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Holism, Collective Intelligence, Climate Change and Sustainable Cities

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Abstract

As the Earth's systems are under increasing unsustainable pressures, human security is clearly at stake. Cities are regarded to be increasingly important sites for climate responses, and something can still be solved if humankind acts quickly. Novel methods to long-standing quandaries, such as climate change, can now be applied. It is proposed that city adaptation and mitigation strategies should draw on collective intelligence and an innovative holism multi-systemic approach to the encompassing problem of climate change by breaking it up into smaller, manageable problems and crowdsourcing a way out by means of online argumentation systems, computer simulations, and collective decision making tools. As 'first responders', cities with similar location or vulnerability characteristics should also be encouraged to transfer best practices between each other. It is futher argued that the enhancements in efficacy and accessibility of big data can be aggregated at a nationwide level in the shape of economic development and sustainability, and in welfare improvements in developing economies. Furthermore, this critical précis argues that whilst adaptation and mitigation strategies are crucial, at the very crux of it, humankind needs a fundamental change of metaphors: from seeing the world as a machine to understanding it as a holistic network.

Keywords: *Climate Change, Cities, Holism, Adaptation, Mitigation, Collective Intelligence, Crowdsourcing, Technological Leapfrogging, Emerging Economies.*

1. Introduction

We are conceivably the first species on Earth that has ever been aware that it could render itself extinct by its own actions [1]. The Earth's land surface and climate have been altered fundamentally from the state they were in a few centuries ago. Scientists now know with significant confidence that these accelerated changes are attributable primarily to human activity, although there is still an incomplete physical understanding of many components of the climate system and their role in climate change [2]. Indeed, the 'Anthropocene' is increasingly regarded as a new geological era in Earth's history, one in which people take centre stage as the defining geological force [3]. Christopher Lasch's publication of *The Culture of Narcissism* represents a significant point for consideration of possible links between a society dominated by narcissistic discourses, and the apparent increasing appearance of narcissistically related issues in human behaviour, and consequent impact on the environment [4]. Subsequently, it is plausible that this massive aggregation of threats to ecological systems arises out of errors in our habits of thought at deep and partially unconscious levels, which have consequently resulted in widespread damage on the planet.

According to the Stern Review, commissioned by the British government in 2007, there is a 50% risk of global temperatures rising by more than 5°C by the year 2100 [5]. Given that Earth's systems are under rapidly growing and unsustainable pressures, and that human systems are inextricably linked to their fate, human security is clearly at stake. If societies are to maintain or establish such security, and successfully pursue together the larger quest for global sustainability - significant social, political, technological, ecological and economic transformation is required [6]. Cities are regarded to be increasingly important

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sites for climate responses, and it is proposed that the use of internet technologies, crowdsourcing platforms, bid data, and collective intelligence can extensively facilitate such responses [7]. Ultimately, choices made today about the types, features and location of long-lived infrastructure, for example, will determine the extent and impact of climate change, and the vulnerability or resilience of cities and communities in it [8].

2. Commodity Fetishism and the Chaos Point

Industrialism and global capitalism, in its inherent need for new markets, has infiltrated even the most isolated cultures and traditions, resulting in the massive 'normalisation', or the subjective internalisation, of narcissistic values [4][9]. Our most basic needs have been distorted and colonised, becoming associated with various commodities, as means to create new desires and profits. These ideals have been abstracted from a social context that makes them attainable for most people, in other words, they have been depersonalized [10]. We see the mass 'addiction' of society in what Carl Marx aptly identified as 'commodity fetishism [11]. The relentless greed for profit and the psychological manipulation of human needs means convincing us that commodities and novelty is elevated above ecological preservation.

Extending on these ideas, Ervin Lazio argues in *The Chaos Point* that we are at a critical juncture in history, and have a limited window to address the dangers we face [12]. During this window of opportunity, or the chaos point as it is referred to, Lazio writes that we either evolve to create a more sustainable world - or the social, economic, technological and ecological system we have now will break down [12]. Whilst the author acknowledges the seriousness of the situation, there is a positive message that something can be done if we act quickly. Drawing on complexity and chaos theory, he points out that humanity, like nature, is a dynamic system that is capable of 'abrupt change': that is, of ultra-rapid transformation. When such a system nears the point where the existing structures and feedbacks can no longer maintain the system's integrity, it becomes super-sensitive and responds even to a small impetus for change. Hence, 'butterfly effects' become possible, where the thinking, values, ethics and consciousness of a critical mass in society can cause rapid and fundamental change.

3. Holism and Collective Intelligence – A Proposed Intervention

No single discipline or scientific domain can understand, let alone address, the complex challenges involved in climate change and sustainability. The call for more integrated and innovative science is dictated by the complexity of the environmental and sustainability challenges that a city or society faces due to climate change. Despite the progress made by many academic groups and scientific institutions across the world, the task of bringing different sciences together in integrated global change remains challenging. Clarity in needed in terms of what integration means in practice, finding effective ways of actualising it, and adjusting institutional practices to support it [13]. However, science's emerging view of man, nature, and the universe is distinctly holistic, and captures the path-breaking South African statesman and philosopher Jan Smuts. In his 1926 book entitled *Holism and Evolution*, Smuts wrote that 'holism (from *ὅλος* = whole) is the term coined for this fundamental factor operative towards the creation of wholes in the universe… its character is both general and specific or concrete, and it satisfies our double requirement for a natural evolutionary starting point' [14]. In this sense, holism, penned Smuts, is the establishment of a new *Weltanschauung* [worldview] within the general framework of science [14]. It was Smuts expressed conviction that a time would come when a true holistic and integrative approach to science would emerge. He believed that the compartmentalisation of science into separate disciplines created both limitations to knowledge and understanding, and the ability to deal with some of the world's most intractable problems. More recently, Gregory Bateson created a paradigm of evolution that included mind [15]. The Bateson evolution emerged from the 'living' universe, and following shortly, the ecosystemic epistemology emerged from the study of a sequence of the 'living' universe. Ecology, in the widest sense, according to Bateson, is the study of the interaction, or interrelation, and survival of ideas and programmes in circuits, as opposed to the isolated object of the Cartesian-Newtonian paradigm [16].

Computer science, through a possible future universal language and through computer communications may connect the entire world in one interlinked, interdependent network. May one not regard this to be the quintessential holistic natural science [17]? The emergence of the Internet and associated information technology has created unprecedented opportunities for new kinds of interactions. As the well-known examples of Wikipedia and Linux illustrate, it is now possible to combine the work of thousands of knowledgeable and interested individuals in ways that were completely impossible a few years ago. The Massachusetts Institute of Technology's (MIT) Climate CoLab innovatively draws on collective intelligence and an multi-systemic approach to the encompassing problem of climate change by breaking it up into smaller, manageable problems and crowdsourcing a way out by means of online argumentation systems, computer simulations, and collective decision making tools. Conceived in a paper submitted to MIT's *Innovations* journal in 2007, the Climate CoLab was developed by scientists at the MIT Center for Collective Intelligence [18]. Instead of subscribing to the idea that only expert scientists have the answers and the political influence to reverse or stabalise climate change, the Climate CoLab approaches the problem with an open source paradigm. The goal of the Climate CoLab is to harness the collective intelligence of thousands of people from all around the world to address global climate change. Inspired by systems like Wikipedia and Linux, the MIT Center for Collective Intelligence developed this crowdsourcing platform where people work with experts and each other to create, analyse, and select detailed proposals for what to do about climate change. Anyone can join the Climate CoLab community and participate. Community members are invited to submit and comment on proposals outlining ideas for what they think should be done about climate change. In some contests, members create proposals for specific kinds of actions such as generating electric power with fewer emissions or changing social attitudes about climate change, in 2016 a contest was launched with the theme 'smart zero carbon cities challenge.' In other contests, members combine ideas from many other proposals to create integrated climate action plans for a country, a group of countries, or the whole world. Experts evaluate the entries and pick finalists, and then both experts and community members select the most promising proposals. To keep proposals grounded in physical reality, members can work with tools on the platform and a specialised team of emission modelers to estimate the impact their proposals could have on greenhouse gas emissions [19].

As of July 2016, more than 500,000 people from all over the world had visited the Climate CoLab site, over 75,000 have registered as members, and over 2,000 proposals have been

submitted. In addition to members of the general public, the community includes over 200 experts on climate change and related topics who serve as Advisors, Judges, and Fellows. Membership has tripled each year, the White House Climate Data Initiative has recognised the project, and media outlets such as the BBC, NPR, PBS, *Boston Globe*, UK *Guardian*, *Discovery*, *Weather Channel*, and *Popular Science* have featured it. The 2015 activities included 15 contests on a range of topics from how to reduce emissions from electric power generation to how cities can adapt to changes brought on by climate change. Nearly 400 proposals were submitted, and winning proposals came from the United States, India, Ghana, Austria, Chile, Kenya, and other countries. Winning ideas have included (a) an inexpensive passive solar tracker that also generates clean water, (b) empowering young students in India to help their parents make smart energy choices, and (c) a policy mechanism to track, account for and reduce emissions caused at sea [19].

In 2014, the Climate CoLab began pilot-testing tools with which community members combine different ideas from many different proposals to create and assess climate strategies for the entire world. In 2015, this approach was expanded to include six regions of the world, including the United States, Europe, China, and India, as well as the world as a whole. Futhermore, winning teams in previous years have presented their ideas in briefings at the United Nations in New York and the US Congress in Washington, DC. In 2013, 2014 and 2015, winners met with relevant experts and potential implementers at the Climate CoLab Conferences each with over 800 attendees (in person and online). In 2015, Climate CoLab winners received a special invitation to attend selected sessions at MIT's Solve conference. At this gathering, many of the world's leading technologists, philanthropists, business leaders, policy makers, and social change agents were challenged to help solve the most difficult questions of our time. By constructively engaging a broad range of scientists, policy makers, business people, investors, and concerned citizens, it is envisaged the Climate CoLab will help to develop, and gain support for, climate change plans that are better than any that would have otherwise been developed [19].

4. Climate Change Mitigation, Adaptation, and Cities. Why Focus on Cities?

4.1. Mitigation

Climate change mitigation generally involves reductions in anthropogenic emissions of greenhouse gases [20]. The projected climate changes in the twenty-first century are so extensive that, even at the low end of the range of possibilities, impacts will require costly adaptations, and in some cases our capacity to adapt will not be sufficient to avoid serious damage to individuals, cities and society. The forthcoming questions are how much should emissions be reduced, how can this be done, and what will it cost [21].

The percentage reduction needed in greenhouse gas emissions to avoid dangerous changes to the Earth's climate is high, around 60% - 80% by 2100, but remains uncertain [20]. Stabilising the Earth's climate requires total emission at some time in the future to be less than or equal to the total removal of greenhouse gases from the combined atmosphere - shallow oceans-land-soil biota system. Removal can occur by natural processes or it can be artificially accelerated. Economic assessments are insufficient since climate change will have value- laden impacts not readily expressed in monetary terms, such as species extinctions or loss of cultural property and values (for example, loss of homelands and independence in the case of some low-lying island nations).

Despite these difficulties, there seems to be wide agreement that global warmings of around 2°C - 3°C may be considered 'dangerous' [21][22]. Examples of mitigation include switching to low-carbon energy sources, such as renewable and nuclear energy, hydropower, solar energy, wind power, biomass energy, tidal wave and geothermal energy, the hydrogen economy, and expanding forests and other 'sinks' to remove greater amounts of carbon dioxide from the atmosphere. Energy efficiency may also play a role, for example, through improving the insulation of buildings and fuel substitution. Cattle-rearing generates more global warming greenhouse gases, as measured in CO_2 equivalent, than transportation [23]. Mitigation strategies include improved feedstock efficiency and changes in human diet [24]. Another approach to climate change mitigation is geoengineering, though such options, such as ocean fertilization to remove CO_2 from the atmosphere and reflection of the sun's radiation back into space, remains largely unproven and potential consequences unknown [25][26].

4.2. Adaptation

Even the most effective reductions in emissions, however, would not prevent further climate change impacts, making the need for adaptation unavoidable [27]. Adaptation is an automatic or planned response to change or minimise the adverse effects of climate change, and strives to maximise any key benefits [21]. Further climate change is already built into the system by past greenhouse gas emissions, that is, we are already committed to it [13]. Even if emissions are stabilised relatively soon, global warming and its effects will last many years, and adaptation will be necessary to the resulting changes in climate [28][21]. If our ability to adapt reaches its limits we have an unacceptable or damaging situation that, at least at the local level, could be considered dangerous, that can only be avoided if we can reduce the level of climate change so as to say within the limits of adaptability. In the broadest global terms, our ability to adapt is what must determine the targets set for reducing greenhouse gas emissions, that is, mitigation policies should aim to avoid situations where we exceed the limits of adaptability [21].

Adaptive capacity is closely linked to social and economic development [13]. City-scale vulnerabilities are likely to be greater in developing country cities [29][30]. Adaptation is especially important in developing countries since those countries are predicted to bear the brunt of the effects of global warming as the capacity and potential for humans to adapt is unevenly distributed across different regions and populations, and developing countries generally have less capacity to adapt [31]. Adaptation thus raises serious questions about equity between countries and even within countries. This is mainly because adaptation is necessary for people or systems that are adversely affected by climate change, but not necessarily for the people or systems that have historically caused the problems [21].

Methods of adaptation will vary according to the city and community, with the activity or industry, with location, and on different scales in time and space, and it is suggested that collective intelligence technologies such as that found in the Climate CoLab can play a significant role in developing such strategies. Importantly, adaptation requires the situational assessment of sensitivity and vulnerability to environmental impacts [21]. It is argued by some that the best way to ensure adaptability is to increase resilience or the capacity to cope with natural year-to-year climate variability such as flood or drought

years. This is true up to a point, but as climate change increases it will lead to extremes that are outside the limits of natural variability. In such cases, ordinary resilience based on past climate variability may not be enough. Moreover, increasing resilience to cope with even greater extremes will be uneconomic, or at least inefficient, unless guided by an understanding of the direction and magnitude of climate change [21][22]. The economic costs of adaptation to climate change are likely to cost billions annually for the next several decades, though the amount of money needed is unknown [5]. Donor countries promised an annual $100 billion by 2020 through the Green Climate Fund for developing countries to adapt to climate change. However, while the fund was set up during COP16 in Cancún, concrete pledges by developed countries have not been forthcoming [32].

4.3. Cities, Urbanism and Climate Change

Modern cities are the largest conglomerates of humans ever seen on our planet, and are being shaped and reshaped in profound and distinctive ways by the strategic selectivities of climate policy, and increasingly by the effects of climate change itself [33][36]. By 2050, more than 70% of the population - 7.6 billion people - are projected to live in urban areas [34]. Cities were initially ignored by most climate change scientists, with early impact studies focused on ecosystems and agriculture. Many researchers assumed that cities in developed countries were inherently 'adaptable' - an assumption shattered by Hurricane Katrina's devastation of New Orleans in 2005. However, for years, the focus on the world's response to climate change has been on nation states, which have been mostly unsuccessful in negotiating comprehensive agreements or taking action. Cities, by contrast, are, for the most part, preparing risk assessments, setting greenhouse gas emission reduction targets, and pledging to act. Urban areas are emerging as the 'first responders' in adapting to and mitigating climate change. Local governments are also often named as key actors in the transformation towards a more sustainable society. Many local decisions can directly affect the environment, such as local authorities' regulation of transportation, building construction, spatial planning, and economic matters [35][36].

Furthermore, cities are increasingly being recognised for mitigation action (for example, within the C40 Large Cities Climate Leadership Group) [29]. It has been estimated urban areas are responsible for 71% of global energy-related carbon emissions, although the numbers vary widely depending on how cities or urban areas are defined [8]. This percentage will grow as urbanisation trends continue. Cities will be exposed to climate change from greenhouse gas induced radiative forcing, and localised effects from urbanisation such as the urban heat island [37][38][39]. Climate change may also create health problems in cities, from heat related mortality, to the spread and exacerbation of diseases [40][41]. Public concerns about the health effects of climate change have the potential to accelerate political action in ways that attention to carbon dioxide emissions alone might not [42][42].

The rapid growth of the world's population, especially the growth of cities, creates growing problems of energy, amongst other domains. Urban centres consume three-quarters of the world's energy. Effective urban planning to reduce sprawl would lower emissions from transportation. Inefficient land use development practices have increased infrastructure costs as well as the amount of energy needed for transportation, community services, and buildings. Smart growth practices, however, include compact community development, multiple transportation choices, mixed land uses, and practices to conserve green space. These programmes offer environmental, economic, and quality-of-life benefits; and they also serve to reduce energy usage and greenhouse gas emissions [8].

Cities are also particularly vulnerable to climate change effects, nearly all being built on coasts or riverbanks [13][44]. Increases in sea level and large storm surges will threaten crucial infrastructure. More frequent and intense floods and droughts will put demands on essential and often scarce water supplies. Climate change will exacerbate urban pressures of rapid population growth and sprawl, poverty and pollution. There will also be other knock-on effects because of cities' concentrated and integrated economic activity, highly complex infrastructure systems and social services, and multilayered governance [8].

Furthermore, it is becoming more common for scientists and policy makers to consider adaptation and mitigation side-by-side, to help determine the synergies between them - a trend that is particularly important for cities. The ability of cities to finance climate adaptation depends on the extent of to which local authorities can tax residents, property owners and businesses. When a city introduces tax credits to encourage energy system retrofits in existing buildings, for example, it helps by adapting to future temperature fluctuations and by reducing the demand for energy-intensive heating and cooling services. In developing countries this capacity varies widely [5][38][44]. Finally, city planners should link climate change issues to broader agendas. Aspects such as sustainable water supplies and sewage treatment strategies, for example, must be evaluated for their links to climate concerns. Cities will also be safer if they consider climate change and disasters together in their risk-reduction assessments [44].

4. Big data, Economic Development, Data Revolution and Technological Leapfrogging in Emerging Economies

Computer technologies have the capability to invert the characteristic association between data and scientific progression. If ICT advocates are to be trusted, the recent upsurge of data will in fact direct considerable developments in technology [45]. Following this line of thought, one can now apply novel methods to long-standing quandaries (such as climate change and sustainable development), approaches that are only achievable now that data is so plentiful. Big data thus has the ability to fast-track economic development in sections of the world where development has been tenuous [46].

Over the previous couple of decades, organisations have progressively sought to undertake commerce that transcends borders, serving to impel economic advancement across the globe. Organisations undertaking commerce across borders have mostly done so without the advantage of data, primarily as data-delivering organisations have been concentrated on local markets. This has denoted greater risk, however, characteristically the benefit of growing into large new markets, or discovering substantial cost savings through cheap labour has more than compensated risk takers [47][48]. Currently, economic advancement in emerging markets is commanding a rise in data, as more schooled administrations labour to make increased data accessible, in order to advance trade. This appears to indicate that economic advancements are a priority, then data, then further economic development [46] [47][48].
However, what if data was the first priority? What if one could witness more data appearing from emerging markets even before governments develop the ability to gather, and make accessible, large volumes of data? Could the transparency

offered by data provide more organisations the self-assurance they require to do commerce in these markets - in effect kick-start the course of economic development? This reverts us back to big data. Humanity is generating so much data nowadays not as a result of everyone choosing to render the production of data as primary importance, or because the government has significantly improved the volumes of data it's gathering and making accessible. More precisely, technology has shaped a world in which individuals are producing substantial quantities of data simply by living their lives, and companies are generating massive amounts of data. Noticeably, this is already the situation in progressive economies. As the price of primary technologies continues to plunge, this will progressively be the situation in emerging economies as well. It is anticipated that when this occurs, one will observe more organisations that engage with data and emerge with the self-assuredness to take hold of new prospects in these markets. The outcome? Economic development in spaces that one would least anticipate. In some regards, this is a description of the leapfrogging phenomenon, in which emerging economies avoid the time consuming and often arduous process of organisation construction and advance straight to the production of large volumes of data. It's worthwhile to observe that this leapfrogging phenomenon may be facilitated by another leapfrogging phenomenon, as developing countries avoid other dated communications technologies and rely on wireless networks and smart devices [49][50]. Overall, if an emerging economy leapfrogged to a recently developed ICT, it would then be exposed to unparalleled possibilities in relieving impoverishment and safeguarding economic growth, as well as developing the potential to eclipse advanced nations in terms of economic development. Consequently, technology leapfrogging is an appealing notion to emerging economies, for instance, rural areas in Cambodia have been narrated to have leapfrogged from an agrarian to an information economy by way of wireless networks [51]. Other rural areas in emerging economies have become adept at accessing medical and health services, through wireless communications technology. Within the African context, information accessible by way of mobile phones has supported agriculturists in Senegal to multiply the profits from their harvests, and herdsmen in Angola to trace their livestock via GPS equipment [50].

In the document *A World that Counts: Mobilizing the Data Revolution for Sustainable Development* developed by the Independent Advisory Expert Group (IAEG), and formed by the UN Secretary General on the data revolution, numerous propositions were posed on how to manage and guide the continuing activities that are now termed 'data revolution' [52]. The Synthesis Report *The Road to Dignity by 2030: Ending Poverty, Transforming all Lives and Protecting the Planet* chose most of the propositions made by the IAEG, staging them in the more inclusive agenda of the Post-2015 Development Agenda that is being negotiated by UN nations [53]. One of the powerful assessments reached by the IAEG Report concerns the privation to build capacity to grow and gain from the data revolution internationally, but particularly in emerging economies [54]. Additionally, the report accentuates the dangers of deepening discrimination. The report highlights that significant disparities exist data 'haves' and 'have-nots', and that outside of a dedicated response, an entirely new discriminatory perimeter will evolve, dividing the globe between those that have access to data, and those who don't [52] [53].

How to shape suitable capacity in emerging economies is a pressing matter, presently under debate on several platforms, such as PARIS21, the World Bank, and the Sustainable Development Network Solutions. Emerging economies need suitable human resources in national statistical offices and systems to fully profit from the data revolution. Furthermore, suitable technical infrastructures are necessitated, as well as appropriate governance configurations. Lastly, the majority of the activities necessitated to advance the appropriate capacities entail economic support and robust coordination midst benefactors and organisations that deliver technical assistance [54].

6. Conclusion

Rooted in the core paradigm of Western science, that is, prediction and control, our modern intoxication with the illusion of control is profound. Yet paradoxically, at a macro-social level, are we, as a species, not more helpless or more out of control than ever before? Without a liveable environment there can be no security, no food, no use and consumption of energy and resources, and no development [55]. The material world, ultimately, is a network of inseparable patterns of relationships, and the planet as a whole is a living, self-regulating system [55][14][56][16].

The COP 21 Paris agreement signals that climate change is back at the centre of the global political agenda, however, it introduces a new, and mainly worrisome, model of voluntary nationally determined contributions by governments which may compromise the effort to limit global temperature rise to 1.5°C [57][58]. As 'first responders', cities with similar location or vulnerability characteristics should be encouraged to transfer best practices between each other. Undoubtedly, computer technologies such as online argumentation systems and computer simulations, can now be used to facilitate 'collective intelligence' for such purposes - the synergistic and cumulative channeling the vast human and technical resources now available over the internet - to holistically address systemic problems like climate change. Technology should not though be considered as an elixir for the earth's quandaries; ultimately, it is unable to deliver the nourishment, psychosocial care, medication, and housing that is urgently required in so many locations. However, online argumentation and computer simulations provide a powerful way to explore many possible models of - and responses to - global climate change, for example.

Web-based forums, a kind of Wikipedia for controversial topics, or Sims game for the future of the planet… an electronic egalitarianism on speed - could facilitate our societal conversation about global climate change, and facilitate reasoned and evidence-based collective decision-making about highly complex issues [18]. Whilst city adaptation and mitigation strategies are crucial, at the very heart of it, we similarly need a fundamental change of metaphors: from seeing the world as a machine to understanding it as a holistic network, here too collective intelligence can play a crucial role.

Furthermore, in ICT's progression course, the prospects presented by freshly materialised ICTs tend to be of a higher calibre to those of preceding renditions of technology. If an emerging economy leapfrogged to a newly developed ICT, it follows then that it would be subjected to unparalleled possibilities in terms of assuaging impoverishment and safeguarding economic advancement, as well as the prospect of outdoing developed nations in economic advancement [50]. Humankind is at a crucial crossroads - in which a new ecosophical approach must be found - which respects the differences and synergies between all (living) systems [56][14][10].

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