Can Science and Technology Meet the Challenges of Public Safety in our Ever-Changing World?

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MOTTO: "We work in structures of yesterday, with methods of today, on strategies for tomorrow, mainly with people that - in cultures of the day before yesterday - have built the structures of yesterday, people who won't any more be within the enterprise the day after tomorrow... "
[Prof. Knut Bleicher]

1. How to be Prepared to be Surprised: From Risk – to Resilience Governance

Interwoven within all the other dimensions (social, cultural, political, economic and environmental) that were investigated 'along and beyond the horizon' at the Public Safety Policy Retreat through its universal, overarching outreach (seeking truth via observation and experimentation) - Science and Technology (S&T) offers the opportunity to bring them all together into a synergetic interdisciplinary framework. In an interdependent world (Fig. 1) Public Safety in Canada has to play in synch with the global dynamics, considering the global risks as major drivers of change to avoid making the very policy of narrow focus on internal problems a risk by itself.

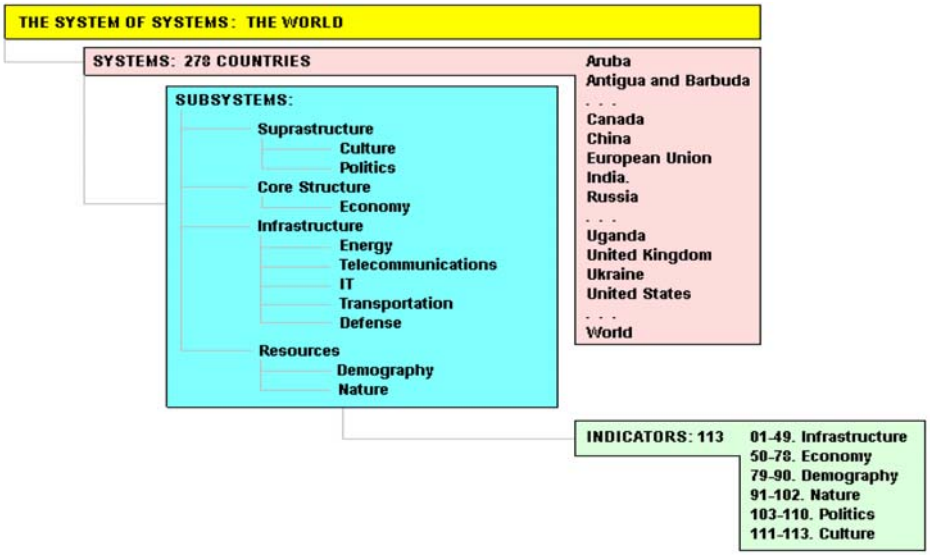


Fig. 1: The World as a System of Systems (from [1])

The major global risks identified by the World Economic Forum 2009 are: Oil and gas price spike; Major fall in US$; Slowing Chinese economy (6%); Fiscal crises; Asset price collapse; Underinvestment in infrastructure; International terrorism; US/Iran conflict; US/DPRK conflict; Afghanistan instability; Transnational crime and corruption; Global governance gaps; Extreme climate change related weather; National Catastrophes: Earthquake; Inland flooding; Pandemic and Infectious disease; Ageing and Chronic disease; Migration; Critical Infrastructure Interdependencies breakdown; Emergence of nanotechnology and other rapid technological innovations risks; Cybersecurity and Data fraud/loss. They all have a clear impact on Canada, with an exacerbated effect due to the interdependencies between these various risk variables, calling for a holistic approach to public safety policy to target social resilience in an uncertain complex world, starting from the reality that it is practically impossible to plan for incidents that we cannot foresee while accepting the reality that we will continue to be faced by such incidents as the world continues to shift under tremendous pressures that are impossible to control [2].

We suggest that a way to cope with the magnitude of the problem is to move from risk governance to resilience governance. From the S&T view, risk is an uncertain (positive or negative) consequence of an event or an activity with respect to something that people value, thus risk governance refers to the actions, processes, laws, traditions and institutions by which decisions about risk handling are prepared, taken and implemented. On the other side, to the scientist, resilience is the ability of a system to absorb changes. With the tremendous pace of change characteristic of the world's dynamics in our day and age, it seems perfectly legitimate to rethink public safety in terms of resilience rather than risk governance, since resilience governance shifts the focus on decisions about vulnerability handling by integrating the principles of good governance, including of living assessment, within the traditional vulnerability handling process.

As architectures of participation of the Web 2.0 type are unleashing the enormous unused potential for collaborative clustering and innovation [3], Public Safety will have to capitalize on these trends re-crafting policies and tools to enable 'response-able' communities. Gaining the power of people networking into a capability to deploy anywhere anytime 'safety nets' brings an invincible ability to respond to any kind of incident by timely and dynamically (re)crafting the structure and configuration of the nets to encompass the resources and skills as they are needed. Interwoven with the capabilities of the traditional emergency response system, architectures of participation can enrich the exchange by deepening and integrating the already rich layers of cross boundary relationship across the organizations involved in the public safety enterprise, enabling the deployment of 'self-organizing security' or 'SOS' networks [4]. This can significantly increase the use of the human capability we spend so much time, effort and money on developing to only limit that capability so it can only operate within the boundaries of one particular role at a time. Citizen-centric safety nets working together with SOS networks of emergency responders catalyzed by a culture of collaboration can

achieve seamless operational and organizational agility in complex situations to bring about the resilient society any public safety system would only dream to provide [5]. This calls for an important shift in the attitude of the Public Safety enterprise in an open society, namely: safety and security WITH rather TO citizens to enable the citizen to become an active participant in the enterprise. Creating the premises for social innovation in the networked society (eSociety) via adequate policies that empower the citizen / first responder to bypass the 'jurisdictional web' and take action will naturally lead to a 'disaster hardened' society by simply unleashing human capital at the right time/place. Accountability in this 'response-able' society can be secured by special applications running on personal devices, which can track the actions of the owner in the midst of an incident and be played back, just like 'black boxes' in the aftermath of an airplane incident. Encouraged to take action and risks just like emergency workers and to take risks that can be later justified via the 'black boxes' - citizens will weave the resilient society seamlessly. A society which thrives on stimulating participation by rewarding initiative and the courage to take creative action can deploy 'safety nets' and SOS networks that can absorb and attenuate the effects of catastrophic surprises – thus is a resilient society.

2. Drivers of Change and Associated Surprises

How will our world look like in 10, 15, 20 years from now? As we are moving from the industrial to the networked society [6] through the rapid rate of change in computing power, Fig. 2, the world is shifting through major transformations in all sectors of the economy and areas of life and work. Information Communication Technologies (ICT) have become a pervasive, general purpose technology that enables: the creation of new knowledge via participatory environments for shared skill and expertise; education (eLearning technologies and virtual environments for training of highly qualifies personnel); health (access to joint medical expertise and information via eHealth technologies, including the electronic health record); enhanced business innovation (eBusiness) by facilitating social network operating systems where collaborative partnerships can spring around new opportunities. ICT is revolutionizing the organization, location and nature of work; the structure and operation of markets for goods, services and intangibles; the management of energy, transportation, and building infrastructures; the conduct of scientific inquiry, research and development; and the general process of commercializing innovation.

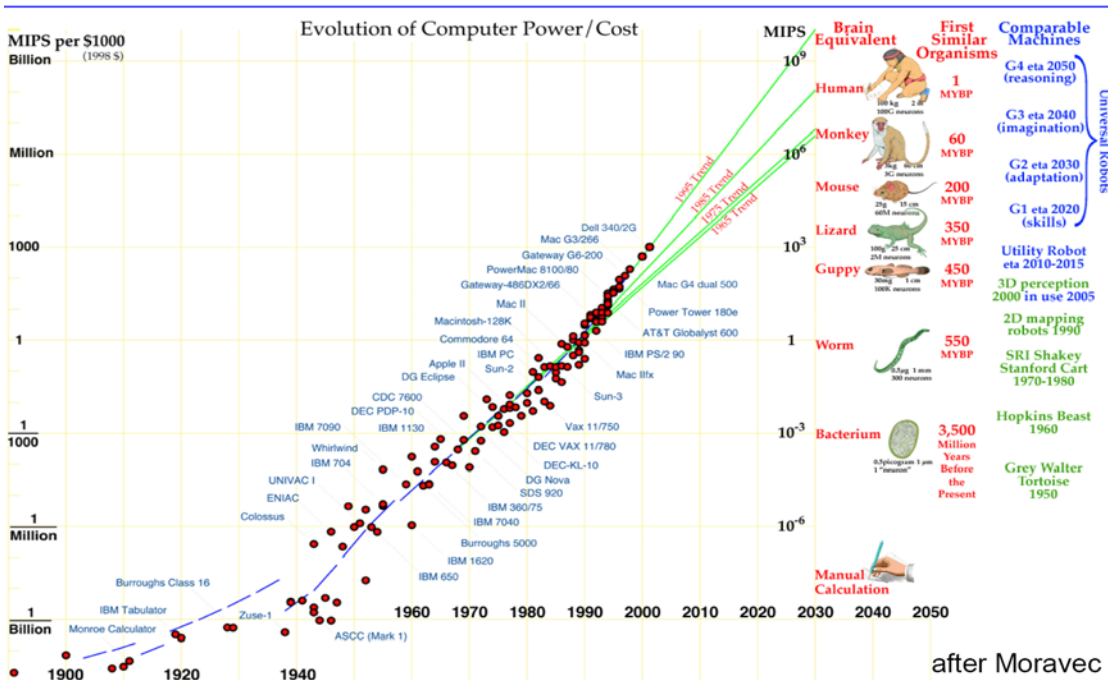


Fig. 2: The rapid pace of ICT innovation

DRIVER 1: Technological Innovation

The main tool which amplifies this radical transformation by facilitating instant access to resources and skills anytime anywhere is the ubiquitous sensor network (Fig. 3) [7]. As a pervasive infrastructure [8] weaved into the current system of systems to seamlessly merge critical infrastructures and social dynamics into global scale socio-technical systems, sensor networks are acting on local 'smart' environments [9] to accelerate the transition to a green and carbon-free world by bringing about the power of social innovation to meet current challenges that seem unsurpassable at the slow pace of today's modes of governance. Sensor networks are leveraging ICT innovation for public safety (Fig. 3) via enhanced monitoring capabilities to prevent and predict natural disasters (fires, flooding, earthquakes and tsunamis) as well as catastrophic failures in constructions; they can provide timely indicators on the levels of pollution and poisonous gas emissions, measure the water quality, amount of precipitations, irrigations and the effects of climate on the agriculture. From tracking the location of individuals hurt in disaster incident areas or lost in the mountains to monitoring the health condition in chronically ill, elderly or for palliative care, sensor networks augmented by personal devices are integrating us into the digital ecology at a

tremendous (yet alarming!) pace, Fig. 4.

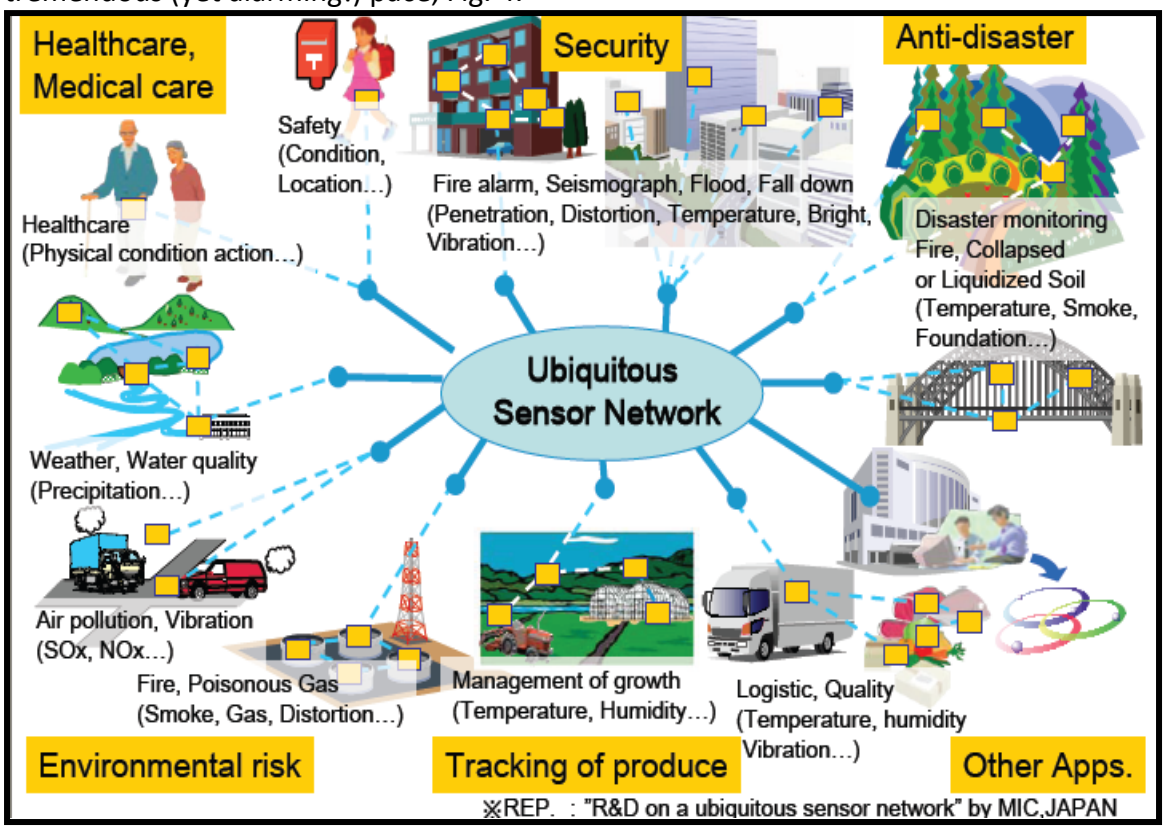


Fig. 3: Advances enabled by the ubiquitous sensor network

SURPRISES on the horizon

This is indeed alarming since, without us noticing, the great opportunity to incorporate the individual into the 'societal immune system' becomes simultaneously a threat to the very individual freedoms. With everyone and everything easily tractable (Fig. 4) the ubiquitous sensor network poses threats to our fundamental values. Thus, a legitimate question in the midst of the so called 'Peace of Mind' society is: What are we making 'safe and secure'? In an open society anything which makes us feel less free is a failure! In this ideal open and transparent society several unavoidable developments can be foreseen which pose difficult challenges to the public safety institution:

- « Panoptic » systems of social control are expanding simultaneously the feelings of security and insecurity. No more taken for granted, security and safety become prominent values and desirable 'goods'.

- In a « transparent world », the power will move toward non-transparent organizations and networks (new mafias, « underground forces », military powers).

- Transparency and open access to information increases the fragmentation in micro, self-organized and « self-selected » communities, and social segregation.

Fig. 4: Panoptic systems which sustain the ubiquitous civilization

Some unintended consequences of concern to public safety spin from the fragility of today's information system, unable to control itself and vulnerable to all sorts of manipulations. Since transparency cannot function without regulation, the power and political game will be run by those who will regulate the "transparency" or those who will be able to control and manipulate it 'from the inside' – those who will control the Internet (as for example Google was discussed at our retreat), those who will control the main auditing bodies, etc). For example privatization policies of public infrastructures and services have been set for the benefit of oligopoly lobbies such as for electricity and telephone where competition was supposed to lead to a better service to the customer, relying on the assumption that the customer makes a rational choice, and the only legitimate one. In their reckless quest for profit companies have hired a sales force to persuade customers, multiplied unreadable tariffs conditions and (in their reckless haste and departure from truth) dismantled their research units with the overall result going against innovation via an enormous waste of time and skills. Such trends give rise to tensions that will weaken old legitimacies. Empowered by access to the information the new generation will begin asking why they have to pay taxes to the government in spite of its poor efficiency, and not to an NGO (nongovernmental organization) which is really serving the common good.

Safety in Cyberspace – A Virtual Illusion?

Perhaps the most delusive threat of all which thrives on the very power of the pervasiveness of the networking and communication infrastructure is Cyberspace itself.

The very glue that links it all together has added a 5th domain of war to the battlefield, after land, water, air and sea. Since the ubiquitous sensor network extends Cyberspace into an "Internet of Things" that has seamlessly interwoven all critical infrastructures, the vulnerabilities proliferate throughout in an absolutely intractable way, giving rise to paradoxical cascading effects that do not follow the laws applied when these systems were built. This makes vital systems practically impossible to protect and defend from Cyberattacks. One must always be 'en guard', yet there are no guarantees that anything can be done in case of an attack. This was the case of Estonia in 2007 when the whole country was practically 'knocked out' since all the electronic business infrastructure and communications systems were annihilated by soviet 'Cyber-warriors' who acted via computers located Estonia itself on in its allied countries, including the US. The seemingly unsurpassable challenge for public safety stems from the reality that nobody is 'shielded' for Cyberattack and everyone can expect an attack at any time. The futility of fighting CyberWars stem from the easiness in which counterattacks can back-fire in a boomerang effect via collateral computer network attack damage from the inside (aka the attack can be coordinated from remote computers that are within the very organization that is attacked.) Thus a counterattack would become an attack on itself with 'Estonia-style' surprises to become prevalent in the near future.

Less atrocious threats, from Cyber-bullying to identity thefts in the digital environment are of high concern to public safety, yet no serious regulatory policy is in place to protect against them. In 2008 Melissa Hathaway, former White House Chief of Cyber-Security made an attempt at policy calling for the institutionalization of a 'Law of the Sea' for Internet commerce, which unfortunately was not yet internationally ratified. With Cybercrime becoming more and more prevalent a Cyberpolice force has to be developed that can keep up with the new kind of threats, otherwise the very benefit of social Cyber-networking will be at risk taking away the benefits to building a resilient society discussed above. In conjunction with these trends one can envision new mental disease developing in a society of individuals living virtual lives with split identities across several avatars, as well as extreme mistrust and paranoia unfolding from being overexposed to the transparency of the panoptic ubiquitous environment.

How far is far? Touching the limits of the impossible 'on the horizon'

What will be the next leap in technological innovation, and how will it impact mankind? With the 'nano-bio' convergence juxtaposed on the multiple interconnected sensor webs, an artificial consciousness appears more than possible within the next 30-50 years [10]. Since INTEL is already growing chips that will enable us to command our computers with the share power of our thoughts (aka brain waves) [11] one can imagine a world in which even our thoughts will not be private anymore. Such technologies are already being used to alleviate the symptoms of Alzheimer and epilepsy therefore a future of technically enhanced humans (Cyborgs) appears to be perfectly plausible… and it is very uncertain how that future will impact on all the other dimensions that have been discussed at the retreat. What is certain is that if such a future will unfold, the impact

will be so radical that all our constructs and governance frameworks, the very way we reason about the universe, existence and life – will collapse. Public safety will become a matter of philosophy, supported by psychology and religion to help us all cope with the new role in the universe and develop a new culture having mankind bow to its own creations.

DRIVER 2: The Increasing Imbalance (Disequilibrium) between Mankind and Nature

Leaving the SciFi realm we can envision equally dramatic scenarios simply by considering the reality of climate change with its overarching impact on our current values, way of life and wellbeing. The enormous effort and the high pace at which we as individuals and governments alike have to act if we are to give ourselves the chance to restore the equilibrium, induces new tensions al the global and local scales and the associated risks as well as foreseeable surprises springing from this abound. While indeed science and technology can find a significant breakthrough, Fig. 5 (from alternative energy sources and modern biofuels to eMobility and smart lightning) to support the smart applications on which the future cities and infrastructures can be built and ICT can indeed enable a green world faster, yet the transformation that has to happen is too radical to be painlessly assimilated by the population. While ICT could reduce CO2 emissions by enabling reductions in other sectors up to 15% of the global emissions – this is definitely not sufficient to counteract the alarming effect of greenhouse gas increases on the environment (in terms of climate change related threats).

Fig. 5: Technologies that can help meet the challenges of climate change

This calls for a radical shift in consumption which cannot be easily accommodated since it requires humongous transformations and improvements in the infrastructure. Regarding households and more generally buildings, most energy consumptions are due to heating or cooling. But the isolation technologies are also well known. The buildings are consuming an important share of the energy because they were built in a time where energy was cheap and decision makers improvident. This points fingers to the absence of initiative of public authorities (or their submission to lobby pressure).

Can we absorb these changes?...

In an ever changing world, which is subject to dramatic shifts of political and economic power, several legitimate questions can point to what we shall expect 'on the horizon': What magnitude of changes can be absorbed 'gracefully'? How good is change given where we are today and where we want to (or better, where we must) get? How fast can we move on the climate agenda vs how fast we must move if we want to get any sense-making results? And ultimately, of major interest to the public safety community: Can we absorb these mandatory changes? A negative answer would be highly destabilizing and calling for a major reform in governance and the very values of our society. Given the magnitude of the shifts required in lifestyle and especially the fact that big dollars are at stake for large corporations, it shall not come as a big surprise that protecting nature may become a military concern, especially given that the major corporations may not be willing to give up on their share of exploitation that easy and will continue lobbying. A strategy for governance along the climate agenda would need to carefully strategize on the following core issues:

- How big changes can be targeted to not destabilize the system?
- What can we control and act upon before we infringe on people's liberties?
- What do we have to accept and brace ourselves for? Can we foresee any unintended consequences and side effects of the global world dynamics of interdependent crises to which technology adds to overdrive the high pace of change?
- Is Canada able to catch up on the dynamics? [14]

3. On Governance as a Challenge to Reason

And so: are we ready for it? Are our governance structures fit and is our society ready to absorb the radical changes needed to bring us in synch with Gaia? A technological breakthrough that will provide an alternative to natural gas and oil is extremely probable by 2025. Most technologies avoiding carbon dioxide emission are already available on the shelf. Research may be useful to improve them, but the real question is the one of the governance necessary to put them in function, related more to social sciences than to hard science. One of the immediate surprises and unintended consequences is the inability to adapt to the required changes. Due to lack of adequate policy frameworks the obstacles are the limited capacity of social processes to manage

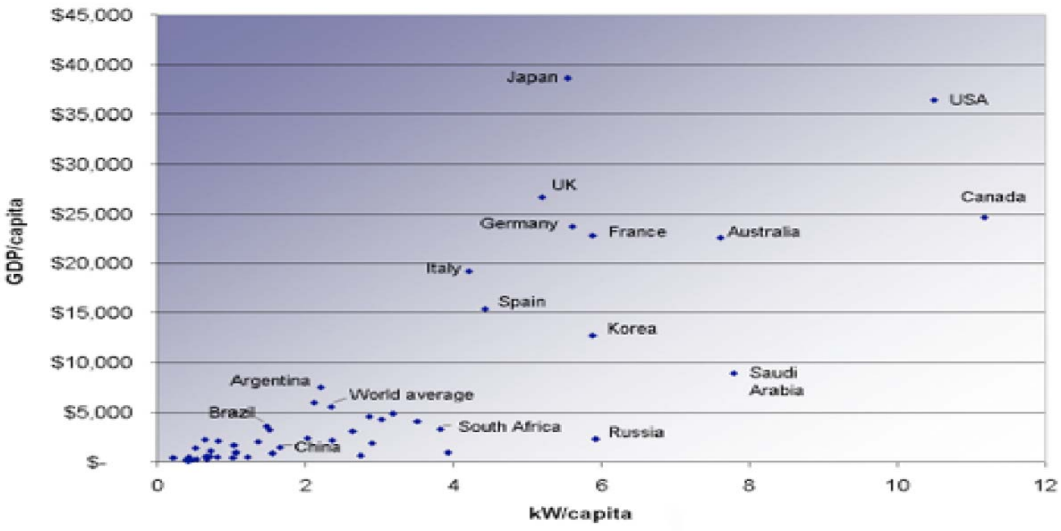
rapid change in institutional design, planning and public services. The market economy, on which we have built all our social constructs of wealth will not function anymore. Not everything that is desirable has a market, that is, people able and willing to pay. Even when a group of people share a desire for a good or service, such as a well-educated populace or protection from attack, individual members of the group may not find it rational to pay for that good or service, no matter how much they each want it.

This awareness calls for a major reform of the systems of global governance. Economy has been considered as the normal starting point of foresight during the last quarter of 20th century. The intense focus on economic efficiency ignores the reality that efficiency is not a goal. It is a means of enabling societies to use resources productively in the pursuit of goals. And some of those long-term goals: social justice and environmental sustainability - may conflict with shorter maximization of economic efficiency. In the near future governments will be faced with the challenge to reason that abandons the present measurement of growth in favor of new a frame that can account for the "real" GDP, including self-production and services rendered by nature. The governance dimension (which has been missing at our retreat!) shall ensure the balance between security of supply, environmental compatibility and efficiency. And the role of a Public Safety enterprise in this endeavor will have to be clearly defined.

The big call for governance will be to carry society through the necessary shift from an exploitation attitude to a planetary gardening one [12] with nature becoming a major concern for public safety (along the lines of thought of the ecological dimension presented by Cleo Paskal at the retreat [13]).

Demystifying the Myth: GDP is not responsible for increased energy consumption

In the climate wars the most challenging is the battle between the well intentioned individual and the large corporations lobbying and pressuring governments and preventing them from taking the necessary action. According to the International Energy Agency created by OECD today's lifestyle is unsustainable, and GDP cannot be blamed for it, as Fig. 6 illustrates.



Energy consumption compared to GDP per capita (Source IEA)

Fig. 6

Canada has a GNP per capita 30% lower than Japan and a consumption of energy per capita double than Japan. The cause is not a colder climate: if it were the case, USA, being warmer than Canada, would have a lower consumption per capita, yet Fig. 6 shows it has nearly the same. In USA and Canada, prices of energy were driven, during the late century, by international market prices, with low taxes added. It was not the case in Europe, where taxes represented the great majority of the price paid by the consumer. US position, being faithful to market ideology, stayed short sighted, because markets are short sighted, but generated long term consequences, that may lead to a collapse of the so-called “American way of life” (and the US leadership too) during the following decades. As a consequence it is anticipated that in the near future policy guidelines, formerly given by politicians and business leaders, will be highly influenced if not determined by the scientific community.

Surprises and Resulting Trends

The barriers between the military and EMOs will be vanishing, since their mandates will converge in the climate and nature protection agenda on the way from consumerism to a planetary gardening world. This will require much more collaboration among the plethora of organizations involved in public safety, each with a different mandate, professional culture and ethos. To be able to absorb these changes the public safety enterprise will have to become an agile force, able to capitalize on the latest scientific discoveries and technological advances to seamlessly deploy fully integrated teams with complementary capabilities able to work in harmony with citizens in the resilient society. The trends that we expect unfolding to support the world absorb the drastic changes needed are:

- A shift from classical nation state strategy concepts to an international state of law, centered on regulations protective of natural resources and enforcing climate policies on citizens;

- Redefining the missions of the military forces and public safety agencies into a global safety and security concept, including nature protection and rescue;

- Open access to information and the increasing role of the « precautionary principle » will lead to the development of local conflicts and scientific controversy;

- The “Scientific community”, though not having any legal status, will appear clearly as the driving force in defining the future economic social and ecological policy, such as it did already through the International Panel on Climate Change, responding to a demand of the United Nations.

- One big hope in developing a resilient world can come from massively introducing environmental care in education to which better access to information through Internet can facilitate the shift towards sustainable technologies backed by the sustainable behavior of the citizen.

Science and technology are not an end in themselves since them alone cannot detangle the intricate web of consequences in which the world got caught in the 21st Century. Yet science and technology can impact greatly the direction in which the world will spin – eventually out of the gloomy fate pending on the horizon…

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