Expert paper

How to implement Responsible Research and Innovation (RRI) in Small and Medium-Sized Businesses (SMEs)

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RESPONSIBLE INNOVATION COMPASS

Content

1. Introduction

ICT is possibly the field where innovation is most visible. Not only has it been fundamentally transformed, but it has been an enabler for change in other fields.

In this paper, we will look at the issues in the ICT industry, related to Responsible Innovation. One of the most discussed and disruptive ones is Artificial Intelligence and its applications in almost all walks of life. It is telling that on the same day, January 10, 2017, two announcements were made: The World Economic Forum published The future of AI, and the implications for you[1]; and the MIT Media Lab and Harvard University announced that, together with a Foundation, they will serve as the founding anchor institutions for a new initiative aimed at bridging the gap between the humanities, the social sciences, and computing by addressing the global challenges of artificial intelligence (AI) from a multidisciplinary perspective.[2]

We will then see why it is extremely difficult -rather impossible- as the MIT initiative implies, for any single entity, be it public or private, to determine what responsible innovation is, what is a desirable future, what societal needs are -and will be, what sustainability means or what the moral implications of innovation are. The reason is that it is a dynamic and changing process. We need mechanisms, venues and, above all, the will to get together and define those terms in relation to the rapidly changing reality, with a multidisciplinary perspective. Hence the importance of building awareness.

Fortunately, there are several initiatives, at different public, private or combined levels that have started to address this challenge. We will briefly enumerate those initiatives and their specific contribution and innovation.

Finally, based on the needs described and the existing experience, we propose a mechanism that could be a step in the direction of helping SMEs to implement RRI.

2. RRI issues in the ICT industry

Of the three fields of high societal interest that the present project is concerned with, ICT has the particularity of being the vehicle for most of the innovation in the two other fields, healthcare and nanotechnology. In its "Visionary Innovation" program, Frost & Sullivan[3], a consulting firm which provides market research and analysis, identifies 12 megatrends of which 7 are directly ICT related. The same study enumerates 51 sub-trends, 28 of which are directly ICT related. IT has come to be the universal tool for nearly all human, social and scientific undertakings, even though new ideas about low-tech innovation are also making surface[4]. With increased voice interface capabilities, we will witness ever more disruptive innovations finding their way to the market.

In addition to this general relevance, ICT has its own specific issues amongst which we will highlight the following.

1) Artificial Intelligence (AI)[5]

"AI is a branch of computer science dealing with the simulation of intelligent behavior in computers, or the capability of a machine to imitate intelligent human behavior."[6]

AI solutions are based on machine learning, a process whereby machines improve their performance through experience. They can reason, communicate and accumulate knowledge to generate new knowledge. They combine the exponentially increasing processing power of the computers with the even more rapid explosion of available data, collected globally, added to the development of new learning algorithms.

One application being more and more frequently exploited is **"bots"**. Using sophisticated algorithms that improve its precision as more data is collected, AI is progressively applied to all areas of human endeavor through robots: design and manufacturing, marketing, financial services, customer service, monitoring, health care and education, among others.[7]

One of the issues that this raises is the question of ethics. "*The term "robot ethics" (sometimes "roboethics") refers to the morality of how humans design, construct, use and treat robots and other artificially intelligent beings.*"[8] Here, as in other fields, the question is the purpose for which the AI tool is used. However, AI is different in the sense that it can be used for massive impact. For example, with good quality voice recognition, **all** phone conversations could be monitored for a given purpose, be it responsible or not.

Another issue is its impact on the **labor market**. Analysts are not unanimous on what that impact is. At one end of the spectrum we find the idea that robots are one of the elements that have disrupted the labor market because*,* with outsourcing and automation, developed countries such as the US, have witnessed a 14% decline in middle skill jobs during the past decade*. "This is expected to double in this knowledge and cognitive era as Artificial Intelligence takes poise and displaces the labour market."*[9] At the other extreme of the spectrum we find a study by the World Economic Forum among 26,000 millennials, according to which when "*they look at the world around them, 70 percent see it as full of opportunities, versus only 30 percent who see it as full of struggles; 86 percent see technology creating jobs, while only 14 percent see it destroying them*"[10].

According to Jeremy Rifkin "*while traditional industries have declined, thousands of new entrepreneurial enterprises — some profit driven, others nonprofit — have arisen".[11]*

In fact, technology in general and AI in particular do not mainly replace humans at the work place but rather allow people to do more useful things that only humans can do. For example, in education, the introduction of computers in class rooms was first considered a threat by the teachers. However, once teachers decided to embrace them, computers became an instrument for the teachers who, thanks to these educational tools, find the time to pay individualized and personal attention to each student and thus enhance the learning process.[12]

2) The impact on our way of life

ICT has revolutionized, and is revolutionizing, many of the concepts on which our society is based. The concept of **property** is being progressively replaced by that of the **sharing economy**; from owning cars[13] to the removal of the middleman to bring down the cost of goods and services.[14] According to Jeremey Rifkin, *"25 years from now, car sharing will be the norm, and car ownership an anomaly."*[15]

In a sharing economy, millennials simply shy away from ownership and instead of acquiring music, buying homes or owning luxury goods, they share them. The old concept of SaaS (Software as a Service) has extended itself to XaaS (Everything as a Service)[16].

Work and the workspace have been impacted in a variety of ways.

Startups and incubators are proliferating because ICT allows them to share space, knowledge, networks, professional services and, most importantly, an ecosystem and an environment that enhances the innovation process. Impact Hubs and Collaborative workspaces allow people in various geographical locations and time zones to work together, abolishing the limitations of time and space.

The Internet, email, telepresence, webinars, among others, have made SOHO (Small Office Home Office) a prevalent reality, thanks to telecommuting. In 2013, 20% of Americans worked from home and the number is rising[17].This evolution has particularly impacted work-life balance as well as family and gender relations.

The concept of retirement is being reconsidered as information technologies allow experienced workers to remain active longer because they can remain relevant and up-to-date.[18]

The medical profession and Health care delivery have undergone significant change. At least one-third of persons living in the U.S. now routinely use symptom checkers, sometimes referred to as Google Doctor, for both routine and urgent conditions, including chest pain. Not only do they get online advice, but they add to the considerable amount of patient data available, which is impacting the way medical research is done, drugs are tested, diagnostics made.

New **business models** have emerged. Uber has based its model on the concept of considering its drivers "independent contractors". Though controversial, this concept is creating a new class of entrepreneurs and changing the labor relations landscape. It has also contributed to the proliferation of the "on-demand economy" and "peer-to-peer delivery services". An important driver of that economy is the flexibility it offers to the consumers to have access to many services and products, anywhere, any time. Another business model

innovation is that of **freemium**. It is a pricing strategy by which a product or service (typically a digital offering or application such as software, media, games or web services) is provided **free** of charge, but money -a pre**mium-** is charged for proprietary features, functionality, or virtual goods. This model gives free access to services to many users while making money only from those who require a higher level of service. It is a sort of **demonetization**.

3) Privacy and Protection of Personal Data

The collection of large quantities of personal data by different public and private entities has reached a level of sophistication that has raised new questions. Fairness, accountability, transparency, the right of the individual over the publication of data concerning her or him are the main worries. The use of cookies and other means of collecting data about individuals and the right to be forgotten are some of the manifestations of those concerns.

The Executive Office of the President of the United States, in its May 2014 report "Big Data: Seizing Opportunities, Preserving Values", refers to a level of pervasiveness that "*demands consideration of how best to balance the opportunities afforded by big data against the social and ethical questions these technologies raise.*"[19]

On the other side of the Atlantic, in the same month, the Court of Justice of the European Union recognized the so-called "right to be forgotten" by ruling that *Google and other search engine providers must delete links to outdated information about a person published on the Internet if the person submits a valid request under the law*.[20] The ruling was based on a Regulation and a Directive of the Commission. The objective is to *give citizens back control over their personal data and to simplify the regulatory environment for business*.[21] On 10 January 2017 the European Commission adopted a proposal for a Regulation on Privacy and Electronic Communications.

4) Power of Social Networks

In 2014, according to mediabistro.com, over 50% of people had learned about breaking news via social media rather than official news sources.[22] Today almost two-thirds of the American adult public get news from social media, with 44% of the public getting its news from Facebook alone.[23]

Citizen journalism is on the rise and the public now has a two-way relationship with the media. This has an empowering effect on the public. The flip side of the coin is that it reinforces narrow opinions by amplifying slanted views or political biases. The algorithms that are embedded in social media will basically show you what you are more prone to look for, i.e. the same opinions as yours, whereas traditional journalism is supposed to present an objective view, representing a balanced perspective.

The other issue is the unchecked spread of fake news. The US election and Brexit campaigns have been cited as examples of such type of news, to the point that the Oxford Dictionaries made "post-truth" their Word of the Year 2016.[24] Post-truth is *an adjective defined as 'relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief*'.

Shortly after, Reuters announced that *Facebook will introduce tools to prevent fake news stories from spreading on its platform, an about-face in response to rising criticism that it did not do enough to combat the problem during the U.S. presidential campaign.*[25]

5) Pervasive Internet of Things (IoT) and its promises

IoT is the network of interconnected things/devices which are embedded with sensors, software, network connectivity and necessary electronics that enables them to collect and exchange data making them responsive.[26]

According to Gartner, 6.4 billion "things" were connected to the internet in 2016. That number will reach 21 billion by 2020.[27] The industries involved are the major tech companies like IBM, Cisco, Google and Microsoft, as well as telecom operators, among many others.

These connected things generate a huge amount of data that enable all things "smart". **Smart meters** optimize the consumption of water and electricity, for example, by offering lower rates to consumers during off-peak hours. The total demand on the grids on peak-hours is thus reduced. **Smart grids** alternate between the use of traditional sources of energy and renewable sources, thus reducing air contamination. **Smart mobility** combines the use of different methods of transportation, by mixing the public, private and other forms of mobility, thus reducing pollution due to traffic. In another example, [d]*ata is collected in a platform,* **Virtual Singapore***, which helps the government understand how the city is functioning in real-time and potentially predict how crowds might react in an explosion or how infectious disease might spread.*[28]

Rifkin considers that IoT will be the main instrument for the societal change: *social capital is as vital as market capital, access is as important as ownership, sustainability supersedes consumerism, collaboration is as crucial as competition, … GDP becomes less relevant, and social indicators become more valuable in measuring the quality of life of society, and an economy based on scarcity and profit vies with a Zero Marginal Cost Society where an increasing array of goods and services are produced and shared for free in an economy of abundance. For the first time in history, the entire human race can collaborate directly with one another, democratizing economic life."*[29]

Some of the issues here are data privacy and security. The information collected on a massive scale can be, like any other instrument, put to wrong use.

6) Trust

This topic deserves a mention of its own because the stability of every human undertaking depends upon it and yet it seems to have been seriously shaken. For some, this is not a real issue. For them the bad news that we read and hear all the time on lack of trust in the society is due to the fact that the media only report the bad news, because that sells.

However, that cannot be the only interpretation. Our society's institutional structure is based on the lack of trust. The purpose of separation of powers in the political theory is to create checks and balances among the three powers. We live in a culture of contest[30]. This is a legacy of the origin of western democracy that was a reaction to the absolute power of the kings.

In the IT field, lack of trust manifests itself in various ways. **Privacy** concerns are one of them. Citizens are concerned that governments and corporations collect a large quantity of data on them. **Security** is another one. Unknown, undesirable entities can have access to huge data bases and can hack accounts and withdraw money, steal identity, substitute themselves to citizens without their knowledge, to name a few.

Another development is that of the **blockchain** concept, whose purpose is to be an alternative to the trust in institutions. Bitcoin is one of the earliest applications of the blockchain technology. What Bitcoin does is to by-pass the authority of the Central Banks. It dispenses with the credibility of the middle man and allows peer-to-peer technology to create money. In fact, it is replacing trust in the central bank, which is fading, by the robustness of the cryptology system that it uses. It is predicted that "*the use of blockchain as a potential way to increase the reliability of transactions and the visibility of the same while maintaining the privacy of transactions will allow ecosystems of partners to interact with more freedom and diversity than ever before.*"[31]

Blockchain technology promoters are looking at other fields such as:

- **Property**: Smart property allows ownership of both physical and non-physical property to be verifiable, programmable and tradeable.
- **Contracts**: Smart contracts are verified on the blockchain, allowing for programmable, self-executing and self-enforcing contracts.
- **Identity**: Blockchain technology allows for identity verification, authorization, and management, significantly reducing fraud.[32]

3. Dynamic process of defining terms

Responsible Innovation existed before the term was coined and some entrepreneurs might find that, in hindsight, they have been applying RRI principles, once they learn what they are.[33] However, it is when we become conscious of a phenomenon and discover its laws that we can devise ways and means to fully benefit from it. Humans had always had an instinctive knowledge of the law of gravity, but only when we discovered the principles that govern that law, and combined them with principles drawn from other laws, did we manage to fly. To liberate the potential of RI we need to understand its foundational principles.

Responsible Innovation has been defined in various ways. Here are a few definitions.

- "*Responsible innovation means **taking care of the future** through collective stewardship of science and innovation in the present.*"[34]
- *RRI "refers to the comprehensive approach of proceeding in research and innovation in ways that allow all stakeholders that are involved in the processes of research and innovation at an early stage:* o *(A) to obtain **relevant knowledge** on the consequences* [and] *the outcomes of their actions and on the range of options open to them,*
  - o *(B) to effectively evaluate both outcomes and options in terms of **societal needs** and **moral values** and*
  - o *(C) to use these considerations (under A and B) as functional requirements for design and development of new research, products and services."*[35]

- Von Schomberg offers the following definition of Responsible Research and Innovation: *"A transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to **the (ethical) acceptability, sustainability and societal desirability** of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)."*[36]

Let us examine these definitions one by one. The **bolded** terms in the definitions above have a commonality: they are all dynamic, relative and diversely perceived and interpreted by different stakeholders. A short analysis of those concepts follows.

- Taking care of the **future** means different things for different people. For some it means leaving the forests intact for the benefit of future generations, for others it means to fell its trees to develop agriculture, feed the people and thus assure the survival of the present generation.

  Another question is **whose** future? There are people that claim that only the future of their country is what matters. The politics and elections in 2016 showed some sad examples of that ideology.

  Sometimes technology forces us to think about the future. Malcolm X once said: "*The future belongs to those who prepare for it today.*"

  Take the example of what is called 5G, the name given to the next generation of mobile networks, as it comes after the 4th generation. Together with its cousin, the Internet of Things (IoT), 5G has forced mobile operators and their infrastructure suppliers, as well as a host of application developers and planners across the world to strive to outsmart the others, imagining what tomorrow will look like, so that they develop the technology for it.

  IoT is at the origin of many "smart" concepts. Smart cities, smart grids, smart meters, smart homes, intelligent transportation and driverless cars are all based on the combination of the cloud's distributed computing, ultra-fast wireless connections and ubiquitous connected devices.[a]

  Companies that get it wrong can pay a dear price for it. Nokia, which was the market leader for smartphones, with a 50% share in 2007, did not see the shift coming in that segment and by 2012 its market share had gone below 4%.

  The implications of the developments in coming years are such that companies are forced to work in collaboration. Several alliances have been formed and companies are working together to set the standards that will govern the IoT industry.[37] It is no longer possible for a single company to define the future of the industry.

- **Relevant knowledge** about the consequences of the outcomes of innovation is a tricky issue.

  Replacing humans with machines, mass production facilities, heavily exploiting the earth's resources and the disconnect between producers and consumers, have resulted in

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[a] "According to Gartner, Inc. (a technology research and advisory corporation), there will be nearly 20.8 billion devices on the Internet of things by 2020. ABI Research estimates that more than 30 billion devices will be wirelessly connected to the Internet of things by 2020." https://en.wikipedia.org/wiki/Internet_of_things.

unemployment[b], excessive consumption[c], pollution[d] and decline in the quality of nutrition[e]. None of those consequences were necessarily intended.

Unintended consequences can also be positive. They have fundamentally transformed the economy. One author has called that the *rapid demonetization of the cost of living*. For Peter Diamandis*, "[p]owered by developments in exponential technologies, the cost of housing, transportation, food, health care, entertainment, clothing, education and so on will fall, eventually approaching, believe it or not, zero."[38]*

He gives the example of what a smartphone provides as an almost "free" service today. Obtaining the same services would have cost 900'000 (nine hundred thousand) dollars a few decades ago. See Annex 1 for a detailed breakdown.

It has not always been this way. Wisdom in the ancient world warned humans of unintended consequences by prescribing caution. The myths of Pandora and Prometheus meant to advise against undertaking new activities if one had doubts about their outcome.

- **Societal needs** vary depending on the physical and cultural conditions of a given society - or even a person - and evolve over time. Attention needs to be paid to the local reality in which a given innovation will be applied. In the early days of computers in class rooms, teachers in developing countries reacted negatively to the technology because they had not been properly prepared and were rapidly overtaken by the students who had the ability to learn to use them rapidly, faster than the teacher could. Programs had to be set in place to train the teachers in the use of the technology.

- The definition of **society** itself has changed thanks to ICT. Whereas communities were usually bounded by geography, we now have virtual communities that require little or no physical nearness.

- The very definition of **Sustainability** has evolved over time. From a primary focus on environment in the 70s it shifted to environmental, social and economic in the 80s and 90s and to poverty alleviation at the turn of the century. The recently adopted Sustainable

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[b] In the USA, in 1850, 60 percent of the working population was employed in agriculture. Today, less than 2.7 percent of the workforce is engaged directly in farming. http://www.converge.org.nz/pirm/nutech.htm

[c] *While the industrial revolutions allowed for mass production, it was not until Henry Ford (1863–1947) introduced his assembly-line system for automobile production that goods could be produced in huge quantities cheaply enough to be widely accessible*. http://science.jrank.org/pages/8818/Consumerism-Consumerism-Mass-Production.html.

[d] *It's interesting to note that natural resources had been stored virtually untouched in the Earth for millions of years. But since the start of the industrial revolution vast amounts of these resources had been exploited within a period of just a couple of hundred of years at unimaginable rates, with all the waste from this exploitation going straight in to the environment (air, water, land) and seriously damaging its natural processes*. http://www.tropical-rainforest-animals.com/Environmental-Pollution.html

[e] *For at least 50 years, American agriculture policies have promoted production of, and ultimately lower market prices for, commodity crops like corn, wheat, and soybeans. Over the last 3 decades in particular, these "cheap food" policies have exacerbated the negative impacts of an industrialized agriculture on the health of the agro-ecosystem, as well as on the health of the humans who must share and be sustained by it. Sustainability and health are two sides of the same food system coin.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3489133/

Development Goals (SDG) have gone further by incorporating the concepts of equality and monitoring & evaluation.

We have seen therefore that all the concepts that have been used in the definition of Responsible Innovation are themselves difficult to define with precision. How do we define *Responsible* then?

Do we ask the legislator to set rules and regulations for that purpose? Do we establish "Ethics Committees" like it is done in hospitals? As the issues are dynamic and relative, how do we adapt the definition to evolving circumstances? Who has the authority to define them?

This raises the issue of governance. Governance can be exercised through a variety of channels or a combination thereof. It could be:

- **By market mechanisms:** Businesses argue that if there wasn't a social benefit to their product they wouldn't have any customers.[39] Therefore you must let the market define what is desirable. But that presupposes that customers are fully cognizant - or are made aware - of the undesirable consequences of their purchases. We know this is not the case.
- **By regulation:** Governments and regulators are expected to know what is good for society, before even a technology hits the market! That is simply not possible; *we are moving too fast and past and present do not provide a reasonable guide to the future*.[40] There is innovation even within the very field of regulation.
  Consider the United Nations climate change negotiations in Paris. As Oxford professor and activist Thomas Hale has explained, *the Paris Agreement of last December represents a paradigm shift in international agreements, from a "regulatory" model of enforceable legal obligations to a "catalytic and facilitative" model that both spurs and helps a wide range of actors meet a rolling schedule of steadily increasing commitments.[41]*
- **By collaboration among different stakeholders**: This is a useful way to combine the knowledge and wisdom of all those involved. Ground rules are required for this approach. Among them is the fact that innovation itself is not the ultimate goal, to which everything should be sacrificed; it is a means that serves a purpose. The collaborative method aims to define that purpose.

Determining what is responsible and what is not is a complex, dynamic and moving issue and is beyond the capabilities of any single agent or institution. Individuals intervene with their sense of moral values; government has a regulatory role as well as that of creating incentives. The market takes care of providing the reality check, i.e. to determine whether there is a fit between the demand and the product or service that is offered.

There is a need for appropriate spaces and institutional venues for all agents to have a meaningful conversation around the question of responsibility of each innovation and to shape desirable futures.

4. Values-based organizations/mindful businesses

The aim of this section is to review some examples of collaborative approaches for defining responsibility. Their experience and learning can contribute to the design of a mechanism, adapted to the needs of the SMEs, for relieving the burden of becoming more responsible. For example, from the Singapore experience, we will learn the concept of forward-looking exercises. From section III we will get an idea of how governments can alleviate the process. Section VI will explain how certification and standards can help. Here is the non-exhaustive list.

I.   **Reflecting on the future**

Singapore's SkillsFuture initiative brings together employers to discuss the changes, industry by industry, that they expect to happen over the next three to five years, and to identify the skills they will need. From those discussions "industry transformation maps" are designed to guide individuals on where to head.[42]

The initiative is headed by the "Council for Skills, Innovation and Productivity", a tripartite body chaired by the Deputy Prime Minister and comprising members from government, industry, unions, and educational and training institutions.

Generous subsidies, of up to 90% for Singaporeans aged 40 and over, are available on top of a credit for every Singaporean above the age of 25 to be freely used to pay for any training courses. According to Ng Cher Pong, SkillsFuture's chief executive, "*the returns on that spending matter less than changing the mindset around continuous reskilling*."[43]

II.   **The Societal Incubator** – a tool for responsible innovation

As we have seen, unintended consequences constitute a problem for the responsible innovator. The idea behind a societal incubator is to combine a safe and responsible use with innovation and engineering. Through open dialogues, participants eager to give shape to Safe-by-Design[f] pay extra attention to risk analysis and technology assessment.[44] The innovator is not alone in performing the risk analysis. *This is characterised by technical, commercial and regulatory uncertainties, which give rise to "waiting games": paralysing dependencies between researchers' firms, public authorities, NGOs and parliaments. A societal incubator could act as a solution to broader waiting games that result from indecisive regulation, investment uncertainties, and the fear of adverse public ideas.[45]*

A Societal incubator creates conditions for an open and participatory learning process and aims to speed up RRI and its chances on popular support.[46]

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[f] Safety by design is a concept and movement that encourages construction or product designers to "design out" health and safety risks during design development. The concept supports the view that along with quality, programme and cost; safety is determined during the design stage.
Within Europe, construction designers are legally bound to design out risks during design development to reduce hazards in the construction and end use phases via the Mobile Worksite Directive (also known as CDM regulations in the UK).[8] The concept supports this legal requirement.
https://en.wikipedia.org/wiki/Safety_by_design

III. Governmental and academic initiatives

Governments can federate different entities to work together, based on incentives. Grand Challenges Canada is one such case.

Integrated Innovation *is the coordinated application of scientific/technological, social and business innovation to develop solutions to complex challenges. This approach does not discount the singular benefits of each of these types of innovation alone, but rather highlights the powerful synergies that can be realized by aligning all three. Integrated Innovation recognizes that scientific/technological innovations have a greater chance of going to scale [and] achieve global impact and sustainability if they are developed from the outset in conjunction with appropriate social and business innovations.*[47]

Carnegie Mellon also has a program named "Integrated Innovation Institute: Engineering + Design + Business". In addition to industry-sponsored projects, it has chartered projects that aim to solve social issues. In spring 2014, two course project teams applied the integrated product development process to solve the problem of sexual assault. In spring 2015, Integrated Innovation Institute students produced a prototype cold-weather homeless shelter as part of Carnegie Mellon's Impact-a-Thon competition.

IV. Public, Private or Stakeholders initiative

The **global humanitarian** lab is a partnership bringing together affected populations, humanitarians, plus the public and private sectors with the shared goal of accelerating humanitarian innovation. It is based on the idea that humanitarian issues we face today are complex and cannot be solved by any one organization.

There are innovative ideas emerging to solve these problems especially in the fields of big-data, digital fabrication, energy, health, robotics, sanitation, shelter and water. However, without global collaboration, across numerous sectors and partners, the potential impact of these ideas is lost: stuck in development, unfunded, or duplicated unknowingly across organizations, wasting resources and time.[48]

The Global Compact, a joint program between the United Nations and private corporations, is the *world's largest corporate sustainability initiative* that intends to implement universal sustainability principles.[49]

There is a proposal for a *quadripartite organization, with representation from governments (their innovation agency, perhaps), industry, academia, and civil society. This last category can play an important role in not only defining the function assigned to innovation, but ensuring that it meets the goal of improving the quality of life for the masses and not end up benefiting a limited group only. Social networks could be used to involve the widest possible participation.*[50]

V.   Funding incentives

Realizing the importance of **collaboration** between companies and universities, several governmental or intergovernmental entities, such as the EU, promote collaboration through funding joint projects. The **H2020** and its predecessors mostly fund projects involving at least 3 organizations.

The Swiss government has realized that if Swiss businesses can turn their ideas into marketable innovations quickly, SMEs will also be able to compete on the international stage. Thus, the Commission for Technology and Innovation (CTI) funds applied research projects, which are carried out by companies working together with universities. The CTI funds hundreds of such projects every year.[51]

VI.   Accompaniment and Certification

Certification, and the journey that the preparation for certification implies, is another approach to responsible innovation. **B Corps** are for-profit companies certified by the nonprofit B Lab to meet rigorous standards of social and environmental performance, accountability, and transparency.[52]

Today, there is a growing community of more than 1,600 Certified B Corps from 42 countries and over 120 industries working together toward one unifying goal: to redefine success in business. The concept of community is at the core of B Lab because the organization supports and accompanies the membership in the learning process towards becoming a force for good.

VII.   Social Entrepreneurship Support

Ashoka's way to contribute to responsible innovation is by promoting social entrepreneurs. Ashoka's vision and understanding of the world comes from its experience in pioneering the field of social entrepreneurship over the last 35 years—finding, selecting, and supporting the world's leading social entrepreneurs (Ashoka Fellows). The network of more than 3,000 Ashoka Fellows is implementing system-changing solutions to human and environmental problems in 92 countries.

*Our work with Ashoka Fellows helps us see patterns of social development across various fields, providing key levers and a new framework for living in the world as a changemaker. We help people see the world differently so they can do differently, fully participating in the new environment. For example, Ashoka **is building and activating networks** to create fundamental changes in the growing up experience of children and young people so that everyone can become a changemaker*.[53]

VIII.   Co-working spaces and ecosystems

Launched in London in 2005, the **Impact Hub network** is present in 80+ locations.

An innovation lab, A business Incubator, A social enterprise community center. Impact Hub offers a unique ecosystem of resources, inspiration, and collaboration opportunities to grow the positive impact of [social entrepreneurs'] work.[54] It is a clear indication of a trend consisting in bringing together a diverse community of members to work in collaboration, inspire one another and cross-fertilize ideas.

IX.   SDGs

At the United Nations Sustainable Development Summit on 25 September 2015, more than 150 world leaders adopted the new 2030 Agenda for Sustainable Development, including the Sustainable Development Goals (SDGs).

The 17 new Sustainable Development Goals (together with their 169 targets)*, also known as the Global Goals, aim to end poverty, hunger and inequality, take action on climate change and the environment, improve access to health and education, build strong institutions and partnerships, and more*.[55] As such they constitute a useful tool to guide companies in their search for defining what is responsible in a given context.

> In the 2014 Sustainability Report, new research by MIT Sloan Management Review, The Boston Consulting Group and the UN Global Compact, shows that a growing number of companies are turning to collaborations — with suppliers, NGOs, industry alliances, governments, even competitors — to become more sustainable. Our research found that as sustainability issues become increasingly complex, global in nature and pivotal to success, companies are realizing that they can't make the necessary impact acting alone.   Co-creation with a multistakeholder approach in a favorable ecosystem is a promising trend.

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5. An attempt to design a collaborative model

In light of what has been discussed, mechanisms need to be adopted to facilitate the implementation of RI by SMEs. We would like to suggest below one such mechanism.

At its inception, an innovation is an idea, normally a solution to a problem or an answer to a need that the innovating SME has identified. The SME then proceeds to undertake a market study to see whether there is a demand for the proposed solution. Already at this stage it should be aware of the Negative Unintended Consequences of its Innovation (NUCoI)[57], if it is to proceed in a responsible manner. But this is not easy because resources are limited. Even more difficult is to have to deal with those NUCoIs. SMEs, unlike large corporations, do not have the financial resources for such an exercise.

But what are NUCoIs? They could be compared to the waste generated by an activity. The Oxford Dictionary defines waste as: *Unwanted or unusable material, substances, or by-products.*

However, in practice, NUCoIs are not really unusable. *Waste from milling is often used on agricultural land as fertiliser. Some milling waste has other uses: wheat bran is widely used as an animal feed, and wheat germ can be prepared and sold as a vitamin-rich health food.*[58] This means that nature has a way to use the by-product of a process as a resource for another process. Unfortunately, humans are the only species that can generate a type of waste - for example, the nuclear type, or large quantities of CO_2 - that cannot be entirely consumed by other species (this until some innovator finds a way to convert those wastes into a useful resource).

Transposing this concept into the innovation process means that any NUCoI should potentially be a resource for another innovation. How can we help the innovator find that use?

An ecosystem of collaboration and sharing is needed to discover the right partner or entity for that purpose. Some of the organizations or entities mentioned under Section C are founded on that principle. Impact Hubs, incubators, public or private innovation centers, Ashoka or B Corp are all spaces where SMEs could exchange ideas, share problems and challenges, and find solutions to the NUCoIs they generate.

The first, and maybe the most important, requirement is for the SME to be willing to take the initial step. It should be open to collaborate with social enterprises that could use the by-products of its innovation for their own innovation. We are not talking about sharing the innovative idea itself but its consequences; the same way that publications talk about what the future holds as megatrends. An SME can announce the consequences of its innovation plans. The other members of the ecosystem will get a glimpse of what the innovation can create as new opportunities.

The next step is to find the right space to start interacting and collaborating with other players in the ecosystem. Why would the CEO do that? We are assuming here that she or he is already committed to the cause of responsible innovation. The purpose of the proposed collaborative model is to create an environment that facilitates the task of the SME in making its innovation responsible, without having to heavily invest in it. The SME's only investment will be the effort of attending such spaces and presenting its dilemma.

What would such a collaboration look like? B Corp and Asoka have extensive experience in bringing together innovators for good. Their learning is invaluable for other entities that want to undertake such projects. Impact Hubs, incubators, publicly run innovation centers and

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communities such as Chambers of Commerce can all start one such collaborative initiative. Let us give an example.

An Impact Hub takes the initiative to create a space to bring together SMEs and members of the Hub community that are social entrepreneurs. At an early stage in their innovation process, the SME members of the group present their upcoming innovation projects and start a discussion on what its unintended consequences could be. A meaningful conversation[g] helps identify and understand those consequences.

Let us say that our SME is a software firm, developing an application that would perform functions that an accountant performs now. This would mean that some people with accounting skills will be out of their present jobs and become available for other tasks. They would become the resource that another innovator - SME, Startup or large corporation - could use. In this context, social enterprises have a particularly important role. They have the flexibility to take on the task and, together with the other institutions involved, find the right answer to the challenge. The time is right for this because the social enterprise sector is growing fast. According to Social Enterprise UK, an umbrella body, in the past 12 months, 38 per cent of social enterprises surveyed saw an increase in their turnover compared with 29 per cent of SMEs.

Tesla, given its size and resources has been able to think of the consequences of the introduction of self-driving vehicles on hundreds of thousands of truck drivers in the US. It claims that truck drivers will not lose their jobs but will witness a *transformation of their role*. In an interview, Elon Musk explained that *the role of a truck driver would then gradually change to more of a "fleet manager" as the logistical tasks around truck driving are being automated*."[59]

This is not dissimilar in principle to "task shifting".[60] Started by the WHO in 2008, task shifting is a low-cost solution that consists of moving specific tasks, *where appropriate, from highly qualified health workers to health workers with shorter training and fewer qualifications*. In Africa, thousands of nurses were trained to perform certain tests that doctors alone had been performing up to that time, thus overcoming the problem of the scarcity of doctors for more complex functions.

Having had the initial desire to be responsible and having found the space where the consequences of its innovation can be discussed, the SME would normally need to spend time and financial resources that can be too costly for it. Here is where other entities have a role. Public institutions can help in a variety of ways. They can promote the concept by financing the research work that needs to be done to identify the NUCoI and to find the partner that would use it as a resource. It is like an environmental impact assessment that needs to be done at the beginning of the process, but in this case, it goes beyond just an assessment and finds the entity that can exploit the by-product.

ICT can play an important role in this area. Big data analysis facilitates the research work. Platforms will permit innovators to share ideas about their own NUCoIs and find out about opportunities that NUCoIs of other companies offer. Some sort of a directory of potential undesirable consequences will be created and transformed into new projects. Apps will make that information available to a larger community. Open source development and crowdsourcing tools will be used to enrich the process.

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[g] See www.ebbf.org and its meaningfulness breakfasts and learning events.

The creation of those spaces, platforms and apps will help RI *to be stimulus for success and not a barrier to innovation.*[61] It puts SMEs and the other stakeholders, including citizens, at the center of innovation.

It has been common to make a distinction between traditional -for profit- companies and social enterprises, the former pursuing financial returns exclusively, while the latter seeks a positive impact on society. This distinction need not -cannot- be maintained in the long run. The very concept of planning for the long term drives the activity to become sustainable and responsible. A process like the one proposed here will lead to the integration of social entrepreneurship within SMEs and large corporations, as opposed to the parallel development of those two worlds.

It must be reminded that this is a conceptual proposition. It needs to be put to discussion among the stakeholders and be improved by an iterative process of learning-by-doing.

ANNEX 1

Dematerialization

>$900,000 worth of applications in a smart phone today

Application	$ (2011)	Original Device Name	Year*	MSRP	2011's $
1. Video conferencing	*free*	Compression Labs VC	1982	$250,000	$586,904
2. GPS	*free*	TI NAVASTAR	1982	$119,900	$279,366
3. Digital voice recorder	*free*	SONY PCM	1978	$2,500	$8,687
4. Digital watch	*free*	Seiko 35SQ Astron	1969	$1,250	$7,716
5. 5 Mpixel camera	*free*	Canon RC-701	1986	$3,000	$6,201
6. Medical library	*free*	e.g. CONSULTANT	1987	Up to $2,000	$3,988
7. Video player	*free*	Toshiba V-8000	1981	$1,245	$3,103
8. Video camera	*free*	RCA CC010	1981	$1,050	$2,617
9. Music player	*free*	Sony CDP-101 CD player	1982	$900	$2,113
10. Encyclopedia	*free*	Compton's CD Encyclopedia	1989	$750	$1,370
11. Videogame console	*free*	Atari 2600	1977	$199	$744
Total	**free**				**$902,065**

*Year of Launch

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