complexity

A 21st Century manual for harnessing civic participation
in grassroots-level collaborative complexity engineering

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Chapter 1: Abstract

In this essay, we assert that while neoliberal globalisation showed a lot of promise, the growing demands of global development amidst a population boom, are severely straining planetary limits and democratic ideals across the globe. Moreover, the inextricable interconnection of human, resource, information and capital flows across the globe means that the world has become more complex (not only complicated), complete with the unpredictability of emergent phenomena and feedback loops, black swans and butterfly effects. This complexity is overwhelming centralised top-down governance institutions into constantly putting out fires from all sides, not to mention the institutional gridlock in planning the way forward for the long-term benefit of humanity.

While things look bleak, all hope is not lost. We argue that the dividends of technological progress and global development have unlocked a new threshold of collaborative capabilities of the global civilian population. The citizen of the 21st century is more educated, more informed and more capable than any century before to engage directly in the governance process. Even the early successes of the nascent commons-based peer production paradigm - which includes the open-source movement and the gift/sharing economy, among many others - hint at great potential waiting to be unleashed.

Giving citizens the opportunity to participate in local governance could help offload some of the prosaic burdens that institutional actors currently face, thus freeing up bandwidth to engage with truly large-scale and long-term problems. In a nutshell, this is analogous to scaling proportionality problems of the form: "It takes X men Y days to solve Z problems". The volume and frequency of issues (Z) or the severity (Y) can be managed by sharing the cognitive load among multiple stakeholders (X).

Our proposed solution, **ComplexCity**, is a platform designed to harness this new civic superpower in a responsible bottom-up manner, complementary with existing top-down global governance institutions, so as to truly tackle the complexity of the world together. At a philosophical level, there are 3 main themes that we hope to address with **ComplexCity**: 1) crowdsourcing holistic and systemic solutions to complex sociotechnical problems; 2) growing resilient commons-based societies; and 3) addressing civic legitimacy to engage with institutional actors in a constructive two-way dialogue. In contrast to dominant commercial platforms such as Facebook, and in alignment with the spirit of P2P, the platform itself is to be cooperatively owned and democratically governed by its members. The platform is also intended to be self-improving and ever-evolving over time, as befits any strategy to grapple with complexity.

Our platform consists of 3 main pillars: 1) Learn, 2) Apply and 3) Build. In the first pillar of **ComplexCity**, Learn, we propose to create a series of educational resources for the layperson to be introduced to complexity science in an accessible way. In a nutshell, Complexity for Dummies in the form of open courseware.

The second pillar of **ComplexCity**, Apply, will provide citizens with a structured socio-scientific framework to: 1) identify and frame wicked problems; 2) gather perspectives from multiple stakeholders impacted by the problem; 3) design and conduct experiments with measurable inputs and outcomes and 4) share the process and results in an open and transparent way among all stakeholders. For institutional actors, this proactive and structured approach provides a pathway to engage in constructive dialogue with citizens, and implement mutually beneficial evidence-based policies.

We intend for the third pillar of **ComplexCity** to be the most impactful contribution to global governance, connecting the following stakeholders: 1) recognized community leaders and solution finders on **ComplexCity**; 2) subject-matter experts and mentors; and 3) national, international and supranational institutions across the private and public sector and 4) donors from grassroots communities, state actors, philanthropic foundations and (social) venture capital. The **ComplexCity** team, will work with a broad coalition of institutions to define civilizational stretch-goals that are desired, and then design carefully framed challenges with significant funding to crowdsource entrepreneurial solutions to wicked problems.

In designing **ComplexCity**, we were heavily inspired by the contemporary dynamism of startup thinking: from hackathons to Lean iteration. These hands-on innovation processes are extremely valuable and relevant even to the commons-based society, and **ComplexCity** employs these principles wherever possible. The ultimate goal then is nothing less than to drive an entirely new economic pathway where human, material, information and financial capital are invested into the commons to grow the commons in a way that is structured, objective, transparent and outcome-oriented, while addressing truly wicked problems and building strong coalitions within and across communities.

(738 words)

Chapter 2: Description of the system

In this essay, we will describe our proposed method and mechanism for grassroots-level collaborative complexity engineering as a means of harnessing civic participation for global governance in the pursuit of common goals.

Section 1: In a time of chaos and crisis, discovering an untapped power

> "The sun shines not on us but in us."
> – John Muir

Part 1: The broken promises of neoliberal globalisation

In the summer of 1989, Francis Fukuyama's widely-read essay, "The End of History" was published. In the ahistorical future that he described, all systemic alternatives to western liberal democracy have been exhausted with the passing of Marxism in Russia and China [1]. Although international conflicts may persist, the conflict in ideology has been overcome, for once and for all, and the winner is economic and political liberalism. The decades that followed Fukuyama's pronouncement bore witness to continued explosion in global prosperity. Today, the sum of exports and imports across nations is higher than 50% of global production [2].

By the 2000s however, economic globalisation, enabled by the relative peace created by postwar multilateral institutions, has started to lose its lustre: it has not been a tide that lifts all boats. Concentration of power among the elite and marginalisation of the rest has culminated in staggering global inequality. The criss-crossing of the manifold global flows made the world more interconnected, but also more uncertain and complex. This engineered interdependence in the global system, with continuously evolving interactions, is increasingly incomprehensible, let alone predictable, for both citizens and their governments. Challenges that emerge involve more countries than ever before and cannot be addressed in isolation.

The 2008 financial crisis was the first systemic crisis of our century, where the global financial system experienced cascading failure in response to relatively modest changes [3]. But, other crises await us; climate change, geopolitical unrest, populist uprisings, and other events can all become cascading threats. As a result, the once-blessed union of economic and political liberalism is unravelling. Currently, the global political order is characterised by a surge of populism and multipolarity. In the background, international terrorist organisations target and radicalise those who feel voiceless and powerless [4].

So far, our institutions have been slow to adapt to this brave new world of complex connectedness. Although more people around the world are becoming aware of the collective risks, this awareness is yet to be translated into concerted action. Failure to address these obstacles further reinforces the likelihood of continued failure, by reducing the legitimacy of ruling institutions and increasing individual apathy relative to collective action.

Part 2: Within the complex mess, we find a hidden strength

From the point-of-view of the individual citizen however, the same arc of history that led Fukuyama to his conclusions has been largely emancipatory: from 1) growing literacy and access to knowledge, 2) longer lifespans with better food, clean water, improved sanitation and healthcare, 3) increasing calls for diversity and inclusivity to 4) an ever-increasing inventory of tools and technologies to interact with one another and the world [5].

Let's briefly focus on the first point. The average literacy and numeracy across the world has risen significantly in the last 2 centuries; while only 12% of the world's population could read or write in the early 1800s, today this statistic has been effectively reversed with only 17% of the world's population remaining illiterate [6]. Consider also that the world's population has exploded in the last century. For comparison, in the 1800s there were 0.9 billion people on the planet, while today there are 7.4 billion [7]. This suggests that there are now billions of people who can share complex ideas than ever before in human history.

Also heartening is the last point on technological progress. 82% of the world has access to electricity, 95% of the world's population lives in an area with a cellular network [5]. To put that in perspective, more people have electricity than have a secondary school education; more people have access to the Internet than have clean water. Millions of people have portable supercomputers in their pocket right now. We have come to the point where a single social network can seamlessly connect almost 2 billion people across the world, allowing individuals to engage in unprecedented conversations without borders. A single person can create a powerful platform that will eventually come to power the most extensive communication tool ever devised by the species, and thousands can collaborate on improving such tools to positively and tangibly impact the lives of billions [8], [9].

We must then ask what role can the newly empowered individual citizen take in navigating an increasingly complex world? It is vitally important to do so, because we believe that nation-states and supranational actors still tend to view citizens from a distant vantage point, where proactive individuals disappear and only passive statistics remain. And yet, a dense underbrush of new citizen initiatives has emerged which, given enough time, resources and legitimacy can meaningfully participate in global governance. Here are just a few examples that underline this picture.

Wikipedia as a platform began as a passion project for a "free-as-in-free" encyclopedia - initially released to the world in 2001 by just a handful of passionate developers - and is now the world's 5th most visited website, serving close to half a billion people per month, with 5 million user-generated articles on just the English site as of 2015 [10]. In Bangladesh, the people-centric (rather than profit-centric) banking model of the Grameen Bank have demonstrated successful outcomes with great implications for sustainable development [11]. Also looking at hybrid online-offline models, an astounding 58 million students audited courses offered by nearly 700 ranking universities via Massively-Online-Open-Courseware in 2016 alone [12]. Close to 15% of MOOC participants earned certification to complement their CVs, and close to 40% of MOOC participants were discovered to be teachers enhancing their own understanding of subjects for students' benefit [13].

The unorthodox nature of these organisations means that the immense value they have generated have not been adequately quantified in any historical GDP score. And yet, none can deny how impactful the knock-on effects have been or can yet be. We believe these examples evidence the infancy of a new economic paradigm called commons-based peer production (CBPP), which engenders a bottom-up self-organised way to generate and distribute skills and resources [14].

By all accounts, this possibility has arrived not a moment too soon. Even as complexity overwhelms the hierarchy of global governance institutions, some critics are referring to these centralized bodies as "an international system of minority rule" - in effect, a global apartheid [15]. In response to the impending Catalonian referendum for independence (October 2017), journalist Neal Ascherson opined that "across the world, people yearn to govern themselves" [16]. Maybe the time has finally come to let them.

While we do not believe that such peer-to-peer interactions through virtual platforms will be a one-size-fits-all panacea for global problems, we do argue that forward-looking solutions to global governance can and should leverage them instead of ignoring this untapped human capital. We thus propose to leverage collective intelligence, introducing the open-source mantra that "given enough eyeballs, all bugs are shallow", in the arena of global governance itself [17].

Section 2: Giving citizens roots of responsibility and wings of independence

> "The future is already here, just not equally distributed."
> – William Gibson

We call our platform **ComplexCity** - a play on words combining *complex* and *city* - to highlight right from the get-go that the nature of problems being tackled are complex with no easy solutions, but that one can begin to address them tangibly at a city level.

In essence, we are proposing to harness civic participation for global governance through grassroots-level collaborative complexity engineering. In other words, we leverage the dividends of globalisation and technological development - namely, unprecedented global literacy, widespread access to information technology, and the potential for conversations without borders - to effectively parallelize the cognitive computation required to solve the myriad problems we face in our complex socio-technical civilization today. In a nutshell, this is analogous to scaling proportionality problems of the form: "It takes X men Y days to solve Z problems". The volume and frequency (Z) or the severity (Y) of global challenges can be better managed by sharing the cognitive load among multiple stakeholders (X).

To do this, we propose to have a platform for global citizens to: 1) **learn** how to appreciate complexity and thus engage constructively with it; 2) **apply** a socio-scientific framework to identify community problems, structure pilot experiments, measure outcomes and thus enact systemic sustainable change within a complex environment; and 3) **build** toward long-term civilizational goals via decentralised initiatives that improve and grow the commons.

In contrast to dominant commercial platforms such as Facebook, the platform itself is to be cooperatively-owned and democratically-governed by its members. This means the activities supported by the platform may evolve over time, as the membership of **ComplexCity** evolves.

Part 1: The philosophy behind **ComplexCity**

There are 3 main themes that we hope to address with **ComplexCity**: 1) crowdsourcing holistic and systemic solutions to complex problems; 2) growing resilient commons-based societies; and 3) addressing civic legitimacy to engage with institutional actors.

Crowdsourcing holistic and systemic solutions to complex problems

We truly believe citizens around the world are ready to play a role in addressing and solving governance challenges. Not only that, citizens are increasingly willing to take on that

responsibility as well. Citizens best understand the problems that affect their communities on a daily basis, more than even well-intentioned public servants in distant bureaucratic environments. They also have more "skin in the game", a vested interest in solving their problems in a manner that is acceptable to all stakeholders within their community. By connecting such stakeholders in a structured conversation, we hope to kickstart a culture of civic ownership of localized problem-solving.

At the same time, we recognise that solutions to complex problems are not obvious, and, in some cases, may even be counter-intuitive to the engineering mindset - which typically defines a local system boundary and disregards externalities. Also, the sheer number of stakeholders that need to be engaged with - especially when values are at stake but patience is in short supply - can be daunting. Therefore, **ComplexCity** teaches members to recognise and appreciate complex systems, and apply complexity-informed tools and techniques.

Growing resilient commons-based societies

The term "commons" refers to resources that belong to everyone, defying conventional notions of individual property or ownership [18]. While a forest or lake may not belong to any one person, it is the birthright of everyone, not least the flora and fauna that live in them. In urban settings, the commons may be resources that are shared social creations, such as community libraries, town squares and mural walls, publicly-funded research or artwork etc. We now also have digital commons such as Wikipedia, Linux, Creative Commons, etc.

The "tragedy of the commons" then is a systemic problem that occurs frequently when there is no joint sense of ownership of the commons, such that a few actors may abuse the resource, permanently and irreversibly degrading it for all actors involved. Thankfully, we know how to address these problems, thanks in no small part to Nobel Prize winner Elinor Ostrom, who defined the key design principles for enduring commons-based communities [19].

When we say that an explicit goal of **ComplexCity** is to grow the commons-based society, we mean to address the "tragedy of the commons" problem by creating a tangible sense of ownership of the commons. In some cases, this may even begin with helping stakeholders identify what resources they have joint ownership of and access to. Without this identification, stakeholders may not even feel they have something at stake to protect and manage, the same way they cherish their private property.

The time-intensive process of developing a commons-based society itself reaps intangible benefits; this helps to grow stronger ties between community members, which is essential for resilience during and after times of crisis.

Civic legitimacy to engage with institutional actors

We do not believe that any existing private, public or supranational institutions are ineffective or irrelevant, they are merely overwhelmed by complexity. Thus, **ComplexCity** neither substitutes nor bypasses any existing institutional actor, but adds a complementary bottom-up mechanism for citizens to have two-way conversations with these institutions and solve problems collaboratively (see Figure 1).
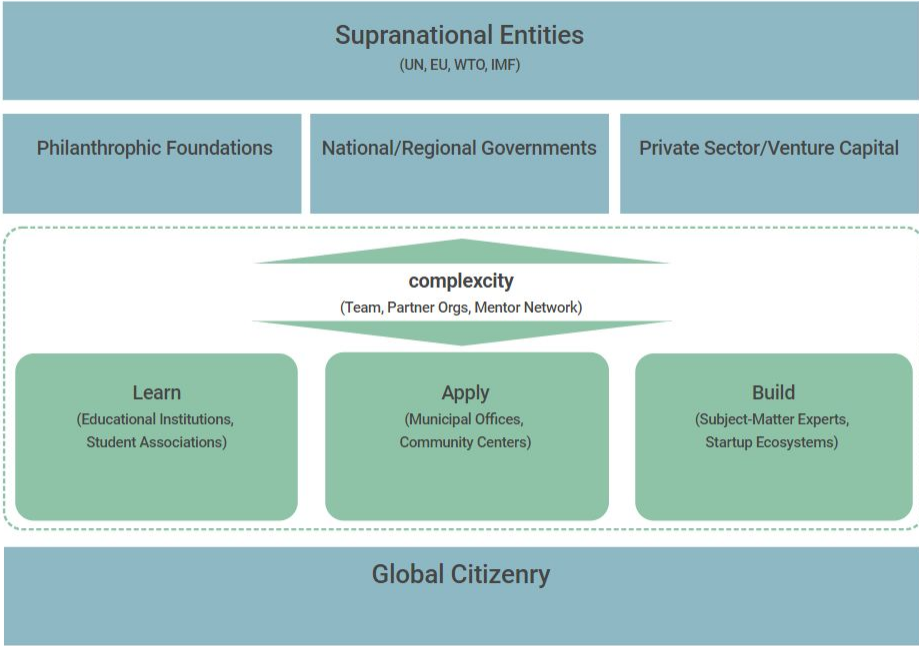
[Figure 1]. **ComplexCity** complements global governance instead of replacing existing private and public sector institutions

Naturally, the key requirement from the citizens' perspective is to have a legitimate platform through which to formally engage with institutional actors. On the institutions' side, a barrage of simplistic, uncoordinated comments from the public may be counterproductive. We attempt to bridge these requirements with **ComplexCity** by: 1) connecting institutions to engaged civic interest groups via structured polls and discussions and 2) encouraging civic interest groups to engage institutions with systematic proposals that can demonstrably achieve desired outcomes.

This is a win-win situation for citizens and institutions. Citizens will finally have more say in how they are governed and the design of solutions to their problems. Chances are local problems can be addressed in a shorter timescale with broad community support. On the institutional side, this offloading of problem-solving can relieve burden and increase resources for handling

larger-scale longer-term issues. Through such collaboration, engaged citizenry may also become more appreciative of the challenges and limitations faced by institutions. In this way, we hope **ComplexCity** can glue bottom-up initiatives with top-down strategic planning in a cohesive manner.

Part 2: The first pillar of **ComplexCity** - Learn

Complexity is a fairly new science, at once daunting and counterintuitive even as one nods in agreement with its basic thesis: the sum of many parts can act in ways that the individual parts never could, and these outcomes cannot always be predicted. Complex systems are all around us, and when we adopt tools and techniques to adapt to them, we inevitably create emergent effects - fundamentally new patterns and behaviours of the system - that require adaptation anew.

At this point, one must inevitably wonder what is the point of studying complexity if it is untameable by definition. According to complexity science researcher Yaneer Bar-Yam, be it the detailed description of specific systems or the general patterns of emergent behaviour, this kind of knowledge enables us to understand, modify, design anew or otherwise create favourable contexts within the complex systems we inhabit [20]. Upcoming research by Blaqswan Collective (working together with the P2P Foundation) suggests that while complex systems generate more entropy than simple systems, there may be "sweet spots" at certain scales to create negentropy [21]. In other words, we can identify the right levels of complexity and solve for desirable outcomes at the right scales.

In this first pillar of **ComplexCity**, we propose to create a series of educational resources for the layperson to be introduced to complexity science in an accessible way. In a nutshell, Complexity for Dummies in an interactive MOOC [22]. We will also feature case studies, ranging from the natural to the industrial to the socio-technical [23]-[25]. The central challenge that needs to be taken on is gathering the ample material already available but translating these into a form that adequately captures the non-linear dynamics while remaining easy-to-understand for the lay-person. There have been interesting attempts over the years to introduce even young people to complex geopolitical scenarios with great success, thus we are reasonably confident this goal is achievable [26], [27].

Although our materials should be accessible to anyone with an interest in complexity, we would actively target students from high school and above, and young professionals. We believe the younger generations are just as capable as adults in critical thinking and problem-solving, have boundless energy, enthusiasm and time, and ultimately the most "skin in the game" to tackle global challenges that would impact their generation. Psychologically, we also believe young people working with communities and institutional actors would mitigate a large part of the creeping cynicism that is usually toxic to altruistic ventures.

At this juncture, the claim that we live in a complex global socio-technical system shouldn't come as a surprise. The difference between a physical complex system (like the human brain) and a socio-technical complex system (like the Internet) is the presence of multiple actors in the system who each have different needs and wants, wherein ideal conditions for one actor may be greatly detrimental to another. Constraints that need to be respected are not only natural or technical, but also social and cultural. In policy analysis, this class of problems are called *wicked problems*, where: 1) there may be incomplete or inconclusive knowledge; 2) a large number of people and opinions are involved, not to mention the power dynamics between these actors; 3) there may be resource constraints or other economic burdens to manage; and 4) the problem at hand may in turn be interconnected with other issues as well [28].

Wicked problems thus require ample tact and a deft hand, patient dialogues and resourceful satisificing to tackle. To be very clear, wicked problems cannot be solved so much as managed or massaged. Any successful strategy must engage multiple stakeholder groups in an inclusive and transparent process to arrive at an outcome that is mutually agreeable to a broad coalition. These types of problems may arise at the level of international geopolitics but equally, at a scale of neighbouring districts within a single city. Increasingly, the (social) enterprise world is navigating similar problems with new frameworks and techniques like design thinking, systems engineering, hackathons and rapid prototyping. We propose to introduce these concepts to citizens so that they can appreciate and address complex problems at the right speed, scale and scope.

To build legitimacy, encourage systems thinking and spark serious multilateral discussions, we also propose that the **ComplexCity** platform facilitates the application of socio-scientific frameworks, such as that of evidence-based policy (EBP) design, to be applied by civic groups to address complex problems in a serious and structured manner [29]. We are inspired by the example of openIDEO, which uses a structured design thinking approach to crowdsource solutions to social problems [30]. The biggest advantage of EBP approaches is that they can be developed and discussed in a standard and transparent manner, which is especially critical when multiple stakeholder groups are involved in a process that naturally takes a long time. Following this structure means even if some stakeholders have to step back, others can follow the thread and pick up where it left off. Another critical advantage is that this process is data-driven and outcome-oriented at the same time, which syncs with the needs of institutional actors who would appreciate such objective problem-solving contributions.

So how can it be done? Consider how a serious scientific experiment is conducted: 1) first, the problem is identified and clearly stated; 2) several hypotheses are generated to explain why the problem may be occurring, and thus suggest an approach to rectify the problem; 3) experiments

are designed with measurable inputs and outcomes to test each hypothesis; 4) experiments are conducted with strict measurements and faithful records of the results; and 5) the data from the experiments are studiously analysed to validate the success or failure of the various hypotheses and conclusions are drawn accordingly. In the case of socio-scientific experiments, all these steps equally apply. In addition: 6) a coalition of stakeholders should jointly co-create possible solutions; and 7) implement them in the form of small-scale pilots, yet again gathering data on success metrics for desired outcomes. We propose to design this framework and refine it with feedback from subject-matter experts, and finally make it available to the public domain as both an online resource and an offline guidebook for structured systems thinking for solving community challenges.

The **ComplexCity** platform will capture experiment designs in a standardized way, and these can easily be found via search by other groups addressing similar problems. It will also have a data platform for recording and visualising quantitative/qualitative data from experiments. It will also feature tools and resources for stakeholder engagement - such as project calendars, polls and discussion boards. Stakeholders and platform users can vote on ideas, each other's comments and generally rate their project-based interactions with one another - all of which generates the potential for gamification and maintaining content quality [31]. The **ComplexCity** team will work with regional ambassadors to moderate discussions, bring third-party stakeholders to the table and help ease any bottlenecks in solution-design processes. Regional ambassadors could be enthusiastic students from the MOOC itself (say university students and young professionals), as well as local partner institutions like municipal offices, community centers and NGOs. We will in parallel attempt to grow a network of mentors, who may be loosely affiliated with **ComplexCity** platform, but can offer advice from experience or subject-matter expertise to civic groups solving relevant problems.

This is likely to be a time-intensive and iterative process for all involved, and not as easy as clicktivism campaigns. However, we strongly believe wicked problems are the problems truly worth solving. In policy analysis circles, practitioners joke that "the obstacle is the way", suggesting that the process itself - including the requisite time and effort, friction and compromise among stakeholders - is extremely valuable because it is critical in building multilateral familiarity and trust [32]. Arguably these intangible factors go a long way in building stronger ties among communities and institutions, a crucial part of shaping resilient societies.

Here again, we wish to reiterate the benefits and sheer necessity of parallelizing the "cognitive computation" necessary to solve wicked problems [33].

We intend for the third pillar of **ComplexCity** to be the most impactful contribution to global governance. In a nutshell, this part would look like a cross between Kickstarter and XPrize [34], [35]. What does this mean and how would it work?

There are few components that need to be in motion independently for this synergy to arise: 1) a constant stream of **ComplexCity** members whose contributions are significant and recognized; 2) a growing list of measurable, long-term, large-scale goals that partner institutions would like to meet; 3) a platform for members to propose and vote on tangible solutions that address one or more of these goals in a reasonable period of time; and 4) a funding platform that disburses significant funding for top-voted projects, where funding may come from a variety of sources.

Pioneers of ComplexCity solutions

In the previous pillars of **ComplexCity** - Learn and Apply - we try to introduce a global community of citizens to complexity of the world and provide strategies, principles and frameworks for navigating wicked problems arising from complexity. Of course, we are aware that there are multiple conversion filters from visitors to participants, from participants to active contributors, and from active contributors to community leaders; in fact we're betting on it. By reaching out to a broadest audience possible - global citizens - we try to tap into the largest possible pool of members. Through social network gamification, we hope to reward and incentivise members over time to be more active and get recognised for their efforts. This natural attrition funnel may give rise a set of passionate contributors, whose efforts over time have been broadly recognised by the member community. To these star contributors (henceforth referred to as pioneers), we provide the possibility of taking on truly challenging larger-scale, longer-term problems with the weight of significant funding behind such efforts.

Decentralised approaches to meet systemic "stretch-goals"

Think of human civilization itself as a complex sociotechnical system that will only continue evolving, constantly facing new challenges and finding new solutions, ad infinitum. Even a global problem like climate change will affect different communities in different ways; and given the resources at hand, these communities will have to employ different strategies to solve these challenges. What we are trying to suggest is that there is no hope for a one-size-fits-all solution. And yet, we can frame broad targets that a multitude of localized efforts can chip away at; this is otherwise understood as a "death by thousand bites" dynamic.

We propose that the **ComplexCity** team work with global institutional partners to define systemic challenges that every initiative can attempt to mitigate, however humble an individual contribution might be. A good example could be seen in the United Nations' Sustainable Development Goals [36]. However, it is not enough to simply identify a need and frame it as a goal - the underlying assumptions have to be thoroughly examined and the "stretch-goals" have to be framed in holistic terms of desired self-sustaining outcomes, not just as a calculus of demand and supply, costs and benefits [37]. Here is where XPrize organizers have a clear systematic approach worth learning from. They not only identify a core need for a target community, but further refine the problem statement based on hard-won lessons from high-stakes low-margin-for-error entrepreneurship [35].

We propose as the **ComplexCity** team to work with institutions in public, private and supranational contexts to identify and frame ambitious but necessary "civilizational stretch-goals", with clear measurable benefits and outcomes. In addition, we may also introduce certain logistical criteria. For example, we could set that proposed solutions should impact at least 10,000 people in a region in a self-sustaining manner within 5 years.

With these global goals defined, we encourage pioneers to design solutions that address one or more of the goals/criteria. One can imagine that hundreds of initiatives at a time on a global level working to address these criteria could make a lot of headway, in a way that centralised groups cannot.

A platform for multilateral multidimensional solution evaluation

It goes without saying that there is no one right answer for wicked problems; there is no black-and-white, true-or-false solution. Every wicked problem is necessarily unique, with historical precedent only suggesting possible approaches but not cut-paste templates. Moreover, we emphasize again that even if two communities face the same class of problems, the solution that works for each may be very different depending on socio-cultural factors and resource availability. As such, addressing wicked problems must necessarily proceed with the support of a broad coalition of stakeholders within local communities. For these kinds of solutions, the wisdom of the crowd is not just a nice-to-have but a need-to-have, a 21st century Delphi method for the networked world [38].

The **ComplexCity** platform thus offers a bazaar environment for proposals and solutions to be voted on and get feedback from the global community, including experienced mentors. A close analogue to this environment is seen in the Kickstarter marketplace where hundreds of potential products vie for attention and monetary support, and where users literally vote with their dollars [34]. Of course, we would also want more from our platform. The wisdom of the crowd could be harnessed by not only voting for an idea, but also actively helping to improve it, connecting related initiatives, sparking lively conversation about values and assessing the

validity/potential/pitfalls of a solution from multiple angles - all important for solving wicked problems.

Prior solutions and projects can always be found using a granular search engine, and relevant ideas can be 'forked' for new initiatives by civic groups across the globe. Solutions old and new may also be visualised on an interactive map showing the geospatial distribution of civic groups addressing real community problems, bringing to life the sentiment behind Bucky Fuller's Spaceship Earth metaphor, the sense that "we're all in this together."

A co-funding platform for promising solutions

As the organisers of XPrize have noted, even the best ideas may suffer if market failures such as lack of sufficient capital or lack of risk-taking confidence prevent these ideas from being developed into viable solutions in the first place [35]. As such, we at **ComplexCity** are convinced that some form of monetary incentive is crucial to ideate and develop self-sustaining solutions to wicked problems. The Build pillar of the platform is where this funding happens, and also where **ComplexCity** itself can eke out financial independence as a self-sustaining platform.

So far, we have gathered the most trusted members who have great enthusiasm in solving community challenges. We provide these pioneers with a series of structured challenges and stretch-goals, co-developed with institutional actors and carefully framed to align local initiatives with desired long-term outcomes. We provide a platform where these solutions can be discovered, discussed and refined via global conversation. Naturally, the final step is to actually provide support to take the most promising ideas and manifest them in reality; support in the form of guidance, incubation and (social) venture capital.

We would have (yearly) challenges that are constructed together with a broad coalition of institutions with a substantial cash prize offered jointly to actually develop the winning ideas. In the run-up to the selection, we also organise seminars and bootcamps to connect teams with subject-matter experts. Teams that solve for multiple stretch-goals may qualify for additional funding or resources from relevant institutions.

Teams that do not win the challenge may still look for funding by multiple means. We call this a co-funding platform because we are source-agnostic. Since these are ideas developed by civic groups for their communities, it could be possible to have the community itself crowdfund these solutions, including local private and public institutions. We may even look to state grants to fund certain projects, especially if the stretch-goals being addressed are relevant to national interests. And finally, the **ComplexCity** platform can connect pioneers to private capital - be it impact investing, philanthropic foundations and/or social enterprise grants - in a series of rounds, conditional on these projects delivering on their roadmaps. In general, we hope that the legitimacy of the platform, the structured business plan and the established credibility of these pioneers will provide donors with enough confidence to fund these projects.

Just imagine, this could kickstart an entire economic pathway where capital is invested into the commons to grow the commons which benefits everyone, in a way that is structured, objective transparent and outcome-oriented, while addressing truly wicked problems and building strong coalitions within and across communities.

Section 3: Glimpses of the future

> "We are called to be architects of the future, not its victims."
> — R. Buckminster Fuller

Before we close off our essay, we would like to spend some time examining some of the implications of such a platform.

Firstly, we are aware that complexity science is in its infancy, and new knowledge is continually coming to light. Moreover, as we mentioned earlier, complex systems exhibit emergent behaviours in response to new inputs. We see **ComplexCity** in itself as a constantly evolving self-improving platform; and would be happy to take on this challenging journey.

General principles for complexity engineering frequently mention the same point, which is foundational to the philosophy of **ComplexCity**: think like a gardener, not a watchmaker. Unlike a watchmaker, we do not have full knowledge or control of our systems; we cannot design perfect complex systems. We cannot prevent weeds, too much sun or too little rain. But we can still set up and maintain the right conditions for flowers to bloom.

In designing the three pillars of Learn, Apply, Build, we were heavily inspired by the contemporary dynamism of startup thinking: from hackathons to Lean iteration. These insights are extremely relevant even for the commons-based economy, and **ComplexCity** employs these principles wherever possible.

Finally and most importantly, we are supportive of universal basic income (UBI) both as a mechanism of social justice, and as a tool to offset technological unemployment. We believe that a UBI should not simply be seen as a (free) handout, but as a salary: citizens receiving a UBI are essentially employees of the state! And as civil servants, they can be called on to perform services on behalf of the state to the community. Even in an increasingly automated world, there will always be social ills to cure and fellow citizens to care for - the good work is never done. In fact, we daresay that even the most advanced algorithms cannot solve wicked problems without human involvement. Engendering a novel "the more you give, the more you get" dynamic, the funding mechanism of **ComplexCity** can even be seen as a beta-test for UBI, wherein citizens earn rewards for volunteering, managing and improving the commons for mutual collective benefit.

(5462 words)

Chapter 3: Argumentation of Constitutional criteria

Core values

We are devoted disciples of holistic thinkers like Buckminster Fuller, and the following has been the underlying (perhaps asymptotic) value that we designed **ComplexCity** with: "Make the world work for 100% of humanity, in the shortest possible time, through spontaneous cooperation without ecological offense or disadvantage of anyone." The strengths of our specific approach are twofold.

Firstly, we embrace the notion of complexity, including: the fundamental interconnectedness of all things and the sheer unpredictability of outcomes given even the most well-constructed plans. From a psychological perspective, acknowledging uncertainty can generally induce anxiety and diminish confidence. However, we argue that it takes hopeful courage to embrace uncertainty, and do the right thing for the right reasons even if one is uncertain if it will succeed. Moreover, by teaching the implications of complexity for our interdependent lives, we seek to foster empathy and solidarity while fully acknowledging diversity in values and beliefs.

Secondly, we emphasize the importance of consensus-driven heterogenous community engagement. Historically, there have always been parties formerly barred from participating in the global governance process, either by design or through sheer inability. In the 21st century, we argue that we have the tools to spark conversations without borders, coherent even with hundreds participating with equal right. By providing tools and building processes that empower and engage citizens, we extend the core values in the GCP assessment criteria: that decisions are guided by the good of all humankind and respect for the equal value of all human beings.

Instead of relying on representatives to define problems and articulate/review corresponding solutions on behalf of all humankind - a tall order for any small group of individuals - we hope to include the diversity of humanity - who are more capable than ever before - directly in the decision-making process via platform-assisted decentralised communication.

Decision making capacity

The obstacles to effective decision making that we have identified are diverging incentives and sheer cognitive load posed by today's complex problems. Therefore, two of the main themes of our proposed model are to align heterogeneous stakeholders' interest by strengthening the sense of co-ownership over our global commons, and to support cognitively challenging decision-making by democratising tools developed to understand and design for complex systems.

A common reaction for citizens and politicians overwhelmed by complexity is to resort to local thinking and short-termism. But this does not have to be the case. Idealistically, a global community of mobilised citizens, who rise up to (rather than recoil from) the challenge of mounting complexity, can be made more aware of our interdependence. In general, once exposed to systems thinking, stakeholders are more likely to rein in individualistic pursuits that are detrimental to the broader community of common destiny. More pragmatically, the conscious cultivation of societal sectors whose main activities is the creation and management of commons (the **ComplexCity** platform project itself and the projects that it supports) augment citizens' ability to organise outside of existing state and market paradigms. Over time, such self-governing collectives could be the basis of a new power structure outside of today's entrenched interests, decreasing institutional inertia in the long run.

The three pillars of ComplexCity - Learn, Apply, and Build - are part of a guided pathway to expose users of our platform to complexity-informed analysis and design. As participants advance through the stages, after demonstrating mastery of key skill sets, the scope for action expands from tackling educational case studies to designing, fundraising, advocating for, and evaluating actionable proposals. Participants are well-situated within a civic-minded network to reach out to peers with specialist knowledge and access public depository of related projects. We argue that such flexible project-based teams, distributed across the world, in combination with machine-assisted knowledge codification, storage, and sharing, will be more equipped to design diverse and resilient solutions for complex problems than permanent civil servants working in siloed departments under time and resource pressure.

Effectiveness

In our interpretation, this criterion mainly relates to effective enforcement of decisions, once they have been made, not the effectiveness of the decision making process itself, the latter being addressed by the previous criteria.

By definition then, "enforcement" refers to the imposition of a course of action upon a person or a group. In theory, the difference between political authority and pure coercion is the voluntary recognition of a governor's legitimacy by a sufficiently large number of the governed. But, in

practice the two are deeply intertwined, for the authority reserves the right to enforce commands in the event of noncompliance through coercive means. To increase any institution's ability to enforce its decisions then, either its legitimacy or its ability to use coercive means (such as monopolised use of legitimate violence) need to be bolstered.

Instead of proposing to place more coercive power within the hands of **ComplexCity** members or the platform itself, by taking away decision making rights from other sectors of society, we discuss the sources of legitimacy for citizen-proposed solutions and the underlying cooperative platform. The gamification aspects of the social network - such as voting, commenting, appreciating (à la Facebook Likes) - over time create a rich terrain of soft diplomacy. In online communities like Reddit, sub-communities inevitably begin to self-organise around mutual values, interests and dislikes. By prescribing some simple rules, and adding cultural nuance where necessary, the network can be moderated to consistently generate constructive dialogue with mutual respect among peers.

By connecting citizens to institutions via structured polls and encouraging systematic proposals that can demonstrably achieve desired outcomes, **ComplexCity** helps to provide procedural and output-based legitimacy to solutions developed and communicated through the platform. By operating under cooperative ownership by its members, the platform opens itself to citizen-member-driven amendments and is bond to reflect the broader norms among the citizenry, thereby increasing its substantive legitimacy.

We also assert that wicked problems do not have black-and-white, true-or-false boundaries with one right answer. As such, communities that grapple with wicked problems can only come to solutions together in a broad coalition with requisite tradeoffs and compromises. ComplexCity teaches members the value of consensus and empathy across multiple stakeholders, which in the long run goes a long way in ensuring compliance with mutually respected decisions.

Resources and financing

We understand this criterion to concern human and material resources required to support the articulation and implementation of decisions. **ComplexCity**, the cooperative platform we propose, only requires relatively few dedicated staff while allowing many participants (be they individuals or institutions) to tap into the cognitive surplus of citizens and civil organisations to solve global challenges (think Wikimedia foundation relative to Wikipedia users).

In terms of financial resources, as a cooperative, members of **ComplexCity** may decide to pay a fixed fee, re-invest a percentage of the funds raised through the crowdfunding element of the platform, or make ad-hoc contributions to the operation and maintenance of the platform. Consequently, the successful staffing and funding for the **ComplexCity** platform is not externally guaranteed. Instead, it is dependent on how well it performs the functions that it claims to deliver:

its ability to empower and assist citizens willing and ready to contribute to the public good. We believe that this is a healthy level of skin-in-the-game.

Trust and insight

The general rules for discussion on the forum will be made explicit, including a call for constructive dialogue, even if it is to be a critique. Such explicit "rules of engagement"/constitution allows members to navigate their discussions with some confidence, and detect when certain members or actions are aligned with the spirit of the forum or not. As mentioned earlier, the social gamification aspects of the site also create a terrain for soft diplomacy, and in general users with a history of "good karma" will be easily recognisable as trusted/trustable parties.

The many activities that **ComplexCity** supports (i.e. receiving and delivering education/training, discussion of proposal, upvoting/donation to projects, etc.) generate a large volume of data. Transparency over the operations of the platform not only requires public access to such data (hence all information derived from the running of ComplexCity is to be open source), but also requires them to be organised and presented in an insightful and concise way. Hence, we propose the development of a platform-wide dashboard, summarising the real-time status of various activities and cumulative progress, with the key performance indicators to be defined by **ComplexCity** members.

Flexibility

We do not assume that this first version of **ComplexCity** that we sketch out is foolproof. Moreover, our target problem, complexity itself, implies the need for constant adaptation. Hence, continuous evolutionary improvement, based on member feedback and contribution before and after release of "stable versions" is an essential component of our vision. Because **ComplexCity**, the platform, supports evidence based discussion, member-initiated projects, and voting/fundraising for specific projects based on member preference, these functions can be effectively used by members to propose, deliberate, and carry out changes relative to the platform itself!

Protection against the abuse of power

By basing its legitimacy on procedural and normative sources (see Effectiveness), **ComplexCity** and the proposals that it helps to advance do not have coercive enforcement power over the internal affairs of nation-states (or that of any other institution, for that matter). We welcome all parties (be it other fellow citizens, the organisation that a particular proposal targets, or other

institutions) concerned with particular elements of any citizen-based proposals to engage directly and collaboratively with the project proponents on the **ComplexCity** platform, to develop ultimately mutually acceptable alternatives.

On the other hand, **ComplexCity** will inevitably come to hold some form of user data based on engagement with the platform: from political preferences to perhaps location data based on project participation. Here **ComplexCity** will attempt to navigate these murky waters as best as possible. For starters, the jurisdiction where **ComplexCity** is registered will grant it certain rights and responsibilities with regards to user data. We will of course adhere to these rules. Users should be able to manage the visibility of their information in a modular manner, and access their own data whenever they wish. Specific sensitive datapoints such as location, financial information etc should be managed with a secure data architecture.

Accountability

We understand accountability as a relationship where an individual/institution carrying out certain functions can be required by another (or many others) to provide information or justification for their actions. As we perceive it, two levels of accountability can be differentiated, in the form of governance through **ComplexCity** and governance of **ComplexCity** itself.

In the first case, project owners, members who have taken upon themselves to advance particular proposals via the **ComplexCity** platform can be required by other members (or any other stakeholder of their proposal) to provide more information and justification on undertaken and/or proposed course of action. To streamline the process of demonstrating accountability toward a large range of stakeholders, upon entering different phases of the project lifecycle on **ComplexCity** (initiation, invitation for collaboration, submission to crowdfunding, etc.) project owners are required to publically answer standardised questions (and if applicable, stakeholder submitted questions) such as main expected deliverables and metrics of success. The declaration procedure gradually becomes more stringent as a project makes increasing demand on community resources (cognitive and financial support by more members) and approaches finalisation.

In the second case, owners of **ComplexCity** (by definition all of its members) can be required by non-members to provide information or justification on their choices in terms of the functioning and management of the platform. In a procedure similar to the one described above (as we have explained previously, amendments to **ComplexCity** and requests for associated resources can be considered a subcategory of projects that are pursued via the platform), a declaration of accountability is to be filed, laying out answers to expected and received questions, whenever significant changes are made to the platform's structure and interactions that it enables.

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