

## Creative Thinking In The Transition To Sustainability: A Study Of Creativity-Relevant Processes In Canadian Energy Industry Organizations.

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### Abstract

The resilience of energy industry organizations is increasingly dependent on their ability to develop creative and innovative pathways towards renewable and sustainable energy production. While the role of innovation in this sector is well documented, the ways in which energy industry leadership team members describe and operationalize creativity within their work practices, and the nature of the creativity-relevant processes that they use to develop new solutions to sector specific challenges remains unexamined. In this paper, we present a new understanding of the creative work of energy industry leaders, based on interviews with participants in the Canadian fossil fuel and renewable energy sectors. Using data from a qualitative interview-based study of fourteen Canadian energy leadership team members, this study employs the dynamic componential model of creativity and innovation (Amabile & Pratt, 2016) to situate the work practices of energy sector teams within a process of creativity and innovation and to identify practices that could be considered creativity-relevant within their daily work. We propose a conceptualization of the problem-solving work of energy industry leadership team members as creative, and provide evidence for the use of storytelling, conceptual prototyping, intra-organizational team discussions, and analogous inspiration searches as creativity-relevant processes.

**Keywords:** Creativity, energy industry, sustainability, innovation, creative practice

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### Introduction

Creative thinking and innovative solutions have come to define success in the Canadian energy industry. Energy industry organizations involved in extracting and developing resources in this primary sector of the Canadian economy (Natural Resources Canada, 2021) are finding new ways to support and facilitate creative thinking within their organizational culture as they work to adapt to rapid technological change, globalization, and increased awareness of climate and environmental considerations (Chasin et al., 2020). As the industry transitions towards renewable and sustainable energy production, thinking creatively about the social and environmental implications of resource extraction has become imperative for fossil fuel extraction enterprises, renewable energy developers, and energy sector service providers (Adkin, 2019). These organizations face intense and increasing pressure from environmental advocacy and regulatory groups, local resource reliant and resource provider communities, and international economic markets to bring new, creative, and innovative solutions to their stakeholders (Neville et al.,

2019). Additionally, with decreasing investment in both the service and extraction industries (Natural Resources Canada, 2019) there is an appetite for “seeing things differently” in an industry ripe for disruption (Abbosh, Savic & Moore, 2018). The Canadian energy sector thus presents a rich case study in the application of unique and deliberate creative practices (Ngo, 2018; Ransom, 2019).

Creativity and innovation in the way we extract, source or generate energy in today’s world is a complex, messy (Brown & Wyatt, 2010) and wicked problem (Rittel & Webber, 1973), and the challenge to generate novel and useful solutions in the context of the Canadian energy industry is often assigned to employee teams in the engineering, strategy or environment, governance and sustainability (EGS) focused areas of an organization. As a result, employee creativity is considered both a core competency and a critical asset to energy industry organizations seeking to improve their organizational performance (Zhang et al., 2018).

The work of generating novel ideas and of selectively retaining those ideas which might prove useful towards the innovation focused aims of the organization as a whole (Amabile, 1988; Amabile & Pratt, 2016), and even more critically of implementing those creative ideas strategically (Kurtzberg, 2005) often requires those tasked with leading these teams to address “interconnected and often diverging social, environmental and financial concerns” (Mitchell & Walinga, 2017). Technological, financial and temporal drivers of innovation (Drazin et al., 1999) in the energy industry can spark both the development of novel, original and unexpected problem solutions (Amabile, Barsade, Mueller & Straw, 2005; Madjar, Oldham & Pratt, 2002; West, 2002), and the translation of those creative ideas into workable solutions for an industry in crisis. The creativity of these team-leaders, and the innovative new directions that are introduced by their teams can result in positive changes to the environmental, social and economic impact of the organization as a whole (Broadstock et al., 2020).

Academics and practitioners alike are increasingly interested in how creativity can be used to meet the challenges facing the oil and gas or renewable energy sectors. Research on the use of creativity in organizations facing externally motivated change in general (Imran et al., 2018), and in the energy industries specifically (Odetunde & Ufodiana, 2017) has revealed that by promoting and facilitating creativity at a team level, organizations are better equipped to implement sustainable innovations that help them meet their strategic goals (Van Woerkum, Aarts & De Grip, 2007). Creativity is increasingly valued within this sector (Jing, 2012; Jordan, 2017), and creativity and innovation training opportunities are becoming more common for employee teams both large and small (Rampa & Agogué, 2021).

However, though many energy industry organizations celebrate creativity in their innovation processes, few are clear about how they actively introduce, support and reward the use of creative practices or “creativity-relevant processes” (Amabile, 1988; Amabile & Pratt, 2016; Evensen et al., 2020). The evidence suggests that supporting and enhancing creativity in oil and gas teams can help organizations innovate in the face of environmental and economic challenges but it remains unclear which creativity-relevant processes are being used by energy industry teams as they practice creativity within their organizations, how those practices are embodied by teams and individuals, and what processes or practices employees in the energy sector context categorize as creative. We know little about which creative practices are most relevant to energy sector teams, and what impact the use of those specific creativity-relevant processes or practices have on team creativity (Shanker et al., 2017).

The study presented here aimed to address that gap in our knowledge of the role, nature and form of creativity-relevant processes in the energy industry by answering two research questions: a) how do energy industry professionals describe and operationalize creativity within their work practices?, and; b) what are the key creativity-relevant processes used by energy industry organizations to generate creative thinking and innovation solutions to sector specific challenges? Using data from a qualitative interview-based study of fourteen Canadian energy industry leadership team members, this study drew from Amabile and Pratt’s dynamic componential model of creativity and innovation (2016) to situate the work practices of energy sector leadership within a process of creativity and innovation and to identify practices that could be considered creativity-relevant within their daily work.

A thematic content analysis of the interview data revealed four common creativity-relevant processes used by leadership team members in energy industry organizations seeking to facilitate the transition from fossil fuel extraction to renewable and sustainable energy production. These processes included: storytelling, conceptual prototyping, intra-organizational team discussions, and analogous inspiration searches. We also found that while the creative practices used by leaders in the energy industry were shared by others within the sector (across both fossil fuel extraction and renewable energy organizations), they did not directly correspond to existing models of creative practices used in the organizational creativity literature. Finally, we found that leadership team members tasked with creative thinking in these organizations did not seek out - or find value in - established forms of creativity training professional development but rather that they were inspired to think creatively by intra-industry peers, often from competing organizations.

This research contributes directly to the literature on the social and organizational contexts of creativity (Zhou & Su, 2010), and to recent calls from the field of organizational creativity studies for field-site examinations of

creative behaviour (Amabile & Pratt, 2016) with particular attention paid to the cultural and contextual factors required for creativity (Anderson, Potocnik & Zhou, 2014). Findings from this study might be used by researchers interested in understanding sector or industry specific forms of creative practice, or by practitioners seeking to identify the creativity related processes that might best address different drivers of innovation within their organizations.

This paper is organized as follows: first we briefly discuss and define creativity as an organizational resource, creativity-relevant processes and creative practices within organizational settings. This is followed by a description of the methodology used to study 14 oil energy industry leadership team members tasked with creative thinking about the transition from fossil fuel extraction to renewable and sustainable forms of resource development in the Canadian energy industry. Then, we discuss the data generated by a thematic content analysis of interview transcripts and provide an analysis of findings related to the “creativity-relevant processes” used in stage three of the dynamic componential model of creativity and innovation in organizations proposed by Amabile & Pratt (2016). Throughout the paper, we draw on literature on creativity and problem solving to frame participant’s responses within the context of both creativity-relevant processes and existing creative problem-solving models, and to frame the drivers of innovation within frameworks of intra-individual and intra-organizational sensemaking. We conclude with directions for future research on how to align the use of creativity-relevant processes with sector-specific drivers of innovation.

### **Conceptual Framework**

#### ***Creativity in organizational innovation***

Creativity has been theorized and operationalized in many different forms (Amabile et al., 2018), but it remains clear that it is a vital and integral component of the innovation process so valuable to organizations and enterprise communities (Anderson, De Drew & Nijstad, 2004; West 2002; Ford & Gioia, 2000; Runco, 2014). Understood as both a process (Rosso, 2014) and an outcome or contribution (Sternberg, Kaufman & Pretz, 2004), creativity is most often defined in the organizational context as the production of new and useful ideas (Amabile et al., 1996). Understanding how organizations might become more creative has become increasingly critical, especially given creativity’s important role in the innovation required for organizational survival (Nonaka, 1994; Shalley & Perry-Smith, 2008). With this in mind, we hypothesize that (H1) creative thinking about the transition from fossil fuel extraction to renewable and sustainable forms of resource development in the Canadian energy industry is generated in a similar way to creativity in other industries.

When understood as a complex engagement between an individual and their work context (at the individual, team or macro organizational level), creativity

is often framed within an interactionist perspective (Shalley, Gilson & Blum, 2009; Liu et al., 2016). From an interactionist perspective, the creativity required for innovation at the team level is presumed to be the result of intersecting individual creative behaviour, group interactions, team processes and contextual influences (Woodman, Sawyer & Griffin, 1993).

Creativity can also be understood as an organizational resource (Jeong & Shin, 2019) or critical capacity of an organization seeking competitive advantage (de Vasconcellos, Garrido & Parente, 2019). In order to develop the innovations required to meet stakeholder and shareholder expectations, organizations may seek to enhance their work environment (Amabile et al., 1996) or to develop the creativity of their employees through leadership engagement (Chaudhary & Panda, 2018; Mehmood et al., 2021), by supporting imagination and creative expression (Thompson, 2018) and perhaps most importantly, by tapping into the tacit knowledge (Sirmon, Hitt & Ireland, 2007) and the creativity of individual employees and team members (Budhiaja, Pathak & Kaushik, 2017). By harnessing the creativity of individuals and teams, organizations are able to build resilience (Cohendet et al., 2021) and innovative solutions to pressing challenges (Anderson, Potocnik & Zhou, 2014) such as those faced by the Canadian energy industry as a whole.

### ***Creativity-relevant processes***

Alternatively, creativity can be framed as part of an ongoing social phenomenon, best conceptualized “not as a personality trait or general ability, but as a behaviour resulting from particular constellations of personal characteristics, cognitive abilities, and social environments” (Amabile, 1983, p. 358). In the dynamic confluence model that defines this perspective researchers have proposed that creativity is an essential component of a multi factor model which outlines three interacting components which must come together in order to yield innovative or creative outcomes in the context of the external influence of the work environment (Amabile, 1988; Amabile & Pratt, 2016). Within this model, the iterative and cyclical social phenomenon of generating creativity and innovation as a team requires a driver (Drazin, 1999) or form of intrinsic or extrinsic motivation (Taylor & Kaufman, 2021), resources in the task domain that can be combined in new ways towards new ideas, and social practices such as innovation management skills or creativity related processes that enable that recombination process (Amabile & Pratt, 2016). We hypothesize that (H2) that the creativity-relevant processes employed by leadership team members in the energy industry will be reflective of sector specific drivers of innovation.

Within this dynamic confluence model, the processes or social practices that individuals and teams use to combine their domain specific skills with their intrinsic extrinsic motivation to generate a new or novel idea are called

“creativity-relevant processes” (Amabile & Pratt, 2016), a term updated from the original “skills in creative thinking” (Amabile, 1988; 1996). These creativity-relevant processes may include personal characteristics that enable the creative team member to be more risk or failure tolerant, the work styles that support iteration and persistence, or mental models, methodologies and perceptual styles that are “conducive to taking new perspectives on problems, pivoting among different ideas, thinking broadly, and making unusual associations” (Amabile & Pratt, 2016, p. 160). The category of creativity-relevant processes can also be used to describe some of the specific methods or tools used to generate creative outcomes such as the creative problem solving (CPS) model (Puccio, Murdock & Accar, 2018), appreciative inquiry (Coghlan et al., 2003), design thinking (Cross, 2011; Buchanan, 1992; Kimbell, 2001), the theory of inventive problem solving (TRIZ) (Moehrle, 2005), mind mapping (Buzan, 1995) or insight problem solving (Mitchell & Walinga, 2017). Organizations seeking to enhance creative capabilities and innovation capacities within their teams can effectively employ specific forms of training (Rampa & Agogue, 2021) but this investment of time and resources is seldom made by energy industry organizations. We hypothesize that (H3) the creativity-relevant processes used by leadership team members in the energy industry will correspond to established creative processes and problem-solving models.

### **Methodology**

As the research questions under investigation in this study were exploratory in nature, we chose to employ qualitative semi-structured interviews to learn more about the creativity-relevant processes employed by energy industry leadership teams tasked with creative thinking towards innovative ends. Conducting interviews with members of leadership teams from across the wider energy industry in organizations that were both transitioning to, and newly focused on renewable and sustainable energy production initiatives provided an ideal opportunity to explore context specific approaches to creativity because these individuals and their organizational cultures were each facing common economic, technological and environmental constraints. Conducting qualitative interviews (Warren, 2002; Symon & Cassell, 2012), and repeated member checks (Candela, 2019) with each of the 14 participants allowed the research team to explore the wider context of the research question, and to surface the unique insights from a variety of contexts. As Symon and Cassell have identified, semi-structured interviews are an ideal method for qualitative work in organizational settings, as they can be structured to support the anonymized sharing of organizational and proprietary information or processes in a way that supports the use of the findings by students and professionals (2012). This research was approved by the Human Research Ethics Board at the researcher’s primary institution, and participants were afforded the opportunity to provide informed consent for

their ongoing participation at several times during both data collection and analysis.

### **Participants**

To explore the nature and use of creativity-relevant processes in the energy industry, we interviewed fourteen members of leadership teams of small, medium and large scale energy extraction or production organizations. To develop our purposive sample of participants for this exploratory study, we used emailed and social media appeals to recruit individuals in energy sector organizations who were tasked with instituting, supporting transitions within their organization from fossil fuel extraction to renewable and sustainable energy production. The purposive sample was developed through primary contact networks and by using industry association membership lists. More than half of the participants were recruited through contacts made with the Canadian Association of Petroleum Producers (CAPP), the Canadian Oil Sands Innovation Alliance (COSIA), the Clean Resource Innovation Network (CRIN), and the Alberta Renewable Energy Alliance. Participants were invited via email letters of introduction to take part in the qualitative interviews based on their fit within a theoretically justified category of innovation-lead in a Canadian energy industry organization, or their status as members of an organization involved in the Canadian energy sector tasked with creativity leading to innovation. Creativity – and the development of innovative solutions to the challenges of the sector itself – was not only vital to each participant’s team’s success, but also critical to the sustainability of the energy industry organizations of which they were a part.

In total, fourteen participants were interviewed by the study team between January of 2020 and December of 2020. The final sample of participants is further described in *Table 1* below.

### **Procedure**

Interviews were conducted in person (prior to March 2020) and virtually using GoogleMeet (between March and December 2020). Participants had the opportunity to review the transcripts of their interviews and to clarify their statements or remove their consent for inclusion prior to the integration of their anonymized data as part of the larger sample for analysis. Interviews were conducted by research assistants who used eight interview questions (each with a further pair of probing questions) to engage participants in a 40 minute conversation about the form, role and scope of creativity-relevant processes in their innovation work. Data collection was terminated when we reached saturation, at fourteen participants.

**Table 1**  
**Characteristics of interview participants**

Organization	Participant's Role In The Organization				Total Participants (n= 14)
	Senior management	Innovation team-lead	Strategic Development team-lead	EGS* team-lead	
Fossil Fuel Extraction Organization (1 – 50 employees)	1	0	0	0	1
Fossil Fuel Extraction Organization (50 – 150 employees)	1	0	0	2	3
Fossil Fuel Extraction Organization (150 - 500 employees)	2	0	1	0	3
Renewable Resource Development Organization (1 – 50 employees)	0	3	0	0	3
Renewable Resource Development Organization (50 - 150 employees)	2	0	0	0	2
Renewable Resource Development Organization (150 – 500 employees)	0	0	2	0	2

\* Environment, Governance and Sustainability

### **Data analysis**

After the qualitative interviews with energy sector participants were anonymized, we used a qualitative data analysis software (NVivo) to conduct a thematic content analysis aimed at deriving coding categories directly from the interview data collected (Hsieh & Shannon, 2005; Clarke & Braun, 2014). To do so, we read the data broadly as a whole to develop a contextual understanding of the participant perspectives. Then we examined the data for commonalities in order generate coding categories (Nowell, 2017). Several initial coding categories were developed from this close reading that addressed the key research questions that this research study sought to answer. These initial coding categories were then discussed by the study team, and member checked with interview participants in follow-up interview sessions. One coding category was adjusted for clarity based on the feedback shared by participants, and three other categories were combined into one in order to increase the transparency of coding use. All other coding categories were found to be well

aligned with the interview participant’s experiences with creativity-relevant processes in their work. To establish inter-coder reliability, a blind sample of data from three participants was then re-coded by the principal investigator. The inter-coder reliability was 93%, providing additional validation to our coding scheme (Belotto, 2018). In addition to the three themes found to be directly related to the hypothesis of this study (reported below in *Table 2*), we also isolated additional themes to be used in future program planning and research work.

**Table 2**  
***Coding Themes***

<b>Coding Category</b>	<b>Number of Unique Sources (n=14)</b>	<b>Total Number of References</b>
Creative processes and practices within the energy industry		
Descriptions of creativity	7	7
Descriptions of innovation	12	21
Creativity training	8	11
Creativity models/problem solving processes	6	8
Motivation and inspiration		
Intra-organizational collaboration	11	18
Inter-organizational collaboration	8	14
Extrinsic motivations for creativity	10	21
Creativity-relevant processes		
Using established models of creativity-relevant processes	14	19
Storytelling	12	18
Conceptual prototyping	9	14
Intra-organizational team discussions	7	12
Analogous inspiration searches	10	11

**Findings**

***The use of creative processes and practices within the energy industry***

We found that while the creative practices used by leadership team members in the energy industry were shared by others within the industry (across both fossil fuel extraction and renewable energy organizations), they did not directly correspond to existing models of creative practices used in the organizational creativity literature. Industry practitioners were both ignorant of existing creative practice models, and reluctant to describe their work practices as creative, preferring instead to use the language of innovation-focused

approaches or models. This may be due to a wider industry-based preference for innovation over creativity, a pejorative view of creativity-relevant processes as framed within the wider cultural discourse, or it might be due to the distinct culture of the sector itself. In either case, we found that energy industry leadership team representatives were more comfortable describing their creative process using the language, and models, of innovation.

The ways in which participants described their process of creative idea generation did, however, align closely with the dynamic componential model of creativity and innovation in organizations (Amabile & Pratt, 2016), confirming our hypothesis that creativity in the energy industry would be generated in a similar way to creativity in other organizational contexts (H1). Participants described moving through a five-stage process from setting an agenda or goal for change, to assessing outcomes that corresponded closely in language and intent to the model presented and referenced the three components of creativity and innovation: motivation to innovate, resources in the task domain and skills in creativity (creativity-relevant-processes) or innovation management.

So, that being said, the first thing that we typically want to do is understand what the problem is, is trying to be addressed. Often, what we find is that people don't have a really good understanding what the problem is that they're facing. We have a tendency to jump into solution mode before we really understand what we're trying to solve. But often, if you're innovating just for the sake of innovation, you create solutions that have no problems. (Participant 4)

When you actually know the least amount of what you're trying to accomplish, what we typically do now with our clients is we do a mini project before we do the big project...we call it discovery project, which could be anywhere from a week to a few weeks' worth of work, that's our market research. (Participant 7)

So we do what's called a spike. So the classical development process, you're doing it in a very structured way to make sure that all the code is done correctly, is written correctly. It's portable, it's maintainable. It's, you can continue to add on to it and so forth. In a spike, you dive in and say, we're not using in regular coding practices, we're just trying to see if we can actually solve this problem. So maybe I basically like the code is super messy, like there might be notes everywhere. It's not well, and it's just to prove that there is a way to solve the problem. And then once you can prove you solve the problem, then you step back and say, Okay, how do we write this correctly? (Participant 2)

When asked about how creative capabilities or innovation relevant training has helped them in their individual or team creative processes, interviewees were universally dismissive of creativity-focused professional development, suggesting that training was: “Quite bullshit don’t you think? You just come up with new ideas or you don’t...we don’t need training in how to colour to help with that” (Participant 6).

I’ve done it but I wouldn’t do it again. Wasn’t too...helpful or useful in what I do every day. Good for the LinkedIn profile though I guess. (Participant 3)

### ***Motives and sources of creativity***

The interviews suggested that energy industry innovators were able to find sources of inspiration in their own work, and in the work of their industry peers. Intra-organizational cross functional team meetings were described as a source of inspiration and creativity, and as a resource for creative problem solving. Some subjects also described how inter-organizational meetings and conferences sparked creative thought and inspired new directions for their creative process.

So typically, I find conversations and communication. So talking with other individuals who I know have had similar problems that I have had, and figuring out how did you solve it? So honestly, I think relying on peers is incredibly important. And having peers within an organization, especially being a female manager, being promoted, as I have recently into a role where I am more senior, I don't have as many peers, it's very difficult. Because it's an uncomfortable space to be. (Participant 5)

Well, it's a competitive industry, because you're, you know, trying to acquire lands and mineral rights that you don't want your competitors to know you have or discovered. So it's required. But to get creative we have to make a shift in the way we work. This idea that you collaborate with other people, and you share your successes and failures with other people. That's a bit of a change for culture. But it's going to come slowly for the energy industry. (Participant 11)

Others described finding the genesis of creative ideas in the work of other industries or participants in the industry that were facing different challenges.

Yeah, so creativity from my context is when you make people look at the world in a different way than we've done previously. Yeah. That can be something fairly simple, you find it in someone else’s back yard but hey it's new to you, something fairly complicated, but it allows them to perceive and address the problems in their organization in ways that they

haven't classically been able to do. To me, that's core innovation, that's creative. (Participant 8)

Typically, our creativity comes from taking something that we do or someone does somewhere else and applying it in a different application. And so, you know, we've seen that in our organization where we've had successes, applying technology in different applications, and solving problems with that. So again, I think it comes down to that perspective of looking at things in different lights. (Participant 5)

Several interviewees mentioned that they would generate the most creativity when motivated by failure, or the threat of competition in a scarcely resourced market. Interviewees who described the work of pitching new ideas in their daily work described the pressure of both presenting a new idea in a high stress situation, and of quickly generating alternatives to a failed initiative in order to gain funding from investors.

You get creative when you need to. You get going when there are dogs barking at your heels, when you've got three minutes to pitch your new idea to some guy in New York, when there's protesters outside you know. When you need to. If you don't then the next guy will eat your lunch. (Participant 1)

It is worth noting that while the research on motivation within creative processes would indicate that the majority of motivating factors are intrinsic or extrinsic (such as the fear of failure or the organizational requirements listed above), the way that participants framed the role of cross-disciplinary intra-organizational peers and inter-organizational colleagues appears to indicate that motivation for developing and employing creativity-relevant processes could also be relational or collaborative. Interviewees discussed the importance of responding to sector specific drivers or instigators of innovation focused projects, and the critical role that a shared understanding of the industry as a whole and of sector specific innovation drivers played in developing that relational or collaborative motivation, confirming our hypothesis (H2) that creativity within this industry was driven by sector-specific considerations.

### ***Commonly used creativity-relevant processes in the energy industry***

In general, we heard a mixed response from interviewees asked about whether they used any specific established form of creative process (such as CPS, the de Bono technique, appreciative inquiry, design thinking, TRIZ, mind mapping or insight problem solving). Many were familiar with the creative process models and were willing to draw equivalencies between their work and their understanding of the processes outlined. Some interviewees were open about

their lack of knowledge about the creative process models shared in the interview questions. But most often, participants described their use of innovation focused processes such as Lean, Agile, Waterfall or Kanban models instead of referencing creative process focused approaches to problem solving.

We're applying, you know, agile principles and using a scrum methodology to learn fast and what doesn't work and, you know, continue with what does work and so using a sprint methodology to do that. So we can, you know, develop these solutions much more quickly than we have in the past. (Participant 3)

We found that leadership team members tasked with creative thinking in these organizations did not seek out - or find value in - established forms of creativity training professional development but rather that they were inspired to think creatively by intra-industry peers, often from competing organizations. This disproves our hypothesis (H3), which was that the creativity-relevant processes used by energy industry leadership would correspond to established creative processes and problem solving models. Instead, participants appear to seek out inspiration for creative work, and motivation for using creativity as a problem solving tool, from their peers across the industry itself.

Though creative thinking about the transition from fossil fuel extraction to renewable and sustainable forms of resource development in the Canadian energy industry appeared to be generated in a similar way to creativity in other industries or organizational settings, the specific creativity-relevant processes described by energy industry leadership team members expanded our understanding of what "counts" as a "skills in creative thinking" (Amabile et al., p, 164). Interviewees shared many descriptions of the mental models, cognitive tools or processes that they used to generate creative ideas, and though none of the descriptions perfectly matched an existing creative practice model, the four creativity-relevant processes that participants described did serve to instigate, enhance or facilitate creative problem solving in their daily work. The creativity-relevant processes most often referenced by energy industry participants interviewed for this study included: storytelling, conceptual prototyping, intra-organizational team discussions and analogous inspiration searches.

### **Storytelling**

The first the skills in creative thinking, or creativity-relevant processes that we identified from the interview data was that of *storytelling*. Twelve of the fourteen participants described "storytelling" as a critical part of their creative work. Framing it as both a creativity-relevant-process and as a resource or domain-specific skill, interviewees repeatedly described the importance of storytelling in setting the parameters for creativity, in idea generation, and as a

primary tool for testing and implementing ideas in a risk adverse organizational setting.

I think I think the storytelling is enormously important if you're gonna buy if anyone's gonna buy any of what you're doing you need to tell the stories they understand. What the storytelling helped us do is answer our own questions as we went along yeah and design it in such a way to flow properly ultimately when you get money, it's all about the numbers anyway. (Participant 12)

How do you how do you persuade somebody that that, you know, what you're doing is the right thing and that they need to invest so you can do the transition? And that there's something in it for them? You can't test the idea on them, they can't test the idea on themselves if there is no story around it. (Participant 9)

### ***Conceptual prototyping***

Interviewees also described ways in which they employed forms of prototyping in their creative practice. In keeping with many other established models for creative processes, their description of prototyping defined it as a way to test ideas in different forms. However, interviewees described prototyping in an energy industry organization as being a conceptual, rather than a physical, process. This second creativity-relevant-process of *conceptual prototyping* was characterized as “Coming up with ideas and then testing them out in my mind” (Participant 11) or “Locking the idea in my head and seeing what it looked like when it came out” (Participant 6). Often, interviewees referred to the creation of an imaginary future which they treated as a lab in which to test their prototypes of new innovative solutions.

But there are times when a certain amount of physical risk is also required in order to test an idea. And that's just not, it's barely acceptable in the regular world, let alone it within our corporate environment. So you just do it in your head, maybe with a pencil and paper. You just talk it out. (Participant 13)

But when I'm sitting in a hotel room, it's still bothering me, we have money, and we're going to be still traditional it just doesn't make sense. I should be thinking differently. So just you know, I had a couple days that I still had to be there and kept just kept on. And so I said, how can how can we use our knowledge from one area and do something totally different with it? And then I started to Google stuff. And then I found this thing that was opposite but was totally the same, and by the time I left Hong Kong, I had this thought that you know what, that's that. (Participant 2)

So the way we approached it was we had a vision of where we want to go, yeah, how we want to get there. We didn't know. Right? Like, you know, your destination, but you don't know your journey. It was almost like backpacking in other countries. And I think that's the way that our approaches, we go and learn something, and we think, oh, this is great. We do it. Sometimes it's right. And we keep on going. And sometimes it's just like, that was stupid, right? So. So it's kind of like it's a path, like all start-ups tend to be a path. It's very rare that you say, this is exactly what we want to build is exactly what we're gonna target and you hit it bang on, it's very rare. (Participant 7)

### ***Intra-organizational discussions***

The importance of team cognition in the creative process is well established (de Mol et al., 2015) Energy industry participants confirmed the importance of working within a team when thinking creatively. But perhaps more interestingly, they also highlighted the critical nature of *intra-organizational discussions* as a creativity-relevant-process. Interviewees described meeting with others from various teams within an organization as a vital part of their creative work and shared how cross-team meetings had helped them to generate creative ideas or to consider existing ideas within a new and novel context.

I mean, we're a tiny company, but it's when you get a bunch of smart people who you don't work with around the table, and you kind of brainstorm on it. There's a lot of research and stuff that comes forward, people bring ideas forward, and then you kind of run through them. (Participant 14)

To get creative we bring people together from, you know, different parts of the business, or we would physically go to the oil sands or the downstream or wherever the work was. (Participant 6)

And each of those projects is generally organized with a cross functional team, right. And that cross functional team has people from the from the business units from the operating areas, or the function depending on where the work is. And so we'll match them with, you know, other subject matter experts and project management skill sets from across the company, folks they don't really work with, and that gets things going. (Participant 11)

### ***Analogous inspiration searches***

Finally, ten of the fourteen participants described a creativity-relevant process that relied on finding inspiration or new ideas from analogous sources, rather than from within their own industry. This process of searching for, and finding,

new “ways of seeing the same old problem” in other industries, other non-energy focused organizations, or from teams facing similar but not equivalent challenges was referred to as *analogous inspiration searches*. Energy industry leadership team members appeared to use this creativity-relevant-process to expand their sphere of influence beyond the often insular energy industry community, and this process was often referred to by participants as the secret to their most creative insights.

But the first thing I did was actually look at, you know, what, what is some different company good at, like, at the core of every company, there's key values and key core competencies, right. And you have to figure that out, because, and you can use that to apply to different areas, either tangential, just adjacent to what you're doing, or like a big step up. (Participant 3)

They are a small company and will sometimes use and build off of innovative ideas that have been used from larger and older companies, but not always from the energy space. (Participant 8)

Perhaps most interestingly, participants did not report that their development or adoption of the four practices described above was influenced by management culture, professional development training or legitimated forms of peripheral participation (Lave & Wenger, 1991) in the community of practice (Gherardi, 2009). Instead they described these skills in creative thinking (described by Amabile & Pratt as creativity-relevant-processes) as having been developed through iterative and cyclical rounds of solving similar or equivalent organizational problems. Participants described the development of these creativity related processes as a direct outcome of having survived in a competitive industry for long enough to have solved “all the different problems there are” (Participant 6), rather than as a new competency developed through deliberate practice.

### Limitations

As this research was exploratory in nature, and highly focused on a specific context of work (the energy industry), there are several limitations worthy of discussion. The data collected through semi structured interviews with the fourteen participants surfaced contextual, rich and insightful descriptions of what it meant to apply creativity-relevant processes in innovation focused work within these types of organizations. However, due to the methodology used in this study, we cannot imply causality in the findings presented here. Further research focused on assessing the creative capacity of specific kinds of teams in this sector to test the themes presented would be of interest.

Secondly, the work conducted by the individuals interviewed as part of this study is itself contextual, and the time period of our interview-based data collection coincided with the COVID 19 pandemic, a severe economic downturn in the energy market (Seskus, 2021), and the cancellation of several major infrastructure projects which had an adverse effect on extraction based participants (and potentially a positive effect on the renewable energy sector) (Chatziantoniou et al., 2021). With this in mind, a broader examination, a longitudinal approach or the use of a larger sample of energy industry organization participants from outside of this specific national context would certainly provide additional insight into the research question presented in this study.

Finally, this study did not examine factors such as team heterogeneity, resources, reward structures, organizational change or strategic direction. The conclusions drawn from this research are thus indicative of the lived experience of individuals operating as part of a larger team: further investigation into the nature, shape, role and accountability of the team context would help expand on the findings presented here.

### **Conclusions**

Our main objective in this paper was to explore the potential of creativity, and creativity-relevant processes as a catalyst for change in the energy industry. The paper builds on the premise that for leadership team members in the energy industry seeking to facilitate the transition from fossil fuel extraction to renewable and sustainable energy production on behalf of their organization, generating innovative and relevant solutions required the use of creativity, creative thinking and creativity-relevant processes in daily work.

Our examination of interview data collected from qualitative interviews with fourteen leadership team members in the energy industry revealed that while energy industry participants (from both fossil fuel focused organizations and renewable energy production enterprises) were reluctant to characterize their work as creative, they did engage with creativity and innovation in manner in keeping with Amabile and Pratt's dynamic componential model of creativity and innovation (2016). Energy industry participants are motivated and inspired to be creative in their problem solving in a way that responds to sector specific drivers of innovation by interactions with inter-disciplinary teams from their own organization, and by collaborations with peers from across the industry community. By employing a series of creativity-relevant processes common to work across their industry (storytelling, conceptual prototyping, intra-organizational team discussions and analogous inspiration searches) energy sector leaders were able to instigate and facilitate creative thinking in their daily work.

Future research examining the enablers and barriers to creativity in the energy industry, and the methods of developing creative capacity within these organizations best aligned with industry specific goals, would also greatly contribute to our understanding of how this sector of the Canadian economy might continue to grow towards a more sustainable future.

### Guidelines for Applying This Research to Practice

Our study has several implications for practice, most specifically in regards to the management of innovation-focused teams in the broader energy sector.

- Enabling connections within an organization appears to be more effective as a way to generate creativity than creativity-focused training or professional development opportunities. To support the creativity of teams and individuals in the tight-knit community of professionals that makes up the energy industry, organizations may wish to consider facilitating cross-team and cross-disciplinary connections between employees at work on different organizational priorities.
- Professional development opportunities such as conferences, seminars and networking events appear to serve more than a social or educational function. Participants described the motivating and inspiring power of discussions with peers across the industry, and the importance of hearing about different approaches to common industry specific drivers of innovation as a part of their creative work. To support this, we suggest promoting employee engagement with the broader professional community as a first stage in innovation-focused work.
- Supporting the creativity-relevant processes used by the energy industry will align existing and established work practices with the innovation goals of a broader organization. If energy industry organizations are seeking new ways to ignite creativity in their leaders' work practices, we suggest focusing on the development of storytelling skills, the establishment of ongoing intra-organizational discussion forums or brainstorming sessions, and on creating a culture where employees have the space and time to prototype conceptually or to engage in the search for analogous inspirations. To foster a culture where these four creativity-relevant processes become a critical part of all daily work, practitioners may consider rewarding their use on live projects, or highlighting the way that they are deployed in the face of ongoing challenges.

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