Collaboration for Complexity –

Team Competencies for Engaging Complex Social Challenges

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ABSTRACT

This paper explores the notions of collaboration within the context of complex societal issues – that exist at the intersection of the so–called 'wicked problems', 'problematiques', 'social messes', 'super–wicked problems' and the more recently postulated, 'post–modern complexity'.

The argument put forward is that these categories of issue complexity belong to a larger unified category, termed *'complex social challenges'* – one characterized by specific cognitive, contextual and cooperative ambiguities.

Experiences of the key stakeholders are considered from the liminal, salutogenic and sense-of-coherence perspectives, to improve both the ecosystemic sustainability and the stakeholder resilience through the enacted collaborative processes.

A specific type of collaboration is proposed for effectively engaging complex challenges, posited as a *'collaboration for complexity'* – that calls for specific team competencies and a new kind of team, entitled the *'complexity–oriented team'* (COT).

An example use-case of a stakeholder population amid a real–life complex social challenge system is investigated.

ACKNOWLEDGEMENTS

DEDICATION

To my mom Liliana, who defines perseverance, love and courage; to my sister Ana, who champions a vision of communities that are vibrant, balanced and inclusive; and to everyone designing the new global collaboration, within which we might create the possibility for manifesting a world that is deeply resilient and sustainable.

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Introduction

This master's research paper (MRP) thesis project focuses on exploring the topic of collaboration for complexity – with the explicit hope of discovering approaches that might enable teams to engage stakeholders within the context of complex challenges in an effective fashion, with an increased likelihood of achieving resilient and sustainable outcomes.

As such, this paper first attempts to posit the intrinsic interrelatedness of phenomena that might be referred to as socially 'complex', from a high–level perspective – arguing that even a preliminary consideration seems to suggest a necessity for applying a more astute theoretical analysis. Next, the paper outlines several formative frameworks, including 'wicked problems' (Rittel & Webber, 1973), 'problematiques' (Ozbekhan, Christakis & Peccei, 1970) and 'messes' (Ackoff, 1974) – arguing that they possess substantive shared characteristics that might qualify them for belonging to a posited larger theoretical category – termed as, *complex social challenges*'.

Next, the paper posits the key characteristics of such *complex social challenges*, and proposes a unifying framework – which is utilized as a basis for identifying specific qualities that collaborative efforts might need to have, in order to be effective in the context of complexity.

The paper then leverages the posited 'collaboration for complexity' characteristics, and attempts to match them with the existing theoretical frameworks – in a way that might help to devise more specific collaboration insights and associated schemata.

The key enabling frameworks considered include 'dilemmas', 'complex adaptive systems (CAS)', 'ecosystemic scales' and 'boundary analysis' – that are leveraged to uncover the required team collaboration capabilities. The posited team capabilities are then explored through the concepts of 'resilience' – building up to the notions of resilient teams, that are proposed to be termed as '*complexity–oriented teams*'.

Finally, the paper delineates the necessary collaborative capabilities from the perspective of ensuring sustainable engagements with the key stakeholders – by examining stakeholder journeys through the spaces of complexity from

the socio–cognitive perspective, and leveraging the frameworks of 'liminality' (Van Gennep, 1960), 'rites of passage' (Turner, 1987), 'sense of coherence' and 'salutogenesis' (Antonovsky, 1979); building up to a proposed unifying model consisting of 'team skills', 'systemic enablers' and 'core abilities', designed to be utilized by the *complexity– oriented teams.*

Lastly, the collaborative capabilities are synthesized into a 'complexity traversal model' engagement roadmap – as a method of assisting the *complexity–oriented* teams in helping to transit the key stakeholders in the midst of *complex social challenges* through the liminal spaces of the uncertain and the unknown, in a way that builds sustainability and resilience.

The proposed analysis, framework and tools are ultimately designed to enable a population to transfer in a liminal fashion – to overcome a complex challenge.

Applicability

The explicit hope of this paper is that the collaborative analysis contained therein might be applicable to a wide range of teams and stakeholders that find themselves in the environment of *complex social challenges*.

Some of the key domains that might benefit from this approach are listed as per below:

- Innovation: organizational innovation teams, entrepreneurs and strategic designers
- Not–for–profits: working on complex societal issues, while engaging diverse populations
- Healthcare: transformation teams working on addressing persistent ecosystemic issues
- Climate change: teams engaging in attempting to create and coordinate cross–sectoral action
- Disaster recovery: long–term disaster recovery (LDR) and humanitarian relief–workers
- Policy implementation: teams focusing on working with urgent issues, such as migration
- Work transformation: cross–industry teams managing transitions to new modalities of work

Overview

In the past several decades – and perhaps accelerating since the 1950s – the world seems to have been facing many increasingly complexified challenges that are largely intractable, highly interconnected, operate across the legal, institutional and geographical boundaries, impact a variety of diverse stakeholders, and seem to require a broad inclusion and effective cooperation of multiple parties to effectively bring about positive change in a manner we might deem as adequate.

More recently, leading authors have commented and expounded on these issues – including Thomas Homer–Dixon, contrasting the rate of growth of problems to the rate of the ingenuity for solving them (*"The Ingenuity Gap: Can We Solve the Problems of the Future?"*), Robert Wright, exploring our socio–biological history from the cooperative perspective (*"Nonzero: Logic of Human Destiny"*), Alexander Manu, investigating the roles of creativity and imagination in empowering organizational innovation (*"The Imagination Challenge: Strategic Foresight and Innovation in the Global Economy"*) and Keith Sawyer, exploring the nature of collaboration and creativity in groups (*"Group Genius: The Creative Power of Collaboration"*).

These leading authors and other key researchers seem to point in the direction of an overarching context, that might in some sense be accelerating the emergence of such complexified challenges –

That, broadly speaking, might be considered to include the general deterioration of the environment and supporting natural ecosystems, the rise of human populations impacting issues such as the availability of urbanization infrastructure, the growth of poverty and increase in land migrations, the elongation of the human life–span combined with the increase of healthcare epidemics such as the Alzheimer's, obesity and diabetes that tend to impact the resilience of healthcare systems and challenge the long–term feasibility of retirement funds, and the emergence of highly sophisticated technological automation that questions the future prospects of what we have traditionally considered as formal employment.

Although in the popular vernacular we have largely tended to refer to such issues as 'problems', from a certain perspective, we might wish to consider these types of issues much more justifiably as 'dialectics' –

Namely, as those types of challenges that do not tend to feature a single, generally agreed–upon solution, and instead seem to imply a set of possible and often conflicting options and opportunities to select from – across such diverse areas as the development of strategy, adoption of innovation, the design of social systems, and the development of effective organizational tools and policy instruments for addressing a range of cultural and communal issues at a variety of scales.

When considering this type of inquiry, several questions seem to naturally arise – including, how might we be able to explore and understand such challenges? What, if anything, might we be able to do about them? And, if some sort of a meaningful action is possible, how might we be able to organize ourselves – so that we might be able to positively impact these types of issue–complexes?

The research literature over the last several decades offers rich grounds for consideration of complex challenges, and their various mechanics and manifestations. Such explanatory conceptual frameworks include the 'wicked problems' (Rittel & Webber, 1973), 'messes' (Ackoff 1974; Horn 2007), 'problematiques' (Ozbekhan, 1970) in collaboration with Christakis and Peccei, and more recently, the 'post–modernist complexity' (Cilliers, 1998).

As such, these frameworks attempt to create conceptual structures as grounds of exploration around the increasingly complex challenges that the world has been facing – where, their posited underlying nature seems to be the one of interconnectedness, indeterminacy and multiple impacts.

Research Directions

On the surface, the conceptual frameworks produced by the research community over the last several decades around the topic of complex challenges seem to share many relevant characteristics.

Such frameworks seem to imply that complex challenges are systemic in nature, and in some aspects analogous to biological metaphors such as the "mutual interdependence, self–regulation, adaptation to disturbances" (Bertalanffy 1956) – where behaviours are enabled by feedback loops, sub–systems and non–linearity; that they imply complexity (far from equilibrium, autopoiesis, attractors), and are posited to be ultimately social in nature, in a sense of multiple stakeholder perspectives being filtered through the lens of individual goals and objectives, such as autonomy, mastery and purpose (Pink 2009).

From the perspective of systems, complex challenges are further posited to exhibit a range of interesting characteristics – including "openness, purposefulness, multidimensionality" (Gharajedaghi, 1999); featuring the plurality of function, structure and process capable of giving rise to the emergence of counterintuitive behaviors.

Complex challenges are additionally resilient to outside influences as they are cross–cutting (many scales involved – micro, meso, macro), relentless (do not ease over time, and frequently get worse), and tend to generate 'resource lock–in' (investment of resources to fight the symptoms, not the core issues).

An explicit intent is to suggest a possible unifying conceptual category – as a means of enabling the exploration and discovery of effective methods for understanding, assessing, and structuring efforts around engaging such challenges.

Given that these types of challenges appear to have a strong social component, this paper proposes a unifying category that might offer an opportunity to identify such issue–complexes perhaps more aptly as, *Complex social challenges (CSCs).*

Challenges of Engaging Complexity

Complex Impacts

As postulated, the world has increasingly been encountering a range of critical challenges – that seem to be escalating in intensity, accelerating in frequency and broadening in terms of their effective breadth of impact.

In this sense, complex challenges appear to impact a variety of diverse contexts; from climate change and natural resource management, to the feasibility of sustainable healthcare, goals of national debt and poverty reduction, and the establishment of balanced education policy and effective responses to the changing nature of work and job equality, to name a few.

These types of issues tend to be exacerbated by the far–reaching impacts and often compounding consequences of both possible action and inaction – making them challenging to address and often frustrating to work with, from the perspective of the engaged stakeholders.

Given that such challenges tend to manifest as 'complexes' of inter–related issues, their impacts are difficult to assess, measure and quantify.

Multi–Variant Causes

Even the very process of attempting to understand *complex social challenges* (CSCs) to a sufficient extent – perhaps as part of attempting to minimize their adverse impacts, while attempting to create some preferred future – tends to overwhelm individual understanding, stretch capabilities of team coordination, exacerbate group decision making processes, and limit the possibilities of effective collective action.

This situation can be visually represented as per the diagram below:
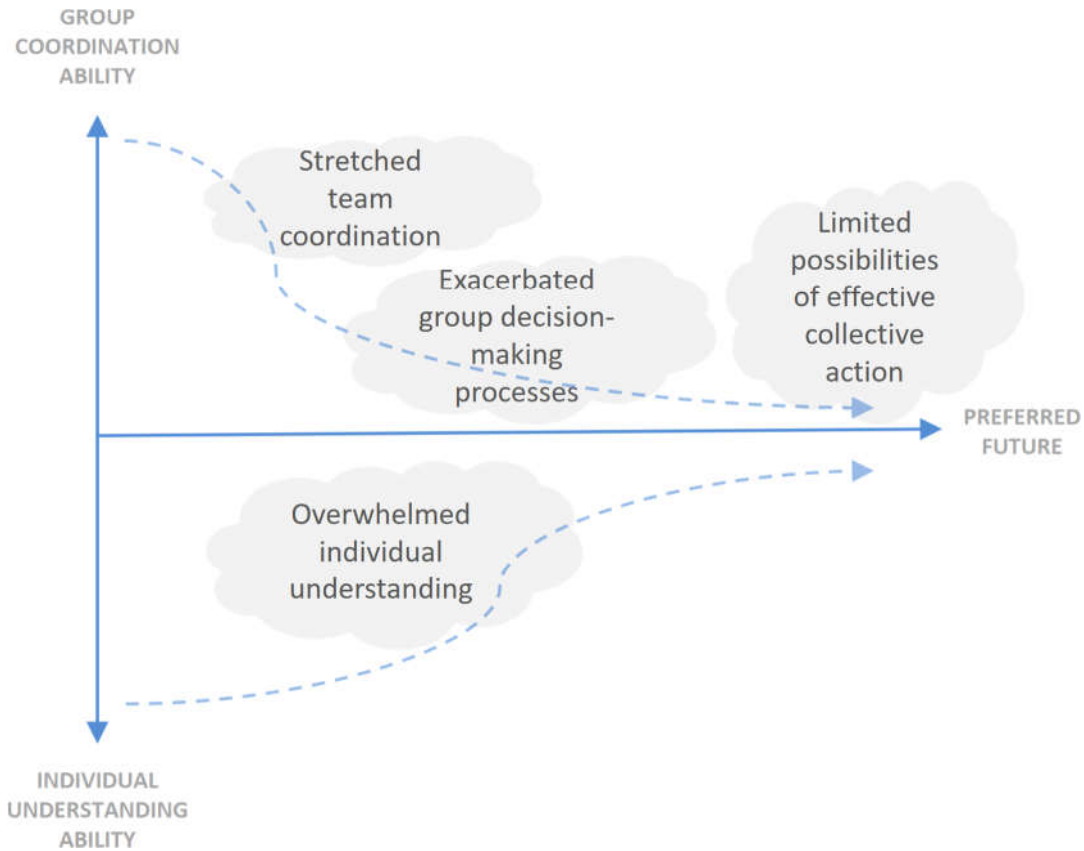
Furthermore, any 'actions' created to address *complex social challenges* often appear to yield ineffective, incomplete or temporary solutions, at best.

These limitations might perhaps be best understood in the context of the fact that 'causes' of such complex challenges seem to be multi–variant – and, to some (likely significant) extent, appear to be influenced by the accelerating interactions between our modern forms of capitalism and the phenomena of globalization; that impact both the global and hyper–local contexts in a myriad of important ways.

Aggregative Risks

The 'signals' of accelerated change in our global / hyper–local contexts feature increased interconnectedness of financial institutions, growing complexity of investment instruments, cross–scale impacts of trans–national organizations and legal frameworks, consolidation of diverse economic entities, the centralization of trading

patterns and their associated unpredictability and fragility expressed in 'boom and bust' cycles, and the resultant cross–pollination of cultural artefacts across the various communication and media channels.

The 'outcomes' of the resultant interactions can indeed perhaps be best described as 'complex' in and of themselves – as they seem to create a rich ground for the generation of a variety of often unanticipated issues, in turn capable of affecting diverse cross–domains and socio–economic contexts; including impacts on the individual psychosocial well–being, broadly considered a key enabler of mobilizing groups and communities towards engaging in constructive action.

An aggregative risk around *complex social challenges* is that they have a capacity to adversely affect some aspects of the 'commons' – those shared assets that are critical for enabling diverse ecosystem members – such as access to drinking water, the availability of clear air, and the preservation of renewable natural resources; and important in social contexts, such as the preservation of linguistic continuity and cultural identity.

Key Research Questions

In consideration of the high–level overview associated with *complex social challenges*, several key questions arise – including:

- How might we understand *complex social challenges*?
- To what extent might we be able to leverage our collective knowledge, understanding, skillsets, assets and capabilities – to be able to sufficiently organize for engaging these types of 'issue complexes'?
- To what extent might it be possible to address or at least positively affect *complex social challenges* – in a manner that we might deem as sufficiently relevant?

This paper will attempt to identify some salient aspects and relevant characteristics of *complex social challenges* – and, to offer a possibility of a unified approach around how it might be possible to consider and engage them from a collaboration perspective.

As such, this paper will be exploring the following research question:

> *How might we successfully collaborate to effectively engage complex social challenges – in a way that enables both individuals and teams?*

To answer the primary research question, this paper will be exploring three key sub–questions – representing distinct yet respectively related areas of inquiry:

1. How might we think about the nature of *complex social challenges* to 'effectively engage' them?
2. How might we 'successfully collaborate' in the context of *complex social challenges*?
3. What 'skills and abilities' might be required to enable effective collaborative engagements?

To start the exploration of the research sub–questions as posited, some key guiding methods will first be outlined – with the capacity to inform the exploration process.

Research Methods

A combination of research methods has been applied towards the completion of this Masters Research project (MRP) – with particular utilization of the following modalities:

- **Literature Review**: a comprehensive review of the existing research literature has been performed, with emphasis on exploring theoretical constructs around the emergence of complex challenges, and the associated social–economic and psycho–social phenomena; as well as, towards investigating explanatory frameworks underlying individual and group cognition, as part of the environment within which collaboration takes place.

- **Case Studies**: several case studies have been examined for relevance, with emphasis on exploring the phenomena of collaboration and the various dimensions of groupwork that represents a field of engagement for collaborative teams. Literature–based sources were primarily utilized – with focus on papers that explored complexity and collaboration in specific contexts (such as challenges in policy creation in healthcare, and outcomes in educational reform); including both localized and geographically cross–comparative studies.

- **Interpretive / Integrative Synthesis** (Noblit & Hare, 1988): interpretive research methods were utilized to explore the nature of possible synthesis between the most relevant theoretical frameworks, while integrative methods were used to combine existing constructs into new conceptual structures – with an intent of developing additional levels of cohesion and explanatory power.

Preliminary Analysis

As a starting point for analysis, a comprehensive literature review has been performed around the associated phenomena – which yielded several high–level observations and salient characteristics of *complex social challenges*. To start exploring the first research sub–question – namely, an inquiry around the nature of *complex social challenges* – the first posited observation that has been offered in the existing literature is the quality of "interrelatedness".

Interrelatedness

As a broad category, *complex social challenges* appear to manifest in a number of seemingly disparate areas of experience.

A potentially highly relevant observation implied by the research literature is that these multiple areas of manifestation are not entirely 'independent' – as an initial colloquial expectation might lead one to believe.

Instead, *complex social challenges* are posited to be highly interrelated across various socio–cultural and socio–economic phenomena – in such a way where they are either interconnected in complex ways, or might even be considered to 'enclose' one another.

For instance, healthcare researchers posit that "modern health care is complex, and mental health care particularly so", where "many of the problems policymakers face are of the 'wicked' variety" – in such a way where "wicked problems are resistant", "problem formulations and their solutions are contestable", "solutions which have 'worked' in one setting may not 'work' in another, and evidence to guide change is open to challenge"; building to situations where "actions trigger waves with widespread system consequences", ultimately calling for an alternative approach that "embraces the idea that the fields to which public policies are typically directed are best thought of as comprising multitudes of interrelated parts" (Hannigan & Coffey, 2011).

In order to explore this notion of seemingly intrinsic inter–relatedness associated with *complex social challenges*, let us consider a hypothetical example of a not–for–profit organization engaged in delivering health and wellness initiatives in global disaster relief areas – that is in the process of updating their organizational strategy as an adaptive response to the changing regulatory environments and socio–political changes around the world.

Exploring Interrelatedness

In relation to the hypothetical organizational goal as posited above – and as a means of setting the stage for illustrating the potential issues that a 'collaboration for complexity' might need to address in such an environment – an exploration of the various associated and interrelated *complex social challenge* components might include several key areas, as per below.

Organizational strategy

The question of organizational strategy engages multiple stakeholders in fundamentally important ways.

Recently, theorists posit that 'many strategy issues aren't just tough or persistent—they're "wicked"', where they "can't be solved, but they can be tamed"; existing in an environment where a "wicked problem has innumerable causes, is tough to describe, and doesn't have a right answer" and where "increasingly, these are the problems strategists face—and for which they are ill equipped" (Camillus, 2009).

The notions of strategy creation are also often associated with innovation – where, whether in emerging or established organizations, innovation is increasingly seen as a critical adaptation strategy that must effectively respond to some set of changing external, environmental and market conditions.

Innovation

Leading researchers posit that innovation and industrial policy can be considered from the viewpoint where "economic growth can be based on the permanent transformation of an economic system via the emergence and/or transformation of multi–agent structures and their inherent competences" – where, the process of managing the transformation risks can be relegated to various devices; including one where a "targeted, co–evolutionary approach can help overcome a lack of dynamic coordination and other failures that originate in coincidence with the emergence of a complex form of industrial organisation, be it an innovation system, cluster or a new industrial sector" (Rosiello, Mastroeni, Teubal, & Avnimelech, 2013).

In attempting to formulate effective policy within such an environment, researchers further posit that complex phenomena, such as "self–organisation and self–transformation are the two sides of the same market process", and advocate for a view where an "innovation systems perspective provides the appropriate rationale for innovation

policy" – within which "systems increasingly transcend national boundaries and increasingly call into question the idea of isolated national innovation policies", highlighting the need for addressing exigent "conflicts and coordination problems" (Metcalfe, 2007, p. 442).

In the face of apparently pervasive interrelatedness, these observations seem to suggest an absence of simple, clear and reliable heuristics – where, Metcalfe (2007, p. 443) further points out that "any attempt to address innovation policy in practical terms requires recognition of wide intersectoral variations in innovation conditions pertaining to the knowledge, technologies and markets in play, the institutions and the actors and their interrelations."

While the concept of innovation might exist at many levels of actuation, in order for it to be successful, it is often posited that a key enabling element is an empowered and enabled organizational culture – as well as, an effective governance structure capable of supporting innovation efforts.

Culture / Governance

An organizational culture is posited to benefit from a degree of broadly shared values, adaptive cross–organizational communication and multi–tier inclusion, to be truly effective. In this context, wicked problems are posited to necessitate an "integrative approach", and "not only require alternative action strategies but also alternative ways of observing and enabling" (Termeer, Dewulf, Breeman, & Stiller, 2015).

Further, the organizational culture and governance structure must be able to align to the policy directives across a variety of operational jurisdictions – while also effectively relating to the key external governance objectives, such as in the area of balanced healthcare policy creation.

Healthcare policy

Policy researchers observe that "some of the most difficult policy problems of the modern era have been described as complex, intractable, open–ended and 'wicked'" (Head, 2008).

Even though the establishment of an effective healthcare policy is likely one of the most critical considerations for the various regulatory jurisdictions around the world – and a key element of sustaining a healthy society – it is in and of itself likely insufficient to be able to fully guarantee effective health outcomes. In this context, leading

researchers argue that "health care systems are complex, and that repairing them is a complex problem", further positing that "health care and the systems within which it is delivered are best understood as complex adaptive systems" (Glouberman & Zimmerman, 2002).

Part of the challenge is that the healthcare system itself interacts, intersects and is embedded into many other key systems – including food accessibility, education and wealth distribution, for instance. When attempting to address some of key healthcare challenges of the modern age – including the enablement of resilient ageing, and the management of Alzheimer's, dementia, obesity and diabetes – the multiple influences of the seemingly 'peripheral' systems seem to have an important impact on healthcare; and are in many ways often recognized as 'critical determinants' of health.

Food security

Increasingly, research shows that access to quality food is of key importance – where the "field of the social determinants of health is perhaps the most complex and challenging of all", and where food is related to the "root causes of ill health, health inequalities and the needs of those who are affected by poverty and social disadvantage" (Wilkinson & Marmot, 2003).

This is increasingly concerning given that "there is mounting evidence that global fisheries are in crisis and about 25–30% of fish stocks are over exploited, depleted or recovering", which "poses severe challenges for marine ecosystems as well as food security and the livelihoods of resource–dependent coastal communities" – and where the associated "wicked problems are complex, persistent or reoccurring and hard to fix because they are linked to broader social, economic and policy issues"; taking place in an enclosing environment where perhaps all too often it might be observed that, "due to socioeconomic and sociopolitical concerns, fisheries governance challenges are particularly wicked when dealing with collapsed fisheries and rebuilding efforts" (Khan & Neis, 2010).

Traditionally, a lack of access to quality food has often been associated with issues around poverty; while most recently, it has been considered as a question around food security, and connected with the notions of access to wealth and wealth–creation in general.

Equitable wealth creation

Contemporary authors observe that "we need a much broader approach to economics: one that takes into account its larger social and natural context", that can "build foundations for a more equitable and sustainable world" – which, as such, "requires attention to the interaction of economic and social systems" (Eisler & Eisler, 2008).

In this sense, our socio–economic context itself is posited to be complexified – with researchers observing that "rather than using its great wealth to create livable, equitable, and ecological communities, our society had done much the opposite", creating an environment where "similar patterns of unsustainable urban development" are "occurring the world over, though they take somewhat different forms in different places and times", and asserting that "radically different alternatives are needed" (Wheeler, 2013).

The questions of equitable wealth creation and its antithesis – poverty – may be traced to a variety of posited underlying causes; while most recently, they may also be connected to the notions around the changing nature of work, and the extent to which sufficient access to wealth might be ensured for the various tiers of the societal stakeholders.

Changing nature of work

In the accelerated work environment where the "emerging present is a fast–changing context for incumbent organizations", and where the "online behaviour is replacing physical proximity, and users engage with digital platforms for the acquisition of products and services", leading authors argue that we must prepare for "a world in which everything is social, augmented and autonomous" and where "objects and spaces will have multiple purposes, capabilities and meanings" (Manu, 2017).

Such accelerated change can have a profoundly disorienting effect for a variety of industries and organizations – where, what we might have traditionally recognized as formal 'labour' is linked to the questions around how and to what extent might such work be considered sustainable in an increasingly technologized and automated society. In this context, "robotisation and applications of artificial intelligence are perhaps the most topical questions of the futures of work, as they replace many of the jobs done today by humans, and thus deeply transform practically every industry" (Ruotsalainen, Heinonen, Karjalainen, & Parkkinen, 2016).

The extent to which the changing nature of work can be analyzed and projected onto a future–forward canvas is also dependent on the notions around sustainability of existing and emerging economies – and perhaps especially in terms of, how the new forms of automation might be absorbed in the various layers of the existing socio–economic infrastructure.

Sustainable economies

Researchers inquire as to "whether it is possible to find ways of thriving in a world full of wicked problems—the most significant of which may be the sustainability crisis", in such a way as to ensure "a healthful and adequate food supply comprised of nature–made foods rather than processed goods" – asserting that, this "demands collaborative actions, new leadership skills and the evolution of global action networks (GANs)" (Waddock, 2012).

Waddock (2013) further posits that this calls for a shift that "needs to happen at the societal as well as the organizational level" – while "creating greater system resilience and using resources more wisely" and "working successfully across boundaries, be they sector, organizational, policy, or functional ones"; even though recognizing that "these approaches do not deal with the problem of resource overuse" and asserting that "they may provide a basis for generating more sustainable approaches to resource use" (Waddock, 2013).

In this sense, the notions around sustainability and capitalism inevitably seem to be enclosed in the larger questions around resource management – and, to what extent any broad resource shortages might be mitigated. For many economies existing in the regions and zones that are susceptible to natural disasters, the sustainability of economic structures is often considered as related to the notions at the intersection of natural resource management are efforts at long–term disaster recovery.

Long–term disaster recovery (LDR)

In the environment of hyper–urgent, interacting issues within which competition for the same set of resources often occurs, it is challenging for teams, groups and organizations to implement effective LDR strategies that are adaptive, capable of standing the test of time, and are also effective in the short–term.

In the Hurricane Katrina disaster recovery example, disaster recover efforts raised a variety of complex questions – including, "how do we fix the levees—not just the physical ones, but the levees of society—to build more resilient

and sustainable communities", where the authors of the study observe that "this is a 'wicked problem' that presents society with a set of 'wicked choices'" (Boston, Wanna, Lipski, & Pritchard, 2014).

A key consideration of any LDR strategy is also the availability of the natural resources before and after a natural disaster – which is related to the questions and policies around natural resource management.

Natural resource management

In the domain of forestry natural resource management, researchers observe that "wicked problems are interrelated ones of organized complexity that cannot be solved in isolation from one another, but also hinge on differing sociopolitical values that clash in the political arena" – and where "professionals frequently find themselves caught up in the dilemma of making decisions", in a prevailing "era of social change" (Shindler & Cramer, 1999).

The questions around the effectiveness of natural resource management also seem to be inextricably connected to the notions around "building resilience into both human and ecological systems", as an "effective way to cope with environmental change characterized by future surprises or unknowable risks" (Tompkins & Adger, 2004) – while developing methods capable of mitigating impacts in some relevant manner, that must also arguably be capable of operating within the environment of climate change.

Climate change

Climate change is increasingly causing, impacting or affecting the frequency and intensity of natural disasters – as well as, the feasibility and effectiveness of long–term disaster recovery (LDR) efforts.

Poverty is a complexifying factor in the context of climate change – where, "adaptation to already discernible climate changes, particularly an increase in extreme events, is an urgent task for all nations", and where a key goal for the developing world is seen as "to build a resilient society" – despite challenges where "coping strategies to maintain livelihood systems can work against long–term adaptation to climate change, unless there is linkage to poverty alleviation" (O'Brien, O'Keefe, Meena, Rose, & Wilson, 2008).

In a broader context, climate change 'has been fairly described as a "super wicked problem" because of its even further exacerbating features', that "include the fact that time is not costless, so the longer it takes to address the problem, the harder it will be to do so" (Lazarus, 2008).

Even a high–level, preliminary analysis seems to reveal a significant degree of interrelatedness between the seemingly disparate issues and challenges – that appear to have many shared areas of socio–economic impact; suggesting that, effectively collaborating within such an environment and towards some set of shared goals might be a non–trivial process – and is likely to require some specific skills and abilities for any teams involved.

Next, in order to facilitate further understanding the notions around visualization are briefly explored – in terms of, how might such levels of interrelatedness be effectively represented.

Visualizing Interrelatedness

Visualizing the interrelatedness of the enclosing *complex social challenge* contexts brings about questions of representation. Leveraging the nested 'systemigram' visual representation developed by Boardman and Sauser (Gharajedaghi, 2005), an analysis of the above–posited interrelatedness might appear as per below:

Figure 2: Visualizing nested inter–relatedness
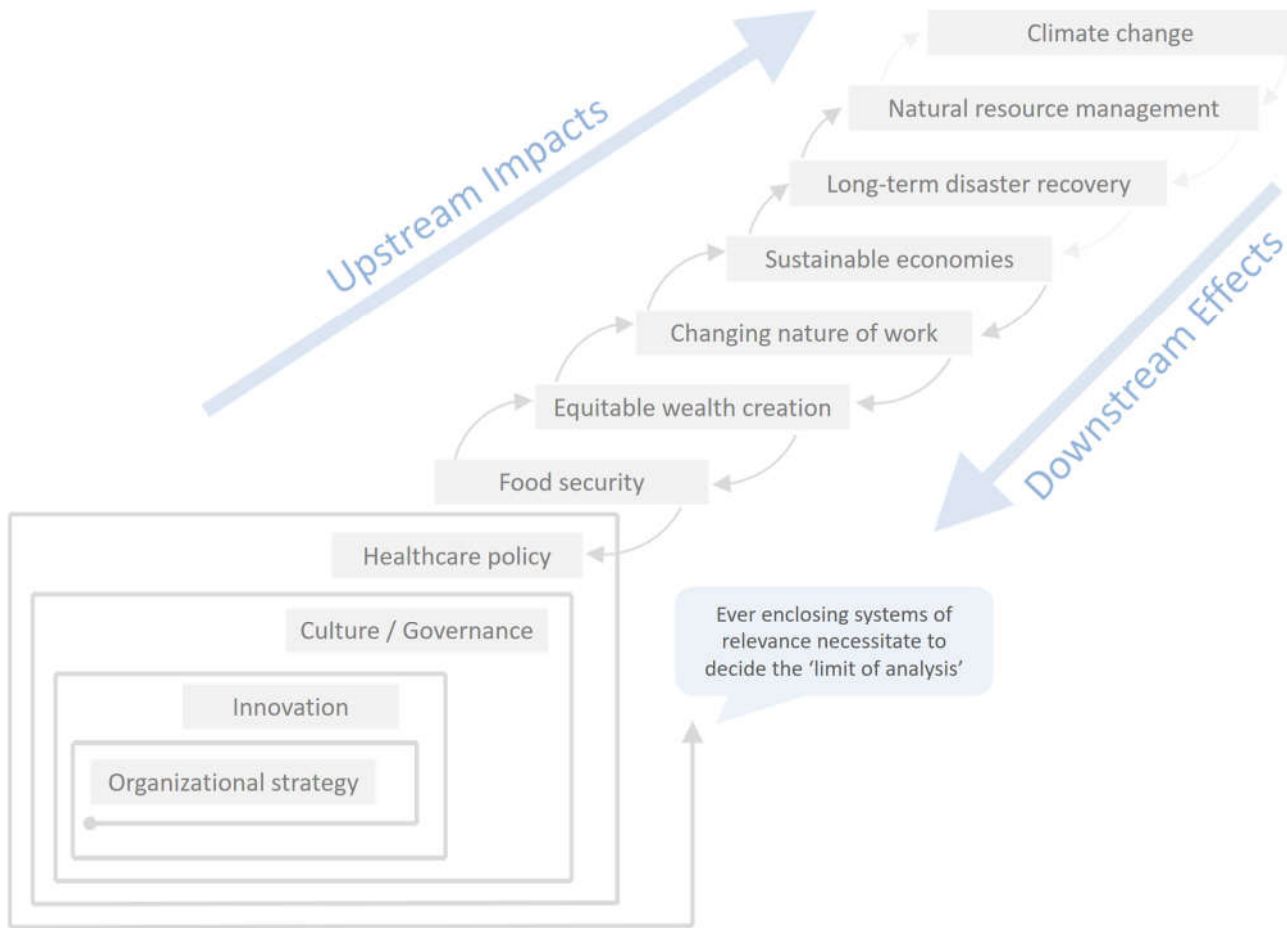
Emergent Questions

This high degree of 'nestedness' – in reference to both a visual metaphor and a concept from ecology – seems to illustrate the myriad of challenges that our hypothetical global disaster relief health organization might be facing, in the process of attempting to develop an effective organizational strategy.

Some of the key questions might include:

- How many levels of 'nestedness' might need to be considered, to attain some sufficient degree of certainty in creating an effective organization strategy?
- What types of issues need to be considered, and which ones might be safely left out?
- When and how might we be able to know that our analysis is 'done' – and, completed?

Preliminary Observations

Even a cursory observation of the proposed 'complex challenge' system seems to reveal some high–level properties – including the:

Networked Relatedness

A consideration of one complex challenge domain inevitably leads to the discovery of relationships to other, related ones – even after an initial or cursory amount of analysis.

From a network theory perspective, the assemblages of complex issues can be considered to form certain types of 'networks', along the lines of relatedness and impact causality.

Because of the high degree of relatedness, different attempts at inferring network–topology models are likely to yield very different representations – that might be equally valid from different perspectives explored. Such perspectives might be characterized by the points of view examined, stakeholders interviewed and organizations considered.

Indefinite Boundaries

Complex challenges tend to transcend traditional analytical segmentations – whether within or across organizational, cultural, societal, legal and even national boundaries.

Further, researchers posit that "models used in the understanding of complex entities, like organisations, are problematic" when considering complex systems boundaries – arguing that, "although boundaries do exist, they have a peculiar nature", where 'although hierarchies form an important part of the structure of complex systems, they are not clearly defined or "nested" as is often assumed' (Cilliers, 2001).

Perhaps this is understandable – since, from the purely epistemological perspective, researchers observe that "within the Universe it is impossible to have a complete representation of anything", given that there is "only one true system; all other systems are temporary and contingent structures whose boundaries are, in a strict sense, illusory" – and where "no boundaries actually exist" (Richardson, 2005).

And yet, Zeleny (2009, p. 91) points out that "all social systems, like all living systems, produce, maintain, and degrade their own boundaries or membranes", where "these boundaries do not separate but connect the system with its environment" – in such a way where, the boundaries are viewed as 'not just "perimeters" but functionally constitutive components of a given system".

In that sense, the boundaries of complex challenges are not strictly 'definite' – where, any team or group of individuals working on analyzing such challenges will by necessity introduce some amount of arbitrariness in establishing the effective 'analysis boundaries'.

The asserted arbitrary 'boundaries' define what is in–scope and what is out–of–scope of the actual analysis – with the effect of both including and excluding various phenomena, stakeholders and information sources in the scope of the analysis itself.

Due to these indefinite boundaries – and borrowing a concept from information theory – we might consider any methodological attempts at building understanding as a process of active construction of 'analysis grammars' – those cognitive / conceptual structures established to engage with a particular domain of inquiry. The emergent 'analysis languages' that such grammars generate might not necessarily correspond across different stakeholder groups and analysis teams – due to the arbitrary assignment of analytical boundaries.

Causal Indeterminacy

In part due to the postulated conditions of high interrelatedness and indefinite boundaries, the 'causes' of complex challenges are viewpoint–related and analysis–dependent – and are essentially indeterminate in a finite sense of a definitive heuristic.

Since one group of stakeholders might choose to define boundaries around their 'complex challenge domain' differently from another – and perhaps, with just as valid of a rationale – it might be possible that the inventory of identified 'causes' may vary significantly.

This implies that any postulated grouping of identified 'causes' of a complex social challenge domain are also likely to be arbitrary, indefinite and indeterminate to some extent – although, they might be entirely valid from a certain point of view and investigative perspective.

Further to exploring the phenomena of 'interrelatedness' – and as a way of starting to think about evaluating the possibilities of effective remediations – another relevant factor in considering the instances of complex challenges is to assess their perceived impacts.

Impacts and Possibility of Remediations

A useful question to consider in relation to remediating *complex social challenges* is to investigate the what ways in which they affect us today – and to what extent they might be likely to impact the world in the future.

Impact considerations are relevant from the standpoint of helping to inform the analysis around whether attempts at positive change are needed and might be possible; and if so, to what extent.

When exploring the notions of impacts around *complex social challenges*, it is relevant to consider the perspectives of both the natural ecologies and socio–economic ecosystems.

Ecological Impacts

Perhaps in part due to the inherent interrelatedness of phenomena present within the domain of *complex social challenges*, diverse areas of socio–economic activity appear to be capable of generating 'trickle down' effects – where, human endeavours increasingly seem to be able to impact natural environments in an incremental and yet aggregative manner; and where, the most significant impacts on ecosystems are probably related to the phenomena of climate change.

 As early as 2004, researchers observed that climate change "has produced numerous shifts in the distributions and abundances of species, and has been implicated in one species–level extinction", with projections for future climate scenarios that assess "extinction risks for sample regions that cover some 20% of the Earth's terrestrial surface", in which the "estimated probability of extinction shows a power–law relationship with geographical range size" – predicting "on the basis of mid–range climate–warming scenarios for 2050, that 15–37% of species in our sample of regions and taxa will be 'committed to extinction'" (Thomas et al., 2004).

Researchers investigating more localized climate change impact projections note that "many European plant species could become severely threatened", where "more than half of the species we studied could be vulnerable or threatened by 2080" (Thuiller, Lavorel, Araújo, Sykes, & Prentice, 2005).

More recently, a study of the reef–building coral species revealed that, "of the 704 species that could be assigned conservation status, 32.8% are in categories with elevated risk of extinction", where the declines are "associated with bleaching and diseases driven by elevated sea surface temperatures" and extinction risk is "further exacerbated by local–scale anthropogenic disturbances"; and where the "proportion of corals threatened with extinction has increased dramatically in recent decades and exceeds that of most terrestrial groups" (Carpenter et al., 2008).

In the face of such concerning observations, researchers argue that "environmental management approaches are incommensurable with the ecocentric responsibility" and are calling for "theory development toward an ecocentric organizational paradigm" (Purser, Park, & Montuori, 1995) – in order to build "energizing new social responses to environmental problems at appropriate ecological scales" that might necessitate "new forms of community interaction and often new social institutions"; that nevertheless "must not bypass the necessity of reaffirming hard–won democratic freedoms" (Barham, 2001).

Some contradictory evidence is also identified – where, for instance, the "Millennium Ecosystem Assessment paradoxically found that human well–being has increased despite large global declines in most ecosystem services" (Raudsepp–Hearne et al., 2010).

Additional examples include pollution of river systems due to mining (Coulthard & Macklin, 2003), an apparent overutilization of limited natural resources in ocean fisheries (Davis & Gartside, 2001; Campling, Havice, & McCall, 2012), and the gradual aggregation of climate–change inducing gasses in the atmosphere (Stern & Treasury, 2007), as the result of industrial activity and burning of hydro–carbon fuels.

In response to these observed issues, Stern and Treasury (2007) state that "working together is essential to respond to the scale of the challenge", where "an effective, efficient and equitable collective response to climate change will require deeper international co–operation", and where the "economic analysis must be global, deal with long time horizons, have the economics of risk and uncertainty and its core, and examine the possibility of major non–marginal change."

In this sense, the research literature seems to have arrived at a broadly shared position that natural ecosystems seem to be increasingly pushed to their limits – in such a way where, the depleting 'stocks' will likely not have time

to replete at the current consumption levels. Examples include ocean fisheries, forests and other natural ecosystems – where, many organisms are either in a state of crisis, or have already been pushed beyond the boundary of extinction.

Further, the resource–depletion and mass–extinction processes are accelerating at an alarming rate – so much so that, scholars are arguing that we are now living in an entirely new age, termed the 'anthropocene' – where, "human activities are exerting increasing impacts on the environment on all scales, in many ways outcompeting natural processes" (Crutzen, 2006).

This sentiment can perhaps be best expressed in an illustrative quote found in Weber and Khademian (2008), referencing the findings from several research panels – and asserting that 'climate change, disturbed weather patterns, collapsing ecosystems, species extinction, pollution from industrial farming practices, deforestation, desertification, huge oceanic dead zones, and numerous other ecological issues only begin to describe the challenges embedded in creating a more sustainable civilizational strategy for humanity" (c.f., Brown, Brown, Plan B 3.0, & Earth Policy Institute, 2009; Intergovernmental Panel on Climate Change, 2007; McKibben, 2010; Waddock, 2011).

Socio–Economic Impacts

Social environments are intrinsically dependent on natural ecosystems – where, depletion of the natural resources can lead to such phenomena as food or water shortages, unplanned industry changes, abrupt job loss and extensive land–migrations.

With the expected "large increase in global temperatures", the projections suggest "greatest decreases both regionally and globally in yields, especially by the 2080" – where, although the "global production appears stable", the "regional differences in crop production are likely to grow stronger through time, leading to a significant polarisation of effects" – capable of creating "substantial increases in prices and risk of hunger amongst the poorer nations, especially under scenarios of greater inequality" (Parry, Rosenzweig, Iglesias, Livermore, & Fischer, 2004).

Climate change also affects the availability of drinkable water – in such a way where it "increases water resources stresses in some parts of the world where runoff decreases", with various projection scenarios showing that as early as 2020, "between 374 and 1661 million people are projected to experience an increase in water stress" (Arnell, 2004).

Some research is focusing on combined impacts of multiple socio–economic forces – where, "certain regions, sectors, ecosystems and social groups will be confronted both by the impacts of climate change, and by the consequences of globalization" with the likely outcome of creating "new sets of winners and losers" (O'Brien & Leichenko, 2000).

Here, further 'nestedness' and interdependency of the various socio–economic phenomena can be observed.

As an example, The Garnaut Climate Change Review "used the results of the science to model the impacts of climate change on the Australian economy, including impacts on agricultural productivity, our terms of trade, and infrastructure" – linking such diverse phenomena as migration policy on the overall GDP, and concluding that the "growth rate for Australian national income in the second half of the 21st century would be higher with migration than without", while examining "how developments in science, diplomacy, political culture and the economy have affected the national interest case for Australian climate change action" (Garnaut, 2011).

Ultimately, researchers observe that the "implications of climate change for the environment and society will depend not only on the response of the Earth system to changes" but also on "how humankind responds through changes in technology, economies, lifestyle and policy", recognizing that "extensive uncertainties exist", and necessitating the "use of scenarios of the future to explore the potential consequences of different response options" (Moss et al., 2010); that will likely require some substantive form of collaboration, in order to be effective.

In this context, the phenomena of globalization seems to make the entire system more fragile and not necessarily additionally resilient, as might be initially suspected – given the distributed nature of the modern socio–economic phenomena; in part due to the propagation of 'hard–coupling' and fragile dependencies throughout the system.

An example are supply–chains that are largely optimized for cost efficiency, and not necessarily unplanned disaster resilience – that are effectively exacerbated by the phenomena of insufficient 'buffers'. Since economic 'buffers' – whether enacted as stock in a warehouse or cash–reserves in a bank – cost something to be maintained, they tend to be minimized for the purposes of competitiveness and efficiency. In the worlds of business and economics, this can lead to unanticipated impacts and even crashes of the financial system – caused by such phenomena as the 'tight–coupling' between the financial institutions, and the high debt–carrying ratios across the spectrum.

In turn, economic issues and difficulties tend to impact many other aspects of the social spectrum – including health, wellness, education, poverty, as well as the emergence of criminal elements in society.

In some part due to the prevalence of fragile interdependencies between the various global systems – and exacerbated by the increasing lack of substantive 'buffers' throughout the ecosystem levels – it is quite possible that the future of our social institutions depends on an ability to adapt to the changing conditions in a gradual fashion; in contrast to, being forced to adapt to abrupt changes amidst tumultuous and largely unpredictable conditions.

This leads us to the question of adapting to change in the context of *complex social challenges* – and, to the exploration of the notion around, to what extent positive change might be effectively possible.

Relevance of Positive Change

Relevance of Remediation

Even when considering an apparent lack of comprehensive stakeholder alignment, it is probably safe to assert that the state of natural ecosystems warrants some significant amount of concern, and highlights a need for relevant and urgent action;

The need and relevance of urgent positive change is further highlighted given that the impact tend to affect a multiplicity of actors and diverse groups, organizations, communities and institutions – often across trans–national boundaries, that include legal systems, governance and regulatory bodies and social welfare and food security systems, for example; as well as, the feasibility of work, delivering healthcare, supporting equality and ensuring geopolitical stability.

Sustainability and Resilience

In thinking about the relationships and relevance of constructive change and positive remediation, much of the research literature highlights the relationships to sustainability and resilience – where, it is recognized that the "sustainability problem in all of its manifestations is, by nature, a wicked problem" (Weber & Khademian, 2008).

The complex interconnections of the sustainability and resilience challenges on a global scale can eventually impact even the largest of ecosystemic structures – including the global climate system.

This can be considered as highly problematic for the feasibility of supporting global populations – since, "sustainability, considered broadly, involves ecological sustainability, and it also encompasses the long–term

viability of organizations and societies and, in particular, human civilization" (Weber & Khademian, 2008; c.f., Batie, 2000).

When these elements combine "with the inherently unsustainable economic/ business imperative of constant growth, consumption, and materialism in a world of limited resources" (Weber & Khademian, 2008; c.f., Ehrenfeld, 2008; Jackson, 2012), it becomes clear that the research literature offers a cogent argument around the notions of sustainability and resilience, and their rising relevance in attempting to engage issues rooted in complexity.

The broad category of existing research seemingly makes is possible to infer that *complex social challenges* are to some extent related to the notions around sustainability – which is, in and of itself intrinsically connected to the concept of resilience.

If such an inference were true – and if sustainability and resilience might be considered as key dimensions capable of 'cutting across' the various aspects of both social issues and natural ecosystemic considerations, then the category of *complex social challenges* might perhaps be most successfully viewed through this combined lens.

This approach might offer additional options and possibilities in reframing key questions around the *complex social challenges* – and assessing them from the perspective of, whose resilience is being supported and enhanced by the various ecosystem transactions and emergent outcomes; as well as, whether such dynamics effectively support and enable the larger ecosystem sustainability over the long term, within a broader set of enclosing and related social, natural and environmental contexts.

Assessment / Remediation Challenges

Based on the initial literature review, several key issues associated with performing assessments of *complex social challenges* can be suggested, from a high–level perspective.

Given that any potential remediation efforts are in principle based on the accuracy and relevance of the initial assessment, then it might be inferred that the resultant effectiveness will also be impacted by any preliminary findings and conclusions.

Future Impact Projections

Dependably on the time–scale horizon, it is challenging to accurately project the anticipated stresses and likely impacts on the natural ecologies and social ecosystems. This is in part due to the high interrelatedness and networked nature of ecosystemic components, the limitations around availability and reliability of data, and the intrinsic requirement to make assumptions around impact–projection scenarios.

Still, many attempts at producing some semblance of projections continue to be made by the various organizations, agencies, and governance authorities around the world.

Stakeholder Goals Alignment

Part of the challenge in understanding the current state and projecting future impacts in social or ecological environments is that not all parties – whether they might be world–wide natural resource management jurisdictions or various community, legislative or organizational stakeholders – might agree on how to interpret the actual current state, or how it might even be best assessed; including the possibility of agreement around the methods via which the current and future state might be most appropriately assessed and accurately projected.

In this sense, key stakeholders from the research, academia and science fields may not always agree with the postulations and methods from the industry, government or organizational stakeholders, for example; resulting in a situation where the stakeholder's goals might sometimes be aligned, and at other times misaligned – or aligned in principle, although across different implied time–scales.

Additionally, stakeholder objectives might not be aligned at all – as in boundary circumstances where the intrinsic goals of various institutions might be at odds with the objectives of specific organizations; such as, when the short–term financial, revenue or return on investment goals might not align with the long–term viability, sustainability or conservation objectives.

Feasibility of Positive Change

Adapting to Change

Given the key challenges that include an effective alignment of stakeholder goals as well as management of perspectives in the assessment of current and potentially desirable future states, we can see that the process of attempting to adapt to change – while enacting remediation strategies that are broadly shared and agreed upon – might not necessarily be a straightforward endevour.

This situation can be further exasperated when emergence of unpredictable events brings about a desire to *slow down* the process of change – so that one may better adapt to the altering conditions.

Paradoxically, this can create a 'drag force' of a certain kind – that can have a negative effect on evolving the actual adaptive capabilities due to a redirection of resources towards combating the process of change, instead of attempting to adapt to it.

Given that the process of accelerated global change is unlikely to significantly slow–down in the immediate and perhaps even foreseeable future, the potential effects of delayed remediation and adaptation can create increasing tensions; both within the *complex social challenges* themselves, and for the associated groups of stakeholders involved.

Imagining Shared Futures

Instead of avoiding or attempting to slow–down what might be perceived as 'external' or 'environmental' change, a more relevant question might be to inquire about what type of transformation might be most desirable – and, what kinds of shared futures might we be able to collectively imagine, and agree upon?

In that sense, a seeming pre–requisite for evolving an effective adaptation strategy might be an ability to re–imagine a set of improved shared futures – that open–up new possibilities, while encompassing effective remediations around the various *complex social challenges*.

Remediating Impacts

To what extent might it be possible to re–imagine shared futures – where the negative impacts of our *complex social challenges* are effectively remediated to some relevant extent?

Experienced collaboration researchers consider "future search as a living process" embedded in a stakeholder participatory approach that gets the "whole system in the room" – to enable "exploring the whole before acting on any part", as part of its core design (Weisbord, Weisbord, & Janoff, 2000).

And, what might be some challenges in the process of attempting such remediations?

In terms of transitions, any attempts at implementing a shared vision arguably need to include a consideration that any identified set of imagined preferred futures must be able to emerge from the bedrock of our current conditions – that effectively circumscribe the shared collective challenges we have co–created in the global setting, up to this point.

This seems to imply a sense of necessity where any remediation approaches must feature both the capabilities of gradual transformation and incremental continuity, in terms of being able to engage the systemic stakeholders towards enacting positive impacts.

If we are to effectively work together towards co–creating a positive shared future, it might be helpful to further explore and attempt to better understand two key areas;

First, what might be the key characteristics of *complex social challenges* – that seem to be able to both dynamically influence our stakeholders, and structurally change the very environment we are working within;

And second, how might we be able to best work together in the context of – while positively impacting – *complex social challenges*?

Enacting Positive Change

Before assessing the key characteristics and attempting to understand how might we best work together within the context of *complex social challenges*, it might also be relevant to consider the questions of immediacy and urgency.

In this sense, being able to enact positive change is related to the questions around how quickly might we need to implement any possible, relevant and available strategies – to effectively remediate some designated set of perceived negative impacts.

This raises questions around the necessities of urgency and timeliness, as part of informing any possible issue remediation strategies – and specifically in the context of risks of non–action.

Urgency of Timely Action

When attempting to effectively engage *complex social challenges*, a question around temporality is likely to emerge – around, why might it be relevant that such challenges need to be pursued in a timely fashion?

In part due to the high degrees of networked interrelatedness and a-causal impacts within the domain of *complex social challenges*, certain structural characteristics are posited to emerge when negative impacts can aggregate, build and evolve over time – with a capacity to accelerate risks categories, delineated as per below:

Table 1: Preliminary characteristics of complex challenges

IMPACT OVER TIME	HIGH–LEVEL ANALYSIS
Increasing asymmetries	• Critical challenges such as the climate change tend to not 'improve' quickly (Lazarus, 2008), and certainly if left to their own devices – without effective coordination and persistent action. Instead, they seem to feature increasing tensions and escalating negative impacts over time, if left unchanged; given that, "time is running out" (Levin, Cashore, Bernstein, & Auld, 2012). • The longer we wait to attempt to address such challenges, the more challenging they are likely to get – due to the increasing asymmetries within a given complex social challenge context. • In an environment where the stakeholders encounter "a class of problems that defy solution, even with our most sophisticated analytical tools", where the "the search for solutions is open ended", and where the stakeholders "champion alternative solutions and compete with one another to frame 'the problem' in a way that directly connects their preferred solution" (Roberts, 2000), it is feasible to anticipate that the experience of an actual 'problem' might degrade over time; for at least some of the participants. • This can lead to the phenomena of increasing 'asymmetries' between the key stakeholders, as supported by the lack of ability to effectively collaborate – in the presence of what researchers term as specific "normative problems", that are identified as "responsibility nexus", "risk

	of false assurance", "politics of urgency" and "claim to be on the knowledge frontier" (Wexler, 2009).
Depleting resources	• With the passage of time, there is a tendency towards an overall reduction of available shared resources – through a process sometimes referred to as the 'tragedy of the commons'; as the result of a "resource depletion driven by individuals acting in their own immediate interests" (Levin, Cashore, Bernstein, & Auld, 2012). • Due to the nature of how ecologies and ecosystems build exergy and create 'value' over time – and given that many shared resources are renewable only up to a certain critical point – non–action tends to bring about sets of conditions that challenge resource availability. This argues for a concerted effort towards re–evaluating and re–aligning the resource usage patterns.
Reduced sustainability	• The process of supporting the feasibility of prevailing socio–economic values and structures – including the notions of property, liberty and democracy (Box, Marshall, Reed, & Reed, 2001), disaster recovery (Peter Tatham & Luke Houghton, 2011), as well as ability to support human population scaling with the basic prerequisites of nutrition (Khan & Neis, 2010), housing and healthcare (Blackman et al., 2006; Braithwaite, Runciman, & Merry, 2009) – can be posited to be ultimately related to notions around sustainability. • Sustainability raises key questions – including the notions around, sustainability of what, for whom, for what reason, and for how long. Being able to make an effective discernment between structures that are necessary versus those that might represent a preference is challenging in the environment where stakeholder goals, viewpoints and perspectives are not entirely aligned. • This tends to further exacerbate the outstanding critical challenges, making them more accelerated and intense in some cases; with the associated risks of overall reductions in effective sustainability.
Reduced resilience	• Decreased ability of systems and ecosystemic actors to 'bounce back' in the face of unexpected perturbations can be considered from the perspective of reduced resilience. • This can lead to an increase in the overall 'fragility' of many systemic actors and ecosystemic stakeholders – giving rise to the goals of enabling capacities for local management (Patterson, Smith, & Bellamy, 2013), enacting private action to reduce public vulnerability (Auerswald, Branscomb, Porte, & Michel–Kerjan, 2006), and the development of strategies that "focus on reflexivity, on resilience, on responsiveness and on revitalisation" (Termeer, Dewulf, & Breeman, 2013).

Described from a systemic perspective, the interaction of the outlined factors creates reinforcing impacts over time – that might be represented as per below:

Figure 3: Complex challenge systemic interactions
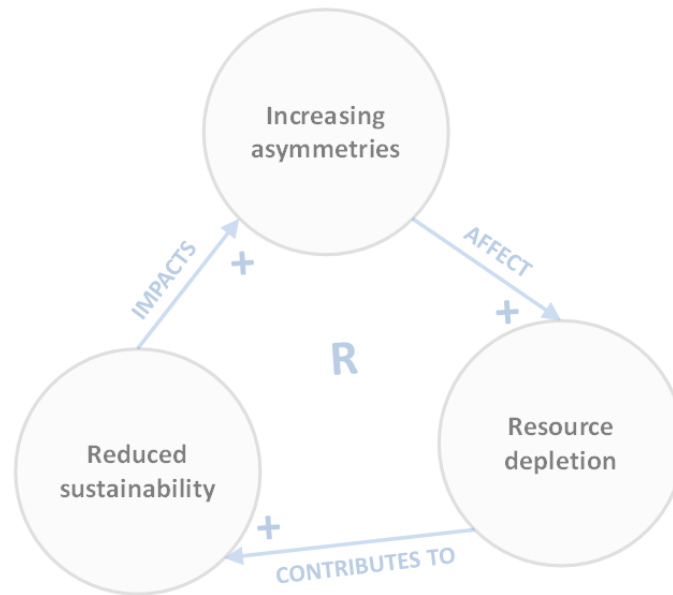
One challenge that might be immediately observed is that the interacting forces seem to reinforce one another through a systemic relationship;

Which presents certain challenges in the context of enacting effective remediations or some type of positive change in general.

Possibility of Enacting Change

Even if we were to agree on the relevance of urgent action, a question might arise as to whether – and to what extent – it might be possible to adapt, remediate and enact positive change in the context of broad–scale *complex social challenges* – that are inherently multi–faceted, and seemingly largely unstructured.

How might it be possible to go about understanding complex societal issues – to build additional ecosystem sustainability and resilience, as key enablers of shared imagined futures?

One consideration is to identify the key factors that might make *complex social challenges* resilient to change – and the types of dynamics that might allow their enclosing social systems to 'persist' in maintaining the various behaviours that tend to keep them in place.

Recent research points out that a key issue in enacting successful change in complex environments might be related to the fact that not all 'problems' may be considered in the same cognitive space.

This is a claim of the Cynefin framework – structured as a sense–making approach that segments issues into 'simple', 'complicated', 'complex' and 'chaotic' – that challenges the "universality of three basic assumptions prevalent in organizational decision support and strategy: assumptions of order, of rational choice, and of intent"; with a goal of assisting the "group sense–making and discourse scenarios" (Kurtz & Snowden, 2003).

To explore the key underlying dynamics of *complex social challenges* – that might further elucidate the grounds within which such assumptions take place – we consider the conceptual frameworks of 'wicked problems', 'social messes', 'post–modern complexity' and 'problematiques' –

To obtain a deeper appreciation of any underlying phenomena, and as a way of enabling potential adaptation efforts and remediation initiatives.

Understanding Complexity

Frameworks for Understanding '*Complex social challenges*'

The research literature over the last 50 years or so offers several important and foundational conceptual frameworks, that represent core research attempts in understanding social phenomena of emerging and often escalating complexity.

The key frameworks considered – and their associated core concepts – are summarized as per below:

Table 2: Key frameworks for understanding complex social challenges

CONCEPT	SOURCE	SUMMARY
'Wicked Problems'	(Churchman, 1967; (Rittel & Webber, 1973)	Posits non–deterministic effects, influenced by the intrinsic uncertainty and lack of alignment in stakeholder problem definition and understanding.
'Problematiques'	(Ozbekhan, 1970; Christakis, 2006)	Proposed by the 'Club of Rome', a global 'problematique' consisting of many inter–dependent challenges. Authors offer 49 initial examples – termed *Continuous Critical Problems (CCPs)*.
'Social Messes'	(Ackoff, 1974)	Posits a macro lens on social challenges, as complexes of intertwined issues, building up to the notion of 'messes' – with emphasis on continuous adaptation and learning approaches.
'Post–Modern Complexity'	(Cilliers, 1998)	Emphasizes understanding of non–linear emergent behaviours with leading mathematical techniques such as chaos theory, network and agent modelling – while acknowledging deeper limitations of post–modernity.
'Super–Wicked Problems'	(Levin, Cashore, Bernstein, & Auld, 2012)	Posits a further level of complexification where asymmetries in time, participation and authority distribution generate future irrationally in policy and other remediation responses.

Although all the frameworks outlined above contribute something arguably tremendously valuable and unique towards our shared sense of understanding, the following sections will briefly examine three key conceptual frameworks that are most relevant to this study – namely, the notions of 'wicked problems', (social) 'messes' and the 'problematiques' – as core vehicles for attempting to understand the key features associated with *complex social challenges*.

In this way, this paper hopes to attempt to discover the unifying features of these types of challenges – and correspondingly, to devise methods for attempting to engage them in some way that is both meaningful and potentially effective.

Wicked Problems

"For every complex problem there is an answer that is clear, simple and wrong." – H. L. Mencken

Introduction

The concept of 'wicked problems' was formally introduced in the paper *"Dilemmas in a General Theory of Planning"* by Horst Rittel and Melvin Webber in 1973 – as inspired by their experiences of intrinsic challenges involved in the process of urban planning in California (the paper was released out of the UCLA).

Horst Rittel started exploring 'wicked problems' years earlier – as relayed by West Churchman in a guest editorial in 1967, where he attests to being introduced to the concept by Prof. Rittel at a conference workshop.

The development of the 'wicked problems' concept was revolutionary from several important perspectives – and perhaps principally because it introduces a category of challenges that are fundamentally different from the more familiar problem–areas, that can be reliably 'solved' using traditional (or 'linear') problem–solving approaches.

In terms of key highlights, 'wicked problems' are posited to share several distinguishing characteristics – including:

- **a lack of shared agreement among the key stakeholders on what the fundamental issues are**
  - Recognizes that different aspects of a 'wicked problem' might be highlighted as relevant – where, the initial definitions of the perceived 'problems' are likely not entirely aligned among the key stakeholders.

- **no pre–defined heuristic for managing 'wicked problems'**
  - Postulates that there are generally no agreed–upon methods for resolving 'wicked problems' – where, there might be multiple potentially valid options and action strategies.

- **'no stopping rule'**
  - Recognizes that the work of associated with 'wicked problems' is not necessarily likely to be 'completed' in a finite sense – and that, it might not be easy to recognize when to stop any in–progress efforts.

Definition of 'Wicked Problems'

More formally, the ten criteria are listed as per below (Rittel & Webber, 1973):

Table 3: Wicked problems key characteristics

#	SUMMARY	CHARACTERISTIC
1	**No definitive formulation**	• "There is no definitive formulation of a wicked problem" (p. 161)
2	**No stopping rule**	• "Wicked problems have no stopping rule" (p. 162)
3	**Not true–or–false**	• "Solutions to wicked problems are not true–or–false, but good–or–bad" (p. 162)
4	**No immediate / ultimate test**	• "There is no immediate and no ultimate test of a solution to a wicked problem" (p. 163)
5	**Every attempt counts**	• "Every solution to a wicked problem is a "one shot operation"; because there is no opportunity to learn by trial–and–error, every attempt counts significantly" (p. 163)
6	**No enumerable solutions**	• "Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well–described set of permissible operations that may be incorporated into the plan" (p. 164)
7	**Each problem is unique**	• "Every wicked problem is essentially unique" (p. 164)
8	**Each problem is symptom of another**	• "Every wicked problem can be considered to be a symptom of another problem" (p. 165)
9	**Explanation determines resolution**	• "The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution" (p. 166)
10	**High stakes**	• "The planner has no right to be wrong" (p. 166)

Overview

The authors emphasize that the "search for a scientific bases for confronting problems of social policy is bound to fail, because of the nature of these problems' (Rittel & Webber, 1973) – and especially recognizing that, "science was developed to deal with 'tame' problems".

A key contention around the core of 'wicked problems' are policy–related issues that 'cannot be definitively described'.

Given that, 'in a pluralistic society there is nothing like the undisputable public good, there is no objective definition of equity, policies that respond to social problems can not be meaningfully correct or false, and it makes no sense to talk about "optimal solutions" to social problems unless severe qualifications are imposed first' –

Further recognizing that, there are "no 'solutions' in in the sense of definitive and objective answers" (Rittel & Webber, 1973).

As counterpoint, the authors emphasize the need to shift attention to the purposefulness ("what do systems do?") as opposed to merely considering their components ("what are they made of?"); while challenging the reader to consider the 'most difficult question of all' – namely, "what should these systems do?" – as a way of exploring key notions around desired outcomes.

Efficiency Orientation

In their analysis, Rittel and Webber also draw attention to the historical roots of our modern modes of reasoning – pointing out that, industrialism and the emergence of planning were "dominated by the pervasive idea of efficiency", that had "emerged from the 18th century physics, classical economics and the principle of least–means".

In this context, efficiency was seen as a "powerful idea" that had "long been a guiding concept of civil engineering, the scientific management movement", and "much of the contemporary operations research" – in such a way where, it "still pervades modern government and industry" (Rittel & Webber, 1973, p. 158).

Legacy of Planning

The impact of efficiency was such that planning "was then seen as a process of designing problem–solutions that might be installed and operated cheaply" – an approach that worked well for a period of time, since it was "fairly easy to get consensus on the nature of problems during the early industrial period", where a given task could be "assigned to the technically skilled, who in turn could be trusted to accomplish the simplified end–in–view" – contrasting to the case of more complex challenges, it was possible to "rely upon the efficiency expert to diagnose a problem and then solve it, while simultaneously reducing the resource inputs" (Rittel & Webber, 1973, p. 158).

'Problems' as Open Systems

Rittel and Webber contrast these historical approaches with the modern needs – where, the emphasis might shift more towards "learning to ask whether what we're doing is the right thing", and "to ask questions about the outputs of actions, and to pose problem statements in valuative frameworks" (Rittel & Webber, 1973, p. 158).

Clearly, the authors argue for a very different approach to planning and problem–solving – where we might "see social processes as the links tying open systems into large and interconnected networks of systems", where "outputs to one become the inputs of others" (Rittel & Webber, 1973, p. 159).

The authors point–out that, in such structural frameworks "it has become less apparent where the problem centers lie, and less apparent *where* and *how* we should intervene even if we do happen to know what aims we seek" (Rittel & Webber, 1973, p. 159).

Waves of Repercussions

A key contention outlined is that "we are now sensitized to the waves of repercussions generated by a problem–solving action directed to any one node in the network" (Rittel & Webber, 1973, p. 159), where "we are no longer surprised to find it introducing problems of greater severity at some other node."

The result, the authors argue, is that "we have been forced to expand the boundaries of the systems we deal with, trying to internalize those externalities".

This seems to suggest a situation where, attempting to 'resolve' any one of the nodes in a network – without understanding the true causes of a given problem–situation – might lead to narrow or broad repercussions elsewhere in the network; and potentially with even more severe impacts.

Limitations of Expertise

Rittel and Webber are critical of the claims of the professionals – such as systems analysists – as making a claim to be able to perform as "universal problem solvers", able to "take on anyone's perceived problem", in order to diagnostically "discover its hidden character" and then skillfully "excise its root causes."

The critique of professionals and the limitations of the domains of expertise has been recognized as a situation where the analysts themselves "have been caught by the very same diagnostic difficulties that troubled their clients" (Rittel & Webber, 1973, p. 159).

Problem / Action Ambiguity

Importantly, Rittel and Webber postulate that "one of the most intractable problems is that of defining problems (of knowing what distinguishes an observed condition from a desired condition) and of locating problems (finding where in the complex causal networks the trouble really lies)" (Rittel & Webber, 1973, p. 159).

The authors contrast the ambiguity of effectively defining a problem with the feasibility of enacting meaningful action – where a key challenge is posited as "identifying actions that might effectively narrow the gap between what–is and what–ought–to–be."

A key implementation issue is identified as a set of engagement circumstances where "as we seek to improve the effectiveness of action in pursuit of valued outcomes, as systems boundaries get stretched, and as we become more sophisticated about the complex workings of open societal systems, it becomes ever more difficult to make the planning idea more operational" (Rittel & Webber, 1973, p. 159).

Envisioning Outcomes

In terms of possible alternative strategies for planning and envisioning outcomes, the authors argue that many have "an image of *how* an *idealized* planning system would function" (Rittel & Webber, 1973, p. 159).

A new way of structuring idealized planning is posited as more of an "on–going, cybernetic process of governance, incorporating systematic procedures for continuously searching out goals, identifying problems, forecasting uncontrollable contextual changes, inventing alternative strategies, tactics, and time–sequenced actions, stimulating alternative and plausible action sets and their consequences, evaluating alternatively forecasted outcomes, statistically monitoring those conditions of the publics and the systems that are judged to be germane, feeding back information to the simulation and decision channels so that errors can be corrected – all in a simultaneously functioning governing process" (Rittel & Webber, 1973, p. 159).

However, the authors argue that "such a planning system is unattainable, even as we seek more closely to approximate it", and posit that it is "even questionable whether such a planning system is desirable" (Rittel & Webber, 1973, p. 159).

Key Conceptual Contributions

In terms of contributing to our overall understanding of complex challenges, Rittel and Webber's analysis offers many conceptual advancements;

Where, the 'wicked problems' are posited to further our understanding in terms of the following:

Table 4: Wicked problem framework key conceptual contributions

Key Feature	Abbreviated Description
'Tame' Is Not 'Wicked'	• Some issues belong to a category of 'wicked problems', where the classical methods of addressing 'tame' challenges are no–longer universally applicable
Problems as Open Systems	• Boundedness of 'wicked problems' is not deterministic in a sense of definitive heuristics – given their apparent nature that's more aligned with open systems
Problem Ambiguity	• 'Wicked problems' consist of issues that are inherently ambiguous, due to a lack of absolute value agreements on a social scale, and differences between stakeholders
Limits of Rationality	• May not be understood by using exclusively rational skills, tools, techniques and cognitive approaches – and instead, require an expansion of capabilities

One–Time Interventions with Consequences	• 'Wicked problems' are sufficiently unique that it is in principle not possible to replicate them in a lab, and run a 'safe experiment' prior to implementation – in such a way where, 'every attempt counts' and has consequences
Planning Obligation	• Planners have an obligation to differentiate 'wicked' from 'tame' problems, and to treat them accordingly – since, every action has potentially severe consequences.

Legacy of 'Wicked Problems'

Rittel and Webber make their argument so persuasively that, even an astute reader might be left somewhat disheartened around the possibilities of being able to effectively deal with and engage these types of social challenges – that seem to be fundamentally rooted in complexity.

One question that might be relevant and that arises from a theoretical perspective is to consider, are the 'wicked problems' the largest category of aggregative types of social issues?

And, might there be other useful frameworks and conceptual constructs that might be able to provide some further basis for the evaluation of these types of social phenomena?

An investigation of the 'Social Messes' framework – as proposed by Ackoff – is posited to be of some further theoretical significance; and is explored next.

Messes

The concept of 'messes' was introduced by Ackoff in 1974, in his book *Redesigning the Future* –

Where, 'messes' are defined as social realities comprised of a myriad of interacting and intertwined issues – some of which might, in and of themselves be considered as 'wicked problems'.

In his initial analysis, Ackoff highlights the importance of solving the right problem – noting that, "ssuccessful problem solving requires finding the right solution to the right problem", and observing that "we fail more often because we solve the wrong problem than because we get the wrong solution to the right problem" (Ackoff, 1974, p. 8).

Systems of Strongly Interacting Problems

In his subsequent work, Ackoff observes that a key issue around problems is that they are not "objects of direct experience", and instead postulates them as "abstractions extracted from experience by analysis" – advising that, we are "almost never confronted with separate problems but with situations that consist of complex systems of strongly interacting problems" (Ackoff, 1979).

Ackoff suggests to "call such systems of problems *messes*" – highlighting their ambiguous, interrelated nature consisting of 'strongly interacting' components, where the "behavior of a mess depends more on how its part interact then on how they act independently of each other" (Ackoff, 1979) – that aggregates to a situation where "reality consists of systems of problems" (Ackoff, 1985). A key identified contentious feature is that 'messes' may not be easily separated into individuated sets of independent components.

Ackoff postulates that, "when a mess, which is a system of problems, is taken apart, it loses its essential properties and so does each of its parts" – where, "the behavior of a mess depends more on how the treatment of its parts interact than how they act independently of each other", and where managing messes is a situation in which "a partial solution to a whole system of problems is better than whole solutions of each of its parts taken separately" (Ackoff, 1979).

Managing Messes

As a key critique of the prevailing approaches, Ackoff observes that it is "standard practice to reduce messes to lists of problems: to prioritize and treat them separately, as self–contained entities" – whether that is effective or possible – given that, most people "do not generally now how to deal effectively with messes, with reality taken as a whole" (Ackoff, 1979). Ackoff proposes that an "effective management requires dissolving messes, not solving or resolving problems" – offering four distinct possible strategies:

Absolution	✓ Posited as, "to ignore a problem or mess and hope it will take care of itself and go away of its own accord." (Ackoff, 1979) ✓ Ackoff argues that this is a 'default' strategy for managing problems - and that, it is attractive because it is "much more difficult to attribute responsibility for not doing something that should have been done than for doing something that should not have been done."
Resolution	✓ Described as, "to do something that yields an outcome that is good enough, that 'satisfices'." (Ackoff, 1979) ✓ In this case, the process involves "a clinical approach to problems or messes, one that relies heavily on past experience, trial and error, qualitative judgement, and so-called common sense" - focusing more on the "uniqueness of a problem or mess than on what it has in common with other problems."
Solution	✓ Explained as, "to do something that yields or comes as close as possible to the best possible outcome, something that optimizes." (Ackoff, 1979) ✓ Involves "a research approach to problems or messes, one that relies heavily on experimentation, quantitative analysis, and uncommon sense" - focusing more on the "general aspects of a problem or mess than its uniqueness."
Dissolution	✓ Posited as, "to redesign either the entity that has the problem or mess, or its environment, in such a way as to eliminate the problem or mess and enable the system involved to do better in the future than the best it can do today, in a word, to idealize." (Ackoff, 1979) ✓ Focuses "equally on the generality and uniqueness of a problem or mess, and it employs whatever technique, tools and methods—clinical or scientific—that can assist in the design process"; where, after a 'dissolution' the original problem is no longer present, and potentially even turned into an opportunity or strength.

In offering this type of analysis, Ackoff effectively proposes a typology of approaches for engaging with and managing complex challenges –

Introducing a key notion where, a particular engagement approach might correspond to the degree of focusing on either a specific problem itself, or the larger context of relationships within the enclosing broader 'mess'.

Social Messes

Horn and Weber extends Ackoff's ideas around 'messes' a step further – arguing that, "a Social Mess is a set of interrelated problems and other messes. Complexity—systems of systems—is among the factors that makes Social Messes so resistant to analysis and, more importantly, to resolution" (Horn & Weber, 2007)

Definition of Social Messes

Horn and Weber (2007) consider a 'social mess' as possessing key defining characteristics, that include:

Figure 4: Characteristics of 'social messes'

- ✓ 'No unique "correct" view of the problem'
- ✓ "Different views of the problem and contradictory solutions"
- ✓ "Most problems are connected to other problems"
- ✓ "Data are often uncertain or missing"
- ✓ "Multiple value conflicts"
- ✓ "Ideological and cultural constraints"
- ✓ "Political constraints"
- ✓ "Economic constraints"
- ✓ "Often a–logical or illogical or multi–valued thinking"
- ✓ "Numerous possible intervention points"
- ✓ "Consequences difficult to imagine"

Cognitive Flexibility

An interesting observed feature is that 'social messes' might require different modes of cognition to engage effectively – that authors posit include 'a–logical', 'illogical' and 'multi–valued thinking'.

Cognitive flexibility is presumably needed to address what the authors term as 'considerable uncertainty' and 'ambiguity' – coupled with consequences that are 'difficult to imagine' in the midst of political, economic and value conflicts and constraints.

Such cognitive flexibility is further posited to be necessary when attempting to manage "numerous possible intervention points" – where those attempting to intervene are likely to additionally encounter a "great resistance to change" (Horn & Weber, 2007).

Key Conceptual Contributions

In terms of contributing to our overall understanding of complex challenges and problems rooted in complexity, Ackoff's analysis – and the subsequent extensions by Horn and others – significantly help in delineating several key features;

Namely, where 'social messes' are posited to further our understanding in terms of the following:

Interrelatedness	✓	'Messes' consist of many components that are intrinsically interrelated, and that combine into a larger whole - where both parts and their relationships are critical
Indivisibility	✓	'Messes' may not in principle be divided into sub-components - because the sub-segmentations do not behave in the same way as the larger 'problem mess' whole
Messy Management	✓	Shift from 'clear resolutions' to 'mess management' strategies, where each potential approach yields a different type of an outcome
Multi-Intervention Points	✓	Shift from a single 'problem to be solved' to attempting to manage multiple possible intervention points, in order to effectively engage 'social messes'
Multi Cognitive	✓	Shift from clear problem-solving approaches to multiple cognitive abilities required to understand and potentially successfully understand 'social messes'.

Legacy of 'Social Messes'

The notions of 'messes' and 'social messes' extend our conceptual understanding of the initial postulations found in the definition of 'wicked problems' –

While effectively proposing an aggregative category of societal issues that are indivisible in a classical divide–and–conquer analytical sense, while requiring enhanced engagement tolls and cognitive abilities.

Considering this rich conceptual legacy, one might inquire as to whether there might be any additional theoretical or other frameworks that are relevant – and in towards the notion of structural understanding of complex challenges, and of any relevant properties that might be considered from an instrumental perspective.
A framework that is posited to be instructive in this endevour is that of problematiques – as introduced by Christakis et. al. (1973).

Problematiques

The concept of the 'Problematique' was introduced in the paper *Predicament of Mankind* as the result of a collaboration between Christakis, Ozbekhan and Peccei (Ozbekhan, 1970), and published by 'The Club of Rome' – as a proposal for addressing a confluence of global challenges that were deemed as highly interconnected, tenuous and demanding of new kinds of conceptual understanding and methodological approaches.

The proposal argued that the global challenges of the modern world are so highly interrelated that it is neither productive to consider them in isolation, nor effective to address them in an independent fashion.

As an example, the group identified 49 highly interrelated challenges, that they labelled as *'Continuous Critical Problems (CCPs)'* – that include key issues such as access to food, the problem of pollution and the continuously escalating population growth; which, via the vehicle of complex interactions, give rise to the "emergence of a new entity called in the proposal the global Problematique" (Bausch, n.d.).

The paper appears to be an attempt to compensate for what the authors perceived to be a methodological, philosophical and conceptual gap for "addressing the complexity and multidimensionality of the Problematique" (Bausch, n.d.) – while offering a range of new perspectives and considerations for working with complex challenges.

Summary of Key Features

The *Predicament of Mankind* (Ozbekhan, Christakis & Peccei, 1970) posits the 'problematique' as a new kind of emergent global challenge – one whose manifest observable effects appear as very much different from the customary, more 'linear' problem–domains; within which it was previously possible to successfully leverage various heuristic–based problem–solving approaches such as numerical methods, quantifiable tools and analytical techniques utilized in fields such as the Operational Research (OR).

If one were to attempt a meta–conceptual synthesis of the underlying assertions posited by this groundbreaking paper, it might perhaps be argued that the authors recognized the need for new approaches in response to identifying the presence of an entirely new class of environmental conditions – that we might consider as 'asymmetries' of a certain kind. Arguably, such conditions were largely not present in the previous historical discourse – and certainly not to the extent made manifest in the dynamics of the problematique itself.

Why choose to term the proposed meta–conceptual manifestation of such conditions as, 'asymmetries'? And in particular, what might we claim is so 'asymmetrical' about them?

If we were to consider the opposite condition – that of proposed 'symmetry' – we might consider a situation where the exigency of a given challenge is met with an effective, and in a certain sense 'symmetrical' response of readiness; given an available set of resources and capabilities available to meet such a challenge.

We then might argue that the opposite might also be true; and in particular that, when faced with a set of challenges for which we might not feel to be adequately equipped to effectively address – whether in terms of the available resources, capabilities or the conceptual, socio–cultural, institutional or methodological tools, instruments and structures – we might then argue that a condition of 'asymmetry' exists; one where we are not actually able to readily and effectively address or engage a given set of challenges, and where we might not feel entirely prepared to meet the exigency of a given set of challenges in a satisfactory manner.

Based on the arguments presented by Ozbekhan, Christakis and Peccei (1970), a meta–conceptual synthesis and the proposed associated asymmetries – are listed as per below:

Scale Asymmetries	✓ Challenging to effectively ascertain relevant scales of impacts and influences ✓ Engaged with cross-scale asymmetries (institutional, political, cultural)
Temporal Asymmetries	✓ Challenging to match time-scales around effective analysis and identification of any potential solutions to the impedance of adaptations and rapid evolution of a global-local problematique
Change Asymmetries	✓ Challenging to effectively adjust rates of change in instrumental tools (policies, institutions, political systems) to the rates of change of 'problems' within the evolving complex situation
Methodological Asymmetries	✓ Challenging to devise effective methods ✓ Myriad of challenges interacting within a given problematique tends to be resistant to traditional heuristics and analytical methodological approaches

Expectation Asymmetries	✓ Challenging to converge on stakeholder expectations ✓ Lack of alignment in 'ethos, morality, ideals, institutions'
Attitude Asymmetries	✓ Challenging to emerge effective stakeholder attitudes that meet exigencies of the problematique
Cognitive Asymmetries	✓ Challenging to shift from considering complex situations as 'problems' with immediate possible 'solutions', to a way of thinking capable of addressing underlying complex dynamics
Understanding Asymmetries	✓ Challenging to leverage cognitive processes to arrive at a vision capable of effectively addressing the problematique ✓ Challenging to understand the actual underlying issues
Action Asymmetries	✓ Challenging to identify definitive action strategies that will be effective with some required degree of certainty ✓ Problematique generates polarized dissonances that contribute to inaction

As such, the proposed problematique summary characteristics – expressed as 'asymmetries' – encapsulate the high–level features that hint at the underlying tensions within the complexes of interconnected, global challenges.

This master's research paper posits that that the uncovered asymmetries might also 'interact' and actively influence one another – as per below:

Figure 5: Complex interacting asymmetries
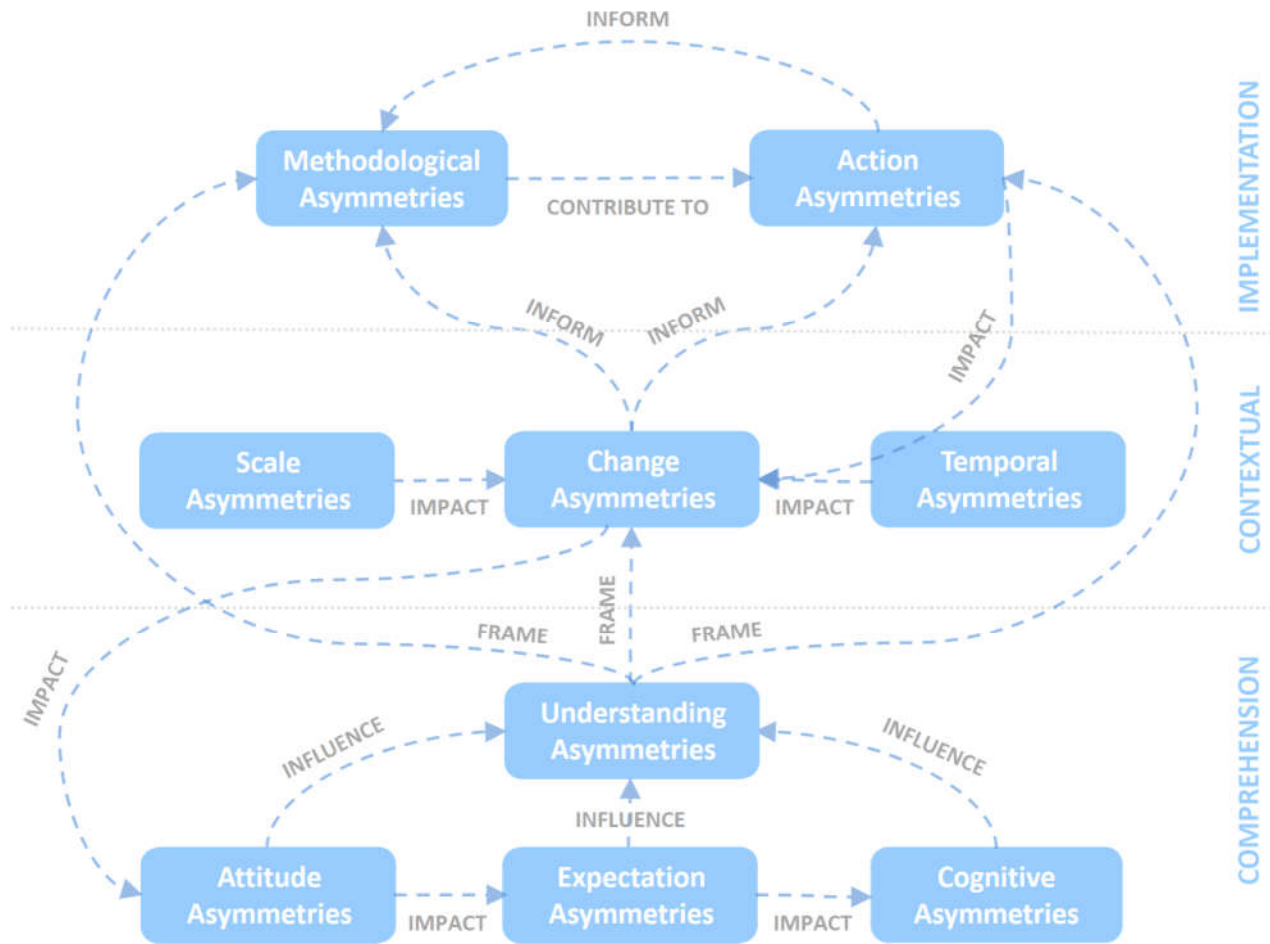
In continuation, it might also be interesting to identify more detailed features embedded within the concept of a problematique – and, to investigate what inter–related characteristics might be implied and represented.

Detailed Conceptual Characteristics

As posited by the authors, the notion of a global 'problematique' necessarily engages us in many additional conceptual, philosophical and methodological challenges.

Problematique Structural Characteristics

As such, some of the proposed principles and their associated conceptual characteristics – argued to be associated with the notion of a global problematique – are posited as per below:

Aggregative and Systemic	✓ **Problem' as Reflection of System-State**: 'Problems' are a reflection of an interpretation of a current or future state that might not correspond to the interpretations of previous system-states ✓ **Events as Components**: Events viewed as intrinsic 'components' of larger systemic structures ✓ **Aggregative Systems**: Structures aggregate into larger complexes that cannot be modelled using exclusively 'linear' approaches ✓ **Meta-system of Problems**: Aggregative systems coalesce into larger complexes that contain groups of meta-problems that generate additional meta-systems and give rise to a 'problematique'
Complex and Non-Linear	✓ **Complex Interconnections**: Complex links between 'problems' make it challenging to 'resolve' related issues independently or in an isolated fashion ✓ **Non-Linear Relationships**: Non-linear relationships - characterized by their highly interdependent nature - bring about conditions that give rise to unpredictable effects ✓ **Interconnected, World-wide Problematiques**: High degree of complex interconnections coupled with non-linear relationships create the world-wide problematiques ✓ **Transcending Boundaries**: World-wide problematiques feature systemic characteristics that tend to transcend institutional, regional and cultural boundaries
Dynamical and Emergent	✓ **Dynamical Situations**: 'Problem-situations' within a given problematique are dynamical and feature constant bi-directional interactions with events and any attempts to enact change ✓ **Short Time-Scales**: Time-scales are short and often getting shorter - as the effects and impacts of a given problematique accelerate ✓ **Emergent Impacts**: Dynamic relationships give rise to emergent impacts that are often unpredictable yet evolutionary in nature ✓ **'Acausal' Systemic Resonances**: Challenging to determine possible and likely impacts with a sufficient degree of accuracy - making it difficult to link 'cause' and 'effect'.

Now that we have considered the proposed meta–synthesis of the key features and principles of the problematiques, it might be useful to consider the characteristics of the participating stakeholders.

Stakeholder Characteristics

The list of posited stakeholder principles and characteristics is as per below:

Problem-Solution Perceptual Fragmentation	✓ **Problem-Solution Mindset**: Participants in a problematique tend to have a problem-solution mindset ✓ **Perceptive Fragmentation**: Human perception tends to parse-out objects and phenomena as discrete in themselves – instead of, parts of complex systems within in a continuum of relationships ✓ **Orthodox Solutions Orientation**: Stakeholders often believe that it is possible to propose external solutions to 'problems' by manipulating them
Unaligned Value-base and Understanding	✓ **Lack of Value-base Alignment**: Value-base alignment is largely lacking among diverse stakeholders - and yet it is necessary to ensure a problematique can be engaged in a cohesive manner and towards well-defined ends ✓ **Unclear Understanding**: It is challenging to understand the phenomena within a given problematique in terms of their nature, boundaries, 'future implications', and even a separation of 'causes' from 'symptoms' ✓ **Multiple Interpretations**: Multiple possible yet seemingly valid interpretations might be cognized around the same observable phenomena

Ecosystemic Characteristics

Importantly, the authors frame the problematique as a concept that firmly resides within the notions of ecosystems and ecologies.

A further insight that seems extraordinarily useful around engaging various stakeholders seems to be that – for one to be effective in engaging within such ecosystems, that are comprised of many characteristics – one must by necessity establish a shared value–base; namely, that value which is characterized as 'good'.

As such, the authors advance the notions of 'ecosystem balance' to be that value–base that is considered as 'good' in an ecological context.

The idea is also put fort to consider ecologies from a networked perspective. The summary of the key assertions and principles is provided as per below:

Multi-Dimensionality of Ecosystem Balance	✓ **Ecosystem Imbalance as Pathology**: Ecosystem imbalance is viewed as the state of 'pathology' leading away from the healthy state of dynamic equilibrium ✓ **Complex Networked Ecologies**: Complex ecologies are comprised of multidimensional relationships between a variety of entities, giving rise to network characteristics ✓ **Ecosystemic Balance as Value-Base**: Ecological balance is viewed as the primary value within complex and networked ecosystems
Limitations of Ecological Analysis	✓ **Challenges of Ecological Analysis**: The scope of ecological analysis is limited due to a large number of characteristics to be possibly measured - which forces selective criteria on the elements to be focused on

Ecosystem Criteria

The authors argue that – to attempt to understand ecosystem–wide impacts and ecological behaviours – specific elements need to be explored from the perspective of the 'fundamental criteria that apply to ecosystems': (Ozbekhan, Christakis & Peccei, 1970, p. 26).

As such, the authors posit fundamental ecosystem criteria are – with a capability of interacting and building a set of complex evolving conditions, as per below:

- Temporality
- Spatiality
- Quality
- Quantity
- Complementarity
- Mutual–determination
- Competitiveness
- Synergy

Ecosystem Evolving Conditions

With the help of considering the fundamental 'ecosystem criteria', Ozbekhan, Christakis and Peccei (1970) offer a perspective on considering the key elements for identifying and measuring the evolving ecosystem conditions.

To some extent, the authors recognize the presence of a 'measurement problem' – where there are many uncertain unknown variables, the totality of which may not in principle be comprehensively understood or fully measured; however, where we nevertheless must select some sub–set to be deemed as 'relevant', in order to attempt to sufficiently understand the totality or some sub–segment of a given problematique.

As such, the key elements to be considered are posited as per below:

Figure 6: Evolving ecosystemic conditions
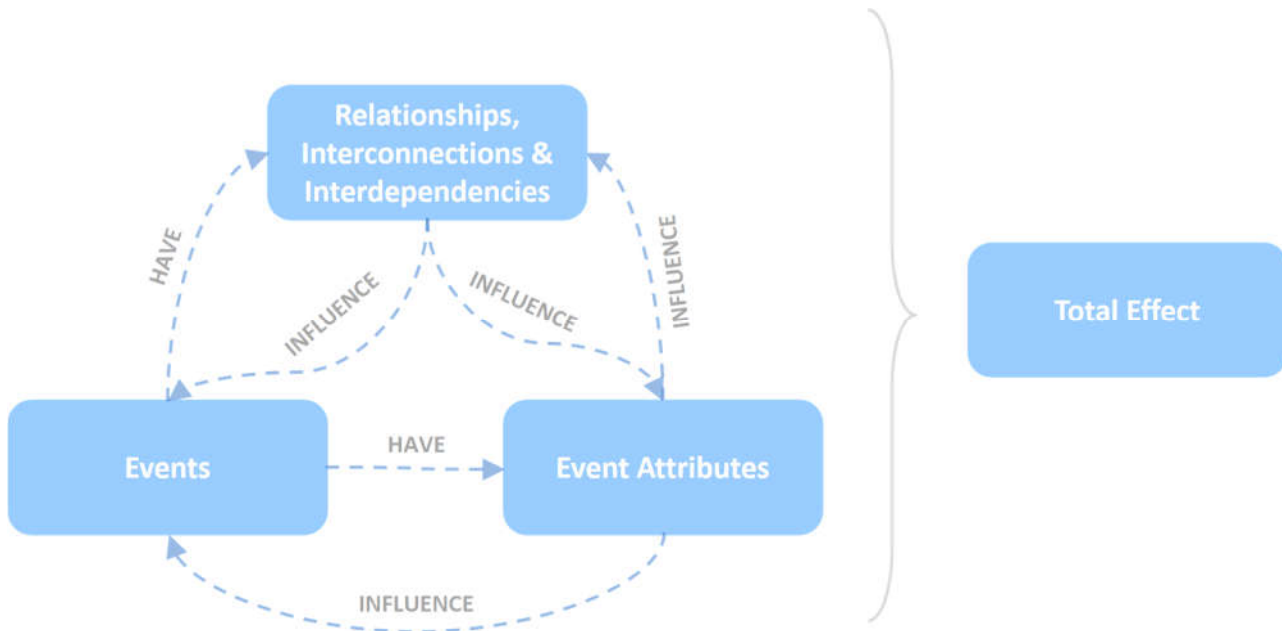
Having considered a range of summarized and detailed characteristics, it is useful to review some possible examples of an active global problematique.

Continuous Critical Problems

The authors provide a set of examples for the key challenges that encapsulate the outlined criteria, identifying them as having the 'continuous' property – in terms of their ongoing evolution, adaptation and change within the context of the overall situation.

As such, the 'Continuous Critical Problems' represent a broad category of challenges that might appear as analogous in terms of considering them as highly interdependent and continuously interacting, while featuring uneven rates of intensity and occurrence throughout the world.

Key Approaches

The authors also hint at the key considerations that might inform general approaches – as per below:

Deeper Understanding through Methodological Synthesis	✓ **Insufficiency of Determinism**: Necessary to recognize the insufficiency of mere determinism when dealing with the problematique in its totality, or some key aspects of it ✓ **Deeper Understanding**: May necessitate methodological inventiveness and a synthesis of various heuristics and techniques ✓ **Need for Comprehensive Analysis**: Need to understand the actual essence of 'events' - along multiple and possibly relevant dimensions of manifestation ✓ **Methodological Challenges**: Due to the innate complexity of the problematique, it is necessary to arrive at a 'unifying framework of concepts' that can provide a 'solid methodological basis'
Future Value-Base Orientation	✓ **Clarify Systemic Characteristics**: Understanding systemic characteristics is necessary to distinguish between the critical vs. non-critical dynamics and behaviours ✓ **Futurity Differentials**: Situations are viewed as problematical only from the perspective of the 'futurity differential' - where either a past situation is viewed as preferable to the present one, or a future situation is defined as ideal ✓ **Future Value-Base Orientation**: In order to engage in systemic analysis and identify a course towards some future state that's deemed as preferential, it is necessary to establish a governing value-base; such as, for instance, the value of 'ecological balance'
Dynamic Engagements with Feedback Loops	✓ **Shared Value-Base**: A shared value-base is necessary to establish an 'agreed upon image' of a preferred future towards which change might be considered ✓ **Dynamic Engagements**: Engagements must be dynamic and adaptive, in order to match the evolutionary nature of the problematique ✓ **Feedback-Based Goals, Means & Objectives Refactoring**: Feedback loops are necessary in order to obtain relevant input from the evolving situations within the problematique - so that the any respective goals, means and objectives might be adjusted in a relevant manner
Uncovering Meaning with Cognitive Synthesis	✓ **Uncovering New Meanings**: Requirement to understand the evolving nature of the problematique from the perspective of uncovering new meaning - both in terms of identifying dynamic patterns and discovering new relevant configurations ✓ **Descriptive Conceptual Model**: Need for a descriptive conceptual model capable of sufficiently encapsulating the perceived reality of the problematique - that can enable an exploration of the alternate problem-set configurations ✓ **Level of Cognition**: from which a problematique is perceived have to be taken into consideration, in order to enable an effective synthesis of methods and approaches

Key Conceptual Contributions

In summary, the concept of a 'global problematique' appears to add a substantive amount of structural understanding, conceptual possibility and methodological value to the endeavour of attempting to understand complex challenges – from the problematique, stakeholder and ecosystem perspectives, as well as the considerations of their underlying asymmetries;

While offering many important frames for considering options for what might constitute effective engagement and positive action.

Next, a proposed conceptual synthesis between the analyzed frameworks is explored –

As an that attempt at unifying key learning from the notions of 'wicked problems', 'social messes' and 'problematiques' into a single coherent whole – and a potential governing framework for informing the possibilities of effectively engaging *complex social challenges* to a further level of detail.

Conceptual Synthesis

After an initial investigation, the conceptual frameworks of 'wicked problems', 'social messes' and 'problematiques' are posited to share specific characteristics – identified and specific challenges and domains – that are considered as manifestations of potentially larger underlying phenomena.

Furthermore, the identified shared characteristics are posited to act in such a way where, the shared challenges can manifest across the hypothesized domains of activity in unique ways that are intrinsically dynamic, temporally dependent and contextually interrelated – as implied by the investigated research frameworks.

Shared Impact Domains

To consider the domains of shared impact, it is helpful to introduce a unifying framework that might help to synthesize the phenomena under consideration in a relevant manner.

In particular – and, given that an explicit hope of this paper is to propose a unified framework that might assist in the consideration of and engagement with people ('stakeholders') in the midst of some type of psychological disequilibrium, such as those that are likely to be found in the context of *complex social challenges* – it becomes necessary to consider the emotional states of such individuals; as an active part of the process within which collaboration is likely to take place.

Leveraging 'affect theory' is proposed as a method of connecting the theoretical and framework considerations with the experiences of actual people and their motivations – as stakeholders in the midst of *complex social challenges*.

Affect Theory

Introduced in the book *Affect Imagery Consciousness*, the affect theory proposes that the psychological and emotional reactions of humans are often fundamentally complex, and non–linear – in such a way where the 'affect' is viewed as a "primary innate biological motivating mechanism, more urgent than drive deprivation and pleasure, and more urgent even than physical pain"; that's not entirely biological and is rather considered as an emotional "amplifier" and the "primary motivational system because without its amplification, nothing else matters" – and where, "with its amplification, anything else can matter", in a way that "combines urgency and generality", "lends its power to memory, to perception, to thought, and to action no less than to the drives" (Tomkins, 1962).

In that sense, it is argued that the notion of 'affect' can bridge our deficiencies in understanding the relationships between the individual and social experience – where "in a fundamental sense emotions influence all interpersonal relations, both on a moment–by–moment basis and in enduring relationships", and where the "psychoevolutionary theory of emotion concerns the relations between emotions and social institutions"; in such a way where the "emotions have not simply biological, but social survival value" (Tomkins, 1962, p.216).

This is seen to be potentially highly relevant in the context of *complex social challenges* – since, the "purely social wishes of the human being are diverse", and are viewed as "derivatives of numerous affects complexly organized to create additions to particular kinds of human communion" (Tomkins, 1962, p.180).

More recently, theorists posit that the affect theory "explains how and when emotions, produced by social exchange, generate stronger or weaker ties to relations, groups, or networks", positing that "social exchange produces positive or negative global feelings, which are internally rewarding or punishing" – and arguing that this "indicates that social units (relations, groups, networks) are perceived as a source of these feelings, contingent on the degree of jointness in the exchange task" (Lawler, 2001).

This is arguably very relevant collaboration in the context of *complex social challenges* – since, the "jointness of the task is greatest if (1) actors find it difficult to distinguish their individual effects on or contributions to solving the exchange task (nonseparability) and (2) actors perceive a shared responsibility for success or failure at the exchange task" – where, the affect theory is seen as a construct that

"explicates the effects of different exchange structures on these conditions and, in turn, on cohesion and solidarity", with implications for the "network-to-group transformations." (Lawler, 2001).

From the individual psycho–social perspective – and as a way of exploring possible boundaries around, how individuals might be engaged into effective collaborations – the affect theory is posited to help understand "how different types of discrepancies between self–state representations are related to different kinds of emotional vulnerabilities", where "different types of self–discrepancies represent different types of negative psychological situations that are associated with different kinds of discomfort" – that might "signify the absence of positive outcomes" (Higgins, 1987).

As such, the affect theory is postulated to be able to help further our understanding of the relationship between an individual and their environment, that can be considered as fundamental for enacting successful collaborations; where, the "organization and meaning, including linguistic, social, and cultural patterning, are all intrinsic to immediate experience" (Spezzano, 2014), and to be useful towards "understanding the structure and the circumplex model of applied dynamics of emotions in general" – exploring "how the circumplex model of emotions can explain extremes of psychopathology and the normal existential issues faced by everyone" (Plutchik, 2000).

In such social contexts, the affect theory is argued to "emphasize the connections between affect, sensual and sensorial culture" (Gregg & Seigworth, 2010) and to help interpret the medium of communication as a type of narrative – where, the "theory construction in the area of stories must distinguish between theories of plan comprehension, theories of narrative comprehension, and theories of the story schema" (Brewer & Lichtenstein, 1982); to understand responses to risk, where the emotional reactions are viewed as "not a simple function of the utility of that outcome", and where it is posited that "unexpected outcomes have greater emotional impact than expected outcomes", reflecting a sense of deep irrationality where "any given outcome is less pleasant if an unobtained outcome is better" (Mellers, Schwartz, Ho, & Ritov, 1997).

As such, the construct of affect theory appears to offer rich grounds for the exploration of the relationship between the individual and their immediate social environment – delineating the urgency, the imbued irrationalities and the possibilities of engaging in constructive action.

Understanding Shared Influences

Furthered by the notions of affective theory, the hypothesized domains of shared influence, impact and activity – implied by the investigation of the research framework characteristics – are posited as per below:

Individual Affect	✓ The influences and activities that take place within the 'wicked problems', 'social messes', and 'problematiques' impact an individual, as an affective domain ✓ Individual effects are experienced on a variety of levels
Social Affect	✓ The influences that impact individuals also extend to the domain of social activity - in modified, aggregated and sometimes highly complex forms ✓ Social effects are experienced on a variety of scales - that include team, group, community and organizational structures

In other words, the research frameworks investigating various types of complex problems experienced in societal contexts seem to imply that there is always at least the individual component, as well as a social dimension –

Both of which may be considered as 'domains' that are necessarily related, and yet represent different and unique perspectives.

Extending the analysis, three specific shared challenge areas are posited to be 'cutting across' the identified shared challenges, as per below –

CHALLENGE	KEY QUESTIONS	KEY INSIGHTS
COGNITIVE AMBIGUITY	o How might I / we be able to think about it? o What modes of cognition might be most appropriate?	o Cognitive ambiguity is experienced as problematical by both the individuals and social structures - manifesting as an abject uncertainty around, what modes of cognition might be required for addressing issues that arise within and about the contexts of complex challenges.
CONTEXTUAL AMBIGUITY	o What conceptual structures might I / we be able to use to describe the phenomena? o What conceptual approaches might be most appropriate?	o Contextual ambiguity is manifested when both individuals and social entities experience a problematical relationship towards defining sufficiently adequate conceptual structures for describing the relevant phenomena and the emergent dynamics, that arise within the contexts of complex social challenges.
COOPERATIVE AMBIGUITY	o How might I / we be able to most effectively cooperate? o What cooperative approaches might be most appropriate?	o Cooperative ambiguity is manifested as problematical for both individuals and teams attempting to coordinate their activities in an effective manner within the context of complex challenges - and in such a way that supports and hopefully reduces the cognitive and conceptual ambiguities present.

Complex social challenges

Overview of Key Characteristics

Those social phenomena that meet the criteria as posited in the aggregative conceptual synthesis around the key research frameworks investigated – that feature the joint dimensions of individual and social affect, as well as the shared challenges of cognitive, conceptual and cooperative ambiguity – are proposed to be considered under a new term, namely that of '*complex social challenges*' (CSCs).

As such, the notion of *complex social challenges* encapsulates the conceptual frameworks of 'wicked problems', 'social messes' and 'problematiques' at an aggregate, higher level –

With a distinct hope of providing a theoretical advantage of a simplified and yet common 'grammar' between the otherwise more involved conceptual frameworks.

Although the traditional conceptual frameworks are arguably extremely important and historically ground–breaking, given their focus on describing the underlying social phenomena in additional detail, they nevertheless seem to be able to benefit from a degree of additional instrumental power – in terms of easily being translated into more implementable methodological approaches and perspectives.

Visualizing Complex Social Challenges

While the proposed concept of *complex social challenges* might be utilized in such a way as to leverage the key notions from the affective theory in order to propose an integration around the intersections between collaboration, individual and social contexts into a semblance of a coherent whole – it nevertheless seems to necessitate further conceptual structures around the possible levels of engagement and implementation; capable of more specifically exploring how might the posited ambiguities embedded in the notions of shared challenges be minimized, mitigated or somehow effectively managed.

Marr (2008) introduces the notion of cognitive levels of analysis – posited as the 'computational level' (which describes what a given system does, and why), the 'algorithmic / representational level' (that explains how a system performs its activities, and what representations and processes it might utilize), and the 'implementational / physical level' (which describes how a given system might be realised).

Considering the levels of analysis associated with cognitive process is posited to be potentially helpful when attempting to effectively collaborate in the context of *complex social challenges*, given their systemic nature.

This paper posits one such candidate typology – consisting of the 'instrumental layer', 'methodological layer' and the 'epistemological layer' – further outlined as per below.

Instrumental Layer

This layer corresponds to the 'key capabilities' that a given collaboration team might require to be able to successfully operate within the context of *complex social challenges* – and should describe the actual instrumental 'skills' that are posited to be needed for effective collaborations.

Methodological Layer

This layer corresponds to the specific methods that collaboration teams might require – to be able to successfully engage stakeholders in the context of *complex social challenges*. As such, it should outline any 'systemic enablers' that are posited to be required – to provide a methodological basis for effectively accommodating for the emergent systemic dynamics.

Epistemological Layer

This layer corresponds to the approaches for iteratively building knowledge, that might be considered as critical for adapting to the ambiguous and dynamic environments of the *complex social challenges* – where information is frequently changing, learning is likely to be incremental and iterative, and the very nature of meaning changes in proportion to the differing value–based perspectives of the stakeholders (Rittel & Webber, 1973). As such, this layer should outline the 'core abilities' for dealing with potentially substantive and persistent ambiguities.

These proposed layers of engagement can be visually represented as per below:

Figure 7: Complex social challenges framework
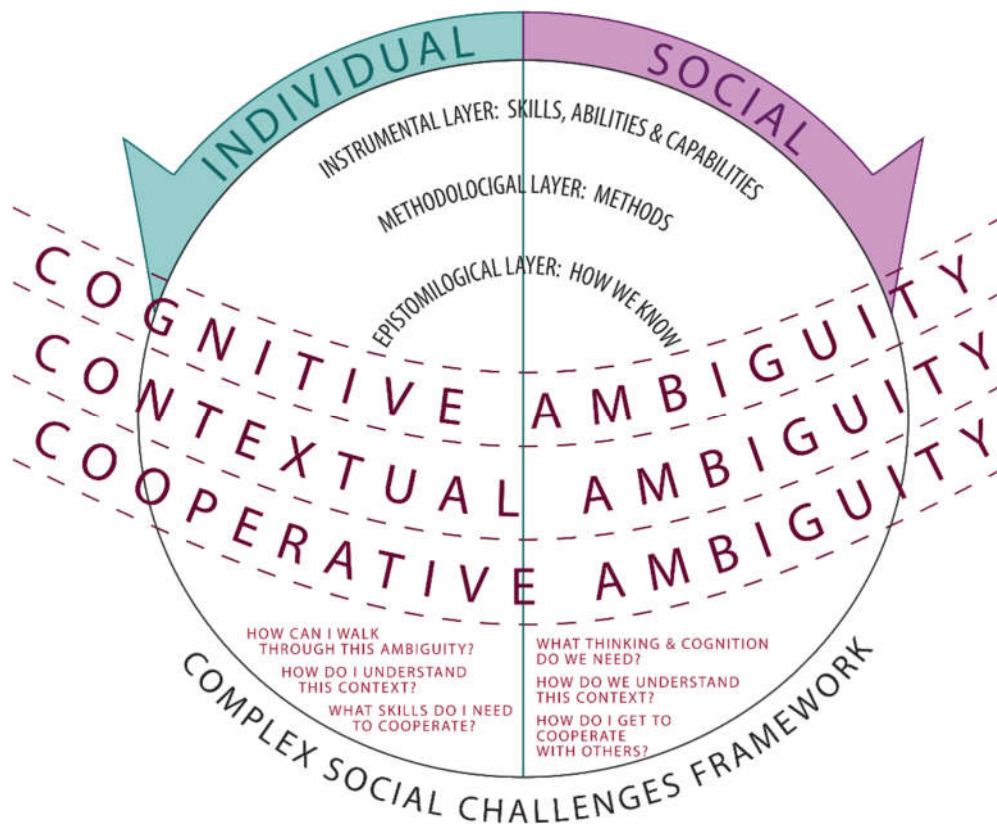
Key Questions

Some outstanding questions can be identified in relation to the *complex social challenges* – that include:

- What deeper properties might be relevant for successfully engaging *complex social challenges*?
- What types of collaboration challenges might be present within such environments?
- In what ways might it be possible to more effectively collaborate within such domains?

Next, an exploration of some of the key dimensions of these questions is explored – using the *complex social challenges* framework to explore the emergent properties.

Emergent Properties

Leveraging the notions of the affect theory and the proposed *complex social challenges* model, it is posited that the emergent properties experienced at the individual and social levels can be explored in some further detail.

In that sense, the emergent properties that are likely to be experienced within the two posited 'affective domains' – identified as 'individual affect' and 'social affect' – can be thought of in terms of intersections of the complex social challenge model characteristics, and the affective domains themselves.

Such intersections are therefore likely to affect the experiences of both individuals and social groups in the context of *complex social challenges* – given the prevailing tasks that necessary to enact successful collaborations.

Leveraging the interpretive / integrative synthesis qualitative research method to "create a holistic interpretation" (Noblit & Hare, 1988, p. 10), the analysis of the posited 'individual affect' domain intersections suggests the 'sensemaking', 'representational' and 'skill misalignment' gaps; while in the 'social affect' domain, the intersections are postulated to result in the 'cognitive dissonance', 'impact' and 'collaborative' misalignments.

Arguably, some of the posited intersections and identified gaps – with emphasis on 'sensemaking' and 'cognitive dissonance' – were not yet sufficiently considered in the literature investigated in this paper; necessitating further methodological explanation and analysis, as per below.

Sensemaking

For individuals, sensemaking – or, making sense out of a given situation or set of circumstances – is argued to be a necessary activity for collaboration, that would be likely impacted by both the 'cognitive ambiguity' property of *complex social challenges*, and the 'individual affect'.

In terms of considering collaboration in this manner, researchers observe that "the rise of globalization is accompanied by an increase in alliances and collaboration", where "a cultural sense–making approach to intercultural collaboration" is seen as increasingly important, as a "framework for analyzing cultural differences— value dimensions and communication styles" that might help to mitigate "cultural barriers to trust", seen as a "key component in collaboration"; in order to "demonstrate how cultural sense making is useful in analyzing intercultural situations" (Bird & Osland, 2005).

Sensemaking is posited to be especially relevant to collaboration in the age of increasing information availability – since, "when people work together to analyze a data set, they need to organize their findings, hypotheses, and evidence, share that information with their collaborators, and coordinate activities amongst team members" (Mahyar & Tory, 2014), where "different operations during sensemaking require different cognitive and external resources" (Russell, Stefik, Pirolli, & Card, 1993).

Perhaps most importantly, "sensemaking involves not only finding information but also requires learning about new domains, solving ill–structured problems, acquiring situation awareness, and participating in social exchanges of knowledge" – where, the "term encompasses the entire gamut of behaviour surrounding collecting and organizing information for deeper understanding" (Pirolli & Russell, 2011).

In organizations, "those who forget that sensemaking is a social process miss a constant substrate that shapes interpretations and interpreting" (Weick, 1995, p.39), given that 'intersubjective meaning becomes distinct from intrasubjective meaning when individual thoughts, feelings, and intentions are merged or synthesized into conversations during which the self gets transformed from "I" into "we"' (Weick, 1995, p.71; referencing Linell & Markova, 1993).

This is arguably relevant in the context of considering intersections with ambiguity – where, "ambiguity signifies the property of words or sentences of admitting more than one interpretation" and noting another condition where

"experiential ambiguity signifies a property possessed by any stimuli of having two or more meanings or even simply of being unclear as to meaning" (Weick, 1995, p.71; referencing Levine, 1985, p. 8).

Different notions of sensemaking and ambiguity are also offered – where "ambiguity is perceived when a lack of clarity, high complexity, or a paradox makes multiple (rather than single or dischotomous) explanations plausible" – where "ambiguity is subjectively perceived, interpreted, and felt" (Weick, 1995, p.71; referencing Martin, 1992, p. 134).

Further, Weick (1995) references March (1994), who notes that "ambiguity refers to a lack of clarity or consistency in reality, causality, or intentionality", where "ambiguous situations are situations that cannot be coded precisely into mutually exhaustive and exclusive categories". Weick (1995) further observes that the ambiguity associated with such conditions implies conditions where "the assumptions necessary for rational decision making are not met."

The contextually–emergent ambiguities and their impacts on the of rational approaches and sensemaking in general are relevant when considering the process of collaboration as it depends on the effectiveness of information acquisition and knowledge management. In this context, the "primary emphasis is placed on moving conceptualizations of users, information and reality from the noun-based knowledge-as-map frameworks of the past to verb-based frameworks emphasizing diversity, complexity and sense-making potentials" – where, knowledge management is considered as a "field on the precipice of chaos, reaching for a means of emphasizing diversity, complexity and people over centrality, simplicity and technology", within which "sense making, as an approach, is described as a methodology disciplining the cacophony of diversity and complexity without homogenizing it" (Dervin, 1998).

Cognitive Dissonance

Whether in the context of individual or group decision–making, research shows that complex environments pose a challenge for effective decision–making processes, encouraging a certain form of non–optimal solutioning – where, an "increased difficulty in making a decision increases the tendency to justify the alternative solution selected, and to show that partiality for the chosen alternative is primarily a post decision phenomenon" (Festinger, 1964).

Furthermore, the relationship between individuals and social groups – which can be considered as relevant when collaborating within the context of *complex social challenges*, where the process of transformation is important for improving the experience of some stakeholders – brings into question the "implications of dissonance for social influence and communication processes", where the "social group is a potential resource for the reduction of dissonance, irrespective of how and where the dissonance has arisen" (Festinger, 1962, p.188) – and where it is postulated that "dissonance reduction does occur through the attainment of social support" (Festinger, 1962, p.217).

The previous findings raise important questions around the role of cognitive dissonance in situations where social support may not be easily obtained – which might be highly relevant to the context of *complex social challenges*, where different stakeholders by definition hold a variety of potentially conflicting value–perspectives (Rittel & Webber, 1973). Considering cognitive dissonance from a long–term behavioural perspective, researchers observe that "the arousal and subsequent reduction of cognitive dissonance can affect relatively important behaviour and that this effect can endure over a reasonably long period of time" (Freedman, 1965, p. 146).

Furthering the notion of ambiguities as they related to the potential of successfully engaging *complex social challenges*, researchers observe that "complex environmental problem solving depends on cross–disciplinary collaboration" – which in itself "depends on the facility with which collaborators are able to learn and understand each others' perspectives" (Pennington, 2008).

The sense of prolonged continuation of cognitive tensions amidst diversity is therefore likely relevant for challenges that are "cross–cutting in that they have many overlapping stakeholders with different perspectives", and are further characterized as 'relentless; they can't be solved "once and for all"' (Weber & Khademian, 2008). The feasibility of enacting collaboration can therefore be considered to be closely related to the concepts of diversity and culture – that are to some extent also affected by the notion of cognitive dissonance. Here, researchers observe that cognitive dissonance has a particular cross–cultural component – where for instance, "studies demonstrate that both Easterners and Westerners can experience dissonance, but culture shapes the situations in which dissonance is aroused and reduced" (Hoshino–Browne, E., Zanna, A. S., Spencer, S. J., Zanna, M. P., Kitayama, S., & Lackenbauer, S., 2005).

Aided by the meta–ethnographic qualitative synthesis research method, where the "meta–ethnography involves the translation of studies into one another" and the "translation of studies takes the form of an analogy between and/or among the studies" (Noblit & Hare, 1988, p. 10), the emergent properties map is posited as per below:

Table 5: Emergent properties of complex social challenges

EMERGENT PROPERTIES	Individual Affect	Social Affect
Cognitive Ambiguity	**Sensemaking gaps**: diverse information sources create filtering/synthesis/comprehension gaps	**Cognitive dissonances**: complex structures create a multiplicity of signals and possible explanations
Contextual Ambiguity	**Representational gaps**: spatially distributed / temporally non–localized limits representation	**Impact misalignments**: limited understanding leads to reduced alignment to solving actual underlying issues
Cooperative Ambiguity	**Skill misalignments**: reduced comprehension impacts utilization of skillsets	**Collaborative misalignments**: multiple stakeholders have different values and problem/solution perspectives

Summarized Characteristics

The emergent properties also seem to imply several distinct broader characteristics –

Suggesting that, the *complex social challenges* may also be characterized as being:

- Non–linear and systems–based
- Heuristically unstructured
- Collaboratively challenging
- Shared–vision dependent
- Based in 'dilemmas'

Each of these broader characteristics is briefly summarized as per below.

Non–Linear and Systems–Based

As investigated in the earlier sections of this paper, multiple researchers observe that the phenomena contained with the context of *complex social challenges* – including the 'wicked problems', 'social messes', 'problematiques' and 'post–modern complexity' – occur within active, dynamic ecosystems.

In this context, even a "simple, nonlinear system can exhibit varying dynamics with differing numbers of possible states based upon the current state of the system" (Sturmberg & Martin, 2013, p. 338) – which seems applicable to complex domains such as healthcare – where researchers increasingly seem to "characterize healthcare activities in terms of complex systems theory", with a focus on "studying complexity in healthcare systems based on degrees of interrelatedness of system components" (Kannampallil, Schauer, Cohen, & Patel, 2011).

Researchers posit that such ecosystems feature many asymmetrical, interacting components comprised of networked structures with multiple sub/systems and feedback loops – often giving rise to non–linear behaviours and various emergent properties.

In one representative case study, the findings revealed that the "hospitals exhibited properties of complex adaptive systems (CASs) that exist in a dynamic state with multiple interacting agents", where the "weaknesses in system 'hardware' (resource scarcity) and 'software' (including PSRA guidelines that reduced hospitals decision space, and poor leadership skills) led to the emergence of undesired properties" (Barasa, Molyneux, English, & Cleary, 2017).

In another example – and within a study on reconciling tensions between broader landscape conservation efforts and agriculture initiatives – researchers observe that the planning process becomes "nonlinear and in frequent need of revision (muddling through)" (Sayer et al., 2013).

In this context, the non–linear and systems–based nature of *complex social challenges* makes them both very difficult to predict and challenging to anticipate –

In a sense where, the traditional problem–solving approaches often 'fall short' of being able to deliver on the promise of formally structured, managed strategies – that might prove as effective in the context of *complex social challenges*.

Heuristically Unstructured

Several of the various characteristics associated with the *complex social challenges* are already registered in the research literature – including the observation that, 'a simpler formulation of wicked problems is that they are unstructured, cross–cutting, and relentless' (Weber & Khademian, 2008).

This 'unstructured and cross–cutting' nature of *complex social challenges* effectively reduces the possibility of arriving at a reliable set of repeatable heuristics – that might be readily re–used and applied in various situations.

And yet, any attempt to engage the *complex social challenges* with some degree of success implies the necessity of understanding the diverse interactions between the key stakeholders, that likely requires some heuristics.

Understanding stakeholders within the context of *complex social challenges* requires some comprehension of:

- **goals**: that are impacted / amplified by the complexity dynamics
- **relationships**: to key social components (interest, power, connection)
- **persistent structures**: consisting of components and social dynamics that enable such challenges to persist

Researchers posit that "there is no definitive formulation of a wicked problem" (Rittel & Webber, 1973), which occurs "essentially because one can't specify all the knowledge needed to solve it" (Smith, 1988) – leading to an environment where a lack of effective, reliable and repeatable heuristics might exist; that can reduce the understanding of key stakeholder needs, while limiting the accurate comprehension of the larger complex social challenge context.

Such an environment is posited to contribute to the creation of 'information gaps', that can lead to further differentiated interpretations – which, as they propagate through the information sharing cycle, can become an input into follow–up decision making and collaboration processes.

Collaboratively Challenging

The outlined emergent properties also represent the background for the emergence of key collaborative challenges – which take place in the context of 'interlinked' issues that are difficult to address by singular business, governmental and socio–cultural entities.

Such challenges "are inherent in systems where every problem is linked to and inextricably interacts with others" (Weber & Khademian, 2008), that are "too complex or difficult to be resolved by single entities" (Ackoff, 1974) – creating an overall environment where the challenges themselves are "complex, intractable, and difficult to resolve" (Weber & Khademian, 2008).

Since addressing *complex social challenges* is postulated to be beyond the capacity of single entities, engaging such challenges effectively requires some degree of 'collective capacity – which implies engaged collaboration competencies, adaptive leadership, access to active networks of stakeholders and a successful leverage of key stakeholder capabilities.

Such a set of environmental circumstances might explain the barriers to effective collaboration within the context of *complex social challenges* – since, working with others is both necessary and required to successfully engage such 'messes'.

Shared–Vision Dependent

The non–linearity and systemic characteristics associated with *complex social challenges* also limits any active efforts towards establishing a commonly shared vision.

In terms of enabling collective decision–making, Sayer (2013) observes that the "need to coordinate activities by diverse actors requires that a shared vision can be agreed upon", where "this requires a broad consensus on general goals, challenges, and concerns, as well as on options and opportunities", and where "all stakeholders need to understand and accept the general logic, legitimacy, and justification for a course of action, and to be aware of the risks and uncertainties" (Sayer et al., 2013, p. 8351).

This is posited as challenging to accomplish in the context of *complex social challenges* – where, by definition the stakeholders hold a variety of differing value–perspectives, "there are no true or false answers", and where "many parties are equally equipped, interested, and/or entitled to judge the solutions, although none has the power to set formal decision rules to determine correctness" – culminating in a situation where the stakeholder judgments "are likely to differ widely to accord with their group or personal interests, their special value–sets, and their ideological predilections" (Rittel & Webber, 1973).

This can impact the "quality of stakeholder engagement, the degree to which various stakeholder concerns are acknowledged, and the investment in building trust and developing a shared vision" – that will "ultimately dictate the success or failure of the process" – which is recognized to have a capacity to be "lengthy and incur significant transactions costs" (Sayer et al., 2013, p. 8354).

In processes that involve collective inquiry, such as the one proposed by Brown (2008), include a step where collaboration involves a focusing question – that "has a lot in common with the hypothesis of a specialized inquiry, the vision of a community and the agenda of an organization", which "must therefore be developed jointly by all the interests involved"; and where "the extent to which this process differs from the usual approach to Western decision–making cannot be overestimated" (Brown, Harris, & Russell, 2010, p. 77).

Other researchers reveal additional potential barriers to establishing shared vision – including one where the "focus on disciplinary 'mechanics'" and the specific knowledge imbued in a given disciplinary area may contribute to an overall "lack of vision" (Brown et al., 2010, p. 122; referencing Morse et al., 2007).

In this context, the interaction of 'cognitive', 'contextual' and 'cooperative' ambiguities – enacted within the 'individual' and 'social' affective domain portions of *complex social challenges* – creates a situation where the availability of methods capable of effectively encapsulating the 'current–state' and envisioning a shared and agreed–upon 'target–state' are likely to be limited, in terms of their availability for the participating stakeholders.

This contrasts with an ideal situation where the methods should be able to help with ameliorating the differentiating value–structures of the participating stakeholders – while successfully bridging the diverse problem perceptions and possible solution definitions.

Arguably, this difficulty in imagining a preferred shared future within the context of *complex social challenges* creates a 'vision gap' – that can limit the potential actuality of any desired improvements, that generally necessitate a transition and a 'change of state' to effectively re–align collective interests to some agreed–upon, shared vision.

A shared vision is further required to provide the motivating power to effectively engage the key stakeholders, assess the most appropriate ecosystem components and orient local resources towards some shared destination – to start the process of actively facilitating stakeholder transitions from a 'current' to some preferred, future state.

One caveat is that the actual definition of a 'current' state is to some extent an abstraction – in an environment where the dynamics are constantly changing, being embedded in the fluid context of a complex social challenge; implying that, the assessment of the 'current state' is also by necessity both a snapshot and an approximation.

Ultimately, *complex social challenges* can be considered to be based in 'dilemmas' – those types of challenges that are social in nature, and that do not have any 'definitively computable' solutions.

Dilemmas may feature many possible approaches – each valid from some different perspective;

Implying that, the *complex social challenges* might consequently not entirely qualify as 'problems' with definitive sets of solutions, and can instead be much better described as 'dilemmas' –

Those types of social issues that challenge our cognitive, contextual and cooperative capabilities in such a way where they are heuristically non–computable, are conceptually 'too big' to be fully understood by any single entity, and feature 'non–homogenous' characteristics that are simultaneously both uniquely 'localized' and 'distributed' across the ecosystem.

Any process of engaging such 'dilemmas' might need to be more structured around the notions of facilitating stakeholder viewpoints, concerns and decisions in an attempt to successfully ameliorate their perspectives into some semblance of cohesiveness – representing the necessity for a novel engagement process that is further investigated in the subsequent sections.

Need for a 'Collaboration for Complexity'

The *complex social challenges* are difficult to understand and engage effectively – due to the multiple dynamic asymmetries and active ambiguities present within them.

Based on their summarized characteristics, they also do not feature ready–made heuristics for 'framing' and defining the core issues present within them – that are actively experienced by diverse stakeholders. This leads to

an environment of low general agreement on what might be the best approach for assessing such challenges – including from what perspective, using what tools, and in what manner.

This presents challenges in identifying and agreeing on what the shared vision around some improved future might be, how it might be possible to get there, and what approaches, methods, capabilities and competencies might be required.

Also present are socio–cognitive complexities that exceed the comprehension capabilities of even the most capable individuals – leading to the necessities for attempting broad collaboration initiatives, where groups and increasingly distributed teams are viewed as a de–facto enabler.

Distributed Team Challenges

Distributed teams have been experiencing a range of issues when attempting to collaborate in the context of *complex social challenges*.

The issues facing distributed teams are not only related to the temporal and spatial collaboration challenges, such as communication and coordination – and are arguably much more impacted by the deep asymmetries and ambiguities embedded within the *complex social challenges* themselves.

For one thing, the inherent ambiguities introduce a layer of additional uncertainty that exacerbates the team formation processes – whether we think through the 'norming, storming, forming and performing' lens (Tuckman, 1965), or through other team–formation frameworks.

For teams, it is not easy to obtain the reliable feedback around, how the team is doing – and whether their performance is meeting the exigencies of a task at hand – in an environment of overwhelming socio–cognitive complexity; limiting the otherwise readily available 'signals' that are customarily necessary to be able to continually engage in the team formation processes.

The same limitations also apply to the notions of affecting positive change in the context of *complex social challenges*.

Given the presence of the temporal, spatial, cognitive and value–alignment asymmetries that limit the feasible understanding of the 'current state' and the emergence of a 'preferred future state' – perhaps in the form of a shared vision – it is not easy for teams to ascertain whether they are fulfilling their objectives, or being effective in making some sort of a positive difference.

This leads to significant challenges for teams that are attempting to engage *complex social challenges* – who often need to invest significant time, effort in resources in managing the effects in a reactive fashion, as opposed to being able to be vision–driven or proactive.

The challenges such teams face include emergent adaptations within the complex social environments where the various stakeholders might attempt to bring some semblance of order to the prevailing complexities –resorting to power–dynamics, institutional positioning, quick solutions, best–guess estimations, and previously successful approaches to resolve the perceived uncertainties, address the information gaps and resolve the 'collaboration deadlocks'.

These types of heuristic approaches often do not work very well within *complex social challenges*, since each complexity situation is postulated to be essentially unique and different – and where particular collaboration strategies, capable of leveraging both the internal competencies and external resources in a context–adapted manner, are postulated as being required for any significant progress.

Need for a Different Type of Collaboration

The inherent dynamic ambiguities and affective domain asymmetries present within the contexts of *complex social challenges* represent an active limitation towards enacting effective collaboration – giving rise to the need for developing a new, different type of collaboration adapted to such environments.

What might be some of the key characteristics of such collaboration?

At its core, the new type of collaboration must be adept at structuring effective engagements involving different types of stakeholders across various scales, in a dynamic complex systems environment – while simultaneously being sufficiently accessible to be realized in the real–world scenarios in such a way that increases feasibility of human–centric outcomes.

To accomplish this task, this new type of collaboration – a 'collaboration for complexity' – needs to be able to address the emergent properties identified within the context of *complex social challenges*;

While offering new types of collaborative capabilities, posited as per below:

Table 6: Collaborative capabilities for complex social challenges

REQURIED CAPABILITIES	Individual Affect *required capability*	Social Affect *required capability*
Cognitive Ambiguity	KEY CAPABILITY: **Individual Sensemaking** • Enable individual sensemaking within complex collaborative contexts featuring information overload, conflicting information, confusing effects and contradictory stakeholder 'signals'.	KEY CAPABILITY: **Shared Understanding** • Support multiple cognitive perspectives to understand the relevant systemic behaviours and structures – and respective positions of key stakeholders.
Contextual Ambiguity	KEY CAPABILITY: **Adaptive Representation** • Enable adaptive representational strategies to support an iterative understanding of the context – including stakeholders, eco/systems, relationships, boundaries and impacts/effects.	KEY CAPABILITY: **Aligned Impacts** • Leverage contextual understanding to align multiple elements into an effective shared vision – that can inform potential, desirable and feasible impacts.
Cooperative Ambiguity	KEY CAPABILITY: **Aligned Resources** • Enable teams to effectively identify and leverage the required individual skills, group knowledge and organizational abilities.	KEY CAPABILITY: **Collaborative Alignment** • Identify key approaches and synthesize into differentiated strategies to enable effective collaborative engagements.

The anticipated advantages of implementing such collaborative capabilities include to:

• Leverage common assets and shared resources
• Engage multiple stakeholders required to enact effective change initiatives
• Leverage multiple perspectives to generate the right level of contextual understanding

Reflecting on the observation that such collaborative approaches take place within the complex socio–cognitive environments where engaging the key stakeholders is of primary importance, the key engagement skills are posited as being able to:

- Identify key interests within stakeholder groups
- Understand stakeholder perspectives

As such, the collaboration for complexity is posited to be structured around the complex socio–cognitive contexts – where the understanding of the human–centric concerns and stakeholder perspectives is of primary importance.

Need for a Different Type of Team

To be able to successfully enact this new type collaboration, it is posited that new types of teams are required – that have access to specific skills and abilities for engaging *complex social challenges* in an effective manner; that we might term as, '*complexity–oriented teams*', or COTs.

The definition of a 'team' in this context is very broad – and delineates any group of individuals that are a) tasked with working within the context of a *complex social challenge*, with the b) goal of attempting to improve the experience of some stakeholders, in such a way where c) the overall resilience of the key stakeholders and the sustainability of the containing ecosystem are enhanced.

It is important to note that this broad definition of a 'team' does not account for the plethora of relevant collaboration theory and phenomena that might be very much necessary and indeed required for enacting successful collaborative engagements at the implementation level – that includes such concepts as designing around the notions of gender equality, organizational hierarchies, stakeholder power structures, cultural considerations such as norms and communication patterns, and technology–assisted mediums and mechanisms capable of facilitating the functioning of geographically disperse teams.

From this broadly considered perspective – that might perhaps even be termed as 'meta–collaborative' – the *complexity–oriented teams* are posited to require specific skills and abilities, to be effective.

In that sense, the key considerations for the *complexity–oriented teams* include the:

- **Skills and abilities**: that are likely required to increase effectiveness
- **Collaborative characteristics**: adjusted to the complex engagement environments
- **Stakeholder engagement process**: necessary to facilitate successful use of skills and abilities

Team Skills and Abilities

Identifying the required team capabilities, as posited above, is a useful first step in exploring how it might be possible to structure collaborative processes for engaging *complex social challenges.*

However, it does not necessarily tell us how the *complexity–oriented teams* might reach such proposed collaborative capabilities – and specifically, what skills and abilities might be required to achieve the necessary levels of competency.

Referring to the postulated *complex social challenges* framework, any team skills and abilities required to collaborate in the context of *complex social challenges* must enable teams to support a certain set of collaboration outcomes – capable of addressing key concerns associated with the various domains of complex ambiguity, as per below:

Table 7: Required collaboration outcomes

COMPLEXITY CHALLENGE	Required collaboration outcomes
Cognitive Ambiguity	**Support comfort in ambiguity**: postpone premature solutioning despite environmental pressures and diversity of perspectives **Engage generative sensemaking**: create relevant and reusable information / knowledge assets **Emerge common approaches**: converge on multiple ideas and divergent perspectives
Contextual Ambiguity	**Process continuous signals**: share and build incremental contextual understanding **Identify new opportunity spaces**: leverage collective knowledge, creative assets and shared resources to identify in–context opportunities **Co–design shared vision**: enable continual adaptation, despite initial and ongoing lack of clarity
Cooperative Ambiguity	**Form effective networks**: connect participants and stakeholders with non–aligned approaches

	Inspire 'ownership' of collective challenges: mobilize for engaged action within specific socio–cognitive contexts **Emerge systemic solutions**: learn from experiences and continuously course–correct

Building New Collaboration Competencies

To a certain extent, it might be argued that some aspects of the identified collaboration outcomes have already been addressed by existing theories – and managed by diverse change–agents in a variety of complex societal and organizational contexts.

For example, strategies such as 'political acuity' have been employed "as an element of policy capacity", that involve "feasibly and successfully steering policies through organizations and systems" at places such as the OECD and the World Bank; where they offer "basic tools for policy managers" such as "compensating losers, spreading losses over time, grand parenting, and insulating decision–makers", in an environment where the "elected leaders need to develop mandates for change, build coalitions, and engage in heresthetics" (Pal & Clark, 2015).

Researchers such as Horn and Weber address critical issues such as 'conflict management' among the key stakeholders by leveraging "mess mapping" and "resolution mapping" processes – defined as "collaborative reasoning tools" designed to address "multiple value conflicts", in order to "acknowledge and contain sharp differences of opinion and conflicting data" – in such a way where the "complexity of most problems can be managed so that stakeholders arrive at a common framework for understanding these problems" (Horn & Weber, 2007).

Boal and Schultz (2007) reference 'storytelling' as a useful approach in strategic contexts – where "organizations are increasingly being described as complex adaptive systems (CAS)", and where the "behavior and structure of an organization emerges out of the interaction of a collection of organizational agents"; in such a way where 'strategic leaders play a crucial role in moving organizations to the "edge of chaos" and aid in organizational learning and adaptation' through the mechanisms of "dialogue and storytelling". In such contexts, the "strategic leaders shape the evolution of agent interactions and construct the shared meanings that provide the rationale by which the past, the present, and the future of the organization coalesce" (Boal & Schultz, 2007).

To mitigate negative psychological impacts, additional techniques such as 'stress management' are often cited as important – where, distinct value is seen in "combining self–management training and stressor reduction to produce positive individual and organizational outcomes" (Munz, Kohler, & Greenberg, 2001).

Considering the abovementioned strategies, approaches and techniques, it appears as implicit that *complex social challenges* constitute a dynamic space with a variety of 'political' conflicts – that involve key dimensions of personal, group and organizational interest, are structured around the notions of 'power', and are likely built around the concepts of individuality that expresses itself through a variety of modalities, such as 'autonomy, mastery and purpose' (Pink, 2011).

In–depth explorations of the associated socio–cognitive phenomena can be further complexified by the notions of 'identity' – a construct that does not yet have a universally agreed–upon meaning, where one foundational theory postulates that the concept of 'self' might be best understood through a theatrical lens, that involves a 'presentation of the self' through the artifact of a 'front stage'; that, when coupled with the notions of a 'back stage', represents the psychological dynamics of the external communicative and cognitive versus the internal reflective self–formation processes (Goffman, 1959).

While the aforementioned concepts and frameworks are of arguably fundamental importance and feature considerable explanatory power, they are not considered in further detail in the course of this study for two reasons;

First, they consider phenomena where other authors and researchers have already contributed substantive levels of insightful analysis, that are likely to be superior to any similar efforts that might be enacted in the course of this study – and as such, represent less of an effective 'research gap'. And second, although arguably very much necessary to consider when enacting effective collaborations, such frameworks might not be sufficient to explain the underlying collaboration competencies in such a way where they are cross–transferable, can apply to the various *complex social challenge* domains, and can help the *complexity–oriented teams* engage not only the various socio–organizational hierarchies, but also the key stakeholders in the midst of complex socio–cognitive transformations – in such a way where their resilience is enhanced and supported.

In the further sections of this study, the explicit focus is on considering how might the *complexity–oriented teams* be able to build relevant collaboration competencies that are capable of informing the discovery of specific supportive

skills and abilities in such a way where they are broadly useful in a variety of contexts, and applicable to numerous *complex social challenges*.

Building towards the goal of uncovering more generally–applicable underlying phenomena capable of supporting collaboration in complexity, we next explore the notion of 'dilemmas' and the dialectical framework – as potential enablers of *complexity–oriented teams*.

Complex social challenges as 'Dilemmas'

Leading researchers postulate that the notions of collaboration are intrinsically connected with dilemmas, and especially in endeavours such as policy development – where "collaborative policy implementation entails dilemmas and paradoxes for involved parties", due to the observation that "expectations on roles and decision–making power differ between actors" (Lindqvist, 2016).

Dilemmas are posited to occur as the result of emergent complexity dynamics in various contexts, such as in education – where they raise questions around ethics and responsibility that "consists in oscillating between the demands of that which is wholly other and the more general demands of a community" (Fenwick, 2009).

In specific domains of *complex social challenges* such as in humanitarian work, researchers point out that "ethical dilemmas and moral issues crystalize at the time of major crises", where "extremely difficult moral choices arise from the complexity of the current environment" due to the fact that "political responsibility, military operations, and humanitarian action are now more interdependent than before" – giving rise to a need to "establish a true partnership between the various players involved in crises" (Moore, 1998).

Given that *complex social challenges* are socially ambiguous, it may be postulated that they tend to have the nature of 'dilemmas' – those types of issues that involve a multiplicity of seemingly valid perspectives, some of which might be partially overlapping, or to some extent be in opposition to one another.

In this sense, the framework of 'dilemmas' might be viewed as principally helpful for disambiguating the multiplicity of possible viewpoints and action alternatives – some of which may be equally appealing to different types of stakeholders, while implying potentially contradictory approaches.

A key determinant of dilemmas therefore seems to be socio–cognitive in nature.

From this perspective, Wark and Krebs (1996) categorize dilemmas into the areas of "low", "moderate" and "high" socio–cognitive conflict" – further segmenting them into additional typologies, including the "antisocial, prosocial and social pressure dilemmas". Building on their work, other researchers observe that "low socio–cognitive conflict dilemmas evoked less complex thinking and less intensive feelings of upset and sympathy than did moderate and high socio–cognitive conflict dilemmas" (Myyry & Helkama, 2007) – indicating intrinsic complexity for the stakeholders in contentious environments, within which they must make decisions and take meaningful action. In that sense, the language of 'problems' does not seem to match the nature of 'dilemmas' – representing those types of challenges that are generally not definitively solvable to the equal satisfaction of all parties involved.

This is in direct contrast to what we might consider as other kinds of 'problems', that might originate in more formalized contexts and logic–based domains of inquiry – including mathematics, physics and engineering – where, a problem in fluid dynamics for example can generally be definitively stated, and where a solution is likely to be agreed upon and be viewed as self–evident to equal satisfaction of all parties, once demonstrated and achieved.

In contrast, dilemmas seem to be much more influenced by the stakeholders involved – and as such, arguably require a different framework for considering their associated engagement, deliberation and decision–making processes.

Dilemmas as Dialectics

How might dilemmas be best understood in the context of *complex social challenges*?

One possible approach is to consider the framework of 'dialectics' – and to posit dilemmas as those types of challenges that are primarily dialectical in nature.

The dialectical framework comes out of the Hegelian tradition, and is structured around the principles of 'thesis', 'antithesis' and 'synthesis' – as a way of actively working with the pairs of opposites, while building towards integrative concepts.

More recently, researchers have extended the concept of dialectics to include many non–traditional and novel areas – in contrast to the initial Hegelian and Marxian roots of the dialectical tradition.

For instance, in applied contexts, researchers use the medium of dialectics towards attempting to understand the complex dynamics of organizations – to explain the notions of "institutional change that more fully captures its totalistic, historical, and dynamic nature", where "change is understood as an outcome of the dynamic interactions between two institutional by–products: institutional contradictions and human praxis" (Seo & Creed, 2002).

In considering the complexities of social relationships, the dialectical view provides a dynamic lens for reconciling the concept of 'change' – as being both "at the heart of social processes" and something that "contradicts the emphasis on stability and consistency that exists in most conceptualizations of relationship maintenance" (Montgomery, 1993).

Baxter and Montgomery (1996) take this work further, and investigate how "contradictory and indeterminate processes at play in relationships" might be minimized – and conclude that "dialectical ways of thinking addressed these shortcomings", as part of developing a new "dialectical approach to understanding communication and personal relationships".

Dialectical ways of thinking are also observed to be culturally–dependant – where, for instance, the 'Chinese ways of dealing with seeming contradictions result in a dialectical or compromise approach— retaining basic elements of opposing perspectives by seeking a "middle way"' (Peng & Nisbett, 1999).

Despite any cultural predispositions, researchers point out that dialectical thinking can be learned – as in the example of *Dialectical Critical Realism (DCR)* – designated as a "developmental, dialogical, and dialectical epistemology for enhancing adults' cognitive development toward dialectic", with the goal of "solving real–world problems in a holistic and transformational manner with a high likelihood of success" – where "emphasis is put on dialectical thinking as a social practice" (Laske, 2015).

Finally, Basseches (2005) conceptualizes "dialectical thinking as a form of organization of thought", used to "integrate dimensions of contradiction, change and system transformation over time in a way that supports people's adaptation when structures under girding their sense of self/world coherence are challenged."

In this sense, the dialectical framework might represent a foundation for working within the context of *complex social challenges*, that feature an inherent value diversity between the key stakeholders and sets of conceptual

opposites in the enclosing environment; with an ability to reconcile seemingly divergent views and a potential to synthesize into novel and emergent constructs.

Potential Impacts of Dialectics

The dialectical framework is posited to be able to provide distinct advantages as a way of effectively working within the context of societal dilemmas.

In terms of specific impacts, the dialectical framework can potentially assist by making it easier to:

- **engage stakeholders**: provide an approach for engaging different stakeholders by allowing for a simultaneous existence of conflicting ideas and value–systems
- **synthesize different points of view**: provide a method of aligning differentiated perspectives, while merging into novel and potentially useful conceptual structures
- **co–design shared solutions**: establish a common ground to support a cooperative design processes

To critically consider the previously defined 'collaborative capabilities' matrix, this paper leverages the adapted 'wind–tunneling' foresight approach and strategy assessment method – frequently applied to complex policy evaluations.

As such, this method is often leveraged to "allow policy–makers to test or 'wind–tunnel' their future policies: by confronting different (sets of) policies with various possible futures" with the goal of determining "which policy options perform relatively well across a range of scenarios" (van Asselt, M.B.A., van't Klooster, S.A., & Veenman, S.A., 2014), in such a way that "can also be used to "wind tunnel" existing policies and policy assumptions against possible future states" (Ramos, 2017) – and ultimately, where it's possible to 'create a conceptual wind tunnel where we can test how well our strategies will "fly" under various conditions' ("IFTF: Scenarios," n.d.).

In this sense, the various proposed 'individual affect' and 'social affect' approaches (such as 'individual sensemaking' and 'shared understanding') are effectively considered as proposed coping strategies – where the potential 'fit' of the dialectical framework as an enabling medium in the context of *complex social challenges* might be evaluated as per below:

Table 8: Assessing potential 'fit' for dialectics

POTENTIAL 'FIT' FOR DIALECTICS	Individual Affect *potential dialectical 'fit'*	Social Affect *potential dialectical 'fit'*
Cognitive Ambiguity	**Individual Sensemaking**: HIGH	**Shared Understanding**: HIGH
Contextual Ambiguity	**Adaptive Representation**: LOW	**Aligned Impacts**: MED
Cooperative Ambiguity	**Aligned Resources**: LOW	**Collaborative Alignment**: MED

While we can notice the seeming applicability of the dialectical framework for enabling some of the key collaborative competency areas, we can also observe a lack of a potential 'fit' in others.

The dialectical framework seems to be mostly applicable towards addressing cognitive ambiguities, and more broadly applicable to the 'social affect' as opposed to the 'individual affect' domains.

This raises the question about the completeness of utilizing the dilemmas framework – and the capacity of the dialectical frameworks in general to fully enable collaborative teams in engaging the levels of complexity present within the *complex social challenges* themselves.

Assessing Additional Conceptual Frameworks

Building on the expressive power of dilemmas and dialectical frameworks, a question might be asked whether any additional conceptual frameworks might be required to provision a sufficient level of understanding for engaging *complex social challenges* – while simultaneously informing a more specific development of key collaborative competencies.

A further inquiry might be focused on the specific features associated with the domain of *complex social challenges* – such as their apparent adaptive capability.

Whether considering 'wicked problems', 'social messes' or 'problematiques', such contexts appear to effectively represent a rich environment for the manifestation of non–linear systemic characteristics that lead to complex behaviours – including feedback loops, dynamic hierarchies, ecosystemic levels, network effects and emergent properties.

Such complex behaviours arguably need to be taken into consideration when attempting to create any collaborative engagement approach that might be successful in engaging complex socio–systemic environments.

Next, a conceptual framework for attempting to understand the capability of active adaptation – that often seems to manifest as effective resistance to change, in complex socio–systemic environments – is investigated in some further detail.

NOTE: The 'evolutionary systems development' approach – reflected on by Ven and Poole (1995), who introduce "basic theories that may serve as building blocks for explaining processes of change in organizations: life cycle, teleology, dialectics, and evolution" – is arguably a formative and potentially highly relevant framework; that was not included in the course of this study, and represents a potential future avenue of research and exploration.

Adaptations and Resistance to Change

Beyond the difficulties of engaging stakeholders and understanding complexity contexts, the research literature observes that *complex social challenges* also exhibit an interesting feature – namely, one where they appear to be able to resist change, in a seemingly highly persistent manner.

This may be considered as a puzzling assertion – since, if we were to take the complex social challenge of 'diabetes' as an example, it would likely not be seen to be in possession of active adaptation capabilities in and of itself; in such a way where, what is perceived as an 'active adaptation' may be considered as an analogue, and a property of the complex systems that are either embedded within, or that contain an arbitrarily established boundary of a given complex challenge.

Complex social challenges can therefore probably not be said to be 'adaptive systems' from an ontic perspective – and perhaps only that they might be to some extent analogous to, and may be effectively epistemologically analyzed through this lens.

As an example of this perspective – and referencing the complex social domain of healthcare – researchers posit that "effective healthcare for the growing number of chronic disease and lifestyle issues must be grounded in a non–reductionist paradigm focused on understanding relationships and applying flexible

problem–solving", where "key principles of complex adaptive systems theory (CAS) are being applied to healthcare planning and research" (Brown, 2006).

Observing that "biological and social systems are inherently complex" (Wilson & Holt, 2001), and considering the context of global health initiatives, researchers propose that "interpreting change in health systems through the lens of complex adaptive systems (CAS) provides better models of pathways for scaling up", where they might describe "how phenomena such as path dependence, feedback loops, scale–free networks, emergent behaviour and phase transitions can uncover relevant lessons for the design and implementation of health policy and programmes in the context of scaling up health services" (Paina & Peters, 2012).

Such approaches are posited to be associated with specific implications – that might include "paying more attention to local context, incentives and institutions" and "anticipating certain types of unintended consequences that can undermine scaling up efforts" – with a goal of "developing and implementing programmes that engage key actors through transparent use of data for ongoing problem–solving and adaptation" (Paina & Peters, 2012).

This is seen to be in contrast to the historically prevailing view, where the "current management thinking largely assumes that a well functioning organisation is akin to a well oiled machine", which "leads to the notion that performance is optimised when work is specified in detail and shared out to distinct operational units" – with the effect where clinical professionals are said to "often object to these detailed specifications, while managers bemoan a lack of cooperation", and where "an alternative to the machine metaphor; that of a complex adaptive system (CAS)" (Plsek & Wilson, 2001) is argued to be necessary.

Similar observations are postulated in other domains of complex social challenge, such as in climate change analysis – where researchers posit that "ecosystems are prototypical examples of complex adaptive systems, in which patterns at higher levels emerge from localized interactions and selection processes acting at lower levels", that demonstrate essential aspects such as "nonlinearity, leading to historical dependency and multiple possible outcomes of dynamics" (Levin, 1998).

Similarly, researchers further observe that although "modeling has been used for decades to assess the possible futures of humanity and the global environment", a gap is identified where "these models do not

always satisfactorily include the adaptive characteristics of systems" – calling for more general approaches that can "simulate change and transition at a macrolevel due to adaptation at a microlevel" and are capable of leveraging "tools from complex adaptive systems research" (Janssen, 1998).

The adaptation ability appears to necessitate an additional level of understanding around, how might *complex social challenges* be able to successfully benefit from the systemic adaptation mechanisms, that build up to an ability of resisting the various efforts at internal or external change – which generates questions around whether and to what extent such adaptations might be supported by any deeper properties or structural characteristics.

How might we be able to understand such resistance to change – to be able to further appreciate the necessary collaborative capabilities, and delineate any associated skills and abilities required by the *complexity–oriented teams*?

Complex social challenges as Complex–Adaptive Systems (CAS)

The research literature offers a conceptual framework for exploring adaptive capabilities, entitled *Complex–Adaptive Systems (CAS)* – as developed by Holland (1995) and others.

As a concept, CAS comes out of the complexity theory – where 'systems' are viewed as "collections of individual actors who organise themselves and create relationships", that continue to "form in response to positive or negative feedback – though a degree of randomness", creating an environment where "new structures and behaviours then emerge as the actors act and react to each other" (Snyder, 2013).

At their core, CAS are considered as 'open systems' – capable of engaging in a range of dynamic processes and exchanges with their enclosing ('external') environment;

Where the 'adaptive' part refers to being able to both maintain a certain degree of integrity between their internal elements and structures – an ability sometimes referred to as 'homeostasis' – as well as, to adjust the dynamic interchange relationships with the enclosing environment in such a way as to support internal cohesiveness.

From this perspective, complex systems might be considered as domains of activity where the "interconnected components' behaviour is not explained by the properties of the components, but rather emerges from the interaction of the components", where the "system is non–linear and relies on feedback to mould and shape its evolution", and where a given system "operates on multiple time–scales and levels simultaneously" – as referenced by Sabelli (2006), citing Kaput and Blanton (2005).

Higher forms of CAS can also be considered as possessing the quality of autopoiesis (Maturana & Varela, 1980) – an emergent ability to establish self–regulatory life processes.

Might it be possible to consider *complex social challenges* as certain types of Complex Adaptive Systems (CAS) – capable of emerging life–like properties and characteristics, including homeostasis – as part of their ability to resist drastic change, and maintain the internal integrity of their constituent elements and components?

Leading researchers reference this possibility – postulating that, "communities are complex adaptive systems" and observing that "complex adaptive systems theory has been recognized as a suitable approach for addressing the wicked problems that occur in communities" (Zivkovic, 2015).

A compelling characteristic of CAS is that they require no 'centralized orchestration' to maintain homeostasis – implying that, they have a capacity to operate in distributed and non–centralized contexts.

Furthermore, CAS possess many of the same non–linear characteristics and emergent properties observed within the complex socio–cognitive contexts themselves – making CAS a potential candidate for further attempting to understand the underlying structures and dynamics of *complex social challenges*.

While the CAS framework seems to describe emergent and adaptive behaviours at a broad, ecosystem level, the *complexity–oriented teams* need to be able to effectively engage the human stakeholders in a very practical and immediate manner.

In this sense, it might be useful to consider some key aspects of the complex adaptive systems (CAS) that the *complexity–oriented teams* need to take into consideration – when attempting to engage key stakeholders in an effective manner.

Adaptation Asymmetries

Within the context of *complex social challenges*, certain types of ecosystem actors appear to be able to adapt much more effectively then other types of stakeholders – arguably giving rise to certain 'adaptive asymmetries'.

On another level, it might also be posited that the adaptive capability of the entire *complex social challenge* ecosystem itself appears to be generally much greater than the adaptive capacity of the individual stakeholders themselves.

In this sense, it is interesting to consider what characteristics of the *complex social challenges* might be responsible for enabling such enhanced adaptation asymmetries.

For one, researchers posit that the *complex social challenges* operate on a variety of different scales, including temporal and spatial – bringing about a range of issues, as in the example of the so–called 'super–wicked problems'; that tend to stretch across time–scales and geographies, manifesting adaptive qualities in a manner that is not always easy for the human–based actors or even organizational stakeholders to counter.

The notion of adaptive asymmetries might point to some of the core issues around *complex social challenges*; where, the adaptive capacity of the overall system – and possibly that of a select group of specific actors – appears to be much greater than the adaptive capability of the rest of the ecosystemic stakeholders.

Enhancing Adaptive Capacity

Significant differences in adaptive capacity are likely to provide an advantage for weathering various types of crisis – such as the various 'boom and bust cycles' observed in the economic theory – allowing certain types of stakeholders to survive and possibly thrive, while weakening or impoverishing other types of ecosystemic participants.

It is important to note that, there are really two types of 'ecosystems' that are being referred to here.

The first, 'challenge ecosystem', is associated with the *complex social challenge* itself – where we might think of something like the exploding onsets of Alzheimer's, obesity and diabetes in the various developed countries around the world;

While the second, 'containing ecosystem' points to the larger, containing environment within which the *complex social challenges* play themselves out – and which is most likely constituent of several interacting social domains (connecting to the previous example, we might think of 'healthcare' as a containing environment – with specific sub–correlations to 'education', 'food wastelands', 'urban planning' and 'sustainable work', as an example).

When thinking about enhancing adaptive capacities, it is important to note that we mean reducing the adaptive capacity of the former (the complex social 'challenge ecosystem' itself), while enhancing the adaptive capacity of the latter (the broader 'containing ecosystems' such as 'healthcare' and its sub–related social domains – along with their constituent participants and stakeholders).

How might we be able to know that we are reducing the 'right' adaptive capacity – while increasing the correct one? And, how might we be aware of the correct degree and extent of reducing / enhancing the adaptive capacities of the various ecosystemic participants and stakeholders?

In this sense, increasing the adaptive capacity of one ecosystemic stakeholder might by necessity imply reducing the adaptive capacity of another – although, not necessarily to the point where the latter loses all capacity for adaptation.

Engaging Complexity as Adaptive Capacity Management

From this perspective, the process of engaging *complex social challenges* may be viewed as an exercise in adaptive capacity management –

Where, a primary guiding value might be posited to be the one of ensuring the long–term sustainability and balance of the 'containing ecosystem' and its constituent components.

In this sense, *complex social challenges* might be considered as 'problematical' only in as much as they tend to reduce the sustainability of the 'containing ecosystem' – while decreasing the resilience of the various associated ecosystemic participants and stakeholders.

A key goal of collaboration for complexity might therefore be reframed as being able to continuously identify and decide, which adaptive capacities have become 'too strong' or 'too weak' for ensuring the sustainability and balance

of the overall 'containing ecosystem' – in a manner that is implementable for the *complexity–oriented teams*, and sustainable from their engagement perspectives.

How might we think about identifying the adaptive deficiencies while enhancing the resilient capacities of the specific stakeholders within the context of a *complex social challenge* – in such a way that, the sustainability of the containing ecosystem itself might also be increased?

And, what might be the relationships between the adaptive capacities of the individual stakeholders and their associated capabilities for enacting collaborative approaches – capable of engaging *complex social challenges* in an effective manner?

To explore these questions further, we next look more closely at the notions of sustainability and resilience.

Sustainability and Resilience

For the purposes of this paper, 'sustainability' is defined as a capacity of an ecosystem to continue its normal dynamic operations, while being able to minimize impacts to its regular operational regimes; in such a way where, the cohesiveness of the constituent elements, components and their relationships maximizes the resilience of the ecosystemic members themselves.

In turn, 'resilience' is defined as an ability of the containing ecosystem and its constituent stakeholders to withstand drastic changes, those that exceed regular tolerances of their operational regimes – in a way that maximizes the structural integrity of their internal relationships, and cohesiveness of their dynamic exchanges with the external environment.

The 'stakeholders' are defined as those containing ecosystem members that participate at a variety of ecosystemic scales – inclusive of the individual, group, communal, organizational and institutional levels.

Operational Regimes

It is challenging to think about the generalized notions around sustainability and resilience without referring to the concept of 'operational regimes' in some manner.

For the purposes of this paper, the concept of 'operational regimes' refers to the sets of coordinated dynamic interchanges enacted at a variety of scales, where autopoietic entities – which describe "systems that are self–producing or self–constructing" (Mingers, 2004) – engage in sets of patterned internal processes and external interactions as part of supporting its integrity and cohesiveness.

As a concept, autopoesis is posited as a useful tool for the study of social phenomena – since the "subsystems and the society itself are autopoietic unities and are thus organizationally closed and self–referring" (Mingers, 1994, p. 141; referencing Luhmann, 1986, p. 172).

This translates to the study of various social structures, such as organizations – where the combination of "autopoietic theory and complex adaptive systems theory" increasingly "provides an improved framework for understanding the nature and dynamics of organizational phenomena" (Goldspink & Kay†, 2003).

In addition, researchers observe that such "complex, organic–like structures can evolve order and purpose over time" – where, for example, "business organizations, typified by semi–autonomous organizational members interacting at many levels of cognition and action, can be portrayed by the generic constructs and driving mechanisms of complex adaptive systems theory" (Dooley, 1997).

These concepts are further supported by the expanded notions of social autopoiesis – that, "focuses on social elements, such as communication, morale, trust, etc. and their relation to social emergence, whereas CAS theory concentrates more on adaptive mechanisms that make a CAS produce emergent order, such as inter–relations, interactions, edge of chaos, feedback" (Alaa, 2009).

In such a context, the concept of 'external interactions' delineates those sets of actions that might take place across and beyond the 'boundaries' of an autopoietic entity itself.

Enabling Operational Regimes

The proposed definitions around operational regimes seem to highlight key structural characteristics more so than directly indicate what enables such operational regimes to function in the first place.

In this sense, the research literature offers the concept of 'exergy' – as an opposite of 'entropy', a measure of disorganization within a system – that describes a generalized amount of energy available for enacting useful work.

In this context, researchers posit that "exergy is also known as availability, the maximum useful work possible during a process that brings the system into equilibrium", and can be considered as "notionally negative entropy" (Robinett & Wilson, 2011, p. 4).

Applied to ecosystems research, this concept can be considered as 'eco–exergy' – a notion that has "been widely used in the assessment of ecosystem health, parameter estimations, calibrations, validations and prognoses", given that it "offers insights into the understanding of ecosystem dynamics and disturbance–driven changes" (Zhang, Gurkan, & Jørgensen, 2010).

Researchers studying complex nested living systems relate there concepts – positing that, "life is an integrated process of nested living systems", where the phenomena of "exergy capturing and accumulation of organizational exergy" occur – as part of the process of "structuring of the system towards maximum entropy production and export of high entropy products; autopoiesis; emergent attractors or optimum operating points; characteristics of nested systems and holarcic levels; and the role of working and latent information" (Günther & Folke, 1993).

Interestingly, Günther and Folke (1993) further observe a teleological ambiguity where, "it is only possible to describe the livingness of a system in a continuous way", where, "from the perspective of self–organizing and nested living systems it is difficult to draw boundaries between living and non–living as well as human and non–human systems".

Connecting these notions with the possibilities of achieving knowledge within social systems, researchers observe that "autopoiesis and the construction of knowledge are inseparable aspects of physical phenomena scalable to many levels of organization" – with the implication that, this approach "unifies theories of epistemology, physical dynamics, life, biological evolution, knowledge and social systems" (Hall, 2011).

Building on these formative theoretical insights, this paper considers 'useful work' as an expenditure of energy directed towards enabling the successful execution of operational regimes, associated with the ecosystemic stakeholders.

It therefore follows that a key enabling determinant of sustainability is the existence of exergy – relating to the amount of energy present within an ecosystem that is both accessible and available to the appropriate ecosystemic stakeholders, in such a way as to enable them to perform useful work and empower their operational regimes.

Negative Resilience

Provided these definitions, it is possible to re–contextualize *complex social challenges* as those types of societal issues that have emerged autopoietic qualities for adaptively resisting change – at the expense of reducing the sustainability of the containing ecosystems, and resilience of the individual ecosystemic stakeholders.

A seemingly appropriate term for such adaptive capacity might perhaps be, 'negative resilience' –

Where, a *complex social challenge* might exhibit capabilities of corralling the available ecosystemic exergy in an overly effective and exaggerated manner, causing possibly detrimental imbalances in the operational regimes of the constituent 'enclosing ecosystem' stakeholders.

In this sense, the 'negative resilience' effectively saps the available exergy within an enclosing ecosystem – or displaces it in such a way where, it makes it unavailable or inaccessible to the majority of the ecosystemic stakeholders.

It is important to note that increasing the 'gradient of accessibility' – for instance, making the ecosystemic exergy available, yet more difficult to access – is to some extent equivalent to making that energy unavailable for the purpose of maintaining the operational regimes of the constituent stakeholders.

The ecosystemic stakeholders might be unable to access such exergy dependably on their degree of resilience, state of energy reserves available to them (to perform relevant actions), and the 'steepness' of the exergy accessibility gradient that's in their way.

Stakeholder Sustainability

A stakeholder experience deemed as unsatisfactory within the context of a *complex social challenge* implies that something about the stakeholder interactions with their environment is either in some way unsustainable – or, that there is a perception that their sustainability might be additionally improved.

Conversely, stakeholders within a given *complex social challenge* system that might identify themselves as 'thriving' are unlikely to also experience themselves as having problematic or unsustainable relationships with their environment.

How might it be possible to increase the sustainability of a specific set of stakeholders, within the context of a *complex social challenge*?

And, by extension, how might collaboration for complexity be able to enhance the resilience of the key stakeholders – in such a way where, the balance of the enclosing ecosystem and its overall sustainability are improved, while reducing the 'negative resilience' of the *complex social challenge* itself?

To explore this question further, it is useful to consider how the *complexity–oriented teams* might be able to distinguish the key elements present within the *complex social challenge* contexts – and in particular, how might they be able to distinguish the ecosystemic 'parts' from the 'wholes', in a way that is sufficiently differentiated to empower meaningful engagements.

Boundary Theory / Critique

> *"I consider it impossible to know the parts without knowing the whole, or to know the whole without knowing the parts."* – Pascal (as cited in Morin, 1999, p. 115)

If sustainability is dependent on the feasibility of maintaining the operational regimes of the ecosystemic stakeholders – that are themselves relying on the accessibility of exergy within their environmental contexts – then in situations where the *complex social challenges* 'capture' a disproportionate amount of available energy through the 'negative resilience' processes, a question arises around how might the *complexity–oriented teams* distinguish between the ecosystemic elements and processes that are 'sapping away' the available exergy, versus those that are contributing to the overall sustainability of the enclosing ecosystem?

While it might not be possible to arrive at a heuristic for definitively answering such a question, the research literature does offers a conceptual framework capable of informing some dimensions of this inquiry – namely, that of 'boundary theory'.

Distinguishing Parts from Wholes

For the *complexity–oriented teams* to be able to engage the domain of *complex social challenges*, they arguably need an ability to identify system dynamics – as well as, an ability to reliably identify those portions of the enclosing ecosystem where their collaborative efforts are likely to create the most feasible and relevant impact.

How teams infer 'boundaries' around a *complex social challenge* system might be of critical importance – since, this effectively 'frames' how a given ecosystem is understood, where the teams might be engaged, and what aspects might be perceived as opportunities.

In this sense, the act of 'framing' and identifying systemic boundaries establishes a space of generative possibility that might be considered to act as a 'complex attractor' – informing any subsequent systemic interventions and 'solutions', that might eventually be identified and created.

How might *complexity–oriented teams* be able to decide in what manner it might be possible to infer the systemic and sub–systemic boundaries – while differentiating between the relevant 'parts' and 'wholes'?

Boundary theory

Boundary theory references some of the key characteristics identified within the context of *complex social challenges* – including the existence of diverse stakeholder perspectives, combined with the intrinsic interconnectedness of the various ecosystemic elements.

Boundary critique might be considered as highly relevant to the *complexity–oriented teams* because "what is to be included or excluded for any analysis of a situation is a vital consideration" (Churchman, 1970), where something that "appears to be relevant [sic] given a narrowly defined boundary, may not be relevant at all if the boundaries are pushed out" (Kagan et al., 2004).

In that sense, boundary theory informs the processes around the construction of meaning, where the validity of analysis "always depend on boundary judgments as to what 'facts' (observation) and 'norms' (valuation standards) are to be considered relevant" (Ulrich, 2002).

As such, the decisions around inferring the extent of active boundaries "cause one to demarcate between what is in and what is out of a particular construct" (Cabrera, 2006) – with an effect of impacting how *complexity–oriented teams* might think about attempting to sufficiently understand the context of *complex social challenges*, and any subsequent possible collaborative engagements and actions.

Leveraging boundary critique to identify different and possibly relevant areas of analysis might provide additional insights around the factors impacting the 'affective domains' within the context of *complex social challenges*.

Several such 'boundary areas' and their associated questions might generate different areas of inquiry (Ulrich, 2000) within the posited affective domains – as per below:

Table 9: Assessing boundaries of affective domains

BOUNDARY AREA	Affective Domain	Question
Self–reflective boundary	Individual	"What are my boundary judgements?"
Dialogical boundary	Social	"Can we agree on our boundary judgements?"
Controversial boundary	Social	"Don't you claim too much?"

In this sense, boundary critique may be used as an instrument for curating through the various inferred, implied and imbued structures within the context of *complex social challenges* –

For the *complexity–oriented teams* to start delineating 'parts' from 'wholes', can infer the relationships between the identified ecosystemic elements, and start creating the context for understanding any emergent properties.

There are some circumstances where any previously identified boundaries are likely to change – including situations where:

- a new stakeholder is discovered, considered or introduced
- the dynamic equilibrium is altered in some fashion
- systemic goals are changed or discovered

In such circumstances, the *complexity–oriented teams* also arguably require a new capability – namely, that of understanding the system dynamics, and how might a *complex social challenge* ecosystem change over time.

A key element of understanding such ecosystem dynamics is to consider the notion of ecosystemic scales.

Inflecting Complexity–Oriented Challenges

Since *complex social challenges* possess many features that tend to 'keep them in place' and make them difficult to fully resolve, they are in some ways more akin to living organisms that exhibit key complex adaptive systems (CAS) characteristics – such as autopoiesis, adaptation and resilience.

Due to the inter–related nature of emerging effects across the ecosystemic scales – and the ambiguity of identifying definitive boundaries – it is also challenging to 'separate' the behavioural impacts associated with the various systemic actors from those of their enclosing environments and complexity contexts; in such a way that clearly outlines all the relevant complex interactions and dependencies.

From this perspective, *complex social challenges* are likely not entirely 'solvable' in a definitive sense – such that, a more relevant goal might instead be to 'inflect' them in some perceivably beneficial or preferential way.

Likewise, since such challenges operate across a variety of scales, there is a need to establish some relevant principle that might be able to 'cut across' the various levels in an integrative manner.

'Resilience' is one such useful construct – which, when assessed for a specific set of stakeholders, can be considered as a unifying principle across a variety of scales (whether at the micro, meso or macro levels – or, in a cross–cutting fashion).

Inflecting Complex Challenges

From this perspective, the endevour of successfully inflecting *complex social challenges* requires the *complexity–oriented teams* (COTs) to be effectively engaged in the process of actively designing for enhancing the resilience of some set of systemic structures and ecosystemic stakeholders.

Since the concept of 'resilience' is posited as required for supporting the notions of 'sustainability' in the context of *complex social challenges*, then enhancing the resilience of some set of stakeholders is also likely to improve their sustainability within the larger ecosystemic context.

To start considering the key team capabilities that might be required for enhancing the resilience of some specific set of stakeholders – across a given complex social challenge system – we next look at the notion of ecosystemic scales.

Ecosystemic Scales

In addition to being able to delineate boundaries and frame the most relevant 'parts' and 'wholes' within ecosystems – as well as, being able to understand the pervasive system dynamics – the *complexity–oriented teams* arguably require an additional ability;

Namely, that of understanding ecosystemic levels – within which the complex systems dynamics take place.

In the complex adaptive systems (CAS) sense, this dynamical perspective can be related to the notions of ecological disturbance – where, "emphasis has shifted from a viewpoint that disturbance is a rare and unpredictable event to treating it as a natural process that occurs at different spatial and temporal scales" (Pickett, Kolasa, Armesto, & Collins, 1989).

As a perspective that applies to multiple contexts, postulating inferences across the ecosystemic scales is recognized as both a promising approach, and a process that should be performed with care. For instance, when applied to organizational theory, researchers observe that "multilevel research is—at its best—complex, rigorous, and able to capture much of the nested complexity of real organizational life" (Klein & Kozlowski, 2000).

The ecosystemic scales are particularly relevant to *complex social challenges* since, the "structure of systems expressing their micro–macro features is closely connected to resilience issues", in such a way where there is a "structural interplay between the micro, meso, and macro levels" – where, the delineation of scales is recognized as non–trivial in a sense that 'the issue of what is "meso" in a specific context depends on how the phenomena involved relate to each other, and not the least the way how the observer system relate to what is observed' (Liljenström & Svedin, 2005).

From this perspective, each ecosystemic level effectively represents an active scale of engagement – within which different types of experiences, actors, participants, stakeholders and systemic dynamics might play greater or lesser roles.

Of course, the very nature of ecosystemic levels might be more epistemological and ontological than ontic – in a sense that, system dynamics have a capability of working 'across' posited scales, and might not necessarily be easily confined to specific categorizations.

Nevertheless, ecosystemic levels might be considered as a useful tool when dealing with a plethora of 'signals' within a given *complex social challenge* under analysis –

While allowing for some amount of 'decoupling' between the relevant phenomena in such a way where certain behaviours and structures might be grouped together for the purposes of understanding the system dynamics to the requisite level of granularity, to create effective engagements.

Understanding Ecosystem Scales

As such, the ability to understand ecosystem scales – defined as a set of distinct layers within the containing ecosystem within which the dynamic relationships take place – is defined as a key ability of the *complexity–oriented teams*.

Although multiple frameworks exist, a generally accepted understanding of ecosystemic scales and their associated levels of analysis are outlined as per below;

Micro Scale

The micro scale of ecosystem analysis often refers to individuals, and in socio–cognitive contexts, to the social structures situated around them – including the contexts of personhood, family, household and potentially even neighborhood.

A key property of this scale is that it is the closest to the immediate experience of the individual members of a particular social ecosystem – in such a way that, the systemic components represent effective 'interaction surfaces' that the individuals are actively exposed to and engaged with.

Meso Scale

The meso scale of ecosystemic analysis refers to the structures between the largest and the micro phenomena – which, in the socio–cognitive contexts, including such notions as communities, organizations and towns.

A key property of this scale – also referred to as the "mid–level" or "mid–range" – is that it serves as a conduit between the 'micro' and 'macro' scales – effectively translating the various multi–scale effects by acting as a 'shearing surface' between the larger–scale phenomena, and the immediate experiences of individuals.

Macro Scale

The macro scale of ecosystem analysis – also referred to as the 'global' level – indicates the largest phenomena that operate across the various ecosystemic participants, and includes such notions as nations, societies and civilizations.

This scale is often considered from the resource transfer perspective – and from the sociological viewpoint, might include such phenomena as public policy, development and zoning regulations and food pricing, among others.

A key property of this scale is that it tends to set a context for other types of activity in the containing levels – since, as an enclosing ecosystem scale, it tends to strongly influence some key characteristics of the broadly–shared phenomena in a way that other ecosystem actors must largely contend with.

Ecosystemic Level Implications

An important point to make is that different ecosystem levels tend to exhibit specific behavioural patterns – and interact in distinct ways.

This is relevant when considering the notions of how it might be possible to effectively work with and engage *complex social challenges* – including the process of understanding how any identified undesirable systems or sub–systems might be 'inflected' in some meaningful manner.

Team Capabilities for Engaging *Complex social challenges*

To develop team capabilities that can enhance the resilience of some specific set of actors within a given *complex social challenge* ecosystem, it is also relevant to consider exactly what such capabilities need to perform – from a stakeholder–oriented perspective.

While attempting to 'inflect' a *complex social challenge*, some stakeholders at a variety of scales – whether micro, meso or macro – are likely to be undergoing a series of profound transformations; that can be considered as a 'change of state' within the construct of the overall ecosystem.

Such transformations are postulated to incur a kind of 'transformational stress' – since, the stakeholders are effectively asked to 'shift' towards a different, and therefore uncertain and unpredictable future.

To some extent, efforts at enacting change are likely to push against the natural tendencies of the complex–adaptive systems towards establishing, enabling and maintaining a sense of homeostasis – where, any attempts at altering the 'usual' state have a variable chance of being perceived as unfavourable by some ecosystemic actors.

Furthermore, whether the 'stakeholders' are defined as individuals, organizations, abstract entities or policy environments, they are nevertheless interpreted by individuals – for whom, any shifts towards uncertain futures are likely to be perceived as 'liminal' journeys; those types of changes that lead towards psychologically and sociologically unsettling experiences.

To compensate for this effect, some of the key abilities of the *complexity–oriented teams* (COTs) need to be structured around developing effective capacities for leading, guiding, encouraging and ushering such shifts through the 'liminal spaces' of the uncertain and the unknown.

Teamwork for Complexity

What type of collaboration might be beneficial for teams engaging challenges rooted in complexity?

In this sense, 'teamwork' is defined as those sets of skills, abilities and capabilities that enable the effective engagement of:

- Internal team resources
- Environmental opportunities
- Other teams and larger groups
- Networks of distributed interest
- Collaboration around shared purpose

Such teamwork also must be able to encourage, facilitate and iteratively develop key collaboration for complexity skills in the stakeholder communities – designed to:

- Build trust to create understanding around common challenges
- Empower a network of champions to enact change
- Leverage group knowledge and wisdom
- Encourage localized ownership
- Emerge collective solutions

The collaborative barriers that *complexity–oriented teams* (COTs) encounter might be considered on a spectrum of specific psycho–social effects – that tend to take place when individuals, groups and communities are faced with engaging the potential uncertainties and realities of the unknown, that often accompany change initiatives.

A useful way to consider stakeholder encounters within these types of scenarios is to explore the concept of 'liminal spaces'.

Journeying through 'Liminal Spaces'

Any inflective strategies devised in the context of *complex social challenges* are likely to involve a process of transitioning some individuals or groups of key stakeholders – possibly including institutions and communities, dependably on the scope of a challenge – through the uncomfortable spaces of 'liminality'.

The 'liminal model' (Van Gennep, 1960; Turner, 1967) describes the key stresses and uncertainties that individuals and communities tend to experience when faced with the premises of the unknown.

Liminality is potentially a useful construct to investigate the domain of *complex social challenges*, since it "helps to study events or situations that involve the dissolution of order, but which are also formative of institutions and structures" (Szakolczai, 2009).

In this context, transformational journeys might be considered as 'liminal' in a sense that they represent transitions through the 'in–between' socio–psychological spaces – that are inherently ambiguous and tend to challenge the customary notions of identity and belonging.

Van Gennep's observations are based on the premise that fundamental individual experiences are intrinsically connected to the relationships with social groups – which was later further explored in the Socio Cognitive Theory (SCT) framework, that investigates how relationships might have reflective, feedback–based and generative qualities when established between individuals and social constructs.

Formative relationships are posited to occur in socio–cognitive spaces where personal agency is recognized to operate "within a broad network of sociostructural influences" that are intrinsically transactional – and where "people are producers as well as products of social systems" (Bandura, 2001).

From this perspective, people are "self–organizing, proactive, self–reflecting, and self–regulating" and viewed as "not just reactive organisms shaped and shepherded by environmental events or inner forces" – where the "self development, adaptation, and change are embedded in social systems" (Bandura, 1999).

This view seems to be further reinforced from the social systems perspective – where human resilience is viewed as an "intuitive response to extreme adversity and/or acute stress", that "does not exist in a vacuum", and is "embedded in functional human relationships and healthy interactions of the individual with the immediate social, cultural, economic, and biophysical environment" (Almedom, 2015).

As such, the dialectical relationships between the individual, social group and the environment are likely to be even more acutely ambiguous in the context of *complex social challenges* – where, the collective experience of an enacted social structure has been shifted, altered or undermined in some manner.

Additional research literature identifies core elements that might make such psychological journeys easier for the key stakeholders – with the possibility of facilitating the perilous crossings across the 'liminal spaces' of uncertainty.

Here, the liminal journey is considered from the perspective of three distinct phases (Turner, 1987) – each with a specific 'rite of passage' designated to perform a socio–cognitive function.

The key 'rites of passage' phases are listed as per below:

- **Preliminary Rites**: encourage separation from the old ('initiation')
- **Liminal Rites**: inspire acceptance of the new ('threshold transition')
- **Post–Liminal Rites**: manage transition back into the world ('new being')

To what extent might the active dimensions of *complex social challenges* – that include the emergent ambiguities of individual and social affect – possibly be influencing the enclosing environment in such a way where it might be additionally challenging to construct any corresponding 'liminal rites'; while making them both functional and accessible to the key stakeholders experiencing transformational stresses?

Leveraging the *complex social challenges* model, it is possible to assess the feasibility of attempting to enact 'liminal rites' in the context of complexity – by investigating the intersections between the 'individual' and 'social' affective domains, and their respective ambiguities.

At each intersection point, the feasibility of enacting a particular liminal rite is evaluated – along with, what type of an affect it is likely to generate in the 'individual' or 'social' context – as impacted by the respective inherent ambiguities.

The proposed feasibility of enacting liminal rites in the context of *complex social challenges* is evaluated as per below:

Table 10: Complexity and ambiguity influences on individual and social affect characteristics

Affective Impacts	Complexity Influences	Individual Affect *'liminal rites' dynamics*	Social Affect *'liminal rites' dynamics*
Cognitive Ambiguity	uncertain interpretations of rapidly changing events within the *complex social challenge* ecosystem	**Preliminary Rites** (APATHETIC): cognitive ambiguities make it challenging for an individual to make sense of the current circumstances, and have confidence to engage the *'rites of separation'* – to actively embark on liminal traversals.	**Preliminary Rites** (DISSONANT): challenging to understand the individual relationships to the 'normal' state of the world, as a pre–requisite for designing some effective rites of separation – that can support an individual initiation into some new way of being.
Contextual Ambiguity	unpredictable emergence and de–cohesive changes in the social context	**Liminal Rites** (AMBIVALENT): dynamic contextual ambiguity makes it challenging for individuals to understand the 'normal' vs. 'new' state of the world – to successfully participate in the *'threshold transition'* rites.	**Post–Liminal Rites** (DECOHESIVE): dynamic changes in social context and de–cohesive fit to larger societal structures makes it challenging to manage transition back into the 'normal' world, to construct an effective sense of 'new being'.
Cooperative Ambiguity	altering social roles within the *complex*	**Post–Liminal Rites** (APPREHENSIVE): challenging to manage transition back	**Liminal Rites** (DETACHED): cooperative ambiguity around shifting social roles

	social challenge ecosystem	into the 'normal' world, in the state of 'new being'; due to unclear cooperative relationships and possible implications.	makes it challenging for group members to participate in facilitating a seamless 'threshold transition'.

More particular implications on performing 'liminal rites' might be as summarized as per below:

- **Preliminary Rites**: challenging to enact the 'death' of the old identity and disavow customary routines
- **Liminal Rites**: challenging to follow a "strictly prescribed sequence, where everybody knows what to do and how" while subjected to the "authority of a master of ceremonies" (Szakolczai, 2009)
- **Post–Liminal Rites**: challenging to perform the rites of incorporation into a cohesive new world

Based on this analysis, it appears to be challenging to perform effective 'liminal rites' in the context of *complex social challenges* – where, the notions of individual identity and social structure are likely to be perceived as threatened or undermined in some manner.

To that extent, it might be helpful to consider additional key elements of enabling teamwork for complexity – that might further enable and enhance stakeholder resilience in complexity–based environments.

Sense of Coherence

The 'sense of coherence' framework comes out of the salutogenic model – that posits health to be on a "health–ease versus dis–ease continuum" (Antonovsky, 1979), and is concerned with the relationships between health, stress, and coping.

As such, Antonovsky views the sense of coherence (SOC) as a:

> "global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that (1) the stimuli deriving from one's internal and external environments in the course of living are structured, predictable and explicable; (2) the resources are available to one to meet the demands posed by these stimuli; and (3) these demands are challenges, worthy of investment and engagement." (Antonovsky, 1987)

Conversely, individuals with a strong SOC "have the ability to (a) define life events as less stressful (comprehensibility), (b) mobilize resources to deal with encountered stressors (manageability), and (c) possess the motivation, desire, and commitment to cope (meaningfulness)" (Wolff & Ratner, 1999).

Interestingly, the salutogenic model does not view challenges as fundamentally problematical in and of themselves – and instead, considers encounters with emergent issues as a normal part of being in social contexts.

Any negative impacts associated with encountering challenges are postulated to be caused by the disproportionate increase in the *Generalized Resource Deficits (GRDs)'* when compared against the availability of *'Generalized Resistance Resources (GRRs)'* – that increase resilience, enhance the overall sense of coherence and enable the creation of effective coping strategies.

Although researchers identify additional dimensions of social well–being, that include "social integration, social contribution, social coherence, social actualization, and social acceptance" (Keyes, 1998), the salutogenic model is compelling in that it postulates three key enablers of enhancing the stakeholder sense of 'social coherence' – as per below:

- **Comprehensibility**: Ability to understand challenges and anticipate future in an orderly manner ('map')
- **Manageability**: Belief that one has skills, abilities and resources to surmount challenges ('hope')
- **Meaningfulness**: Sense that managing challenges is worthwhile ('purpose')

Referencing previous observations about the affective characteristics of *complex social challenges* from the socio–cognitive perspective, it is likely that at least some key stakeholders will experience certain sets of tensions – when it comes to attempting to maintain their 'sense of coherence';

In part due to the following gaps:

- **Lack of map**: stakeholders are generally not provisioned with a 'map' of the liminal space traversal
- **Lack of hope**: stakeholders may not feel ready to effectively manage challenges
- **Lack of purpose**: stakeholders may not always be able to construct cohesive meaning in–context

The lack of sufficient, adequate and accessible psycho–social resources during liminal traversals generates a stress response in the ecosystem participants – indicating a possible gap that might need to be fulfilled by the *complexity–*

oriented teams, in terms of being able to effectively support and enhance the resilience of the key stakeholders in some manner; as a necessary requirement for undertaking and persisting in liminal journeys.

Resilience as Support in Undertaking Liminal Journeys

To be able to 'shift' through the complex challenges, the *complexity–oriented teams* are likely to require skills that increase the overall sense of resilience for the key stakeholders.

A possible key strategy for enabling stakeholder resilience in ecosystemic contexts is to ensure that the salutogenic 'sense of coherence' is supported across the various levels of stakeholder engagement.

When posited to be related to stakeholder experiences at different ecosystemic scales, the sense of coherence is viewed as an enabling cross–layer construct and a "concept that can be applied at different system levels, at an individual level, a group (family), on organizations and societal level" (Eriksson, 2017).

Examining the social support perspective for enabling such coherence, a bidirectional relationship is postulated between the systems–level and individual resilience – where the "effective interventions to enhance resilience necessitates understanding that resilience in the individual is dependent on multiple layers of society" (Sippel et al. 2015).

What key competencies might the *complexity–oriented teams* require, to be able to help enhance stakeholder resilience – as determined by supporting a salutogenic sense of coherence, while enabling effective 'liminal traversals' across multiple ecosystemic scales?

Complexity–Oriented Teams – Key Competencies

The key competencies associated with the *complexity–oriented teams* need to be able to support "comprehensibility" – as a method of understanding challenges in a way where future may be anticipated in an orderly fashion, by providing some sort of a 'map'; "manageability", as a way of enhancing one's belief in their own skills, abilities and resources to surmount challenges that builds towards a sense of 'hope'; and "meaningfulness", as a way of supporting an orientation towards believing that managing challenges is worthwhile, giving rise to an enhanced sense of 'purpose'.

Such collaboration competencies also need to be able to empower the *complexity–oriented teams* in designing engagement experiences that can sufficiently enhance stakeholder resilience – to the point where the key stakeholders can more successfully participate in any 'liminal rites' of passage, as part of transiting through the degrees of a *complex social challenge* ecosystem.

Such team collaboration competencies are likely to be structured around developing certain sets of core abilities – that can be leveraged by the *complexity–oriented teams* within engagement contexts – as per below:

Table 11: Key team competencies

#	Key Team Competency	Key Abilities
1	Postpone Solutioning	**stakeholder buy–in**: 'going on a journey'. **empowered team**: someone to journey with.
2	Extend Ambiguity	**team trust**: to enable a shared journey into uncertain and potentially 'uncharted' territory. **iterative sensemaking**: as a continual process of making increasing 'sense' out of emergent situations.
3	Iterative Context Understanding	**identify multiple perspectives**: correlate to stakeholders, while constructing relevant categories of meaning. **converge on experience categories**: identify 'experience attractor' areas associated with multiple perspectives of stakeholder experience.
4	Aggregative System Composition	**identify systemic signals**: detect signals that indicate presence of systems–based dynamics – and be able to distinguish from 'noise'. **identify systemic boundaries**: continually identify areas of shared activity, purpose and experience – that enclose systemic structures with a tendency of exhibiting cohesive sets of behaviours.
5	Re–Frame Challenge Boundaries	**concept pivoting**: ability to identify key conceptual structures and position them as 'central' – while re–organizing related elements in reference to them. **stakeholder needs synthesis**: ability to understand which needs might belong to 'unifying categories' – that deepen the understanding of the key stakeholders.
6	Identify Active Ecosystems	**correlate systemic impacts**: identify what systemic impacts are affecting which stakeholders, and in what manner; then classify and prioritize them. **prioritize active sub–components**: distinguish and differentiate which systemic components are responsible for most of the relevant impacts on the specific stakeholder audiences.

7	Design Inflection Points	**identify inflection points**: **coordinate integrated action**: engage key stakeholders to support emergent localized, context–aware initiatives.

Such key competencies are likely to be required by the *complexity–oriented teams* when facilitating the stakeholder journeys through the liminal spaces of *complex social challenges* –

Where, the key underlying issues need to be approaches in a very much different fashion than in the case of the more typical, 'tame' problem domains.

Use–Case: Addressing 'Tame Problems' vs. *Complex social challenges*

Several studies consider approaches that might work well in the domain of *complex social challenges* – in contrast to the types of heuristics typically employed when addressing 'tame problems'.

One such illustrative study was performed in Australia around the *'Learning to Learn'* project – which identified key dimensions of complex challenges that illustrate the need for leveraging different approaches.

The summary of key findings is presented as per below:

Based on the '**Box 1. Guiding principles from Australia's Learning to Learn project**' (Snyder, 2013):

Table 12: 'Tame' vs. complex social challenge characteristics

#	Tame Problems	*Complex social challenges*	Key Complexity Characteristics
1	iterative improvement	emergent transformation	linear –> 'milestones' (improvement) vs. incremental –> 'new states' (transformation) 'system loops' may limit / buffer incremental change (might appear as limited progress) systemic energy aggregation needed to reach tipping points tipping points required for transformation
2	centrally–defined tasks	ecosystem–evolved approaches	no centralized awareness of all issues emergent / adaptive relationships

			catalysts often facilitate relationship building
3	solution heuristics	complex–adaptive inflections	no predetermined solution knowledge a complex adaptive system might be the 'most compressed form' of a solution
4	clear definable outcomes	continuous feedback learning	no reliable previous knowledge continuous discovery and learning sustainable goals via continuous feedback loops trust needed to broker, maintain relationships
5	risk mitigation methods	adapting to shared challenges	no clear method of detecting and anticipating all inherent risks in advance emergent discovery of key challenges
6	best–practice frameworks	exploring world–views	intransigent stakeholders building trust and relationships as foundation for emerging intrinsic capacity
7	enforcing rules and regulations	expanding shared identity	seemingly conflicting rules, goals and objectives create a sense of irreconcilable constraints identity as a 'connective tissue' and integrative construct creating shared identities
8	minimizing unanticipated change	dancing with uncertainty	unpredictable complex systems dance still implies adhering to a set of dynamic rules – and doing so gracefully
9	driving centralized change	encouraging local change	no possibility for ecosystem–wide policy
10	deployment + adoption planning	sustainability + resilience design	no fixed final solution

Key Stakeholder Resources

Where might such key stakeholders and resources be found?

Rather than looking 'externally' for solutions, research findings based in practical contexts seems to suggest that the key resources for effectively engaging key systemic challenges might be within such systems themselves.

In this context, the enclosing ecosystems are generally thought of containing rich grounds of underutilized resources – expressed as a sense of 'collective wisdom' – such that, a most effective approach for innovating within *complex social challenge* systems might be to enable the intrinsic capabilities, and free–up their internal knowledge.

Key Systemic Capabilities

To be able to access the underutilized internal skills and competencies – including the effective expression of the 'collective wisdom' – there is a requirement for developing a certain 'minimal set' of core systemic capabilities.

To what extent, the *complexity–oriented teams* might require specific systemic capabilities – including:

Table 13: Systemic capabilities of complexity–oriented teams

SYSTEMIC CAPABILITY	ACCESSED VY	CRITICAL SHIFT
Systemic Learning	enabling strategic feedback loops	• from strategies that operate *on* people, to strategies that enable and work *with* people • from 'replaceable people as a cog in the machine' to 'people as a strategic asset to identify new learning'
Cross–Scale Interaction	deep horizontal and vertical interactions	• from 'centers of excellence' to 'cross–sections of collaboration'
Integration	enacting key learning, and coordinating across ecosystems	• from 'top–down' solutions push, to emergent, localized 'bottom–up' context–aware initiatives • from 'centralized action' (Victorian ideas of body – "head of…") to 'distributed cognition' (complexity)
Experimentation	implementing small initiatives	• from 'up–front cost/benefit, risk analysis' to iterative learning through assessment and experimentation

As such, any team capabilities for enhancing stakeholder resilience must be able to take into consideration the team capabilities for effectively supporting stakeholder journeys through the liminal spaces of the uncertain and the unknown.

Resilient Teams

To build resilient outcomes for the variety of the ecosystemic actors, the *complexity–oriented teams* need to themselves be resilient – for which, they must leverage the metacognitive strategies and frameworks.

What metacognitive strategies might the *complexity–oriented teams* require, to be resilient?

And, what metacognitive frameworks might be a possible 'good fit', to facilitate effective engagements in the context of *complex social challenges*?

Destructive Team Dynamics

Resilience is viewed as a key enabler for *complexity–oriented teams* – in terms of helping such teams to engage complex societal challenges in a sustainable manner.

As such, it's possible to consider resilience as a key team capability when attempting to manage issues frequently encountered by the *complexity–oriented teams* – due to the socio–cognitive pressures experienced by teams in the *complex social challenge* contexts.

Many of the issues experienced by teams can be considered as cumulative in nature – and might be considered as 'destructive team dynamics' – that include the following:

Table 14: Destructive team dynamics and complex social challenge influences

DESTRUCTIVE TEAM DYNAMIC	COMPLEX SOCIAL CHALLENGE INFLUENCE
fatigue	a *state* of being impeding one in effectively engaging a complex challenge
disenchantment	a *perception* that team might not be able to reach positive outcomes
disillusionment	a *belief* that a given complex challenge might not be positively changed

As such, these destructive team dynamics are postulated to be complexity–oriented issues – that also share a common, *continuous engagement* characteristic, not generally present within non–complexity environments.

The continuous engagement characteristic also contributes to the *cumulative effect* – empowered by being embedded in a complex set of systemic relationships that can give rise to multiple causal manifestations that affect team performance.

Some of the team–performance impacts are delineated as per below:

Table 15: Destructive team dynamics vs. team–performance impacts

DESTRUCTIVE TEAM DYNAMIC	COMPLEX SOCIAL CHALLENGE INFLUENCE	TEAM–PERFORMANCE IMPACTS
fatigue	relentless; cross–cutting; multiple stakeholders with urgent needs	uncertain when to / unable to pause; unpredictable escalations in intensity; external factors seem to dictate pace; inability to 'match' sustained personal output with external needs and exigencies.
disenchantment	lack of clear heuristics; continuous likelihood of potential failure as part of engaging complex systems	team stresses due to internal and external pressures; insufficient information to make clear decisions; some stakeholders at odds, or not satisfied despite progress; challenges in team collaboration.
disillusionment	'super–wicked' temporal / spatial accelerations; solutions only impact parts of systems	even when teams perform well, *complex social challenges* tend to exhibit 'systemic homeostasis' and manifest resistance to change; new systemic issues emerge while existing are being addressed.

These 'destructive team dynamics' are also postulated to be able to impact the feasibility of enacting sustainable engagements, for teams engaging within the context of *complex social challenges* – identified as per below:

Table 16: Destructive team dynamics and sustainable engagement strategies

DESTRUCTIVE TEAM DYNAMIC	INFLECTIVE VECTOR	AFFECTIVE DOMAIN	IMPACTS	SUSTAINABLE ENGAGEMENT STRATEGY
fatigue	state	individual	too tired to carry on engaging a complex challenge; change of feeling about self	personal coherence; built on sustainable personal engagements (re–frame personal identity as exploration)

disenchantment	perception	team	team might not be able to reach a positive outcome; change of relationship to team	team coherence; built on mutually supporting experiences (re–factor value, meaning of team contributions)
disillusionment	belief	world	a given complex challenge might be unsolvable; changes in worldview.	worldview coherence; iterative pivoting for incremental successes (re–position change and positive impacts)

Each successive team challenge appears to be as more difficult to correct than the previous one.

As the 'inflective vectors' change from a 'personal state' (experienced by at least one team–member) to a 'shared perception' (held by one or more team–members) to a 'reinforced belief', the intervention requirement escalates in terms of personal and team abilities required to sustain the complexity–oriented engagement in an effective manner.

This raises a question around, how might it be possible to empower such sustainable engagement strategies – while improving the effective team resilience?

Capabilities for Building Team Resilience

Specific *team capabilities* are required to enable sustainable engagement strategies – and to ensure that the teams themselves are resilient in the context of *complex social challenges*.

One such identified team capability is intellectual or *cognitive resilience*.

This type of resilience enables a team to keep on being engaged in an effective manner, in the face of highly contentious issues that tend to occur within the context of *complex social challenges*.

Cognitive Resilience

As a key team capability, *cognitive resilience* is precluded on being able to effectively manifest a range of relevant team skills;

That are oriented both internally – towards the team–members themselves – and externally, towards the enclosing ecosystem, as a method of engaging the external environment in an effective manner.

All the skills identified are further postulated to have a *continuous* component – in a sense that they need to be executed on a continuous and iterative basis, within the context of *complex social challenges*.
 The identified team–skills – required to manifest the team capability of *cognitive resilience* – are posited as per below:

Table 17: Team skills for complexity collaboration

TEAM SKILL	IMPACTS	ENABLERS
1. **Re–Factor Meaning**	Reduce information overload by continuously creating higher order meaning structures	diverge / converge loops; applied creativity; design thinking; iterative sensemaking; systems modelling; anticipatory futures; visual thinking; design for *dynamic information density*
2. **Build Trust**	Continuously manage internal and external trust–building to strengthen relationships	engage stakeholders early and often; create inclusive culture; build change champions; encourage ownership via co–design; leverage intrapreneurship; share limelight; celebrate together
3. **Iterate Success**	Continuously build confidence and reduce risks with small iterative engagements	design for iteration; create bounded engagements to manage risks; re–frame failure as active learning; act on small ideas; use *observe–reflect–make* loops; human–centric 'stickability'
4. **Re–align Approaches**	Align strategy to the observed outcomes, team responses and stakeholder feedback	create effective stakeholder information feedback loops; design modular delivery architectures; gauge adoption with distributed change coordinators
5. **Re–frame Purpose**	Reflect core purpose in new ways within the changing strategy approaches	iterative model of stakeholder–relevant goals and objectives with enabling dependencies / inter–relationships; target–state vision with gap analysis; purpose systemigram

Reviewing the postulated team–skills necessary to enable the team capability of *cognitive resilience*, some key questions arise – including the consideration around, how might cognitive resilience strategies be most effectively supported in the context of *complex social challenges*? To consider this question, it also might be useful to consider what systemic behaviours the *complexity–oriented teams* are most likely to utilize – when engaging in activities that place demands on cognitive resilience.

Systemic Enablers of Cognitive Resilience

In addition to the key identified team skills, the *cognitive resilience* capability is postulated to be supported by the following systemic engagement enablers – further described as per below:

- **iterative learning**: *create feedback–loops* for establishing continuous input and reflection
- **value pivoting**: *reframe and re–contextualize* relationships to identify opportunities
- **adaptive delivery**: *re–create approaches* with iterative stakeholder engagements

The systemic enablers can be further delineated as per the following table:

Table 18: Systemic enables and implied abilities

SYSTEMIC ENABLER	APPROACH	IMPLIED ABILITIES
1. **Iterative Learning**	*create feedback loops* for continuous input and reflection	**1)** understand the systems / stakeholders with focused situated initiatives, enabling continuous learning loops, **2)** structure to discover implicit / explicit stakeholder perspectives, expectations, and systemic outcome boundaries, **3)** iteratively aggregate learning – leverage cognitive distribution, minimize information overload and build increasingly relevant foresight models and future scenarios.
2. **Value Pivoting**	*reframe and re–contextualize* relationships to re–imagine new value, identify potential assets, and emerge opportunities	**1)** re–position personal / team identity as long–term adaptive constructs, **2)** synthesize learning to re–imagine existing, and identify new assets (i.e. tangible vs. intangible, core vs. transient), **3)** re–contextualize value to enable pivoting into new opportunities (aka 'constructive failure'; Steve Jobs: calligraphy –> new GUIs, expelled from board –> animation company; NASA: failed launches –> new technologies, etc.)
3. **Adaptive Delivery**	*re–create approaches* through systemic insights for more impactful, iterative stakeholder engagements	**1)** create strategy that is componentized, modular and adaptive – so that learning can inform re–structuring of activities, **2)** crate deliverables that have a degree of self–containment, with clear links to other components – to minimize the domain of uncertainty, and make iterative progress possible while changing or re–prioritizing where required, **3)** tell stories to engage stakeholders into a new vision

The systemic enablers can also be represented as a diagram – as per below:

Figure 8: Core team skills for engaging complexity
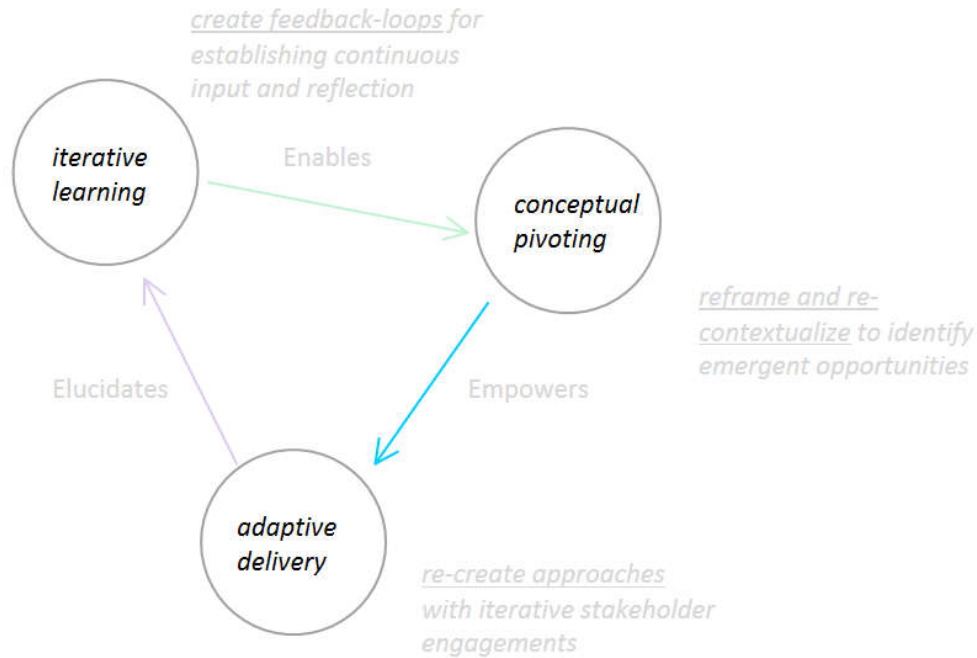
When successfully employed, the systemic enabler team–skills support *cognitive resilience* by reducing and 'pre–emptying' emotional responses and channeling the cognitive diversity in constructive ways –

To afford additional space for 'conceptual maneuverability' necessary to work around the core issues, and by extension, to enable sustained engagements in the context of *complex social challenges*.

Core Abilities Supporting Cognitive Resilience

One outstanding question may be identified around, what additional skills might be required by the complexity oriented teams to successfully address some of the core identified issues around the dilemmas themselves – given their inherent ambiguity.

As such, specific core abilities are postulated as required, to support the key *team skills* and *systemic enablers*, as necessary preconditions of supporting the team capability of *cognitive resilience.* The posited core team abilities are outlined as per below:

Table 19: Core team abilities for complexity collaboration

CORE ABILITY	ABILITY DESCRIPTION	INTERNAL FOCUS	EXTERNAL FOCUS
1. **Dialectic Thinking**	Cognicize multiple opposing and seemingly incompatible perspectives – as part of both individual and team sensemaking processes. Be able to cognitively recontextualize complex challenges as 'dilemmas' – with multiple valid perspectives, and without many pre–decided, reliable, prescribed solutions or heuristic responses.	individual	team–members, stakeholders
2. **Dialectic Engagement**	Approach stakeholder engagements through the dialectic lens – acknowledging the variety of often conflicting perspectives as a manifestation of cognitive diversity and ultimately 'wisdom' present in a complex challenge system. Create 'safe spaces' for the expression of conflicting views and perspectives – both internally (within team) and externally (with stakeholders).	team	stakeholders, groups, communities
3. **Framing Dilemmas**	Enable comprehension of *complex social challenges* as a system of interrelated 'dilemmas' – with implicit (teamwork model) and explicit (engagement strategy) enabling design for synthesizing a variety of conflicting perspectives into relevant insights. Leverage cognitive diversity to understand systemic challenges, and continuously re–frame when comprehension increases.	team	stakeholders, groups, communities, systems, ecosystems, ecologies

The relationship between the *complexity–oriented team* core collaboration abilities can be visualized as per:

*Figure 9: Team abilities for engaging complexity*
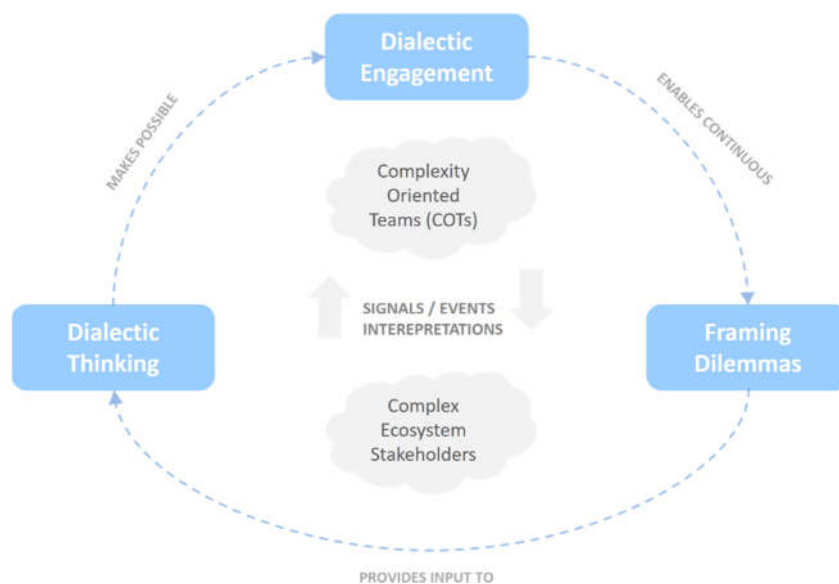
Here, this diagram depicts the observations that, the **a**) posited 'core team abilities' are related in a continuous and interactive manner, in a such a way where they 'loop' throughout the lifecycle of a given complexity engagement – and are iterated as the additional levels of informational depth, insight, realization and collaborative stakeholder engagement are revealed; and **b**) the relationship between the "complexity oriented teams" and the "complex ecosystem stakeholders" is recognized as the primary generative dynamic – one that manifests through a plethora of 'signals' and 'event interpretations' that necessitate the use of the 'core team abilities'.

Visualizing Cognitive Resilience

A representation of how the postulated key team *skills*, *systemic enablers* and *core abilities* bring about a set of factors necessary to support *cognitive resilience* is offered as per below:

Figure 10: Visualizing cognitive resilience sphere of interaction
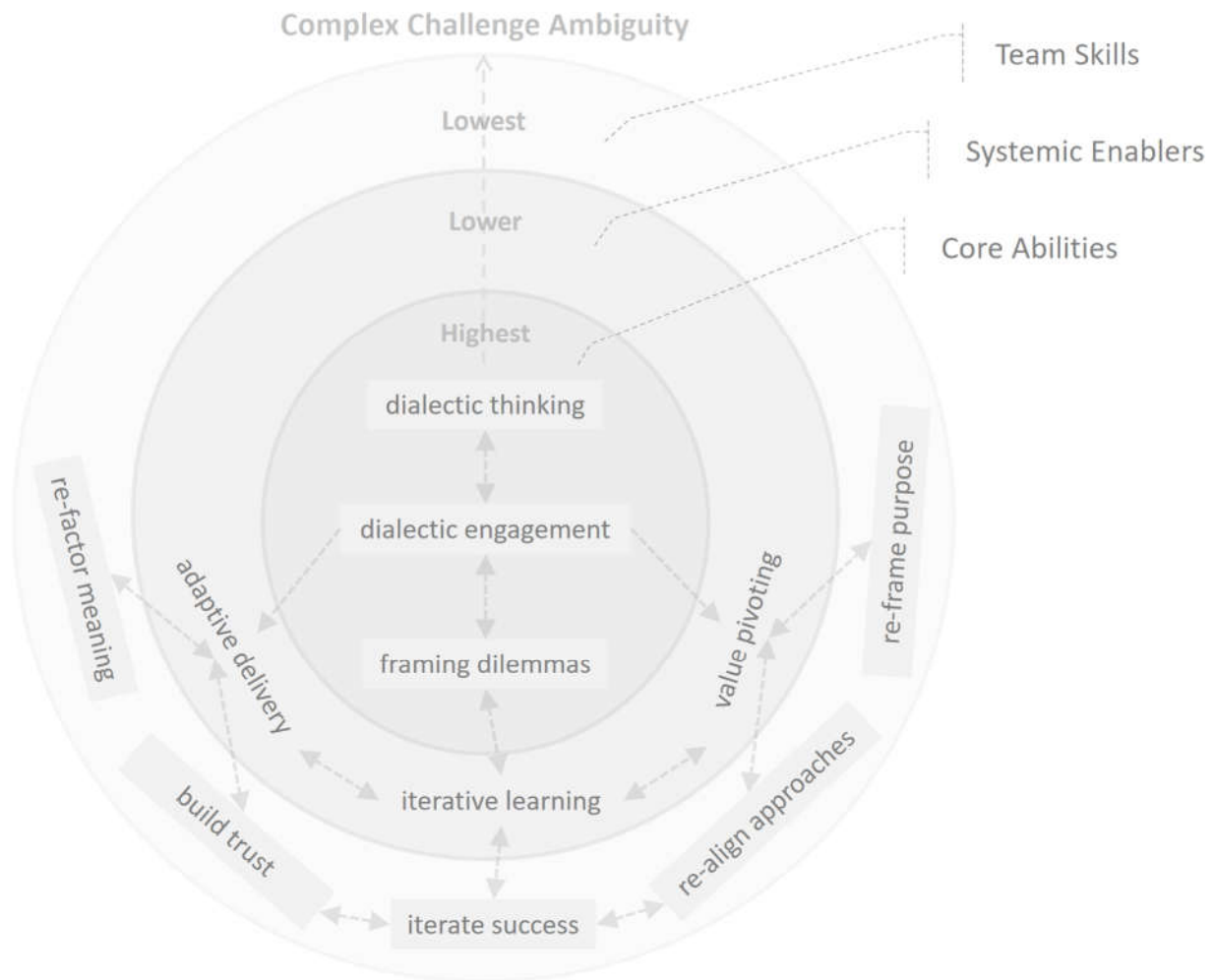
Here, this diagram depicts the observations that, **a**) in order to ensure sustainable collaborative outcomes in the context of *complex social challenges*, all three interrelated levels are simultaneously engaged – in such a way where they are mutually supportive, and provide disambiguation and increasing levels of information coherence, as they relate to the situationally–embedded meaning 'across' the various levels of analysis; and **b**) the three levels of *complex social challenge* engagement are posited to be able to move at varying 'speeds' – where, different types of collaborative engagements might imply specific uses of the postulated 'team skills', 'systemic enablers' and 'core abilities' involved.

The team capabilities that give rise to *cognitive resilience* ensure that the *complexity–oriented teams* can engage the domain of *complex social challenges* in a sustainable manner – while maximizing the opportunities to engage key stakeholders in a way that effectively leverages collective capabilities.

The question of how might such collaboration capabilities be utilized is explored in the next, concluding section – coupled with an illustrative application example.

Transitioning through Complexity

The collaboration for complexity skills, abilities and capabilities associated with the *complexity–oriented teams* are not an end in and of themselves.

Instead, their intended purpose is to help teams in becoming more effective in assisting the key stakeholders to 'transition' through the trying landscape of the *complex social challenges* – in their journey of becoming more resilient and sustainable.

What might such a journey look–like – both from the stakeholder perspective, and from the point of view of the teams that are attempting to facilitate them?

Furthermore, what might be some of the key challenges that the complexity oriented teams might encounter?

Complexity Traversal Model

The following is a proposed generalized model for envisioning the process of facilitating stakeholder journeys through the context of *complex social challenges*.

It is based on the concept of reaching three specific 'plateaus' – where, the *complexity–oriented teams* have an explicit opportunity to evolve the engagement methods in a way that develops specific collective capabilities.

In this sense, the framework is highly facilitative in nature – since, it is understood that – to address the *complex social challenges* in some effective manner – it is the very stakeholders themselves that must acquire some necessary degree of resilience, to be able to inflect the key social challenges and 'shift' the ecosystem towards some preferred shared future.

The key characteristics of the three 'plateaus' are as per below:

Plateau of Possibility

The first 'plateau' is characterized by the pervasive issues that tend to persist in the *complex social challenges* – including doubt, lack of trust, fear, presence of contending opinions and the prevalence of the established views.

To reach this plateau, the *complexity–oriented teams* must perform 'shifts' in three important dimensions – in expectations, approach and thinking.

If successful, this plateau offers a sense of possibility for transformation – where it becomes possible to re–imagine the current circumstances and accept the existence of hope for discovering actions that might lead to a shared preferential future, and an improved world–view.

Plateau of Competence

The second 'plateau' is characterized by the issues that tend develop after teams have been working in the context of *complex social challenges* for some time, and have already realized some gains – and include the presence of issues such as the uncovering of hidden tensions and narrow identities, the emergence of suppressed competition and the clinging to the old success patterns and localized goals.

To reach this plateau, the *complexity–oriented teams* must perform 'shifts' in three key sensitive dimensions – in social being, orientation and enabling.

If successful, this plateau offers a sense of possibility for collaboration towards a shared vision – where it becomes possible to emerge the 'group genious' and start leveraging the otherwise hidden competencies that might already exist in the collective groups of key stakeholders, albeit in a generally under–utilized fashion.

Plateau of Capability

The third 'plateau' is characterized by the implementation–level issues around attempting to inflect *complex social challenges* – including the lack of understanding of systemic structures, ecosystemic hierarchies, network effects, complexity and emergence.

To reach this plateau, the *complexity–oriented teams* must perform 'shifts' in three final dimensions – in risk management, change coordination and implementation.

If successful, this plateau offers a sense of possibility for achieving genuine capability towards implementing inflective strategies – where the plurality of views, perspectives and competencies can be engaged in a way that creates genuine impacts in the enclosing ecosystem, to inflect the overall ecology towards sustainable and improved stakeholder experiences.

Visualizing the Complexity Traversal Model

While a detailed exploration of how the *complexity–oriented teams* might employ their capabilities, skills and abilities to reach each 'plateau' on the traversal model is beyond the scope of this paper, a summarized visualization of the 'roadmap' is presented as per below:

Figure 11: Complexity traversal roadmap
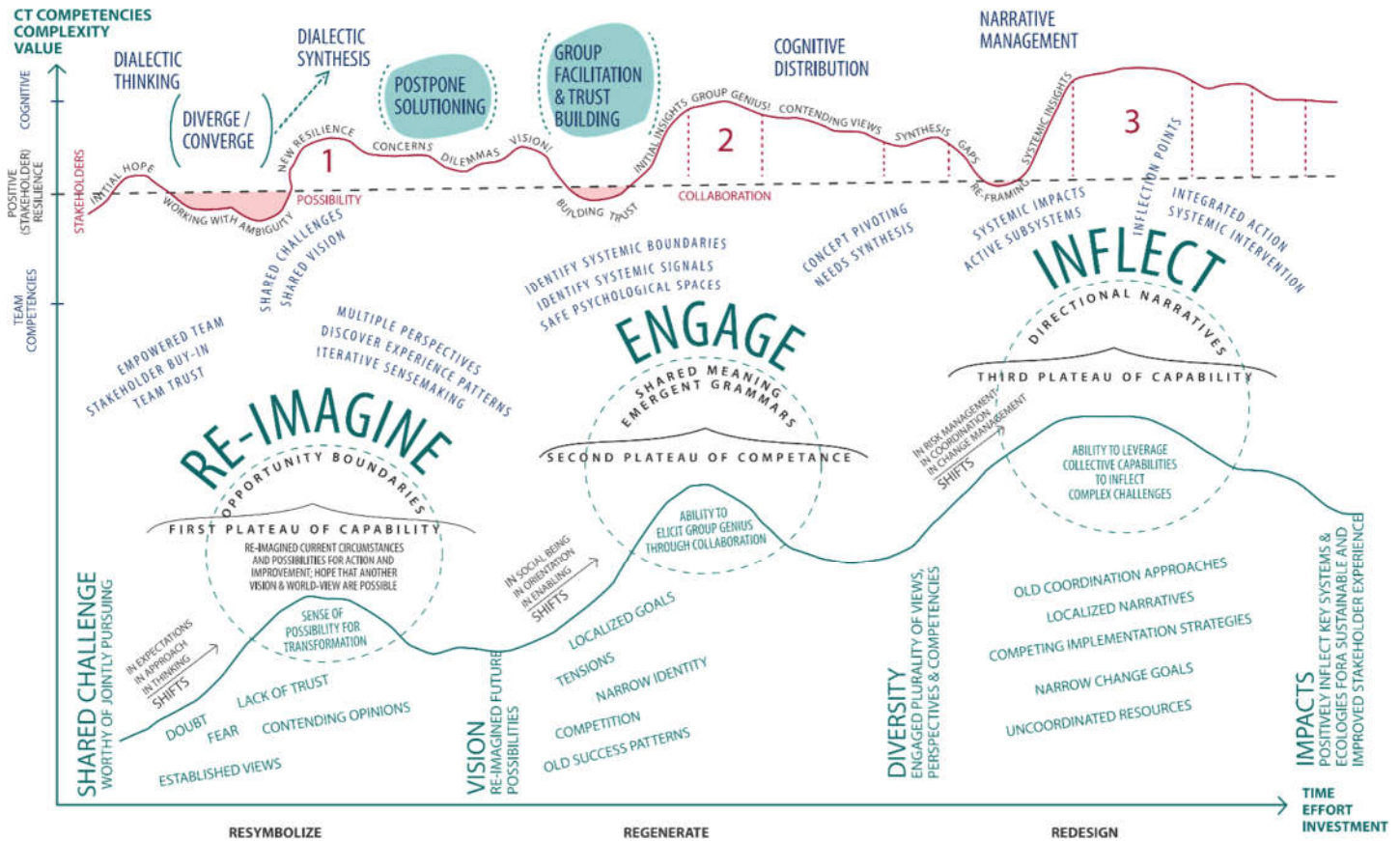
Example Use–Case

Given the prevalence of complex issues facing the modern world, there are many issues that might be justifiably selected as an example use–case.

Among these, the question of forced human migration is arguably one of the most relevant and challenging issues to consider, today – as it concerns multiple socio–economic spheres, and impacts the individual, cultural, ethical, legal, legislative, political, organizational, healthcare, humanitarian and other aspects of modern life.

The emergent problematiques around the *complex social challenge* of Syrian migrants has attracted the world attention in a way that has generated a plethora of opinions, conflicting perspectives and points of view.

In the midst of this global dilemma is a population of real human beings, that seem to find themselves in what certainly appears to be an unbearable – and perhaps for most of us in the western world, rather unimaginable – set

of circumstances; undergoing hardships that one might more readily associate with the realities of past world wars, then with the exigencies of the modern world.

The example below outlines how the *collaboration for complexity framework* – coupled with the notions of *complexity–oriented teams* – might be utilized to engage such migrant crises, in a way that enhances the resilience of the key stakeholders, and the sustainability of the enclosing ecosystems.

Syrian Migrants Complex Social Challenge

Summary Overview

Researchers posit that, "around 3% of the world's population (n = 214 million people) has crossed international borders for various reasons" – where, "Syria has been going through state of political crisis and instability resulting in an exodus of Syrians to neighbouring countries" since March of 2011 – resulting in a situation where "more than 1 million Syrian refugees are residents of Lebanon, Jordan, Turkey, Egypt and North Africa", and pleas for the international community to "step up efforts to support Syrian refugees and their host governments" (El–Khatib, Scales, Vearey, & Forsberg, 2013).

The situation of the Syrian migrants is very complex. According to Özden (2013), the "number of displaced Syrians crossing the border into Turkey has dramatically risen", where some "182,621 Syrian refugees were living in Turkey mid–February 2013" – according to the United Nations Refugee Agency. This created an entire range of complex socio–economic issues and a situation where "anti–immigrant, anti–Arab discourses have surfaced among the Turkish public", and where the "Turkish governments' openly hostile position to the Syrian regime" became "closely linked with Turkish domestic politics and foreign policy", giving rise to "an anti–immigrant position accusing displaced Syrians of being armed, sectarian rebels" – affecting the "political framework of the host–society" (Özden, 2013).

In a manner typical of *complex social challenges*, this refugee crises has many socio–economic, healthcare and political dimensions that create fundamental impacts on a very human scale.

The displacement of the Syrian refugees is also widely distributed among a host of countries – where approximately "600 000 Syrian refugees registered by the UN High Commissioner for Refugees (UNHCR) reside in Lebanon" – which is disputed by the Lebanese Government, that has "estimated this number to be about 1·5 million—which

corresponds to an increase in Lebanon's population of more than 25%" – creating extraordinary pressures where the "living conditions of Syrian refugees are tragic", and where "many have lost their homes and family members", giving rise to a situation where, despite the observed "solidarity between populations", the " Syrian refugees put pressure on the Lebanese health–care system and economy, and Lebanon hosting capacities are overstretched, thus transforming the so–called Syrian crisis into a Lebanese–Syrian crisis" (Refaat & Mohanna, 2013).

Given that *complex social challenges* often create trans–national and trans–governmental impacts, they are additionally challenging to deal with.

In the case of Jordan, "half a million Syrian refugees have come", where "between 1500 and 3500 Syrian refugees are now arriving each day" – and, despite the fact that "Jordan shares history, culture, and a long open border with Syria" and "provides access to preventative and curative services to Syrian refugees", there is nevertheless a great deal of pressure created because of the fact that "70% of Syrian refugees are residing among host Jordanian communities", of which "only 30% of the Syrian refugees reside in camps" – where, given the "larger proportion of refugees outside the camps, not all needs can be adequately addressed"; despite the fact that the "Jordanian MOH provides full access to health services for the Syrians outside camps along with the local Jordanian population" and certain "non–governmental organisations and private sector practitioners also deliver services to Syrian refugees outside the camps" (Murshidi, Hijjawi, Jeriesat, & Eltom, 2013).

Despite all this goodwill, the capacities are described as 'overstretched', for a variety of critical health services – including the neonatal incubators, surgical care demand and cancer treatment – which "requires labour–intensive efforts by providers as well as expensive medication and therapies", and has consequently "strained MOH's budgets and workforce" (Murshidi, Hijjawi, Jeriesat, & Eltom, 2013).

In that sense, researchers observe that migrants "have had major challenges to meet their health care needs throughout history especially in war zones and natural disaster times", where the "health care needs of Syrian refugees have been becoming an increasingly important issue" – with an increased "prevalence of post–traumatic stress disorder (PTSD)" (Alpak et al., 2015).

In fact, researchers postulate that the "most common mental health problems among refugees are depression and posttraumatic stress disorder (PTSD)" – with attempts towards deploying "eye movement desensitization and reprocessing (EMDR)" therapy, as an "effective treatment for PTSD" (Acarturk et al., 2015).

These highly contentious and often disastrous circumstances are tempered by the observation that "there are currently more people displaced by conflict than at any time since World War II", where the "profile of displaced populations has evolved with displacement increasingly occurring in urban and middle–income settings" – creating "an epidemiological shift away from communicable diseases that have historically characterized refugee populations", and given rise to the "high prevalence of non–communicable diseases (NCDs)", that pose a challenge "in terms of provision of appropriate secondary and tertiary services, continuity of care, access to medications, and costs" (Doocy et al., 2015).

Engaging the Complex Social Challenge

This use–case presupposes the existence of at least one – and likely many – *complexity–oriented teams*, trained in the use of the collaboration for complexity methodology, and designated to engage the particular *complex social challenge* of Syrian migrants from the on–the–ground perspective – where they have access to both the refugees and the various ecosystemic stakeholders, including those in the governmental and non–governmental domains; that are directly responsible for attempting to improve the humanitarian and societal outcomes of the migrant communities.

Establishing a 'Complex Engagement Loop'

The first step that the *complexity–oriented teams* would be performing is to establish a 'complex engagement loop' – as a mechanism of actively engaging with the ecosystemic stakeholders – as per below:

Figure 12: Complex engagement loop – Syrian migrants
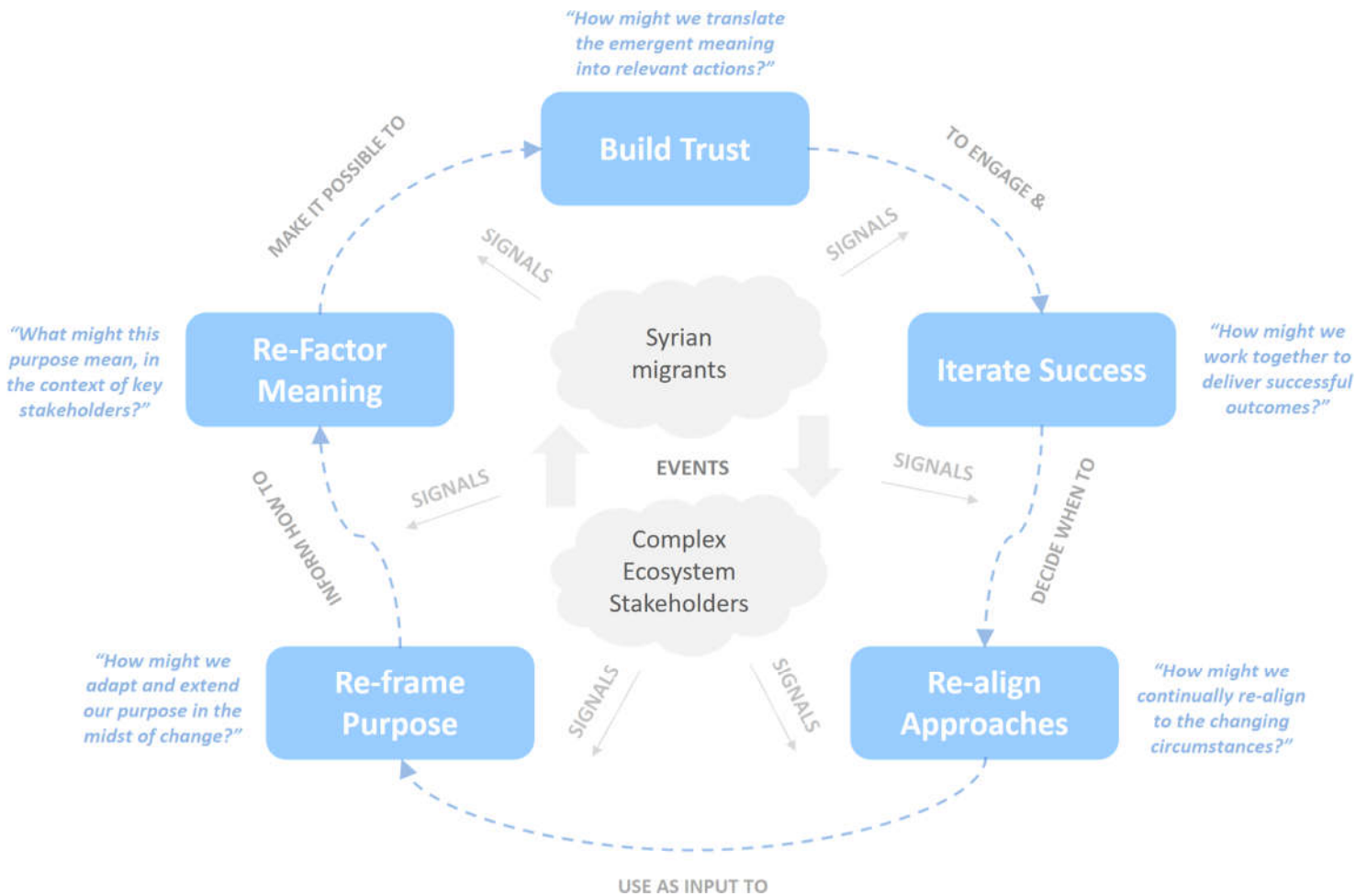
As part of this loop, the *complexity–oriented teams* would engage the key ecosystemic stakeholders to **a)** understand the situation from a multiplicity of contexts and experiential perspectives, to arrive at adaptive understanding ('Re–Factor Meaning'), to **b)** be able to continuously evolve stakeholder relationships to create trust ('Build Trust'), so that it might be possible to **c)** define the first sets of small initiatives to create successful outcomes ('Iterate Success').

Such outcomes would invariably meet with some types of limitations in the evolving context of the *complex social challenge* – that would necessitate teams to **d)** evaluate in what manner it might be necessary to alter strategies ('Re–align Approaches'), which then becomes an input into **e)** discovering different sets of questions that might help to 'Re–frame Purpose' – with a capability of informing enhanced notions of establishing new meaning, and starting a new loop for achieving further levels of adaptive understanding.

Transitions through Complex Social Challenges

As the next key task, the *complexity–oriented teams* need to ensure that the insights gained through the 'Complex Engagement Loop' are effectively translated into actionable strategies – with a capacity of helping to effectively 'transit' the key stakeholders through the uncomfortable spaces of liminality, that are associated with *complex social challenges*. Such actionable strategies would inform the various aspects of the engagement process – as well as, any implementations delivered in the 'Iterate Success' phases.

An overview of the liminal journey might be represented as per below:

Figure 13: Complexity traversal liminal journey
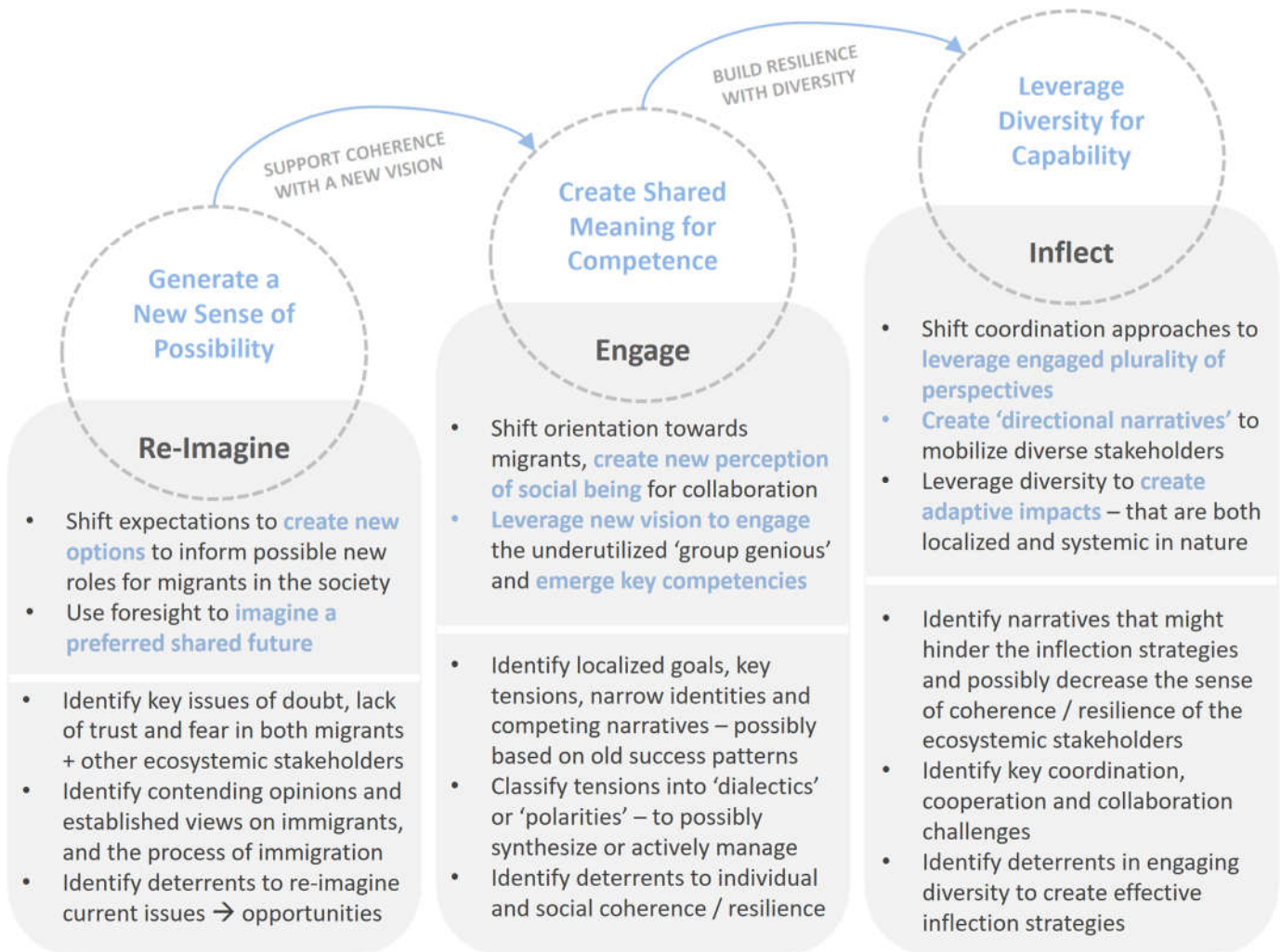
In terms of additional detail, the process of managing the liminal traversals would include the following stages:

Stage 1: 'Plateau of Possibility'

The key goal in this stage of the liminal traversal is to 'Re–Imagine' the current circumstances – in such a way as to enable open new sets of possibilities for the key stakeholders, and create a ground for alignment and collaboration.

The principal enabling team competency at this stage is to 'Postpone Solutioning' – during which the stakeholders are invited to 'go on a journey' with an empowered team of collaborators, where the solutions that might seem initially obvious are not necessarily yet selected and immediately implemented.

To do that, being able to 'Extend Ambiguity' is required – to build team trust, and provide a context for enabling a shared journey into the uncertain and potentially uncomfortable spaces of liminality.

As part of this process, iterative sensemaking is required – to enable a continual process of making incremental 'sense' out of the emerging situations.

To assist in this process, the framework might be utilized in the following manner:

Table 20: Key team competencies and required abilities for the 'Plateau of Possibility'

Key Team Competency	Key Team Abilities	Potential Implementation
Postpone Solutioning	• **stakeholder buy–in** • **empowered team**	• Identify key stakeholders and meet with the governmental and immigration representatives to create a distributed / embedded team and establish cross–functional communications • Present potential benefits of implementing highly systemic solutions, that might be innovative in relation to current strategies • Meet with representatives from the Syrian refugees / migrant community, and present the case for understanding circumstances in further detail – to improve the overall experience
Extend Ambiguity	• **team trust** • **iterative sensemaking**	• The team builds trust in their ability to successfully engage the *complex social challenge* by starting to leverage the core *cognitive resilience* abilities of 'Dialectic Thinking', 'Dialectic

		- Engagement' and 'Framing Dilemmas' to engage in iterative sensemaking processes - The preliminary insights – created through the first several sets of generative dialogues with the key stakeholders – can be utilized to re–imagine the present circumstances and co–design the possibility and vision of an improved shared future

Once a potential shared future has been re–imagined and a new vision has been established, it is possible to proceed to the next plateau – that of building competence.

Stage 2: 'Plateau of Competence'

The key goal in this stage is to 'Engage' the key stakeholders – to create sufficient shared meaning to be able to successfully enable key underutilized competencies that exist in the various stakeholder groups and communities.

To accomplish this, the *complexity–oriented teams* need to more fully engage in 'Iterative Context Understanding' – which implies the processes of identifying multiple perspectives that are correlated to stakeholders, engaging in construction of relevant categories of meaning, and converging on groupings that faithfully relay multiple viewpoints in a cogent manner.

The 'Aggregative System Composition' phase allows the *complexity–oriented teams* to start translating the categories of meaning into some minimal set of systemic descriptions and artifacts –

A part of this process entails a detection of environmental 'signals' that might indicate the presence of systems–based dynamics – where the key task is to be able to effectively distinguish the relevant information from 'noise'.

At some point, the identified 'signals' should be sufficient to attempt to infer some 'systemic boundaries ' – that might be defined as continually evolving areas of shared activity, purpose and experience – that enclose systemic structures with a tendency of exhibiting cohesive sets of behaviours.

This makes it possible to 'Re–Frame Challenge Boundaries' – as part of which, the *complexity–oriented teams* are likely to perform intensive conceptual pivoting, while attempting to identify the key conceptual structures and re–

organize related elements to create meaningful wholes; so that a stakeholder needs synthesis might be accomplished, in such a way where the most relevant needs of the key stakeholders are 'mapped' and understood as key challenges.

The specific implementation items might be considered as per below:

Key Team Competency	Key Team Abilities	Potential Implementation
Iterative Context Understanding	**identify multiple perspectives** **converge on experience categories**	- Create a distributed, active network of stakeholders / champions - Meet with governmental, not–for–profit, NGO and Syrian migrant stakeholders to map–out and understand different perspectives - Create key categories of meaning from multiple viewpoints
Aggregative System Composition	**identify systemic signals** **identify systemic boundaries**	- Create systemic models based on real experiences of the key stakeholders, and identify boundaries that encapsulate the emergent dynamics of the Syrian migrant crisis - For instance, separate the 'back home' causes from the 'migrant experience' dynamic outcomes – and identify how the relationships across the various ecosystemic scales (micro, meso and macro) are arranged, between what stakeholder groups, and to what extent – considering a range of specific socio–economic domains (i.e. individual, family, education, political, health, etc.)
Re–Frame Challenge Boundaries	**concept pivoting** **stakeholder needs synthesis**	- Understand what parts of the stakeholder journey and context–embedded experience are most related to broad underlying challenge categories – in such a way as to - Correlate and synthesize stakeholder needs into the relevant challenge categories, in such a way as to bring about additional levels of cohesiveness and insight. For Syrian migrants, such categories might perhaps be broadly identified as 'Home–Country Departure Challenges', 'Travel and Transition Challenges' and the 'Arrival Challenges' – and should be encapsulated in the language of the key

		stakeholders, using their own terms and terminology.

To be successful in this stage, the *complexity–oriented teams* can be significantly assisted by the systemic enabler skills – as per below:

Figure 14: Systemic enablers for engaging complexity
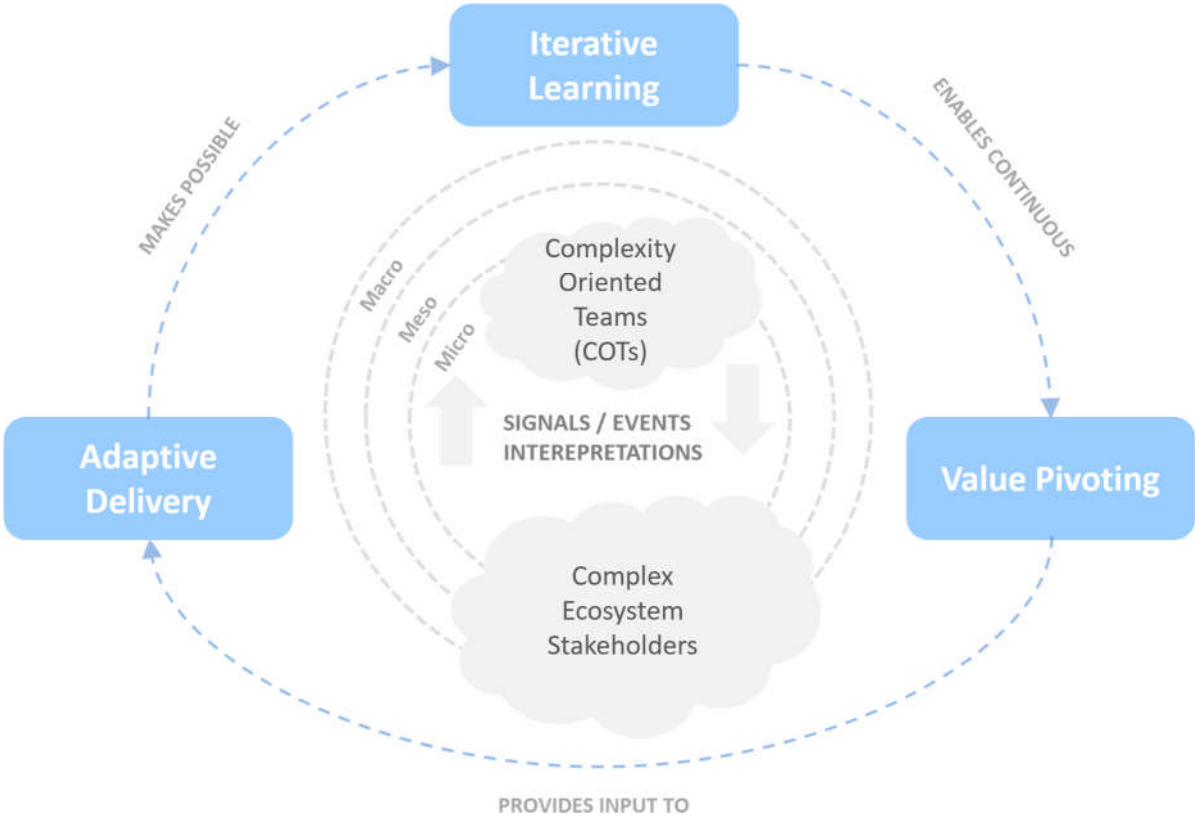
Once this is accomplished, it might be possible to proceed to the third stage in facilitating liminal journeys in the context of *complex social challenges* – namely, the 'Plateau of Capability'.

Stage 3: 'Plateau of Capability'

The key goal in this final stage of the liminal traversal is to actuate the engaged collaborative competencies – developed in the previous stages – and the evolving understanding of the *complex social challenge*, into a set of

capabilities that can produce actual inflective strategies; that are both implementable, and effective in terms of their capacity to improve the key stakeholder resilience and the sustainability of the enclosing ecosystems.

To accomplish this, the *complexity–oriented teams* must be able to 'Identify Active Ecosystems' to correlate systemic impacts across the different stakeholder audiences – while prioritizing any 'active sub–components' to distinguish which systemic elements are responsible for most of the relevant impacts, in terms of which specific stakeholder groups.

This makes it possible to 'Design Inflection Points' – a process which identifies the possible relevant courses of action in a coordinated and integrated fashion; to help engage the key stakeholders to support the emergent, localized and context–aware inflective solution initiatives.

The specific implementation tasks might be approached as per below:

Table 21: Key team competencies and required abilities for the 'Plateau of Capability'

Key Team Competency	Key Team Abilities	Potential Implementation
Identify Active Ecosystems	• **correlate systemic impacts** • **prioritize active sub–components**	• Map–out the way in which the 'enclosing ecosystem' parties and stakeholders (i.e. government authorities, NGO, not–for–profit, legal / legislative, border management, law enforcement, housing, credit bureau / lending / banking system, language training, funds investment and work–placement agencies) are generating ecosystemic impacts – and identify any 'active sub–components' that might significantly improve the stakeholder coherence / resilience and sustainability of the overall ecosystem.
Design Inflection Points	• **Identify inflection points** • **coordinate integrated action**	• Identify a set of key possible inflection points – such as for instance, in the **a**) 'departing experience' – making the process of leaving the home country safer for the key vulnerable populations (i.e. ensuring protection of unaccompanied women and children), **b**) 'transition experience' – making the process of moving from 'there' to 'here' more safe and less dangerous (i.e. by potentially blocking and/or minimizing the criminal elements), and **c**) 'arrival experience' – ensuring that the key 'Active Ecosystem' parties are enabled, prepared and actively anticipating the likely challenges in a way that enables

| | | design of creative and systemic solutions – with a potential of enhancing the overall ecosystemic value. |
| | | Create a cross–expertise implementation network of collaborative teams capable of implementing the designated inflection points – and coordinate for effective engagement across the ecosystemic scales and domains of influence / experience. The use of 'directed narratives' might improve adoption of any inflective strategies – leveraging the medium of storytelling to 'compact' the implementation intricacies into stories that are readily understood, easily remembered and freely propagated. |

Transitions through Ecosystemic Scales

The proposed activities outlined in the examined *complex social challenge* engagement plateaus also imply being able to meaningfully integrate across the relevant ecosystemic scales.

As an example, in the context of Syrian migrants, the process of considering the stakeholder sense of coherence and resilience – as it manifests across the multiple ecosystemic scales – might be represented as per below:

Macro Scale

- Examine the effect of policy instruments and broader frameworks (such as trade relations, legal and legislative) in terms of their impacts on the developing migrant crisis.
- Understand the sustainability of the overall ecosystem from the 'macro' perspective.

Meso Scale

- Understand the stakeholder reliance on the 'in-between' supportive socio-economic systems – including immigration, housing, banking, healthcare, law enforcement, language training and work placement.

Micro Scale

- Understand the stakeholder needs and explore the impacts of possible inflection points at the individual and family levels – through the lens of supporting Sense of Coherence (SOC) and the overall resilience.
- Leverage frameworks such as DIKW to make sense of additional dynamically evolving situational elements.

Conclusion

The modern age has brought about a range of opportunities and perhaps invariably a set of emergent phenomena that we have colloquially often referred to as 'problems' – that might instead be much better recognized as 'dilemmas' and recognized as *'complex social challenges'*.

Since *complex social challenges* exceed the conceptual boundaries of 'problems', they may not in principle be 'solved' in a definitive sense – and must therefore by 'inflected' in such a way where a community of stakeholders can build towards the notions of some preferential shared future.

Operating in an environment of prevailing informational and contextual ambiguity, the *'complexity–oriented teams'* are postulated to be a key vehicle for effectively engaging such *complex social challenges*. Their key tasks are

comprised of facilitating complex ecosystemic transitions by identifying key systemic components and stakeholders whose sustainability needs to be improved – while devising effective strategies for improving their resilience.

A key insight is that, to facilitate systemic transitions and enhance the key stakeholder resilience, the *complexity–oriented teams* need to themselves be sustainable in the context of engaging such challenges – and must be able to manifest the quality of *cognitive resilience*.

Cognitive resilience is posited as required to successfully engage complex socio–cognitive environments – that are characterized by high degrees of ambiguity, non–linear system dynamics, emergent effects and multiple stakeholders featuring a variety of differentiated values and often conflicting perspectives.

Such stakeholder input must be meaningfully aggregated – both in terms of providing valuable input and ensuring the requisite levels of cognitive diversity – to mitigate key ecosystemic risks, and ensure sufficient collective capability to effectively imagine a preferred shared future and devise appropriate inflective strategies.

To be effective in facilitating such ecosystemic transitions, the *complexity–oriented teams* require a range of key skills, systemic enabler and core abilities – as part of supporting their cognitive resilience, and developing core team competencies in the new field of, *collaboration for complexity*.

Future Directions

A core aspiration of this paper has been to attempt a design synthesis and attempt logical inferences based on some of the brilliant research work that has been published in the last several decades – with a particular emphasis on pointing in the direction of how might it be possible to develop specific capabilities for engaging the domain of *complex social challenges* more effectively – so that, the stakeholders in the midst of such challenges might be eased through the complex transitions they find themselves in, while traversing through the liminal spaces of the uncertain and the unknown; in such a way where their resilience – as well as the overall sustainability of the enclosing ecosystems – might be enhanced and supported. As such, the future directions of this work are proposed to include the following dimensions of engagement – as per below.

Workshops on *Collaboration for Complexity*

The proposed typology of engaging *complex social challenges* described in this work – coupled with the notions around the *complexity–oriented teams* – will be structured as a series of workshops on how it might be possible to effectively engage social complexity; both from the perspectives of addressing the ecosystemic sustainability and stakeholder resilience needs.

The intended audiences will be designed in such a way as to engender the most expedient adoption and communication of these tools – as well as, their effective utilization and implementation.

Consulting Work

The hope is that the workshops will generate additional strategic design and innovation work – that might be expressed in terms of providing consulting services, and with the purpose of additionally enabling organizational, institutional and governmental teams in engaging *complex social challenges*, and 'problems rooted in complexity' in an effective manner.

Book on 'Thriving in the Midst of Complexity'

Based on consolidating the experiences in the workshops and the associated consulting work, the goal is to publish a book on how it might be possible to design for thriving in the midst of *complex social challenges* – targeting the academic, governmental / not–for–profit, and business audiences through specific chapter–structure that speaks to the distinct needs of each audience.

Complex Collaboration Platform

Aggregating insights from the individual, group and context–centric design perspectives acquired in the course of delivering the workshops, consulting work and the book, the goal will be to deliver a multi–faceted collaboration platform oriented towards addressing *complex social challenges* – in such a way where, it might be possible for the academic, governmental / not–for–profit, business and active participant audiences to effectively collaborate to enhance the resilience and sustainability of both key stakeholders and the enclosing ecosystems.

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