digitization and sustainability. The shift is fueled by the need of owners to run facilities more efficiently **Subs and suppliers adaptability** - Some subcontractors and suppliers have already embraced the digital environment	**Digitization** - Digitized construction workflow environment

- Cyber threats slowed down the shift towards remote work tools **Resources** - Limited availability of skilled workforce **Digitization** - Some suppliers and subcontractors don't have digital workflows in place **Resistance to change** - Resistance to change within the organization from senior PMs ,unionized leadership, and middle management **Nature of industry** - Construction nature is fragmented and fast paced which poses various challenges in the face of new technologies implementation or change initiatives	- Subcontractors and suppliers can quickly adapt to digitization - Engineering is adapting quickly to digitization **Digitization** - Shift towards data centricity and agile methods on a project level supported the organizational digital transformation efforts **Technology** - Advances in technology software tools and data interoperability are growing **Remote work** - Remote work increased collaboration across the organization locally and internationally - Remote work allowed operations to keep going during the pandemic despite travel restrictions **Workforce** - Non-unionized workforce is younger, less bureaucratic, and easier to adapt to new changes	

| | **Supportive leadership** | |
| | - Leadership across the organization are supporting the sustainability efforts at the project and enterprise level | |

Strategic Response		
External	**Internal**	**Challenges**
Partnerships - Working closely with subcontractors and suppliers to adopt digital workflows - Working with subcontractors and suppliers to promote green practices and lower carbon emissions **Relationships with private and public entities** - Working with universities to equip future graduates to proficient in technology and data analytics to prepare them for jobs of the future **Resources** - Outsource technology experts when needed to	**Budget** - Assigning a yearly budget for the digital transformation initiative **Investment** - Increased the investment in handhelds, stations on the jobsites, and communication devices **Digitization** - The shift to "working with data" versus "working on paper" was gradual **Project execution** - Focusing on advanced work packaging (AWP) as the core of project execution and implementing digitization to support it **Internal capabilities**	**Budget** - There is no historic data on how long the digital transformation should take and how much it should cost **Owner/client requirements** - The digital transformation initiative depends on clients' requirements and type of projects **Nature of industry** - The pandemic recovery for vertical construction and heavy civil projects is faster than other projects - Construction nature is fragmented and fast paced which poses various challenges in the face of new technologies implementation or change initiatives - Engineering and procurement are faster to embrace the digital transformation than construction **Market shift** - The focus toward the energy sector is delaying some projects **Resistance to change** - Craft leadership and unionized workforce are slow to adapt to digital workflows **Workforce** - There exists a heavy reliance on unionized workforce in mega petrochemical projects

149

develop specific software packages **Training** - Introducing the digital environment to the unions (at the international level) through training sessions **Recruitment** - Hiring specialized workforce to support the digitization effort	- Developing in-house software tools to fulfill the organization's evolving digitization requirements and support AWP **Resource efficiency** - Utilize internal resources effectively to leverage software development **Scaling** - Scale up successful change initiatives from the project level to the enterprise level (pull from project) **Supportive leadership** - Leadership supported digitalization and scaling up efforts **Diversity and inclusion** - The organization allows employees with diverse educational backgrounds to take on different roles over their career **Recruitment** - Hiring specialized employees with expertise in robotics, data science, and advanced materials **Technology**	**Training** - Virtual training and simulation is dependent on the type of project – difficult to implement in mega complex projects

150

	- Testing physical innovations such as robotic welding machines and benchmarking KPI for offsite and onsite work **Remote work** - Using remote working tools that are easy to use to allow better integration with different corporate software **Training** - Providing internal training (virtual and physical) on tools and new processes **Feedback collection** - Collecting feedback continuously from the workforce through surveys or observations regarding the use of technologies and areas of improvement	
Structure		
External	**Internal**	**Challenges**
- ◇	**Network** - There is a strong network within the organization that crosses different Global Business Units (GBUs), different	- ◇

151

	projects, and different functions that supports change buy-in **Feedback collection** - Having an independent team that collects feedback on digitization from projects and reports back to corporate construction	

People and Culture	
People and Culture	**Challenges**
People – Internal **Supportive leadership** - Organization leadership is supportive of the change initiative - Growing motivational field leaders rather than hunters and gatherers **Effective leadership** - Organization leadership continuously communicates the importance throughout the organization **Recruitment** - Hiring specialized employees with expertise in robotics, data science, and advanced materials - Recruiting younger project professionals that have more digital capacity **Diversity and inclusion** - The organization allows employees with diverse educational backgrounds to take on different roles over their career **Internal capabilities**	**Operating model** - Changing a 50–year old legacy execution model is challenging **Resistance to change** - Resistance to change within the organization from senior PMs, unionized leadership, and middle management - Resistance to return to office work environment instigated by the fear of going back to old processes and procedures - Some project managers did not embrace the new digitized workflow and left the organization - Craft leadership and unionized workforce are slow to adapt to digitization - The challenge of where the money is best spent to convince groups that resist change to change or to move past them **Training** - Virtual training is dependent on the type of project and is difficult to implement in mega, complex projects

- Employees have the ability to preserve and adapt **Training** - Introducing digital environment to unions by providing training to unionized workforce - Providing internal training (virtual and physical) on tools and new processes **Feedback collection** - Having an independent team that collects feedback on digitization from projects and reports back to corporate construction **Network** - There is a strong network within the organization that crosses different global business units (GBUs), different projects, and different functions that supports communication and collaboration **Termination** - Project managers that resisted the shift to the digitized execution model left the company **People – External** **Recruitment** - Hiring experts in data management and data governance to support the digitization effort - Hiring non-unionized workforce for smaller, renewable projects in strong union states **Network** - Engaging with a wide breadth of suppliers **Culture** **Anticipation** - The company is forward-looking **Supportive leadership**	

153

- Leadership supports front-end investments that enable change **Process re-engineering** - Integrating engineering and construction and shifting the engineering mindset on deliverables to support construction **Network** - Work environment allows individuals to establish a strong network across different GBUs **Organizational commitment** - A nourishing and can-do culture that supports the lookout for new innovations and progress	

Processes and Technology		
External	**Internal**	**Challenges**
<>	**Digitization** - The shift to "working within data" versus "working on paper" was gradual **Anticipation** - Engineering is adapting its deliverables to what construction needs **Project execution** - Focusing on advanced work packaging (AWP) as the core of project execution and implementing digitization to support it	**Training** - Virtual training is dependent on the type of project and is difficult to implement in mega, complex projects **Process re-engineering** Wrestling with the question of how to get good at changing what the organization does and how it does it in a dynamic fashion

	- Looking for the best tool for the solution - Processes and procedures are well structured, well written, and available to everyone **Internal capabilities** - Developing in-house software tools to fulfill the organization's evolving digitization requirements and support AWP **Resource efficiency** - Utilize internal resources effectively to leverage software development **Technology** - Testing physical innovations such as robotic welding machines and benchmarking KPI for offsite and onsite work - Using mobile apps connected to work packaging management system to facilitate two-way data transfer for construction crews and enhance decision making data transfer for construction crews	

| | **Remote work**
- Using virtual machines to access the design tools located in one of the international offices so project operations are not interrupted
Using remote work tools that are easy to use and allows better integration with different corporate software | |

7.1.8 Organization C Framework

Case Study: Implications of a new capital projects operating model implemented during overall company transformation
Timeline: 2019 – Current
One Interviewee: Capital Project Performance & Capability General Manager
Key Enablers (Inputs): organizational and key work process re-design (mergers, acquisitions, and new business functions)
Measures of Success (Outputs): Satisfaction of customers, employees, and shareholders, internal KPIs, and alignment with enterprise business objectives

Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Nature of industry	**Market expansion**	**Portfolio**
- Inconsistent performance across large capital projects over extended period	- Concurrent market expansion of mega capital projects	- Change in project portfolio, focused on less mega projects, as well as the introduction of energy transition projects. Need to ensure a clear focus on both leading in returns and lower carbon
Operating model	**Strategic objective**	
- The existing operating model centralized management of the workforce which created process, behavioral, and clarity of accountability challenges	- Fundamental shift in the enterprise business objectives from growth to returns	
	Pandemic	
	- The pandemic tested the resilience of the capital projects operating model	

Strategic Response		
External	**Internal**	**Challenges**
External/internal benchmarking	**External/internal benchmarking**	**Project execution**
- External benchmarking to understand competitiveness with industry peers	- Performing internal studies to the root causes of inconsistent project performance and advise strategic recommendations	- Overly complicated processes compared to other companies
- External perspective on organizational approaches with peers in the industry as well as outside of the oil and gas industry	- Comparing the operating model performance to competitors and non-oil and gas industries	**Nature of industry**
		- Challenges in maintaining adequate organizational capability due to the diverse and unique nature of capital projects (time constrained,

157

	Metrics - Developing internal metrics to track the progress of organizational performance **Restructuring** - Restructuring of existing legacy functions into one technical center dedicated to support the enterprise including the execution of capital projects, upstream and downstream (utilizing a new operating model) **Project execution** - Strengthening the linkage between the technical functions and business units in the early phases of capital projects. Centralizing execution of early phase work to help de-bias perspectives and to more efficiently understand competitiveness of opportunities **Communication** - Communicating key strategic changes in the capital projects operating model to those involved, both project practitioners and business leaders - Continually reinforcing the role capital projects play in the forward success of the company and making sure the message is very consistent and consistently reinforced **Integration** - Centralizing early phase work within the technical function teaming with	multifunctional, multi-dimensional and transitory) **Portfolio** - Shift in portfolio (mega projects to a large number of medium size projects, as well as energy transition projects) and investment mentality (returns focused versus growth / developer mindset)

| | business units. Note that decision authority lies within the business units for each individual opportunity / project. **Competitive advantage** - Placing increased focus to define competitiveness during early phase work leading up to concept selection. Post concept selection turn focus to delivering predictably **Stage-gate processes** - Applying an agile mindset and agile workflows within the overall phase gate progression model for capital projects **Accountability** - The center function retains the accountability to steward enterprise project professional organizational capability, though they are embedded within the business units when working on individual capital projects. **Career progression** - The center function maintains responsibility for the career development and progression of the project professionals and the business units are responsible for their performance **Training** - The center function provides internal training and competency development | |

	to business unit assigned project professionals	
Structure		
External	**Internal**	**Challenges**
- <>	**Restructuring** - Restructuring existing functions into one technical center with the capital projects function as one of the functions in that technical center	- <>
People and Culture		
People and Culture		**Challenges**
People – Internal **Shift in the required skillset** - Identify the right people for the right position **Organizational design** - Taking a fit for purpose mindset to assembling a project team (org design) **Communication** - Keeping the change messages simple to ensure buy-in from different employees - Continually reinforcing the role capital projects play in the forward success of the company and making sure the message is very consistent and consistently reinforced **Strategic objective** - Continually reinforcing the shift to the investor mindset and ensuring selected capital projects lead in returns, with a focus on lower carbon **Project execution** - Continually reinforcing execution discipline and progression with a condition-based mentality **Training** - The technical function provides internal training and competency development to business unit assigned project professionals		**Operating model** - Maintain focus on intents and principles. The prior operating model for projects was overly prescriptive and resulted in teams following the process in a "check the box" mentality, as opposed to meeting the intents of the process **Internal capabilities** - Given the uncertainty in the amount of capital projects activity the organization can do, having key leaders and project professionals understand the long-term benefits of the new operating model when there is no obvious "moon landing challenge / driver"

Recruitment
- Reorganizing the project professionals out of the old project function and into the business units. Eliminate employees being loaned out to business units; instead, they are accountable to business unit heads where the projects are housed, rather than a centralized project function / company

People – External
- ◇

Culture
Strategic objective
- Shifting from a growth mindset to an investor mindset
- Increase focus on intents and principles and become less prescriptive on process and procedure

Communication
- Driving a culture of clarity, understanding, and alignment on principles
- Clearly articulating the importance of why change is happening going forward

Processes and Technology		
External	**Internal**	**Challenges**
- ◇	**Integration** - Centralizing early phase work within the technical function teaming with business units. Note that decision authority lies within the business units for each individual opportunity / project **Competitive advantage** - Placing increased focus to define competitiveness during early phase work leading up to concept selection. Post concept selection turn focus to delivering predictably **Stage-gate processes**	- ◇

	- Applying an agile mindset and agile workflows within the overall phase gate progression model for capital projects **Recruitment** - Eliminate employees being loaned out to business units under the old operating model to making project professionals part of the business units **Continuous improvement** - Reinforce the changes made to the model to build confidence	

7.1.9 Organization D Framework

Case Study: Implications of Remote Work on an Airport Authority
Timeline: 2018 – Current
One Interviewee: Digital Facilities and Infrastructure Manager
Key Enablers (Inputs): Organizational Remote Work Transformation
Measures of Success (Outputs): Operational Performance

Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Nature of industry - Employee oversight culture (employees need to be physically present to perform the work)	**Remote work** - Rolling virtual meeting software tools to minimize work-related travel for some business units (before the COVID-19 pandemic) **Pandemic** - The pandemic pushed the organization to adopt virtual meeting globally within the organization **Nature of industry** - Airport's facilities are large, which makes in-person meeting challenging	**Internal capabilities** - Adaptable work environment
Strategic Response		
External	**Internal**	**Challenges**
Partnerships	**Anticipation**	**Network** - Loss of social interactions in the workplace

- Strengthening partnerships by reaching out to key personnel regularly	- Updated organizational emergency plans which identified operational risks and response actions **Accountability** - Performing daily morning virtual meetings to increase accountability, assign tasks, and discuss any challenges **Training** - Performing informal training related to virtual meeting tools **Communication** - Communicating with management via different means and calling them when possible	**Remote work** - Technical challenges to connect to the local network via VPN due to increased number of users **Project execution** - Uncertainties related to project execution and governance (some projects were canceled while others were accelerated since the airport was not as busy as usual) **Communication** - Different methods of communication offer different levels of permanence (can dictate whether it can be used for reference in case of a contractual conflict)

Structure		
External	**Internal**	**Challenges**
- <>	- <>	- <>

People and Culture	
People and Culture	**Challenges**
<u>**People – Internal**</u> **Effective leadership** - Leadership across the organization prepared for worst-case scenarios **Training** - Upskilling employees via internal training	**Regional/unit requirements** - Different units within the organization have different cultures **Training** - Training new employees in a remote setting is challenging **Retaining workforce**

Accountability - Sharing daily progress with management via emails to ensure follow-up and increase accountability **People – External** - <> **Culture** **Organizational commitment** - The airport has a pride-based culture		- The imposed hiring freeze stressed the organization to retain current employees
Processes and Technology		
External	**Internal**	**Challenges**
- <>	**Anticipation** - Updated organizational emergency plan which identified operational risks and response actions **Technology** - Moving to a segregated cloud service to mitigate cyber-attack threats - Using a centralized common data environment where all project models are located	**Remote work** - Technical challenges to connect to the local network via VPN due to increased number of users **Communication** - Different methods of communications offer different levels of permanence (can dictate whether it can be used for reference in case of a contractual conflict)

7.1.10 Organization E Framework

Case Study: Implications of a new market segment shift on an EPC Company **Timeline:** 2017 – 2021 **One Interviewee:** Regional Talent Development Manager **Key Enablers (Inputs):** organic growth, business incubation, diversifying project portfolio, organizational re-design, training and retaining, divesting non-core businesses **Measures of Success (Outputs):** driving growth across portfolio, pursuing contracts with fair and balanced terms, reinforce financial discipline, foster a high-performance culture		
Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Market shift - New mega-project opportunities are becoming less frequent and more competitive **Nature of industry** - Cyclical nature of some projects, such as pharmaceuticals and Oil & Gas - Taking on projects after previous contractors who failed to deliver **Resources** - Lack of key resources while operating in a new country **Leadership changes** - Multiple changes at the corporate level due to yearly attained financial losses **Portfolio** - Lump sum gas fired power projects resulted in continuous financial losses **Competitive bids**	**Market shift** - The energy sector is transitioning from the from the Oil and Gas focused-projects due to the drop in prices and the low carbon future 2050 goal - The market is shifting toward technology projects (such as microchip manufacturing and data centers) - The market is shifting to projects supporting low carbon goals such as hydrogen, and carbon-capture - This newly entered market operates quickly and technology changes almost daily which requires flexibility and agility in delivery and design **Internal capabilities** - The good organization project backlog and financial capacity	**Market shift** - Shift to renewable energy due to UN SDGs and government commitments to achieve low carbon goals by 2030 (green technology and carbon-capture) - Increased reliance on data centers due to the shift toward remote work environments and technological innovations (cloud computing) **Sustainability** - Achieving sustainable market growth **Organizational design** - The need to design fit for purpose organization

- Competitive projects' bids are costing the company and resulted in challenged projects **Owner/client requirements** - Different owners require different software tools, which add additional cost related to training and integration into current workflows **Resistance to change** - People working on projects within a specific segment cannot easily adapt to technology projects type of work - Resistance to change when moving to a new market, or when changing the type of project - Resistance to change within the organization enabled by the shift in project portfolio	- The organization is always ready to take on complex projects	

Strategic Response		
External	**Internal**	**Challenges**
Portfolio - Undergoing Shift from mega to medium/small capital projects - Diversifying sources of income by investing in businesses dealing with new technologies (modular nuclear reactors) and signing agreements to be the sole project delivery partner – business incubation initiatives **Market expansion**	**Leadership changes** - New CEO was assigned **Restructuring** - Ongoing restructuring of the organization into three business units with independent reporting **Portfolio** - Suspended gas fired power projects **Retaining workforce**	**Clients/owners needs** - A client can fit within more than one business unit depending on the project causing challenges in selecting the unit in charge of the project **Retaining workforce** - The cyclical nature of work is causing employees to seek other opportunities earlier (not waiting to till the end of project

167

- Growing organically by taking on FEED, owner's rep, and consulting roles to build a stronger relationship with potential clients before bidding the projects - Growing multiple small/medium projects it into a program effort (Data Centers) **Nature of industry** - Adopting a growth strategy to support the cyclical nature of projects **External growth opportunities** - Continuously improving and expanding the relations with existing/new clients	- Creating incentive programs to retain skilled labors (daily retention programs) **Diversity and inclusion** - Building a diversified workforce from different business groups - Focusing on Diversity and inclusion **Human resource allocation** - Decreasing projects design cost by seeking global workforce due to their lower hourly rate - Lowering costs by releasing highly paid employees but keeping the skilled SMEs **Resource efficiency** - Utilizing the workforce efficiently to keep them from staying idle **Training** - Enhance and certify workforce skills via partnerships with educational institutions, incentives, and in-house training centers **Knowledge management** - Learning the new software tools required by different owners and integrating them into the reporting process **Remote work** - Created a centralized tool to connect different projects cost reporting - Working in a cloud-based environment	- Availability of the right type of workforce – retaining skilled labor and getting or training new ones - Craft workers will jump a job for a slight difference in salary **Resources** - Lack of key resources while operating in a new country **Competitive bids** - Competitively bid projects are costing the company more and resulting in less favorable contract terms **Market shift** - The newly entered market sector operates quickly and technology changes almost daily which requires flexibility and agility in delivery and design **Workforce** - Hiring subcontractors mitigates the primes' workforce related challenges, such as finding the proper workforce. However, it stresses the primes to ensure that the subcontractors comply with safety procedures and protocols **Organizational design** - The organization is still undergoing organization changes to become more fit for purpose (deciding the suitable structure, size, and portfolio)

Structure		
External	**Internal**	**Challenges**
Partnerships - Signing an MSA with an owner chemical company or other companies to serve the corporate long-term goals **Investment** - Investing in modular reactors business **Restructuring** - Divestment of non-core businesses	**Restructuring** - Ongoing restructuring the organization into three business units with independent reporting	**Clients/owners needs** - A client can fit within more than one business unit depending on the project causing challenges in selecting the unit in charge of the project

People and Culture	
People and Culture	**Challenges**
<u>**People – Internal**</u> **Leadership changes** - A new CEO was assigned to the company **Retaining workforce** - Retaining skilled workforce through incentives, upskilling and certified training opportunities **Resource efficiency** - Utilizing the workforce efficiently to keep them from staying idle **Training** - Opened craft training centers for big projects to professionally certify and upskill the current workforce (welding schools at project sites) - Provided creative incentive programs to train skilled labor **Human resource allocation** - Redistributing expensive labor force to mega projects, in order to balance the average labor cost per project (Human resource allocation) <u>**People – External**</u> **Partnerships** - Partnered with technical colleges to create tailored training programs and courses that meet the business needs	**Nature of industry** - The cyclical nature of work is causing employees to seek other opportunities earlier (not waiting until the end of project) **Resistance to change** - Resistance to change when moving to a new market, or when changing the type of project - People working on projects within a specific segment cannot easily adapt to technology projects type of work **Retaining workforce** - Availability of the right type of workforce – retaining skilled labor and getting or training new ones - Craft workers will jump a job for a slight difference in salary

Culture
Organizational commitment
-   Fostering a high-performance culture with purpose
Diversity and inclusion
-   Supporting diversity internally
Anticipation
-   The company is forward-looking, and organically expanding
External Interactions
-   Continuously improving and expanding the relations with existing/new clients
Internal capabilities
-   The organization is always ready to take on complex projects

Note: the above section is a two-column table; the right column reads:

-   People issues to address when designing the organization to become more fit for purpose – challenge in keeping key people with the required experience and skill set while lowering the pay scale especially for managerial positions

Processes and Technology		
External	**Internal**	**Challenges**
Human resource allocation	**Knowledge management**	**Owner/client requirements**
- Decreasing projects design cost by seeking global workforce due to their lower hourly rate	- Learning the new software tools required by different owners and integrating them into the reporting process	- Different owners require different software tools which causes interoperability challenges that affected project cost reporting process
Remote work	**Technology**	**Training**
- Working with other external organizations in a cloud-based environment	- Created a centralized tool to connect different projects cost reporting	- The different software tools require training and integration within the existing workflows
Relationships with private and public entities	**Resource efficiency**	**Remote work**
- Maintaining strong relationship with engineering-focused universities	- Utilizing the workforce efficiently to keep them from staying idle	- Working in a cloud-based environment grants the participants access to financial project documents which is not desirable in GMP projects
- Invest in engineering schools with large population of minority students	**Reporting**	**Resources**
- Investing STEM programs at schools	- Developing data standardization processes to ensure consistent project benchmarking and progress reporting which will help in ensuring adequate future project estimates	- Lack of key resources while operating in a new country
	Technology	**Competitive bids**

	- Building digital twin, to help throughout different project lifecycles	- Competitive projects' bids are costing the company and resulted in challenged projects. **Market shift** - This new market operates quickly and technology changes almost daily which requires flexibility and agility in delivery and design

7.1.11 Organization F Framework

Case Study: Implications of the adoption of Integrated Project Delivery (IPD) on a manufacturing organization Timeline: 2015- Current One Interviewee: Construction group manager Key Enablers (Inputs): Supportive leadership, partnering, and training programs Measures of Success (Outputs): financial performance (stock and profit), shareholders satisfaction and collaboration, and successful project completion (cost and time)		
Drivers of Change		
Weight of the Past	Push of the Present	Pull of the Future
Training - Challenges in the understanding of how IPD contracts works across PMs and Engineers even with formal training **Resources** - Limited availability of experienced IPD employees which is limiting the organization from taking new projects **Resistance to change** - Resistance to IPD adoption and implementation by different owners in the industry	**Organizational design** - Shift from a design-bid-build, to Design-Build, and later to IPD project delivery approach to reduce time, cost, and risk - Completion of multiple projects using IPD approach **Nature of industry** - Market pressure to deliver projects quicker is pushing the organization to complete the facilities using new delivery approaches	**Organizational design** - Increase the organization's operational efficiency, decrease project timing, increase innovation, and reduce cost
Strategic Response		
External	Internal	Challenges
Integration	**Communication**	**Training**

172

- Allowing different stakeholders to participate in pre-engineering phase in order to help in formulating the scope of work **Subs and suppliers adaptability** - Subcontractors and suppliers are adapting to IPD **Partnerships** - Partnering with specialized suppliers to exchange IPD knowledge and support the implementation and trusting their experience **Project execution** - Sharing profit numbers with different trade partners participating in the project to incentivize project participants and to increase collaboration and transparency (shared Risk/Reward) **Recruitment** - Hiring specialized employees with expertise in IPD to help in training and support across different projects	- Communicating key benefits of IPD to different business units via different methods including seminars, meetings, trips, and literature case studies (using facts, proofs, and successes of other industries to promote IPD)	- Challenges in the understanding of how IPD contracts works across project managers and engineers even with formal training **Organizational design** - Lack of a regimented process to achieve the IPD transformation across the organization and the network **Resistance to change** - Resistance to IPD adoption and implementation by different owners in the industry **Nature of industry** - Challenges in properly estimating projects in the industry (IPD or non-IPD) - Challenges in planning career tracks across the industry (no formal recruitment and career progression system) **Retaining workforce** - Challenges in retaining planning engineers across the industry due to them seeking project management positions or wanting to retire

- Hiring specialized accountants to ensure the financial viability of the organization		

Structure		
External	**Internal**	**Challenges**
Organizational design - There is a small stable network of contractors for different projects	**Integration** - Align internal resources (financial and legal teams) with IPD and Lean Construction	**Network** - The small stable network of contractors working with the organization must adopt IPD using their own resources to maintain their relationship as the organization does not directly provide training in IPD to their supply chain partners

People and Culture	
People and Culture	**Challenges**
People – Internal **Training** - Training project managers and engineers on IPD contracts and Lean Construction **Supportive leadership** - Leadership supported the IPD efforts **People – External** **Recruitment** - Hiring specialized employees with expertise in IPD to help in training and support across different projects - Hiring specialized accountants to ensure the financial viability of the organization **Culture** **Innovation** - A culture that supports innovation and trust **Workforce** - A culture that prioritizes workforce safety	**Resources** - Limited availability of experienced IPD employees which is limiting the organization from taking new projects **Resistance to change** - Resistance to change within the organization from senior project managers and engineers - Resistance from the finance group due to the major changes to the contract costing structure - Resistance to IPD adoption and implementation by different owners in the industry **Retaining workforce** - Challenges in retaining planning engineers across the industry due to them seeking project management positions or wanting to retire **Reporting** - The organization was not accustomed to sharing their budget under previous project delivery systems (i.e., design-bid-build

Anticipation	where budget is kept a secret to try and get best price) and project teams were not used to the new collaborative, shared risk model
- The organization is forward-looking and an early adopter of lean practices	
Organizational design	
- The organization used to implement a legacy project delivery model and was able to transition to a more collaborative, integrated project delivery model	
- The organization recognizes that culture and trust are very important and without this, the IPD tools, processes and workflows won't be as successful or deliver expected results	
- In-person meetings and co-location of project teams in the early phases of IPD were found to be important for developing the interpersonal relationships that allowed a shared culture and trust to develop.	
Supportive leadership	
- The organization leadership provided an incentivization scheme (shared risk / reward) to stimulate the desired behavioral and cultural shift	
Resources	
- The organization is involved in professional organizations (such as CURT and LCI) which helped it find proper resources to achieve buy in and support	

Processes and Technology		
External	**Internal**	**Challenges**
Resources	**Training**	**Organizational design**
- The organization is seeking internal approval to bring in outside resources to help with alignment, training and change management	- Training employees on IPD using different means such as conferences, in person meetings, professional coaches and	- Lack of a regimented process to achieve the IPD transformation across the organization and the network
		Nature of industry
		- Challenges in properly estimating projects in the industry (IPD or non-IPD)

- The organization is using an experienced IPD coach to help them with project setup and kickoff has been very helpful on past and current IPD projects	visits to other experienced organizations **Resources** - The involvement in professional organizations (such as CURT and LCI) helped the organization find the resources - Literature on IPD conducted by the organization helped convince internal stakeholders and develop buy-in	

Case Study: Implications of Public-Private Partnerships (PPP) on a government agency
Timeline: 2010 -
One Interviewee:
Key Enablers (Inputs): Agency transitioning from a self-developed capability to growing that capability in the industry and purchasing the service while fostering competition
Measures of Success (Outputs): Mission objectives successfully complete, safety, lower costs, stimulating industry, providing competition among services purchased, and agency being one of many customers to what industry provides

Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Organizational commitment - Vision across the leadership team never established **Strategic objective** - Implementation was directed but rational was never provided to agency or industry **Resistance to change** - Employees resisted the change because they did not understand the vision, and therefore, the implementation did not make sense **Communication** - Poor communication between senior leadership	**Portfolio** - Shifting to a model that grows capability in industry in an ecosystem of competition from which the government agency can purchase services **Partnerships** - Partnership between agency and industry to achieve a common mission - Creating jobs and improving the economy via PPPs (their services become available to other customers in the country)	**Market expansion** - Growing industry and associated infrastructure capabilities to achieve agency goals as many others - Agency not having bought services from industry can take those savings to advance future development needs

and rest of agency resulted in inefficiency and strife between agencies and industry resulting in low trust or a common goal		
Strategic Response		
External	**Internal**	**Challenges**
Partnerships - Partnering with industry for common goals that used not to involve industry	**Portfolio** - Shifting from self-sufficient (doing everything) to partnering with the industry **Restructuring** - Cancelling existing programs to support PPPs efforts (lowering costs and shifting resources)	**Strategic objective** - Ambiguity regarding organizational purpose, and drivers behind the change initiatives - Trying to determine the role of the agency with regard to what was being provided by the industry
Structure		
External	**Internal**	**Challenges**
Partnerships - Partnering with private service providers, and seeding them with money and technology to perform project operations	**Restructuring** - Organization had to change from performing development to insight and oversight for development	**Retaining workforce** - Retraining personnel for insight and oversight
People and Culture		
People and Culture		**Challenges**
<u>**People – Internal**</u> - <>		**Human resource allocation**

People – External		
Relationships with private and public entities - Understanding what the agency vision is to effectively implement **Culture** - <>		- Working with PPP bureaucracy caused frustration among employees (cancelling programs and shifting resources)
Processes and Technology		
External	**Internal**	**Challenges**
Partnerships - Seeding private companies with money and technology to perform previously in-house developments to help in lowering the cost of operations and help in creating new jobs	**Human resource allocation** - Shifting resources and changing roles and responsibilities to supporting the vision **Process re-engineering** - Ensuing processes adhere to agency safety expectations	**Communication** - Answering the question of 'why needed' which means communicating the rationale for change **Supportive leadership** - Leadership supporting insight and oversight actions required for safety

7.1.13 Organization G-Internal Framework

Case Study: Implications of a new support model with a government agency		
Timeline: 2010 -		
One Interviewee:		
Key Enablers (Inputs): Burnout, cost, and career advancement associated with an old model that was not applicable to the new environment		
Measures of Success (Outputs): Mission objectives completed, reduction in number of people leaving, execution costs, and safety.		
Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Supportive leadership - Senior-level leadership team formulated the vison, saw that the change was necessary **Resistance to change** - Middle-level leadership resisted the model because of the weight of the past - The vision was not supported - Employees resisted change when merging different organizational units (cultural clash) - Employees resisted the new model because they never had visibility into the real vision of senior-level leadership	**Portfolio** - Transitioning from an old sequential model for increased responsibility in real-time operations to a new model that in parallel allowed increased responsibilities across the real-time operations workforce - Transitioning form continuous operations to segmented operations as a function of need	**Operating model** - Organization recognized with new customer support that the old model would result in increased cost, increased attrition, and moral issues and affectively developed a new model which delineated those concerns while not compromising the organizational culture or values

Communication - Senior-level leadership thought the message was being communicated through middle-level management, but it wasn't - Change efforts were inadequately communicated from senior leadership to employees **Shift in the required skillset** - Overall, this change caused concerns because people had to certify according to a new model that may not be fit for everyone especially those that grew up in the old model - Change initiatives resulted in sidelining the old unit leaders which ended up leaving the organization (new positions were not offered to them) **Organizational commitment** - Senior leadership credibility was shaken as a result of this new model not taking root initially until they figured out the middle		

management was a problem. - People thought this new model comprise the organization's values because it accelerated the ability for employees to take more responsibility quicker (which was in contrast to the old model) - Culture eats strategy for lunch - The fact that the culture was so ingrained in the middle managers who did not support the new model		
Strategic Response		
External	**Internal**	**Challenges**
- ⬦	**Restructuring** - Restructuring the organization by merging some units - Restructuring the internal career progression model (hire and certify within a short period of 1.5-2 years) instead of the slow 5-7 years progression model **Communication**	**Workforce** - Recognizing that the workforce (lowest level of the organization) did not have the same vision as the senior leadership team **Organizational commitment** - Is the organization compromising its values with this new model because it accelerated the ability for employees to take more responsibility quicker (which was in contrast to the old model)? **Resistance to change** - Challenges in achieving 'real' buy-in from middle management

	- Senior leadership team did an excellent job formulating the vision but struggled to communicate it effectively to the workforce - Leadership recognized that middle management was polluting the message and then directly communicated the change efforts to the workforce to achieve buy-in **Career progression** - Adopting new career progression model which required knowledge across multiple systems to advance	

Structure		
External	**Internal**	**Challenges**
- ◇	**Restructuring** - Restructuring by merging organizational units to align with the new model for operational support	**Resources** - Not all individuals possessed the skillsets needed to support this new model (instructors were needed and not everyone is a teacher)

People and Culture	
People and Culture	**Challenges**
<u>**People – Internal**</u> **Effective leadership**	**Resistance to change**

- Choosing effective leadership to lead the change efforts and the newly merged units (helps in minimizing cultural clashes between the old units) **Communication** - Bridging the gap between senior leadership and employees and building trust by directly communicating the change initiatives via small groups **Termination** - Sidelining old unit leaders that chose not to adapt **Training** - Creating work progression programs within the organization to train and certify fresh grads in a short period to take on leading positions (specialists/instructors) while teaching them interdependencies within the organization **Human resource allocation** - Shifting employees to different roles to allow them to gain new insights and opening new opportunities (shifting from specialized to a broader knowledge) **People – External** - <> **Culture** **Supportive leadership** - Growing leaders by engaging them in a challenging work environment **Organizational commitment** - Operating as one and treating everyone the same	- Challenges in convincing unit leadership to support the change effort - Resistance to change from senior employees regarding the new progression model without compromising the organization's values (fresh grad can progress to achieve senior roles in a shorter period of time) **Communication** - Middle management didn't communicate the senior leadership change effort massage clearly which resulted in low buy-in rates **Organizational commitment** - Losing employees' motivation when shifting to new positions due to the merger - Concerns with compromising the organization's values **Shift in the required skillset** - Current employees are facing challenges such as job security (sidelining) and career path changes (from specialized roles to broader roles)

Processes and Technology		
External	**Internal**	**Challenges**
- <>	- <>	- <>

7.1.14 Organization H Framework

Case Study: Implications of acquisitions on a Power generation company Timeline: 2017- Current Two Interviewees: VP of Corporate Business Development and Strategy and Director of Project Solutions Key Enablers (Inputs): Acquisitions, supportive leadership, partnering, succession planning, and training programs Measures of Success (Outputs): financial performance (stock, profit), shareholders satisfaction		
Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Gov't participation/control/support - Strict rules, regulations, and procedures for nuclear facilities **Restructuring** - The organization didn't perform any previous acquisitions	**Market expansion** - Understating the rules, regulations, and challenges of newly entered markets (hydro- and gas-powered plants) **Nature of industry** - Shutting down nuclear plants – main assets that are reaching their end of life	**Sustainability** - Carbon neutrality by 2050 as set by the UN Sustainability Development Goals implementations
Strategic Response		
External	**Internal**	**Challenges**
Internal capabilities - Acquiring organizations that had experience in	**Market expansion** - Setting a strategic growth plan that considers	**Restructuring** - The organization underwent an acquisition for the first time. Additionally, the acquired company operates in another country

hydro and gas generation to bridge the knowledge/capability gap, support low carbon transformation, and prepare for future project opportunities	available resources to expand portfolio **Integration** - Allowing subsidiaries to participate in subsequent growth opportunities **Strategic objective** - Prioritizing succession planning **Integration** - The organization set up an internal integration team to be the liaison between the organization and the various subsidiaries - The organization decided to integrate some subsidiaries and allowed others to operate independently based on multiple factors such as location of operation and culture - Involved teams upfront **Communication** - Communicating change efforts and upcoming acquisitions' challenges to both leadership and employees **Supportive leadership**	and thus the legal and socio-political environments of both acquiring and acquired companies are different - The acquisition was time compressed and the strategy was executed quickly **Communication** - The organization is still identifying the proper information flow procedures with subsidiaries

	- Leadership supported the acquisition efforts **Effective leadership** - Leadership communicated with each other regarding the change efforts **Human resource allocation** - Properly allocating resources to support the acquisition efforts by leveling the workload for full-time employees involved in the acquisition **External/internal benchmarking** - Created a team to analyze the impact of acquisitions on the workforce and the possible shift in skillsets **Reporting** - Updating financial reporting processes to ensure a proper information flow between the subsidiaries and the organization **Process re-engineering** - Improving various internal processes (communication and approval) to support	

	acquisition and integration efforts	

Structure		
External	**Internal**	**Challenges**
Organizational design - Legal structure of the subsidiaries was based on jurisdictional regulatory, legal, and tax considerations	**Integration** - The organization set up an internal integration team to be the liaison between the various subsidiaries - The organization decided to integrate some subsidiaries and allowed others to operate independently based on multiple factors such as location of operation and culture	**Organizational design** - Understanding how the governance structure would work

People and Culture	
People and Culture	**Challenges**
People – Internal **Shift in the required skillset** - Identifying current Internal capabilities by looking closely at the staff skills/experiences regarding future growth to devise a labor strategy plan **Supportive leadership** - Leadership supported the acquisition efforts **Effective leadership** - Leadership communicated with each other regarding the change efforts **People – External**	**Human resource allocation** - Challenges of resource allocation and unionized workforce

188

- ◇		
Culture		
Innovation		
- A culture that supports innovation, agility and progress		
- A culture that allows people to take risk, fail, recover, learn, and proceed		
Communication		
- A culture that is based on transparency and open communication		
- A culture that communicates good news as well as challenges		

Processes and Technology		
External	**Internal**	**Challenges**
- ◇	**Reporting** - Updating financial reporting processes to ensure a proper information flow between the subsidiaries and the organization **Process re-engineering** - Improving various internal processes (communication and approval) to support acquisition and integration efforts **Organizational design** - Developed an M&A playbook to guide future	- ◇

189

	efforts and highlight areas of diligence	

Case Study: Implications of the market shift a service organization within an owner capital project company **Timeline:** 2016 – Current **One Interviewee:** VP of Technical and Projects Solution **Key Enablers (Inputs):** Re-alignment of project portfolio to serve corporate goals and the shift in market needs and organizational re-design (downsizing, partnering) **Measures of Success (Outputs):** Satisfaction of customers, employees, and shareholders		
Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Shift in the required skillset - Challenges in changing the workforce skillset without causing disapproval and voluntary dropouts	**Gov't participation/control/support** - There is an increase in environmental regulations and investments supporting low carbon initiatives in various countries **Market shift** - The energy market is shifting toward renewables - There is a drop in gas prices - There is a slow growth of coal energy customer customers **Clients/owners needs** - Good relationships with different customers that fully support the organization's change initiatives	**Sustainability** - Carbon neutrality by 2050 as set by the UN **Anticipation** - Predict current and future customer demand
Strategic Response		
External	**Internal**	**Challenges**

Communication	Resources	Clients/owners needs
- Communicating the organization change strategy to customers to eliminate ambiguity and ensure buy-in and support	- Setting a strategic plan that takes into account available resources and the future projected needed resources to achieve portfolio transformation	- Addressing customers' fear of losing the support and services offered by the organization due to the change initiative
Strategic objective	**Strategic objective**	**Shift in the required skillset**
- Setting an Integrated Technical Strategy with customers that explains how the organization will transition its employees over the next 10 years	- Tailoring the strategy based on the future work of the organization	- Some project delays happened due to retooling – hiring new employees, relocating or releasing existing employees
Training	**Internal capabilities**	**Retaining workforce**
- Training contractors working with the organization to fulfill the gap caused by downsizing and the shift in the organization portfolio	- Identifying skillsets that are no longer requested and those that are transferrable to help support the corporate strategy	- Understanding the complexity of retaining, transitioning, and reducing the workforce
Partnerships	**Restructuring**	
- Partnering with external organizations to perform services/works that are no longer provided by the organization	- Managing an organizational retooling to optimize resources and talents to meet the anticipated shift in customer demand and organization portfolio	
Integration	- Accelerated the retooling efforts by offering employees within the Integrated Technical Strategy voluntary transition packages	
- Bring the supply chain along through the change initiatives	**Communication**	
	- Communicating change efforts to employees, customers, and stakeholders in a concise, regular, and transparent manner to ensure buy-in	
	- Adapting and adjusting the communication efforts according to the audience	
	Training	

External	Internal	
- Offering continuous internal training and providing specialty training by third parties when needed **Technology** - Shift towards new technologies that support low carbon transformation		

<table>
<tr><td colspan="3" align="center">Structure</td></tr>
<tr><td align="center">External</td><td align="center">Internal</td><td align="center">Challenges</td></tr>
<tr><td>Partnerships
- Partnering with external organizations to perform services/works that are no longer provided by the organization</td><td>Restructuring
- Managing an organizational retooling to optimize resources and talents to meet the anticipated shift in customer demand and organization portfolio</td><td>Retaining workforce
- Understanding the complexity of retaining, transitioning, and reducing the workforce</td></tr>
<tr><td colspan="3" align="center">People and Culture</td></tr>
<tr><td colspan="2" align="center">People and Culture</td><td align="center">Challenges</td></tr>
<tr><td colspan="2"><u>People – Internal</u>
Supportive leadership
- Leadership balanced between business and compassionate decisions
- Leadership continuously considered the longevity of their people throughout the change initiative
Career progression
- Offered employees a transition package to allow them to seek other opportunities outside the organization
Restructuring
- Accelerated the retooling efforts by offering employees within the Integrated Technical Strategy voluntary transition packages
Shift in the required skillset
- Identifying current skillsets within the organization by closely examining the staff skills and experiences regarding future projects in order to achieve the strategic response plan</td><td>Resistance to change
- Challenges in changing the workforce skillset without causing disapproval and voluntary dropouts
Retaining workforce
- Understanding the complexity of retaining, transitioning, and reducing the workforce</td></tr>
</table>

- Hiring a balance of generalists and specialists depending on the type of project

Training
- Offering continuous internal training and providing specialty training by third parties when needed

Communication
- Communicating change efforts to employees, customers, and stakeholders in a concise, regular, and transparent manner to ensure buy-in
- Adapting and adjusting the communication efforts according to the audience

<u>People – External</u>

Clients/owners needs
- Ensuring strong relationships with clients and maintaining a continuous line of communication to ensure buy-in and support for change efforts

<u>Culture</u>

Anticipation
- The organization is forward looking – the organization is continuously looking ahead to ensure its present supports its future
- The organization had a mindset about working for the present and future, while celebrating past successes
- The organization recognizes that change is constant

Organizational commitment
- The organization continuously seeks to empower employees through organizational initiatives
- Employees make decisions that best serve the corporate goals

Processes and Technology		
External	**Internal**	**Challenges**
- ◇	**Technology** - Shift towards new technologies that support low carbon transformation **Continuous improvement**	**Operating model** - Understand how processes and technology need to change

	- Ensuring change initiatives take the right amount of time and are not rushed through **Strategic objective** - Adjusting the Integrated Technical Strategy according to the unfurling conditions (accelerate and decelerate change as needed)	

Case Study: Implications of low carbon future on a Service Provider EPC company
Timeline: 2014 – 2015 (Merging business units)
2019 – Present (Splitting business units and focusing on green chemicals production)
Participating Company: capital project service provider organization (EPC provider)
Key Enablers (Inputs): Technology investment, Re-alignment of project portfolio to serve corporate goals, organizational re-design (merge, split and divest)
Measures of Success (Outputs): Carbon emissions, financial performance (stock, profit) and capital project portfolio (right projects selected, executed well)

Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Regional/unit requirements - Different regions require different approaches and technologies (each market has its own pace and things will not happen at the same time; for example, implementing green projects is easier in countries where energy is generated via renewable sources) **Resistance to change** - Employees resisting change when moving under the merged business unit (different segments had a different culture and set of expertise required, which caused various challenges when merged) **Nature of industry** - Chemical plant projects are complex and require specific set of skills,	**Gov't participation/control/support** - There is an increase in environmental rules and regulations and investments supporting low carbon initiatives in various countries (such as European Union, Brazil, and Canada) **Market shift** - The energy market is shifting toward renewables - Nuclear projects are not publicly accepted as a viable green energy solution **Sustainability** - Hydrogen production is a key topic for the future of decarbonization and green future - Many industries (steel production, energy, transportation) will benefit	**Sustainability** - Carbon neutrality by 2050 as set by the UN

knowledge and technologies that varies from project to project	from hydrogen infrastructure in general and this will help in decreasing their carbon emissions	
Scaling - Scaling and marketing of green chemicals projects is challenging due to its relatively higher cost (different supply chain, different customers, and different infrastructure)	**Restructuring** - Different organizational units have overlapping assignments which can be merged **Competitive advantage** - Maintain competitive edge in the green market	
Strategic Response		
External	**Internal**	**Challenges**
Partnerships - Partnering with specialized local and international entities to exchange low carbon transformation technologies and implementation knowledge (mainly in green chemical projects)	**Portfolio** - Corporate announced the focus on chemical business segment and green projects - The portfolio of capital projects was realigned to serve corporate core strategy and stay ahead of competitors **Restructuring** - Restructuring the organization by merging groups and then splitting these groups and divesting some units **Human resource allocation** - Pooling of resources (regions with multiple business units pooled its resources and supported each other) **Organizational design** - Shifting the organizational governance system to allow accountability and streamlined decision making (The units	**Restructuring** - Post-merger caused financial challenges (impact on profitability) due to more complex structure **Organizational design** - After merging different business units in the past, the approval procedure for new processes complicated the overall process and caused the loss of employees' motivation, and accountability call. The new reorganization reverting back to independent structures needs to address these inefficiencies **Restructuring** - Splitting business is always challenging as it disrupts an ongoing operation and puts more efforts into the existing units to adapt to the new model

	work independently but they will communicate and decide decisions affecting the organization collectively, especially for large scale and strategic projects) **Adaptive changes** - Change was phased, gradual, and was communicated via emails, Q&As by different organizational leaders.	
Structure		
External	**Internal**	**Challenges**
Market expansion - Consider acquisition of organizations specialized in low carbon to bridge the knowledge/capability gap **Partnerships** - Partnering with specialized local/international entities to exchange low carbon transformation technologies and implementation knowledge (mainly in green chemical projects)	**Restructuring** - Restructuring the organization by merging units - Splitting and divesting some units that do not align with the long-term corporate strategy	**Gov't participation/control/support** - Merging with companies outside the local regions is lobbied and not accepted by the government **Resources** - Splitting of units have caused a loss of resources (number of employees drastically decreased) **Restructuring** - The merger has caused challenges to organizational governance, communication, and the approval procedure of new processes (Roles are interdependent and leadership unit positions were not clear - who makes the decisions?
People and Culture		
People and Culture		**Challenges**
People – Internal **Accountability**		**Restructuring**

- Empowering employees and increasing their sense of accountability by ensuring their voices are being heard and promoting their contributions even if they are small **Adaptive changes** - Change was phased, gradual, and communicated via emails **Feedback collection** - Q&As sessions were held by different members to answer employees' concerns (CEO or other board members) - Provided employees with feedback regarding their suggestions **Shift in the required skillset** - Identify the right people for the right place. **People – External** **Owner/client requirements** - Perform projects as per the client's requirements (operate a facility, or design, build, and operate the facility) **Culture** **Organizational commitment** - Strong culture and allegiance to the organization (operating for hundreds of years and it has strong traditions) **Communication** - Incorporating corporate goals into the organization cultural events to support buy-in efforts	- Merging and rebranding legacy units caused cultural challenges due to the strong corporate pride within different units **Resistance to change** - Different segments had different cultures and expertise, which caused various challenges when merged - some employees embraced their status quo and resisted change. In addition, employee accountability decreased, which affected their motivation **Regional/unit requirements** - Recognizing cultural differences between business groups and between countries **Shift in the required skillset** - New projects and market conditions are shifting employees' required skill set (generalists vs specialists)

Processes and Technology		
External	**Internal**	**Challenges**
- <>	**Internal capabilities** - Identifying the capabilities, knowledge, and competencies available internally (green chemicals projects) **Research and development** - Extensive R&D, with strong focus on green chemicals and decarbonization	**Nature of industry** - Chemical plant projects are complex, and they require specific set of skills, knowledge, and technologies, which varies on project basis **Scaling** - Scaling and marketing of green chemicals projects is challenging due

		to its relatively current higher cost (different supply chain, different customers, different infrastructure) **Research and development** - Research and Development is very costly

7.1.17 Low Carbon Framework

Case Study: Implications of low carbon future on Owner and Service Provider Capital Project Organizations
Timeline: 2015*– Present
Participating Companies: Owner capital project organizations (Energy, Chemical, Oil and Gas), service-provider capital project organizations, and consultants
Key Enablers (Inputs): Technology investment, diversifying project portfolio, organizational re-design, training and retaining
Measures of Success (Outputs): Carbon emissions, financial performance (stock, profit) and capital project portfolio (right projects selected, executed well)
*The Low carbon transformation was initiated when the Paris Agreement was signed in 2015

Drivers of Change		
Weight of the Past	**Push of the Present**	**Pull of the Future**
Knowledge	**Gov't participation/control/support**	**Sustainability**
- Organizations have a gap in the knowledge and skill set needed for a low carbon future (organizations have no prior experience)	- There is an increase in environmental rules and regulations enforcing or supporting low carbon initiatives	- Carbon neutrality by 2050 as set by the UN Sustainability Development Goals implementations
Resistance to change	- Governments renewing commitments toward Sustainability Development Goals implementations	- Scale of Green investments
- Leadership resisting the low carbon initiative within the organization (short- term success rates versus long-term investment goals)	- Ambitious U.S. government targets – installing 500,000 EV charging stations by 2030, transforming at least 20% of school busses to EV	
- Employees resisting change when moving to a new market or when changing the type of project	- U.S. government providing consumer incentives to promote EV – $100 Billion in consumer rebates	
Market shift		
- The complete departure from traditional energy sources is not directly possible on a global scale.		

The transition is gradual and requires time. - Profitability vs. investment – the cost of green technologies poses an obstacle for their wide adoption by the organization	**Market shift** - The energy market is shifting toward renewable sources - The public, the media, and the stockholders are promoting the shift toward renewables **Pandemic** - The COVID-19 pandemic is promoting the shift to the virtual work environment and the use of cloud platforms **Technology** - Major yacht companies are introducing hydrogen powered vessels – this new technology will affect the maritime transportation industry	
Strategic Response		
External	**Internal**	**Challenges**
Operating model - Moving to a cleaner supply chain **Investment** - Investing in low carbon startups **Partnerships** - Partnering with specialized local/international entities to gain low carbon transformation technologies and implementation knowledge - Partnering with government agencies and universities to bridge	**Strategic objective** - Setting strict sustainability and carbon-neutral goals, that takes into account the impact on community, environment, and economy - Using social media to promote organizational image as a leader in environmental transformation **Portfolio** - Changing capital projects portfolio	**Metrics** - Ambiguity regarding how organizations set their low carbon goals and the metrics they use to align their actions with their goals **Nature of industry** - The capital projects industry does not have a major player or even a group of major players taking on global initiates and changing the market, unlike the manufacturing industry

the low carbon skill set capability gap either through laws, programs, or grants

External interactions
- Changing the interface with the clients to develop close relationships to better serve their needs

External/internal benchmarking
- Performing labor market analysis to detect market trends

Communication
- Initiating low carbon discussions with the Union to revise union agreements

to stay ahead of competitors
- Shifting from mega plant projects (coal/gas) to multiple small renewable projects or converting existing facilities to renewable ones (renewable diesel facility)

Restructuring
- Restructuring the organization by creating new groups or merging others
- Creating subunits that will be responsible for overseeing the execution of low carbon initiatives (such as creating an enterprise risk management group)

Process re-engineering
- Lowering carbon emissions without minimizing production by adjusting or closing production processes (such as reducing gas flaring)
- Incorporating climate change plans and processes into the whole project lifecycle
- Modifying internal operational workflows and processes to lower carbon emissions

Investment
- Investing in green technologies

- The severity of the low carbon shift process varies depending on the type of the organization

Adaptive changes
- Organizations can either shift incrementally to a low carbon future or perform a complete shift toward green projects

Strategic objective
- Challenges in articulating long-term and short-term strategy
- Different views among leadership on short-term success rates and long-term investment goals
- Challenges of keeping up with the changing market conditions – service providers' low carbon goals will depend on their clients' requirements
- Understanding what is mission-critical vs. mission-centric

Project execution
- UN sustainability goals are cascaded differently in projects depending on the organization

Gov't participation/control/support
- Changing political factors (new governments) stresses

	such as carbon capture, biomass, and renewables **Supportive leadership** - Leadership building trust with employees by sharing the low carbon change plan to support internal buy-in efforts **Internal capabilities** - Organizations redesigning their facilities to support their low carbon transformation goals - Identifying required vs available resource pool for low carbon transformation and devising a resourcing plan to address the gaps **Communication** - Communicating strategic organizational decisions to potentially affected business units to give them time to prepare adequate responses	organizations' low carbon strategy - Challenging legislative & lobbying factors which can also affect current projects and future partnerships – governments not supporting carbon capture initiatives by major O&G companies, and NGOs lobbying to reject carbon capture initiatives. Thus, making future partnerships difficult to achieve without a legislative support **Portfolio** - Changing the portfolio will create uncertainty especially for the unionized labor force and will result in legal hurdles - Shifting to smaller projects caused various problems such as underestimating and underbidding **Supportive leadership** - Challenges of leadership not taking ownership of the long-term low carbon transformation plan **Human resource allocation** - Ambiguity regarding how the organizations should develop labor strategies (develop local talents

		and train them, hire new ones, or diversify)
		Communication
		- Challenges in communicating change plans without causing confusion
		- Sharing the strategy with employees at different levels in the organization can pose some risks of getting the strategy out to the public
		Investment
		- Small construction firms do not have the capacity to invest in technology and innovation
		- Profitability vs. investment – the cost of green technologies poses an obstacle for their wide adoption by organizations
		External growth opportunities
		- The pressure on automotive industry leaders to deliver will widen the EV market, disrupt the supply chain, and will increase the number of local/international competitors thus increasing stress on capital projects organizations
Structure		
External	**Internal**	**Challenges**
Restructuring	**Restructuring**	**Internal capabilities**

- Acquiring organizations/startups specialized in low carbon to bridge the knowledge/capability gap **Partnerships** - Partnering with government agencies and universities to bridge the low carbon skill set capability gap either through laws, programs, or grants - Joining Electric Vehicles coalition and partnering with local transport companies to promote electrification	- Creating subunits that will be responsible for overseeing the execution of low carbon initiatives (such as creating an enterprise risk management group) - Restructuring the whole organization by creating new groups or merging others - Shifting to new, smaller office buildings - Moving headquarters to new locations to attract needed low carbon talents	- Given the novelty of the structural changes its early to predict how they will be impacting the organization in the long term

People and Culture		
People and Culture		**Challenges**
People – Internal **Workforce** - Revising union agreements to meet the changing resources strategy **Recruitment** - Targeting specialists in the low-carbon field and building a network of international experts and professionals (from Brazil, Europe, and North America) **Partnerships** - Working closely with the clients to identify areas where the workforce can be mobilized to (teams who had worked on nuclear and gas projects may have transferable construction skills to renewable projects) - Partnering with startup companies to help execute carbon capture projects - Partnering with government agencies to create special immigration tracks to attract a skilled workforce **Training**		**Resistance to change** - Challenges of convincing executive leadership to support the change effort **Resource efficiency** - The need to do more with less - Ambiguity related to future strategic changes and their potential impacts on the organization, encourages highly skilled employees to exit the organization during change due to fears related to shifts in career

- Partnering with Universities to create a properly trained workforce to take on low carbon change
- Developing training programs for clients

Supportive leadership
- Assigning sustainability managers at GBUs and at projects to oversee the implementation of sustainability plans

People – External

Supportive leadership
- Leadership supportive of change initiatives

Communication
- Bridging the gap between leadership and employees and building trust by sharing the impact of the change initiatives
- Sharing corporate strategy with employees helps them understand what will happen and how they will be impacted

Termination
- Identifying skill sets and projects that don't align with the low carbon strategy
- Providing employees with cut off dates to remove the transition phase stress and anxiety and allow them to reskill or apply for new internal positions by making an Expression of Interest (EOI)

Shift in the required skill set
- Junior and intermediate engineers are easier to mobilize to new positions compared to seniors
- The shift toward small to medium-sized projects requires smaller agile teams led by generalists instead of specialists

Internal capabilities
- Identifying current internal capabilities by looking closely at the staff skills/experiences regarding low carbon future projects in order to devise a labor strategy plan
- Increasing the utilization of 'bench' individuals – shifting oil and gas people to biomass projects to bring their knowledge into new markets

path and long term job security
- Challenges of determining the ratio of SMEs to generalists
- Resistance to change when moving to a new market or when changing the type of project (SMEs leaving)

Resistance to change
- Resisting the low carbon initiative within the organizations (short-term success rates versus long-term investment goals)

Anticipation
- Emergence of workforce development issues such as having the ability to anticipate rather than being reactive

Workforce
- Availability of the right type of workforce – need to identify how skill sets can be transferred, acquired, and trained

Market expansion
- Different people-related issues with the push to be international (loosing SMEs)

Organizational commitment
- Employees' motivation is generation dependent (job security, life/work balance, benefits,

Training - Using different training programs to shift the skill set of the current workforce to take on the low carbon change (train and redeploy to new roles within the organization) - Creating intern programs within the organization to bring awareness to renewables and prepare interns for the new market **Organizational commitment** - The acknowledgment of trust provides a strong connection to the organization, even if some employees will be leaving - Strong corporate culture facilitated organizational change **<u>Culture</u>** - <>		incentives) **Career progression** - Challenges in transferring highly paid SMEs to a new position in medium and small-sized projects - Current employees are facing job security and career path challenges due to the low carbon transformation strategy being adopted by different organizations (adopting new technologies, modifying/closing exiting process or business segments)

Processes and Technology		
External	**Internal**	Challenges
Partnerships - Performing business incubation initiatives to support new low carbon technologies with the aim to be a future provider of these technologies **External/internal benchmarking** - Performing labor market analysis to detect market trends (in 2 to 5 years) such as the number of graduates, their specializations, and available skill sets	**Internal Capabilities** - Identifying the capabilities, knowledge, and competencies available internally and needed to go on low carbon projects. Based on these efforts, HR will the required numbers of employees needed to be internally trained, and the number of the new personnel to be hired **Organizational design** - Decreasing air travel to lower the cost and decrease carbon footprint	**Sustainability** - Some companies minimize their carbon footprint by offloading it to other companies (shifting from inhouse to cloud computing to offload emissions resulting from computing energy consumption) **Integration** - Companies do not have an integrated carbon chain (not taking responsibility for the emissions throughout the value chain)

External Interactions - Changing the interface with the clients and developing close relationships to identify areas where the workforce can be mobilized to (teams who had worked on nuclear and gas projects may have transferable construction skills to renewable projects)	- Changing vehicles fleets to EV and hybrid. - Facilities are installing solar panels - Digital transformation by - Standardizing and centralizing the engineering information (information is accessible and searchable) - Using software tools to help minimize carbon footprint **Remote work** - Shifting to a virtual environment by investing in teams, skype. **Technology** - Identifying the proper technologies needed to take on the low carbon transformation - Do more with less by leveraging technology (data analytics)	**Digitization** - Digital transformation has caused a loss of knowledge (focus on data and tools and not the knowledge behind them) - Data computation has high carbon impact

APPENDIX . ORGANIZATION NVIVO EXTRACTS

Figure 0-1 Organization A

Figure 0-2 Organization B

Figure 0-3 Organization C

6-Strategic Response - Challenges

Remote work

Network

Communicati...

Project execution

5-Strategic Response - Internal

Training

Anticipation

Accountability

Communication

2-Push of the Present

Remote work

Pandemic

Nature of industry

15-Pro and Tech - Internal

Technology

Anticipation

13-People and Culture - Challenges

Training

Retaining workforce

Regional-unit requir...

10-People - Internal

Training

Effective leadership

Accountability

4-Strategic Response - External

Partnerships

3-Pull of the Future

Internal capabilities

12-Culture

Organizationa....

1-Weight of the ...

Nature of indu...

16-Pro and Tech - Challenges

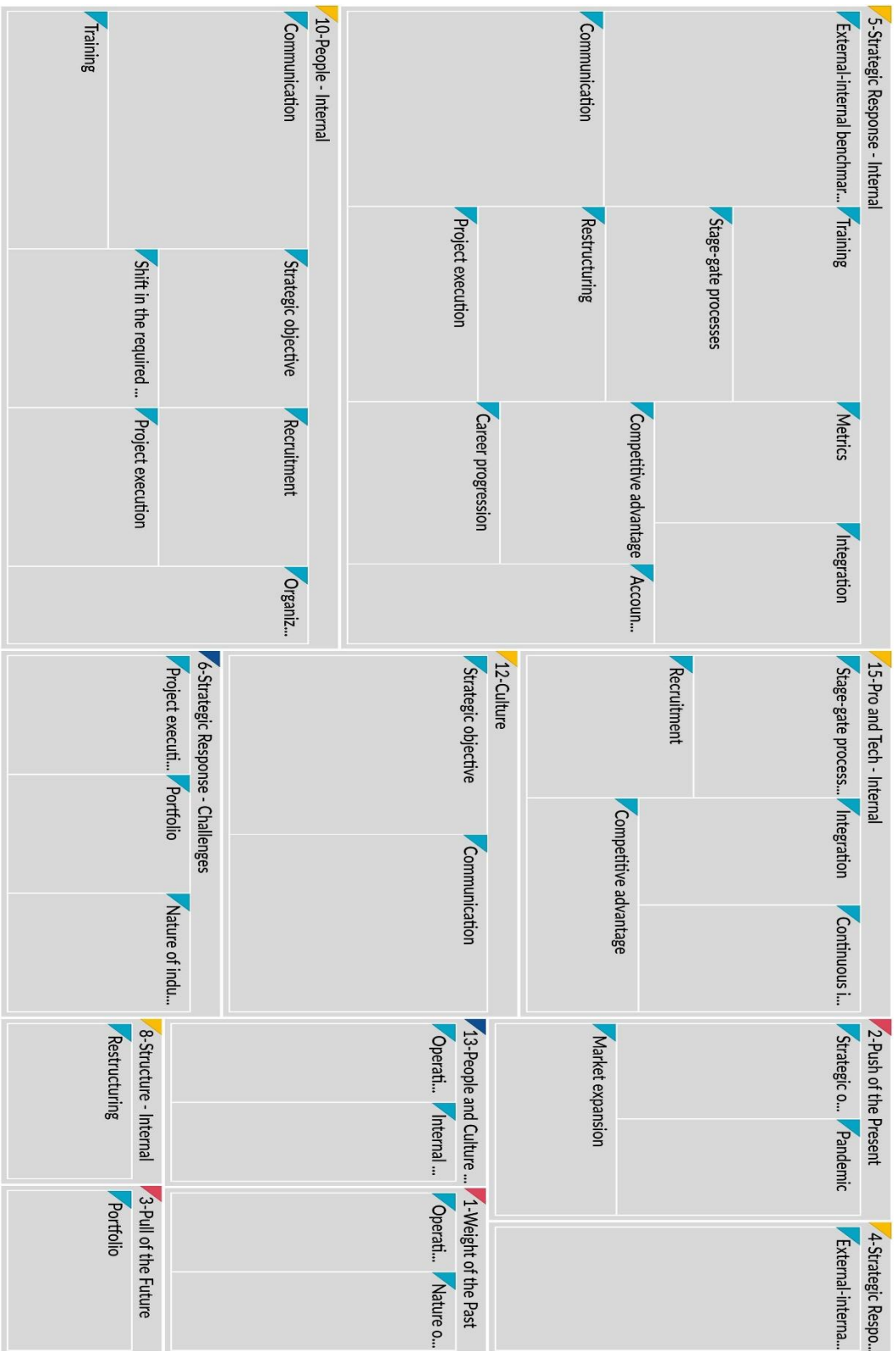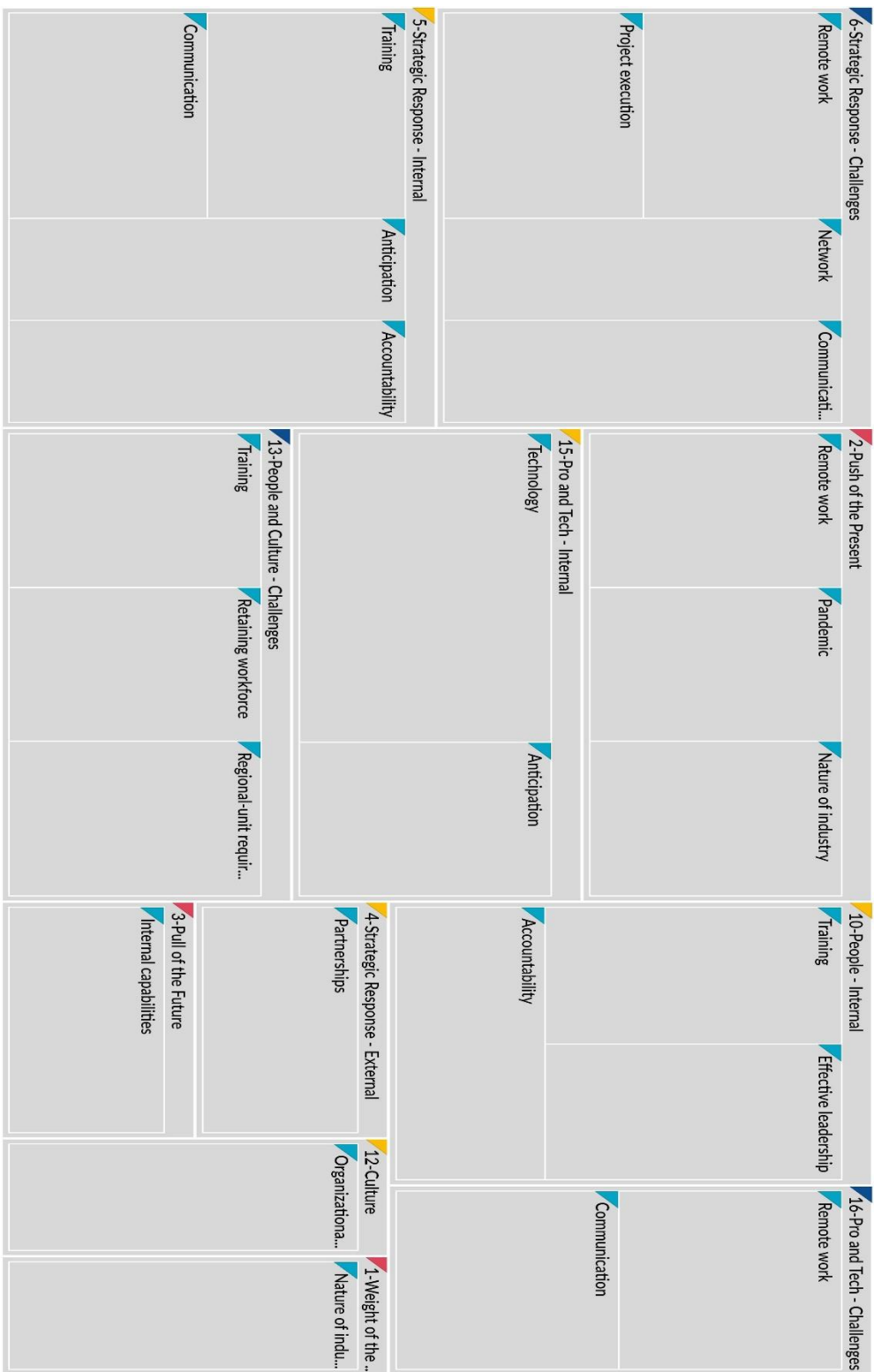Remote work
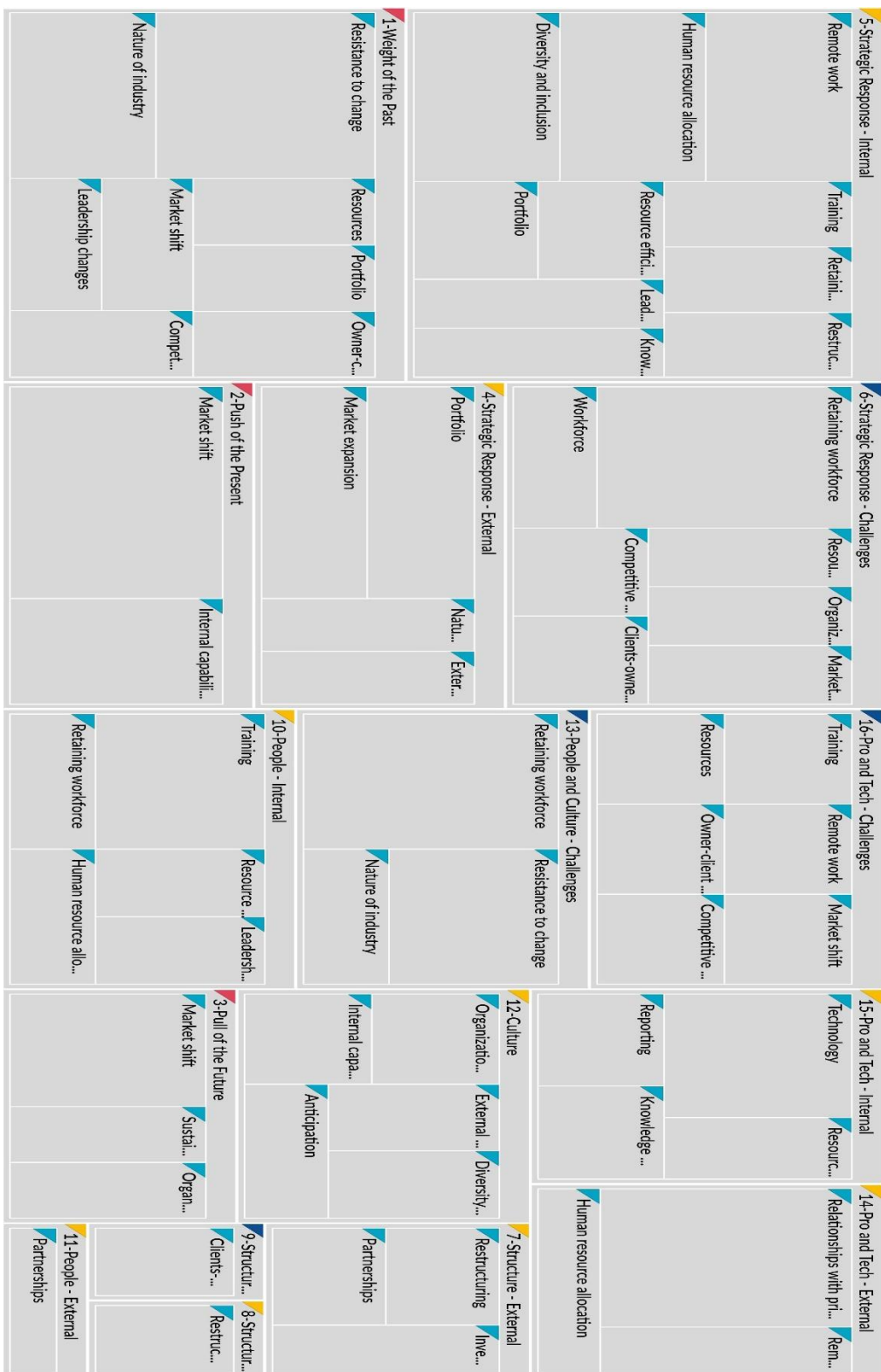
Communication

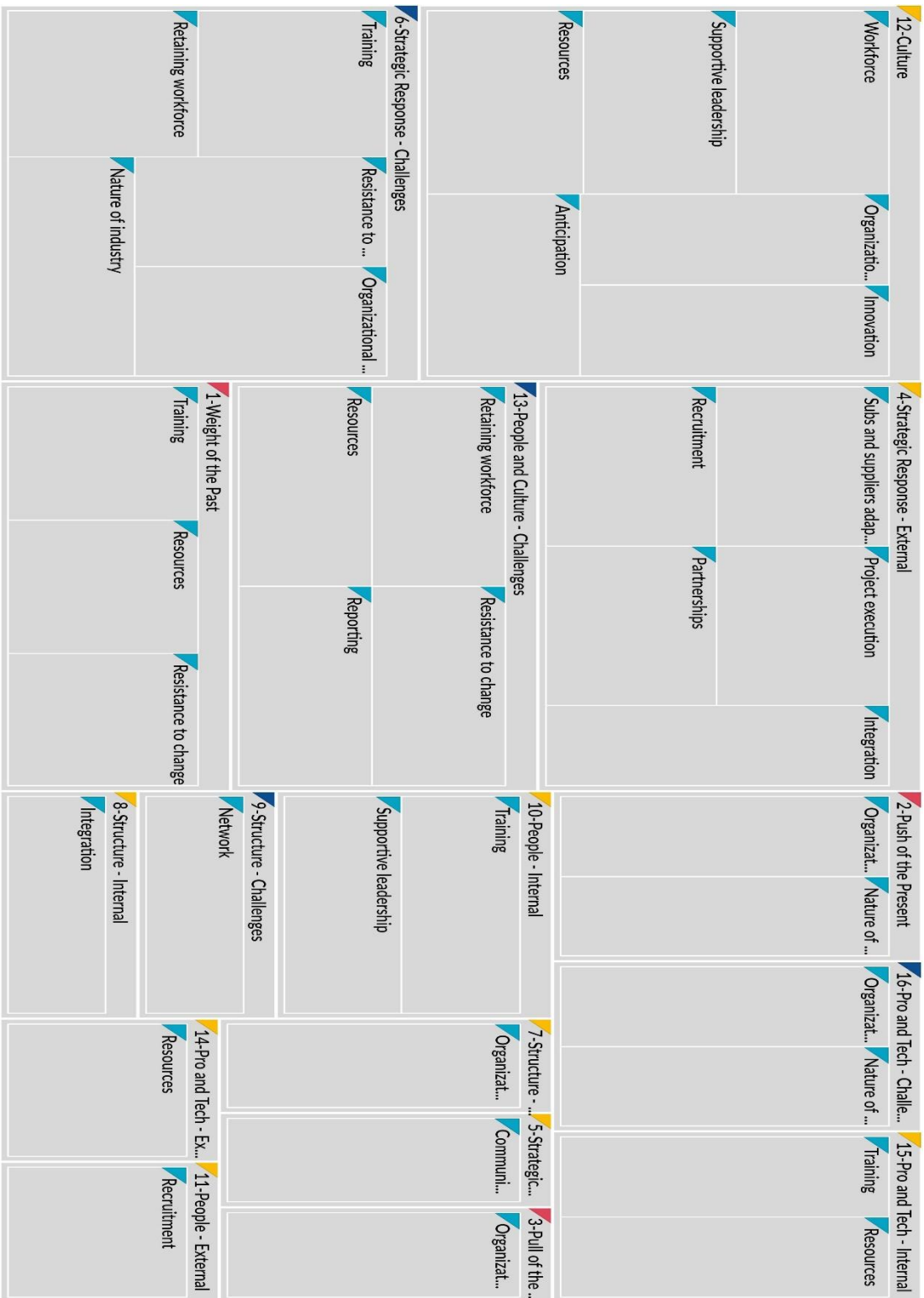Figure 0-4 Organization D

213

Figure 0-5 Organization E

Figure 0-6 Organization F

215

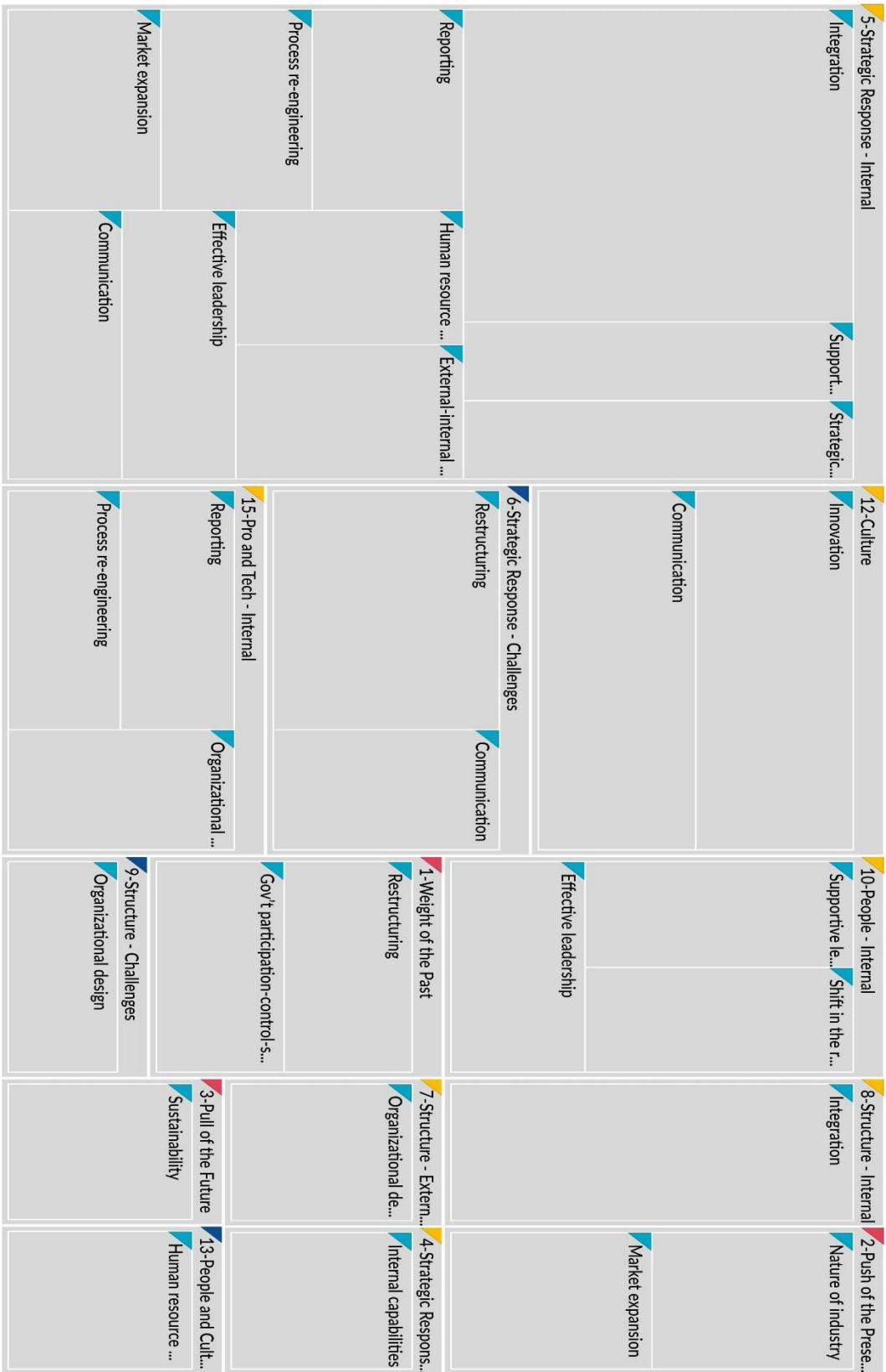Figure 0-7 Organization G-External

216
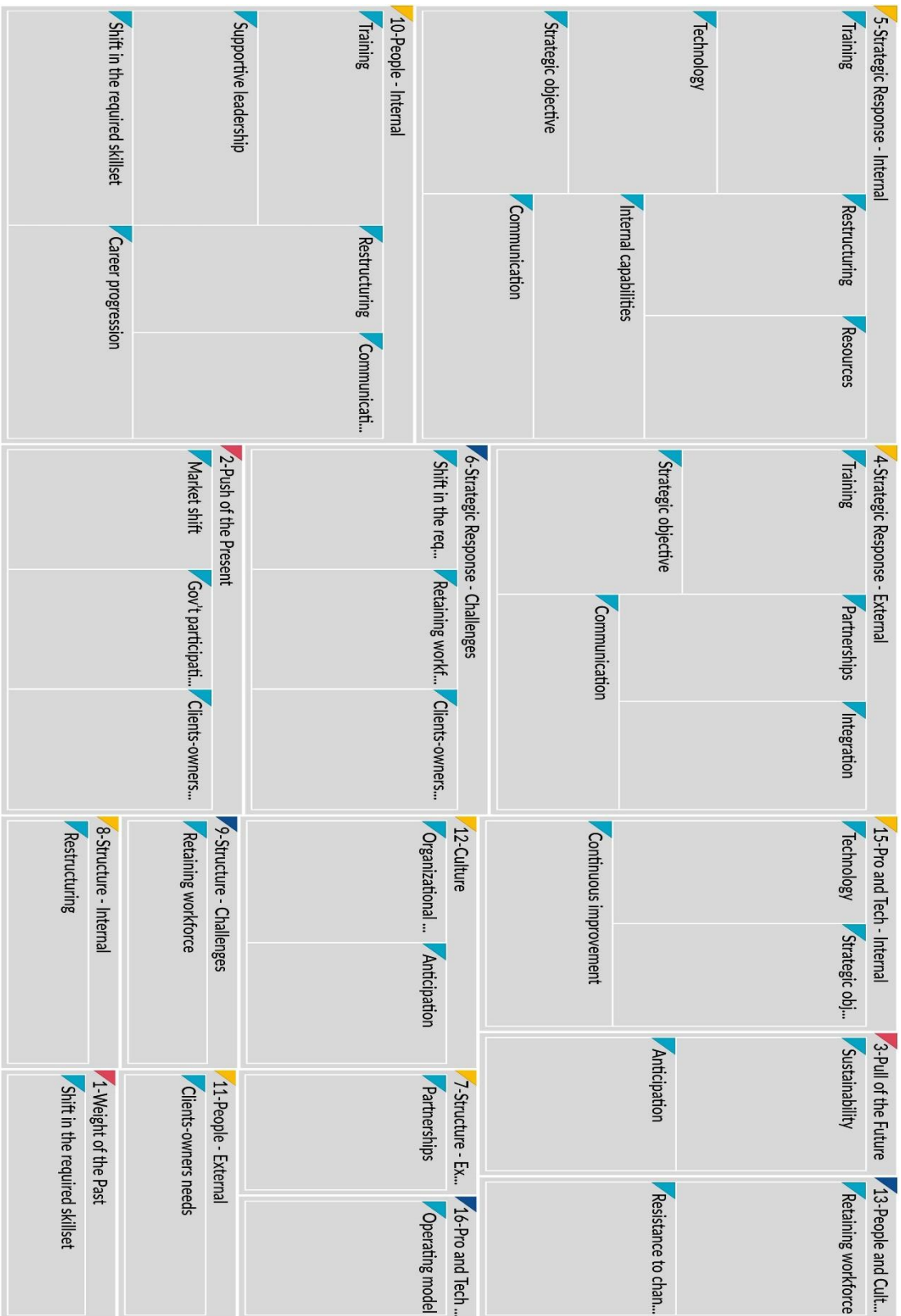
Figure 0-8 Organization G-Internal

Figure 0-9 Organization H

Figure 0-10 Organization I

219

2-Push of the Present

Sustainability

Market shift

Restruc...

Gov't par...

Competitive advantage

5-Strategic Response - Internal

Portfolio

Organizatio... Human res...

Restructuring

Adaptive changes

10-People - Internal

Feedback collection

Shift in the required skillset

Adapti...

Accoun...

13-People and Culture - Challenges

Shift in the required skillset

Resistance to change

Restructuring

Regional-unit requirements

1-Weight of the Past

Scaling

Regional-unit requirements

Resistance to change

Nature of industry

9-Structure - Challenges

Restructuri...

Resources

Gov't participation-control...

7-Structure - External

Partnerships

Market expansion

8-Structure - Internal

Restructuring

Internal capabilities

6-Strategic Response - Chal...

Restructuring

Organizational design

15-Pro and Tech - Internal

Research and development

12-Culture

Organizational commitment

Communication

16-Pro and Tech - Challenges

Scaling

Research a...

Nature of industry

4-Strateg...

Parthe...

3-Pull of ...

Sustai...

11-People - External

Owner-client requir...

Figure 0-11 Organization J

220

BIBLIOGRAPHY

Accenture. (2020). *Capital Projects | Accenture*. https://www.accenture.com/us-en/services/industry-x-0/capital-projects

Alavi, M., & Leidner, D. (1999). Knowledge Management Systems: Issues, Challenges, and Benefits. *Communications of the Association for Information Systems*, *1*. https://doi.org/10.17705/1CAIS.00107

Ameh, P., & Karette, B. (2015). *Benefits of Attending to Change Agent's Schemas*.

Armenakis, A. A., & Harris, S. G. (2009). Reflections: Our Journey in Organizational Change Research and Practice. *Journal of Change Management*, *9*(2), 127–142. https://doi.org/10.1080/14697010902879079

Baker, K. A. (2000). Chapter 13. Organizational Communication. *Organizational Communication*, 15.

Baldoni, M., Baroglio, C., May, K. M., Micalizio, R., & Tedeschi, S. (2017). Supporting Organizational Accountability Inside Multiagent Systems. In F. Esposito, R. Basili, S. Ferilli, & F. A. Lisi (Eds.), *AI*IA 2017 Advances in Artificial Intelligence* (pp. 403–417). Springer International Publishing. https://doi.org/10.1007/978-3-319-70169-1_30

Barki, H., & Pinsonneault, A. (2005). A Model of Organizational Integration, Implementation Effort, and Performance. *Organization Science*, *16*(2), 165–179. https://doi.org/10.1287/orsc.1050.0118

Barnes, R. (2020). *Market Shifts – Stay Alert and Be Ready*. Breaking Blue. https://breakingblueresearch.com/ourthinking/market-shifts-stay-alert-and-be-ready/

Barnett, W. P., & Carroll, G. R. (1995). Modeling Internal Organizational Change. *Annual Review of Sociology*, *21*(1), 217–236. https://doi.org/10.1146/annurev.so.21.080195.001245

Barone, A. (2020). *Capital Projects: What You Need to Know*. Investopedia. https://www.investopedia.com/terms/c/capital-project.asp

Beer, M. (1971). Organizational diagnosis: An anatomy of poor integration. *American Psychological Association Conference. Washington, DC*.

Beer, S., & Casti, J. L. (1975). *Investment against disaster in large organizations*.

Bladt, J., & Filbin, B. (2013, March). *Know the Difference Between Your Data and Your Metrics*. https://webcache.googleusercontent.com/search?q=cache:ydfrtaY1OHkJ:https://hbr.org/2013/03/know-the-difference-between-yo+&cd=19&hl=en&ct=clnk&gl=us

Borgatti, S. (2016). *Statistical Horizons and Social Network Analysis*. 16.

Borgatti, S., Everett, M., & Freeman, L. (2002). *UCINET for Windows: Software for social network analysis*.

Borgatti, S., Everett, M. G., & Johnson, J. C. (2018). *Analyzing Social Networks*. SAGE.

Borgatti, S. P., & Halgin, D. S. (2014). Analyzing Affiliation Networks. In J. Scott & P. Carrington, *The SAGE Handbook of Social Network Analysis* (pp. 417–433). SAGE Publications Ltd. https://doi.org/10.4135/9781446294413.n28

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Budhwar, P., Crane, A., Davies, A., Delbridge, R., Edwards, T., Ezzamel, M., Harris, L., Ogbonna, E., & Thomas, R. (2002). Organizing/theorizing: Developments in organization theory and practice. *Management Research News*, *25*(8/9/10), 1–193. https://doi.org/10.1108/01409170210783368

Burke, W. W. (2018). *Organization change: Theory and practice* (Fifth edition). SAGE.

Caldas, C. H., Elkington, R. W. T., O'Connor, J. T., & Kim, J.-Y. (2015). Development of a Method to Retain Experiential Knowledge in Capital Projects Organizations. *Journal of Management in Engineering*, *31*(5), 04014083. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000322

Can, U., & Alatas, B. (2019). A new direction in social network analysis: Online social network analysis problems and applications. *Physica A: Statistical Mechanics and Its Applications*, *535*, 122372. https://doi.org/10.1016/j.physa.2019.122372

Carruthers, J. (1990). A Rationale for the Use of Semi-structured Interviews. *Journal of Educational Administration*, *28*(1). https://doi.org/10.1108/09578239010006046

CDC. (2020, February 11). *Coronavirus Disease 2019 (COVID-19)*. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/science/about-epidemiology/identifying-source-outbreak.html

CFI. (2020). *Organic Growth*. Corporate Finance Institute. https://corporatefinanceinstitute.com/resources/knowledge/strategy/organic-growth/

Chicksand, D. (2015). Partnerships: The role that power plays in shaping collaborative buyer–supplier exchanges. *Industrial Marketing Management*, *48*, 121–139. https://doi.org/10.1016/j.indmarman.2015.03.019

Child, J. (2012). Organization: A choice for man'. *Man and Organization. London, George Allen and Unwin, 1973c*, 234–255.

CII. (2013). *Integrated Project Risk Assessment*. 128.

CII. (2018). *CII - Benchmarking & Metrics*. https://www.construction-institute.org/resources/knowledgebase/best-practices/benchmarking-metrics

CII. (2020). *CII - Topic-Summary-Details*. https://www.construction-institute.org/resources/knowledgebase/knowledge-areas/general-cii-information/topics/rt-360

Collis, D. J. (1994). Research Note: How Valuable are Organizational Capabilities? *Strategic Management Journal*, *15*(S1), 143–152. https://doi.org/10.1002/smj.4250150910

Cooper, J. Fenimore., & Nirenberg, J. (2012). *Encyclopedia of Leadership "Leadership Effectiveness."* (Vol. 1–4). https://doi.org/10.4135/9781412952392

Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (2002). Optimizing the Stage-Gate Process: What Best-Practice Companies Do—I. *Research-Technology Management*, *45*(5), 21–27. https://doi.org/10.1080/08956308.2002.11671518

Córdova, F., & González, P. (2017). The "Mission to Mars" Case Study, Galbraith's Star Model and other Relevant Organization Theory, Critically Evaluate the Reorganization of the Mars Programme that Resulted from the Introduction of the "Faster, Better, Cheaper" Approach at NASA. *Journal of Systemics, Cybernetics and Informatics*, *15*(3), 66–69. https://doaj.org

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Cronin, C. (2014). Using case study research as a rigorous form of inquiry. *Nurse Researcher*, *21*(5).

Crowley, L. G., & Hancher, D. E. (1995). Evaluation of Competitive Bids. *Journal of Construction Engineering and Management*, *121*(2), 238–245. https://doi.org/10.1061/(ASCE)0733-9364(1995)121:2(238)

Damanpour, F. (2017, August 22). *Organizational Innovation*. Oxford Research Encyclopedia of Business and Management. https://doi.org/10.1093/acrefore/9780190224851.013.19

Dent, E. B., & Goldberg, S. G. (1999). Challenging "Resistance to Change." *The Journal of Applied Behavioral Science*, *35*(1), 25–41. https://doi.org/10.1177/0021886399351003

Dey, P. K. (1999). *Process re-engineering for effective implementation of projects*. 13.

Dick, T. D. (1995). Accelerating change for competitive advantage. *Organizational Dynamics*, *24*(1), 77–82. https://doi.org/10.1016/0090-2616(95)90037-3

Doty, D. H., Glick, W. H., & Huber, G. P. (1993). Fit, Equifinality, and Organizational Effectiveness: A Test of Two Configurational Theories. *The Academy of Management Journal*, *36*(6), 1196–1250. https://doi.org/10.2307/256810

Dyduch, W. (2019). Organizational design supporting innovativeness. *Przegląd Organizacji*, *6*, 16–22.

Elgendy, M. (2016, February). *Business Needs vs. Requirements | moelgendy blog*. http://mohamedelgendy.com/blog/business-needs-vs-requirements.html

Elmaghraby, S. E. (1990). Project bidding under deterministic and probabilistic activity durations. *European Journal of Operational Research*, *49*(1), 14–34. https://doi.org/10.1016/0377-2217(90)90117-T

EPA. (2020). *How to improve resource efficiency in your business | Environment Protection Authority Victoria* [Text]. Environment Protection Authority Victoria. https://www.epa.vic.gov.au/for-business/how-to/lower-environmental-impact-business/improve-resource-efficiency-business

Erdogan, B., Anumba, C., Bouchlaghem, D., & Nielsen, Y. (2005). Change Management in Construction: The Current Context. *Change Management*, 11.

Evans-Greenwood, P., Williams, P., & Hillard, R. (2019, February). *Digitalizing the construction industry*. Deloitte Insights. https://www2.deloitte.com/us/en/insights/topics/digital-transformation/digitizing-the-construction-industry.html

Ferris, G. R., Dulebohn, J. H., Frink, D. D., George-Falvy, J., Mitchell, T. R., & Matthews, L. M. (2009). Job and Organizational Characteristics, Accountability, and Employee Influence. *Journal of Managerial Issues*, *21*(4), 518–533.

Flyverbom, M., & Garsten, C. (2021). Anticipation and Organization: Seeing, knowing and governing futures. *Organization Theory*, *2*(3), 26317877211020324. https://doi.org/10.1177/26317877211020325

Forrest, R., Brown, P., Zeranski, O., & Vasconi, M. (2020). *Excellence in capital projects: A goal yet to be achieved*. https://www.kearney.com/energy/article?/a/excellence-in-capital-projects-a-goal-yet-to-be-achieved

Freeman, L. C. (1978). Centrality in social networks conceptual clarification. *Social Networks*, *1*(3), 215–239. https://doi.org/10.1016/0378-8733(78)90021-7

Gerdin, C., Björkander, M., Henriksson, M., Nilsby, P., & Singe, M. (2010). *Change Management in Project-Based Organizations—A case study of a construction company*. https://www.pmi.org/learning/library/project-based-organizations-change-management-6471

Grebitus, C., & Bruhn, M. (2008). Analyzing semantic networks of pork quality by means of concept mapping. *Food Quality and Preference*, *19*(1), 86–96. https://doi.org/10.1016/j.foodqual.2007.07.007

Grossoehme, D. H. (2014). Overview of qualitative research. *Journal of Health Care Chaplaincy*, *20*(3), 109–122. https://doi.org/10.1080/08854726.2014.925660

Grunspan, D. Z., Wiggins, B. L., & Goodreau, S. M. (2014). Understanding Classrooms through Social Network Analysis: A Primer for Social Network Analysis in Education Research. *CBE Life Sciences Education*, *13*(2), 167–179. https://doi.org/10.1187/cbe.13-08-0162

HBS. (2020, March 20). *Types of Organizational Change & How to Manage Them | HBS Online*. Business Insights - Blog. https://online.hbs.edu/blog/post/types-of-organizational-change

Henao-Calad, M., Rivera Montoya, P., Universidad Pontificia Bolivariana, & Uribe Ochoa, B. (2017). Knowledge Management Processes and Intellectual Property Management Processes: An Integrated Conceptual Framework. *AD-Minister*, *31*, 137–160. https://doi.org/10.17230/ad-minister.31.8

Hiatt, S., Grandy, J., & Lee, B. (2015). Organizational Responses to Public and Private Politics: An Analysis of Climate Change Activists and U.S. Oil and Gas Firms. *Organization Science*. http://dx.doi.org/10.1287/orsc.2015.1008

Holland, S. M. (2008). *Non-Metric Multidimensional Scaling (MDS)*. 8.

Homburg, C., Workman, J. P., & Jensen, O. (2000). Fundamental changes in marketing organization: The movement toward a customer-focused organizational structure. *Journal of the Academy of Marketing Science*, *28*(4), 459–478. https://doi.org/10.1177/0092070300284001

Hossain, S., Hasan, M., & Saleh, F. (2019). *Factors Affecting Organizational Design: A Study on the Selected Dimensions in the Bangladeshi Context*.

Imamoglu, S. Z., Ince, H., Turkcan, H., & Atakay, B. (2019). The Effect of Organizational Justice and Organizational Commitment on Knowledge Sharing and Firm Performance. *Procedia Computer Science*, *158*, 899–906. https://doi.org/10.1016/j.procs.2019.09.129

Inayatullah, S. (2008). Six pillars: Futures thinking for transforming. *Foresight*, *10*(1), 4–21. https://doi.org/10.1108/14636680810855991

Inayatullah, S. (2013). *Futures Studies: Theories and Methods*. 30.

Indeed. (2021, February). *What Are Strategic Objectives? (With Examples)*. Indeed Career Guide. https://www.indeed.com/career-advice/career-development/what-are-strategic-objectives

Isaksson, R., Hallencreutz, J., Turner, D.-M., & Garvare, R. (2011). Change management from a stakeholder perspective. *QMOD Conference on Quality and Services Sciences: 29/08/2011-31/08/2011*, 886–901.

Jacobs, G., van Witteloostuijn, A., & Christe-Zeyse, J. (2013). A theoretical framework of organizational change. *Journal of Organizational Change Management*, *26*(5), 772–792. https://doi.org/10.1108/JOCM-09-2012-0137

Janicijevic, N. (2011). Methodological approaches in the research of organizational culture. *Ekonomski Anali*, *56*, 69–99. https://doi.org/10.2298/EKA1189069J

Kashif Imran, M. (2021). *Exploring the Concept of Organizational Change Leadership with Empirical Investigation to analyze its impact on Successful Organizational Change: Evidence from Pakistan*.

Kates, A., & Galbraith, J. R. (2007a). *Designing your organization: Using the star model to solve 5 critical design challenges* (1st ed). Jossey-Bass.

Kates, A., & Galbraith, J. R. (2007b). *Designing your organization: Using the star model to solve 5 critical design challenges* (1st ed). Jossey-Bass.

Ketata, I., Sofka, W., & Grimpe, C. (2015). The role of internal capabilities and firms' environment for sustainable innovation: Evidence for Germany. *R&D Management*, *45*(1), 60–75. https://doi.org/10.1111/radm.12052

Kotler, P., & Keller, K. L. (2009). *Marketing Management 13th Edition. New Jersey: Prentince Hall International*. Inc.

Kotler, P., & Singh, R. (1981). Marketing Warfare in the 1980s. *The Journal of Business Strategy*, *1*(3), 30–41.

Krippendorff, K. (2004). *Content analysis: An introduction to its methodology* (2nd ed). Sage.

Leana, C. R., & Van Buren, H. J. (1999). Organizational social capital and employment practices. *Academy of Management Review*, *24*(3), 538–555.

Liao, J. (2005). Corporate restructuring, performance and competitiveness: An empirical examination. *Competitiveness Review: An International Business Journal*, *15*(1), 33–48. https://doi.org/10.1108/cr.2005.15.1.33

Magaldi, D., & Berler, M. (2018). Semi-structured Interviews. In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of Personality and Individual Differences* (pp. 1–6). Springer International Publishing. https://doi.org/10.1007/978-3-319-28099-8_857-1

Maritan, C. A., & Lee, G. K. (2017). Resource Allocation and Strategy. *Journal of Management*, *43*(8), 2411–2420. https://doi.org/10.1177/0149206317729738

Mathers, N., Fox, N., & Hunn, A. (2010). *Using Interviews in a Research Project*. 34.

McCoy, J. W. (2021, August 30). 9 Organizational Design Models You Should Know. *AIHR*. https://www.aihr.com/blog/organizational-design-models/

McFillen, J. M., O'Neil, D. A., Balzer, W. K., & Varney, G. H. (2013). Organizational Diagnosis: An Evidence-based Approach. *Journal of Change Management*, *13*(2), 223–246. https://doi.org/10.1080/14697017.2012.679290

Mckinley, W., & Scherer, A. G. (2000). Some Unanticipated Consequences of Organizational Restructuring. *Academy of Management Review*, *25*(4), 735–752. https://doi.org/10.5465/amr.2000.3707703

McKinsey. (2017). *Introducing the Next-Generation Operating Model* (Digital McKinsey, p. 127). https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/introducing%20the%20next-generation%20operating%20model/introducing-the-next-gen-operating-model.ashx

McKinsey. (2018). *Improving digital construction technology through improved organizational structure*. https://www.mckinsey.com/business-functions/operations/our-insights/capital-projects-creating-digital-first-organizations

McKinsey. (2020). *The next normal in construction*.

McKinsey. (2021a). *How disruption is reshaping construction*. https://www.mckinsey.com/business-functions/operations/our-insights/the-next-normal-in-construction-how-disruption-is-reshaping-the-worlds-largest-ecosystem

McKinsey. (2021b). *Capital Projects 5.0: Reimagining capital project delivery* (p. 27) [Operations Practice]. https://www.mckinsey.com/~/media/mckinsey/business%20functions/operations/our%20insights/capital%20projects%2050%20reimagining%20capital%20project%20delivery/capital-projects-50-reimagining-capital-project-delivery.pdf

McLinden, D. (2013). Concept maps as network data: Analysis of a concept map using the methods of social network analysis. *Evaluation and Program Planning*, *36*(1), 40–48. https://doi.org/10.1016/j.evalprogplan.2012.05.001

Metcalf, L., & Casey, W. (2016). Chapter 5—Graph theory. In L. Metcalf & W. Casey (Eds.), *Cybersecurity and Applied Mathematics* (pp. 67–94). Syngress. https://doi.org/10.1016/B978-0-12-804452-0.00005-1

Michel, T. (2007). *Creating project-based organizations to deliver value*. https://www.pmi.org/learning/library/project-based-organizations-deliver-value-7330

Miterev, M., Mancini, M., & Turner, R. (2017). Towards a design for the project-based organization. *International Journal of Project Management*, *35*(3), 479–491. https://doi.org/10.1016/j.ijproman.2016.12.007

Mohd Kasmuri, S. H., Ismail, Z., Mohd Nordin, R., & Hashim, N. (2020). A Systematic Review of Employee Turnover Antecedents in the Construction Industry. *Environment-Behaviour Proceedings Journal*, *5*(13), 65. https://doi.org/10.21834/e-bpj.v5i13.2100

Müller, R., & Blomquist, T. (2004). *Analysis of Roles and Responsibilities of Program and Portfolio Managers*.

Nadler, D. A., & Tushman, M. (1999). The organization of the future: Strategic imperatives and core competencies for the 21st century. *Organizational Dynamics*, *27*(1), 45–45.

NCSS. (2021). Multidimensional Scaling. *Multidimensional Scaling*, 16.

Neuby, B. L. (2016). Organizational Technology. In A. Farazmand (Ed.), *Global Encyclopedia of Public Administration, Public Policy, and Governance* (pp. 1–7). Springer International Publishing. https://doi.org/10.1007/978-3-319-31816-5_30-1

NVivo. (2010). *NVivo 10 for Windows Help*. https://help-nv10.qsrinternational.com/desktop/concepts/about_tree_maps.htm

Nvivo. (2022). *Nvivo 12 hierarchy chart font size*. NVivo Community Forum. https://forums.nvivobyqsr.com/topic/8030-nvivo-12-hierarchy-chart-font-size/

Oakland, J. S., & Tanner, S. J. (2007). A new framework for managing change. *The TQM Magazine*, *19*(6), 572–589. https://doi.org/10.1108/09544780710828421

Oldham, G. R. (1976). Motivation through the design of work: Test of a theory. *Organizational Behavior and Human Performance*, *16*(2), 250–279. https://doi.org/10.1016/0030-5073(76)90016-7

Orzeł, B., & Wolniak, R. (2022). Digitization in the Design and Construction Industry—Remote Work in the Context of Sustainability: A Study from Poland. *Sustainability*, *14*(3), 1332. https://doi.org/10.3390/su14031332

Palmer, B., Walls, M., Burgess, Z., & Stough, C. (2001). Emotional intelligence and effective leadership. *Leadership & Organization Development Journal*, *22*(1), 5–10. https://doi.org/10.1108/01437730110380174

Rondoni, A., Grebitus, C., Millan, E., & Asioli, D. (2021). Exploring consumers' perceptions of plant-based eggs using concept mapping and semantic network analysis. *Food Quality and Preference*, *94*, 104327. https://doi.org/10.1016/j.foodqual.2021.104327

Ross, L. (2008, March). *Budgeting: Topic Gateway Series No. 27*. https://web.archive.org/web/20130810055251/http://www.cimaglobal.com/Documents/ImportedDocuments/cig_tg_budgeting_mar08.pdf

Rubenstein, A. L., Kammeyer-Mueller, J. D., Wang, M., & Thundiyil, T. G. (2019). "Embedded" at hire? Predicting the voluntary and involuntary turnover of new employees. *Journal of Organizational Behavior*, *40*(3), 342–359. https://doi.org/10.1002/job.2335

Russo, C. (2019). *Creating Preferred Futures of Australian Health Care*. 8.

Salleh, K. M., Sulaiman, N., & Talib, K. (2010). Globalization's Impact on Soft Skills Demand in the Malaysian Workforce and Organizations: What makes graduates

employable? *Undefined*. /paper/Globalization%27s-Impact-on-Soft-Skills-Demand-in-the-Salleh-Sulaiman/fd0f925b5d54b68050cb618bd8888c6f4407e180

Sammy, J. (2013, January). *Needs and Solutions, Requirements and Designs*. https://www.iiba.org/professional-development/knowledge-centre/articles/needs-and-solutions/

Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H., & Jinks, C. (2018). Saturation in qualitative research: Exploring its conceptualization and operationalization. *Quality & Quantity*, *52*(4), 1893–1907. https://doi.org/10.1007/s11135-017-0574-8

Schober, D. K.-S. (2016). *Digitization in the construction industry*. 16.

Scott-Young, C., & Samson, D. (2008). Project success and project team management: Evidence from capital projects in the process industries. *Journal of Operations Management*, *26*(6), 749–766. https://doi.org/10.1016/j.jom.2007.10.006

Senior, B., & Fleming, J. (2016). *Organizational change*. Pearson Education.

SHRM. (2008). Diversity & Inclusion. *SHRM-LI*. http://shrmli.org/community/diversity-inclusion/

Smith, P. A. C., & Sharicz, C. (2011). The shift needed for sustainability. *The Learning Organization*, *18*(1), 73–86. https://doi.org/10.1108/09696471111096019

Stacey, R. D. (2007). *Strategic management and organisational dynamics: The challenge of complexity to ways of thinking about organisations*. Pearson education.

Stobierski, T. (2020, January 21). *What Is Organizational Change Management? | HBS Online*. Business Insights - Blog. https://online.hbs.edu/blog/post/organizational-change-management

Stough, L. M., & Lee, S. (2021). Grounded Theory Approaches Used in Educational Research Journals. *International Journal of Qualitative Methods*, *20*, 160940692110522. https://doi.org/10.1177/16094069211052203

Stroh, L. K., Brett, J. M., & Reilly, A. H. (1992). *All the right stuff: A comparison of female and male managers' career progression. - PsycNET*. /doiLanding?doi=10.1037%2F0021-9010.77.3.251

Ulrich, D., & Lake, D. (1991). Organizational capability: Creating competitive advantage. *Academy of Management Perspectives*, *5*(1), 77–92. https://doi.org/10.5465/ame.1991.4274728

Urquhart, C. (2012). *Grounded theory for qualitative research: A practical guide*. Sage.

Usenko, L., & Zenkina, I. (2016). Modern Trends and Issues of Corporate Reporting Data Disclosure on Organization Activities. *Mediterranean Journal of Social Sciences*. https://doi.org/10.5901/mjss.2016.v7n3p212

van Doren, D., Driessen, P. P., Runhaar, H., & Giezen, M. (2018). Scaling-up low-carbon urban initiatives: Towards a better understanding. *Urban Studies*, *55*(1), 175–194. https://doi.org/10.1177/0042098016640456

VardiReddy, P. K. R. (2017). *Organizational Change Adoption Within the AEC Industry: Change Management Practices and Employee Reactions to Change* [M.S., University of Kansas]. https://www.proquest.com/docview/1945500126/abstract/E55CF280CF834621PQ/1

Vermeeren, B., Kuipers, B., & Steijn, B. (2014). Does leadership style make a difference? Linking HRM, job satisfaction, and organizational performance. *Review of Public Personnel Administration*, *34*(2), 174–195.

Weerakkody, V., Janssen, M., & Dwivedi, Y. K. (2019). Handbook of Research on ICT-Enabled Transformational Government: A Global Perspective. In *Https://services.igi-global.com/resolvedoi/resolve.aspx?doi=10.4018/978-1-60566-390-6*. IGI Global. https://www.igi-global.com/book/handbook-research-ict-enabled-transformational/www.igi-global.com/book/handbook-research-ict-enabled-transformational/476

Zangaro, G. A. (2001). Organizational commitment: A concept analysis. *Nursing Forum*, *36*(2), 14–22. http://dx.doi.org.ezproxy.uky.edu/10.1111/j.1744-6198.2001.tb01179.x

Zott, C., Amit, R., & Massa, L. (2011). The Business Model: Recent Developments and Future Research. *Journal of Management*, *37*(4), 1019–1042. https://doi.org/10.1177/0149206311406265

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Education
Jan 2020 - March 2022

- **University of Kentucky –** Kentucky
  Master's in Construction Management, **GPA: 4.0**, Thesis: Adapting through Organizational Change in Capital Projects' Organizations

Sep 2018 - May 2019

- **American University of Beirut -** Lebanon
  Master's in Civil Engineering, **GPA: 3.67,** Thesis: Analyzing Construction Workflow On BIM Based Oil And Gas Projects

Work Experience
(Jan 2020 - Jan 2022) - Research Assistant - University of Kentucky - United States
(Nov 2018 - April 2019) - Digital Skills instructor - American University of Beirut- Lebanon
(Oct - 2015 - May 2018) **-** Project controls and Automation engineer - Consolidated Contractors Company - Oman/UAE
(Feb 2013 - April 2016) - Civil Engineer - Soubra Engineering consultant Office - Lebanon
(July 2015 - Sep 2015) - Research Intern - Purdue university - Indiana
(Mar 2012 - Sep 2015) - Site Engineer - United Nations Relief Works Agency - Lebanon

List of Publications:
Nov 2021 - Interactions between Construction 4.0 and Lean Wastes
Nov 2021 - Integrating Construction 4.0 Technologies: A Four-Layer Implementation Plan
Oct 2020 - Construction 4.0: A Roadmap to Shaping the Future of Construction
June 2020 - Transforming the AEC industry: a model-centric approach
May 2020 - Digital twin in construction: An empirical analysis
April 2019 - Analyzing construction workflow on BIM based oil and gas projects
July 2015 - Post measuring the last planner metrics in shelter rehabilitation projects
March 2015 - The lean approach helps manage UN refugee project in Lebanon
June 2014 -The reduction of construction duration by implementing contour crafting (3D printing)
January 2013 - Optimizing workflow for shelter rehabilitation projects in refugee camps

Awards:
Feb 2018 - Technical and Operational Excellence best practice award - Omani Society for Petroleum Services (OPAL)
Jul 2016 - Best Hands on Tool for Advanced Work Packaging (AWP) implementation