

Using Information and Communications Technology Advances to Leverage the Search of the World New Balance with Less Resources

-Part 2-



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Abstract

The paper analysis is focusing on the potential contributions of information and communications technology (ICT) in the context of geopolitical emerging crises, which show that, behind the critical resources/materials and informational war, the information will be the supreme aim, as its power to enable all other critical values, in such dynamic and complex processes, where ICT has the fundamental role, is and will be more and more used to obtain the desired targets. That is why the role of ICT in leveraging savings should be deeply conceived starting from the meaning of costs which must consider ALL the human values, starting with life, but including the quality of life and other human values like humankind evolution/transformation.

*Evaluating the ICT role, we believe that the actual World crises represent a major risk for the Earth ecosystem and the humankind life, because of the unprecedented level and extent of the crises, where the lack of information or material/technological resources/progress is intended to be compensated by the use of brutal (military some time) force (or hybrid war), which rise other unprecedented existential dangers, for people and our planet. We also consider that such major crises and challenges reveal, in fact, the complexity of World problems, long time misunderstood, along with the incapacity of incumbents to solve or prevent them, before reaching such dangerous levels or “points of no return”. **One major implication of reaching such stage of critical World context is the risk, already proved by some visible trends, to lead the actual challenges of balance between democracy and authoritarian solutions to the point where only force could avoid the worst scenario.***

On the other hand, this last stage should be analysed in the context generated by World crises, where the old problem of the balance between democracy and security, very much influenced by the prominent role of ICT potential, could degenerate to new dangers or even catastrophes, because of threats like the hybrid war (recalling, for example, infrastructures destructions/sabotages, fake news or ChatGBT vulnerabilities) or other geopolitical conflicts.

Consequently, some crucial links of the World dramatical context with a proper/optimal ICT development are necessary, but they should be timely analysed, for keeping the right role of ICT in the Information Society (IS) on the way towards the Knowledge Based Society (KBS) and also the accurate knowledge refining in order to leverage its influence on Earth ecosystem and humankind evolution, as we repeatedly expressed [3][11][13][16][24].

Beyond any pessimistic impressions, the role of a proper ICT development which should mitigate such risks is anyway very necessary and we have approached some concrete examples that show the potential of ICT, including the human intelligence (HI) and artificial intelligence (AI) synergy, to reach such aims. Among the examples, the actual image of ICT potential is very well illustrated, as 2023 expected technology advances with substantial growing [1].

One of the actual most promising ICT advances is based on linking physical and virtual entities, as the digital twin technology does, being a suitable fit for the actual World crises, either materials or conceptual, but, although it may be seen, in a way, similar with the virtual reality technology, it is even much more productive and powerful, as it could bring solutions, using real time data, for many of the complicate challenges of the present and also for other that we cannot foresee.

Beyond all known advantages and expected benefits of electrical cars (another 2023 top growing technology), mainly around reducing carbon footprint and non-fossil consumption, we consider that it is worth to notice other two prominent potential benefits of this industry development, as leveraging the research for innovations to improve actual battery technologies (which is for long time on a saturation level) and also advances in the general striving for the intelligent storage and transportation of the different forms of energy, which are crucial for the Earth ecosystem. It is also well known and equally used the global feature of the automotive industry to leverage a plethora of subsequent industries/branches, which provide all the necessary parts and bring considerable economic and technological benefits for World progress.

Although it could appear much different from electrical cars, we believe that the future will rise another analysed example of similar industry: the autonomous robot [2]. The novelty rises from their penetration in the large industry of the airport services and further in restaurants economy, but, more than the actual economic benefit and context, it is important to notice the technological advances, while matching the restrictive environments (no GPS access) and combining the advance of 3-D lidars, cameras, and ultrasonic sensors. We observe that the system is a relevant example of ICT potential to contribute to new solutions in adverse new environments, i.e., just the World new challenges could bring.

The challenges where ICT support is expected to help, in the dramatic evolutions and World crises context, becoming more complex and difficult to mitigate, could put complicate tasks for the ICT advances and this way the combination of HI and AI tends to be a critical factor for the World future and humankind safe evolution. Recalling just some prominent potential “odds” World have to face, from climate changes, Earth resources fading, social unbalances or geopolitical/security crises to earthquakes, consumption or changes in human behaviour/values, we could understand why it is necessary to optimize and obtain maximal efficacy and efficiency from the “team” HI-AI, which seems to be the main ingredient of ICT advances and eventually of the complex consequences of ICT services, products and applications when supporting IS/KBS progress. The analyse and identification of such challenges are, naturally, also more and more complicate and consequently some relevant examples were also considered.

Starting from the general case of defence, which is better known, where every new arm is generating the appearance of its counter-arm, but without detailing here the challenges induced this way for World crises context, it was interesting to observe the similitude with the case of ICT advances benefits versus the vulnerabilities and risks which are sooner or later exploited by the cybercrime and all other misused applications of ICT. It is relevant, including the above similitude, to also mention an observation, we have often revealed to our students, referring to an inherent vulnerability of ICT, but exceeding this time the IT processes and laying in the communications “garden”, as the vulnerability generated by any emission which could be exploited/intercepted by enemy, we also call it the “Achille’s heal” of the communications. This vulnerability was strongly mitigated by the implementation of defence applications of “spread spectrum systems” principles, we also presented in the early monograph in Romania we recalled in [22]. These observations show the complexity, diversity and the deepness of the potential vulnerabilities, considering just ICT “garden”, where “odds” and threats could appear and action (without neglecting other domains/factors). More than these, our opinion is that, along with the general actions exploiting the ICT vulnerabilities, the complexity of ICT products, applications, services and systems, proliferated all over the World, a specific area of intrinsic or potentially dangerous threats could be generated, especially through the critical infrastructures they are built in, as IS/KBS tend to become more and more dependent of massive ICT presence/infrastructure. The actual debate on AI applications induced risks is just the “tip of the iceberg” we have repeatedly mentioned [11][13][16].

Consequently, the security domain became crucial in the context of IS/KBS, while ICT development must safely cover both positive and negative implications of progress.

The analysis of some relevant examples has detailed and confirmed the real dimensions of the above assertions, although the World context complexity and dynamic, along with ICT fast advances, rise inherent relativity/approximation and time sensitivity on any arguments.

Starting from one of the most credible safety level on Earth, as it is provided for the spatial systems, where NASA is the prominent centre of expertise and software test automation is an essential instrument of risks minimization[4], the needed combination of HI and AI could take a multitude of scenarios, from designing to configure and exploit ICT in its worldwide products, services and applications, but we consider that modelling, designing and simulating are crucial for ICT development optimization, especially in the complex and complicate context of Earth ecosystem. Although the NASA case of “software test automation to emulate complex user behaviours” is just one of the relevant scenarios, considering its critical importance, the HI component in the design phase was enforced with the highest level of human experience and expertise, while confirming, among other benefits, our earlier opinions about the crucial role of analysis time versus the complexity and the fast development of ICT (and generally of high-tech applications) [16][24][26][27], because “on the ground...you can take time to solve them”. Among the main factors which could determine the capacity of the systems to reduce the risks, the prominent role of the communications, generally in mission-critical cases, was also revealed, based on their crucial importance on managing the remote spatial systems and platforms.

As we already pointed [6][9][22], learning, from the ICT techniques and algorithms of development and also of processing data, brings not only the natural benefits of use, but it could inspire the ways of thinking or acting for organizations, incumbents or individuals, in order to better face the actual and emergent World challenges/crises. The lessons would be even more valuable in the most complex and complicate scenarios, like the example of cyber resilience vast domain revealed [5]. This way we have just arrived to the top of the World dramatical evolutions potential consequences, which, although we do not know exactly, we know how it is better to be approached: “anticipate unexpected risk”. Another refined knowledge we have to consider in our “new normality” is to analyse our risk tolerance and then the best response strategy. Concluding, both anticipation and tolerance, as complex and dynamic targets, are more and more difficult to define and reach, but it is also sure that, **for the World stage we are in, the alternatives become fewer and critical as we neglect or fail to see where we are going to. This way, the man (HI), along with imagination and wisdom, using machine-controlled power (as AI), are the needed last resorts to find the expected alternatives for the World crises and decline, which actually ask more creativity from ICT, as an essential requirement.**

Consequently, we have to use all these learned lessons and timely refine our knowledge, taking into account the complexity and the dynamic of World changes, which is clearly a continue process of analyses and actions, where man and machine have to be used in a synergic combination in ICT advances design and applications, including AI, robots and so on.

Keywords: Electrical cars, Digital twin technology, Software test automation, Artificial intelligence, Risk tolerance, Autonomous robots, World crises

JEL Classification: L63; L86; M15; O31; O33

The true sign of intelligence is not knowledge but imagination
-Albert Einstein

1. Developing information and communications technology with more innovation and imagination, oriented to saving costs in World's decline context

In an everchanging World, the meaning of cost could be elusive, as so many human or material values tend to be reconsidered, sooner or later, while the history is written (or not!).

For example, starting from food or water and further arbitrarily counting iron, copper, gold, oil or houses, for remembering just a few, the material values were always linked with human values like life, but in different, changing and sometimes strange ways, as the centuries of history have flown.

Without philosophical intentions, we still could observe, considering also the well-known Maslow pyramid, among those strange changes of values and associated costs, that food and water suffered the most dramatical evaluations, but their availability tend to become again critical for human life on Earth.

Still, we consider that the most relevant example could be the information value and cost, for present and emerging amazing World evolutions.

More than these, the geopolitical emerging crises show that behind the critical resources/materials and informational war, the information will be the supreme aim, as its potential to enable all other critical values, in such dynamic and complex processes, where information and communications technology (ICT) has the fundamental role, is and will be more and more used to obtain the desired targets [14][19][20][21][23][25].

Before further details, still, it is also important and sad to observe that, today, the life value of a person tends, in fact but not recognized officially, to decrease, in some non-democratic countries, while Russia's aggression in Ukraine is the most awful example of disrespect for all human values and creations on Earth.

This way we have just arrived to the point where the role of ICT in leveraging savings should be deeply conceived starting from the meaning of costs which must consider ALL the human values, starting with life, but including the quality of life and other human values like humankind evolution/transformation.

Coming back to the ICT role, we believe that the actual World crises represent a major risk for the Earth ecosystem and the humankind life because of the unprecedented level and extent of the crises, where the lack of information or material/technological resources/progress is intended to be compensated by the use of brutal (military some time) force (or hybrid war), which rise other unprecedented existential dangers, for people and our planet.

More than these, we consider that such major crises and challenges reveal, in fact, the complexity of World problems, long time misunderstood, along with the incapacity of incumbents to solve or prevent them, before reaching such dangerous levels or "points of no return".

A further major implication of reaching such stage of critical World context is the risk, already proved by some visible trends, to lead the actual challenges of balance between democracy and authoritarian solutions to the point where only force could avoid the worst scenario.

We consider that this last stage should be analysed in the context generated by World crises, where the old problem of the balance between democracy and security, very much influenced by the prominent role of ICT potential, could degenerate to new dangers or even catastrophes, because of threats like the hybrid war (recalling, for example, infrastructures destructions/sabotages, fake news or ChatGBT vulnerabilities) or other geopolitical conflicts.

This way, we consider that some crucial links of the World dramatical context with a proper/optimal ICT development are necessary, but they should be timely analysed, for keeping the right role of ICT in Information Society (IS) on the way towards the Knowledge Based Society (KBS) and also the accurate knowledge refining in order to leverage its influence on Earth ecosystem and humankind evolution, as we repeatedly expressed [3][11][13][16][24].

Probably, such pessimistic impressions could be considered overdone, but the role of a proper ICT development which should mitigate such risks is anyway very necessary and we further approach some concrete examples that show the potential of ICT, including human intelligence (HI) and artificial intelligence (AI) synergy, to reach such aims.

The actual image of ICT potential is very well illustrated, as 2023 expected technology advances with substantial growing, by [1]:

“Heavily powered by the rise in technological innovations and software-centric solutions, our world is now closer than ever to tackling and overcoming many of emerging technology's most complex challenges. The promising capabilities of these new tools, including digital twins, AI, electric vehicles (EV) and autonomous vehicles (AV), quantum computing, and 6G, will continue to evolve in 2023. Keysight Technologies believes this will be a pivotal year as we continue to innovate, learn, and leverage technology for a brighter future.”

One of the actual most promising ICT advances is based on linking *physical and virtual* entities, as the *digital twin technology* does:

“In 2023, we will see significant advancement in the form of digital twin technology being superimposed on physical systems. This mixed reality will bring numerous benefits to various sectors ranging from healthcare to manufacturing to retail.

For example, imagine if a surgeon can operate with an artificial intelligence (AI) assistant providing input on human anatomy and patient history instead of having to recall these details from memory. This sounds futuristic, but work is already underway to make it a reality, so expect to see more companies cropping up next year to help further blur the line between the physical and the virtual worlds.”

Beyond the above impressing *futuristic image*, we consider that the *digital twin technology* (DTT) impact is not only a suitable fit for the actual World crises, either materials or conceptual, but, although it may be seen, in a way, similar with the virtual reality technology, it is even much more productive and powerful, as it could bring solutions, using real time data, for many of the complicate challenges of the present and also for other that we cannot foresee. This is why DTT is an issue worth considering for later detailed analyses.

A further example for 2023 top growing technologies, as they “*drive more integrated and intelligent energy consumption*”, is provided by the electric vehicles (EV):

“Within the next decade, electric vehicles will become an energy repository for users, whether on the road or in their homes. According to the United States Department of Energy, the number of consumer EVs offering at least 300 miles of range tripled from 2021 to 2022.

Intelligent applications will look at calendars to determine the energy required to power the next day's travel, and the individuals will utilize the remaining battery for their home energy needs. I predict major power providers will awaken to this possibility by 2025 and realize that electric vehicles pose a clear and present threat to their static grid infrastructure.”

Beyond all advantages and expected benefits of electrical cars, mainly around reducing carbon footprint and non-fossil consumption, we consider that it is worth to notice other two prominent potential benefits of this industry development:

- leveraging the research for innovations to improve actual battery technologies, which is for long time on a saturation level;
- advances in the general striving for the intelligent storage and transportation of the different forms of energy, which are crucial for the Earth ecosystem.

It is well known and equally used the global feature of the automotive industry to leverage a plethora of subsequent industries/branches, which provide all the necessary parts and bring considerable economic and technological benefits for World progress.

Although it could appear much different, we believe that the future will rise another, similar, industry: the *autonomous robot*.

The next example we shall analyse is relevant and might confirm our estimation, by some details exceeding the main aim presented by [2]:

<<Sometime next year, an autonomous robot might deliver food from an airport restaurant to your gate. The idea for Ottobot, a delivery robot, came out of a desire to help restaurants meet the increased demand for takeout orders during the COVID-19 pandemic. Ottobot can find its way around indoor spaces where GPS can't penetrate...

Ottobot is the brainchild of Ritukar Vijay, Ashish Gupta, Hardik Sharma, and Pradyot Korupolu. The four founded Ottonomy in 2020 in Santa Monica, Calif. The startup now has 40 employees in the United States and India. Ottonomy, which has raised more than US \$4.5 million in

funding, received a Sustainability Product of the Year Award last year from the Business Intelligence Group.

Today Ottobot is being piloted not only by restaurants but also grocery stores, postal services, and airports. Vijay and his colleagues say they focused on three qualities: full autonomy, ease of manoeuvrability, and accessibility.

“The robot is not replacing any staff members; it’s aiding them in their duties,” Vijay says. “It’s rewarding seeing staff members at our pilot locations so happy about having the robot helping them do their tasks. It’s also very rewarding seeing people take their delivery order from the Ottobot.”>>

From the beginning, we should observe that, although it seems to be an example of startup, here we see another iceberg tip, as generally the industrial robots have a long enough history and even the walking robots have it.

Perhaps, the novelty rises from their penetration in the large industry of the airport services and further in restaurants economy, but, as we have said, other further details might bring relevant issues for our actual context:

“For 15 years Vijay, an IEEE senior member, worked on autonomous robots and vehicles at companies including HCL Technologies, Tata Consultancy Services, and THRSI. In 2019 he joined Aptiv, an automotive technology supplier headquartered in Dublin. There he worked on BMW’s urban mobility project, which is developing autonomous transportation and traffic-control systems. During Vijay’s time there, he noticed that Aptiv and its competitors were focusing more on developing electric cars rather than autonomous ones. He figured it was going to take a long time for autonomous cars to become mainstream, so he began to look for niche applications. He hit upon restaurants and other businesses that were struggling to keep up with deliveries.

Ottobot reduces delivery costs by up to 70 percent, Vijay says, and it can reduce carbon emissions for small-distance deliveries almost 40 percent. Ottobot using wheelchair technology, the Ottobot can maneuver over curbs and other obstacles.”

Now we can observe the main links with the electric cars industry and more than these, with autonomous transportation, i.e., two gigantic industries of the future.

More than the economic benefit and context, it is important to notice the technological advances, while matching the restrictive environments (no GPS access):

“Within the first few months of the startup’s launch, Vijay and the Ottobot team began working with Cincinnati/Northern Kentucky Airport. The facility wanted to give passengers the option of having food from the airport’s restaurants and convenience stores delivered to their gate, but it couldn’t find an autonomous robot that could navigate the crowded facility without GPS access, Vijay says.

To substitute for GPS, the robot used 3-D lidars, cameras, and ultrasonic sensors. The lidars provide geometric information about the environment. The cameras collect semantic and depth data, and the short-range ultrasonic sensors ensure that the Ottobot detects poles and other obstructions. The Ottobot team wrote its own software to enable the robot to create high-information maps—a 3D digital twin of the facility.”

Combining the advance of 3-D lidars, cameras, and ultrasonic sensors, the system is a relevant example of ICT potential to contribute to new solutions in adverse new environments, i.e., just the World new challenges could bring.

Maybe one of the intrinsic features of this industry development is the update use of other similar innovations from mobility domain (wheelchair technology) and extend this way the potential applications areas:

<< “Imagine passengers are boarding their plane at a gate,” he says. “Those areas get very crowded. During the robot’s development process, one of our engineers joked around, saying that the only way to navigate a crowd of this size was to move sideways. We laughed at it then, but three weeks later we started developing a way for the robot to walk sideways.”

The team took its inspiration from electric-powered wheelchairs. All four of the Ottobot’s wheels are powered and can steer simultaneously—which allows it to move laterally, swerve, and take zero-radius turns. The wheelchair technology also allows the Ottobot to maneuver outside an airport setting. The wheels can carry the robot over sidewalk curbs and other obstacles.

“It’s rewarding seeing staff members at our pilot locations so happy about having the robot helping them do their tasks.”>>

Finally, it is not a surprise to see that the applications domains/industries are very large and could easily be perceived from the practical tasks and features the system provide:

“Ottobot is 1.5 meters tall—enough to make it visible. It can adjust its position and height so that its cargo can be reached by children, the elderly, and people with disabilities, Vijay says. The robot’s compartments can hold products of different sizes, and they are large enough to allow it to make multiple deliveries in a single run. To place orders, customers scan a QR code at the entrance of a business or at their gate to access Crave, a food ordering and delivery mobile app. After placing their order, customers provide their location. In an airport, the location would be the gate number. The customers then are sent a QR code that matches them to their order.”

This way, the image of ICT potential for leveraging solutions in the new context generated by World crises is clearer, but this is far from considering it enough efficacy or efficient if we just recall the large uncertainty and diversity of the above presented Earth ecosystem dramatically changing context, which needs deeper and timely refined knowledge and analyses.

2. Man and machine against all odds

The challenges where ICT support is expected to help, in the dramatic evolutions and World crises context, becoming more complex and difficult to mitigate, could put complicate tasks for the ICT advances, where the combination of HI and AI tends to be a critical factor for the World future and humankind safe evolution.

Recalling just some prominent potential “odds” World have to face, from climate changes, Earth resources fading, social unbalances or geopolitical/security crises to earthquakes, consumption or changes in human behaviour/values, we could understand why it is necessary to optimize and obtain maximal efficacy and efficiency from the “team” HI-AI, which seems to be the main ingredient of ICT advances and eventually of the IS/KBS progress.

The analyse and identification of such challenges are, naturally, also more and more complicate and consequently some relevant examples should be considered.

The inherent secondary effects of the general technological progress are largely known and sometimes even expected, but, as World is becoming more complex, with ICT massive and fast proliferation in all industries or human activity fields, new and quite extremely dangerous threats appear, either naturally (because of the concrete technical reliability) or especially because of the ICT potential to be misused, in what is called cybercrime plethora.

Perhaps, the general case of defence is better known, where every new arm is generating the appearance of its counter-arm, but without detailing here the challenges induced this way for World crises context, it is interesting to observe the similitude with the case of ICT advances benefits versus the inherent vulnerabilities and risks which are sooner or later exploited by the cybercrime and all other misused applications of ICT.

It could be relevant, including the above similitude, to also mention an observation, we have often revealed to our students, referring to an inherent vulnerability of ICT, but exceeding this time the IT processes and laying in the communications “garden”, pointing the vulnerability generated by any emission to be exploited/intercepted by enemy, we also call it the “Achille’s heal” of the communications. This vulnerability was strongly mitigated by the implementation of defence applications of “spread spectrum systems” principles, we also presented in the early monograph in Romania we recalled in [22].

These observations show the complexity, diversity and the deepness of the potential vulnerabilities, considering just ICT “garden”, where “odds” and threats could appear and action (without neglecting other domains/factors).

More than these, our opinion is that, along with the general actions exploiting the ICT vulnerabilities, the complexity of ICT products, applications, services and systems, proliferated all over the World, a specific area of intrinsic or potentially dangerous threats could be generated, especially through the critical infrastructures they are built in, as IS/KBS tend to become more and more dependent of massive ICT presence/infrastructure. The actual debate on AI applications induced risks is just the “tip of the iceberg” we have repeatedly mentioned [11][13][16].

This way, the security domain became crucial in the context of IS/KBS, while ICT development must safely cover both positive and negative implications of progress.

The analysis of some relevant examples could detail and confirm the real dimensions of the above assertions, although the World context complexity and dynamic, along with ICT fast advances, rise inherent relativity/approximation and time sensitivity on any arguments.

Perhaps, one of the most credible safety levels on Earth is provided for the spatial systems, where NASA is the prominent centre of expertise and *software test automation* is an essential instrument of risks minimization, as it is also presented by [4]:

“The centerpiece of NASA’s Artemis missions, the Orion spacecraft is an engineering wonder. It’s a symphony of software — with all systems operating in perfect harmony to shuttle passengers and payloads safely through the cosmos. And when it comes to essential software systems, few things are more crucial than the cockpit displays the astronauts rely on. A veritable nerve centre for the spacecraft, they control everything from thrust vectoring to status-check monitoring.

Long before the first Artemis mission lifted off, NASA needed to ensure its highly complex software systems — including the cockpit display software — were ready for the rigors of spaceflight. That’s why they selected Keysight Eggplant test automation platform to test the Orion spacecraft’s three cockpit displays.

By using software test automation to emulate complex user behaviours — such as the hand motions used by the astronauts to display essential cockpit data — the Eggplant software helped NASA save precious time during development while minimizing the risk of human error.”

The needed combination of HI and AI could take a multitude of scenarios, from designing to configurate and exploit ICT in its worldwide products, services and applications, but we consider that modelling, designing and simulating are crucial for ICT development optimization, especially in the complex and complicate context of Earth ecosystem.

The above case of *software test automation to emulate complex user behaviours* is just one of the relevant scenarios, but, considering its critical importance, the HI component, in the design phase, was enforced with the highest level of human experience and expertise:

<<NASA’s software team needed someone with firsthand astronaut experience and subject matter expertise, so they enlisted the help of now-retired NASA Chief Astronaut and Navy SEAL Chris Cassidy to help develop and test the spacecraft’s cockpit software.

"I don't think I was really appreciative of the level of effort and technical challenges that go into robust testing," Cassidy said. "Problems are a lot easier to solve on the ground. That's where you can take time to solve them, where you're not going to hurt somebody."

But that's not all he has to say on the subject. Not by a long shot.>>

We consider that another essential idea could be noticed here, as confirming our earlier opinions about the crucial role of analyse time versus the complexity and the fast development of ICT (and generally of high-tech applications) [16][24][26][27], because *on the ground...you can take time to solve them*.

Some of the main factors which could determine the capacity of the systems to reduce the risks are also shortly pointed:

“Joining him are Keysight’s own Greg Patschke, General Manager of Aerospace, Defense, and Government Solutions, and Jay Epps, Solutions Engineering Manager. Boasting nearly a hundred years of combined experience across the aerospace, defense, and engineering sectors, the trio will answer a wide range of questions. Here are just a few.

- What are the best practices in software test automation for critical missions in space and defense?*

- How do you test for extremes and anticipate the human side of software use?*
- How will digital twin technologies put a communication network on the moon?*
- How do you test complex integrations for mission-critical 5G and satellite communications?”*

We would note here the prominent role of the communications, generally in mission-critical cases, reflected above and based on their crucial importance on managing the remote spatial systems and platforms [12][15][17][18][22][26][27].

Finally, a realistic image of the impact of *software test automation* on improving safety for *space travel and mission success* is presented:

“It's tempting to look at Orion as our next giant leap into the cosmos. But it's just a small step towards the Artemis mission's ultimate goal: Mars. Eighty-one million miles stretch between Earth and the red planet. But that's nothing compared to the technological leaps needed to make the journey.

Although it's fun to daydream about what those bold new technologies will look like, the truth is much more realistic. Systems like navigation, decision-making, and communications depend on software. As long as that remains the case, any future mission to Mars will rely — at least in part — on software test automation to help ensure safe space travel and mission success. After all, you can't afford to take shortcuts when lives are on the line. That's why it's so important to test early and often.”

As we already pointed [6][9][22], learning, from the ICT techniques and algorithms of development and also of processing data, brings not only the natural benefits of use, but it could inspire the ways of thinking or acting for organizations, incumbents or individuals, in order to better face the actual and emergent World challenges/crises.

The lessons would be even more valuable in the most complex and complicate scenarios, like the cyber resilience vast domain could reveal, as it is also presented by [5]:

“We live in a time of unprecedented technological innovation. We are more digitally connected in our work and personal lives than ever before. If you can dream it, you can print it on a 3D printer. The Nanobots of the Terminator movies are routinely used in medical procedures, and cars drive themselves – or at least are trying to!

But technological innovation isn't confined to the good guys. For every technological advancement that makes our lives better, easier, and more convenient there are seemingly two new cyber-attack techniques, or two forms of new malware designed to damage our businesses and our bank accounts.

A quick google search will show that today's security programs are being outpaced by a rapidly changing threat landscape. For organizations of all sizes and across all industries, it's not a matter of if they are attacked, it's a matter of when. It is undeniably clear that one's perimeter WILL be breached at some point. So, as security professionals come to terms with the reality that they cannot prevent attacks from happening, they need a new strategy: Resilience.”

Confirming the inherent combination between benefits and vulnerabilities, we have mentioned above, here we also observe the rising of the known confrontation of action-reaction (good/bad guys), but emphasizing its actual essential feature (*a rapidly changing threat landscape*).

In the same time, the main practical and also visionary point (*it's not a matter of if they are attacked, it's a matter of when*), we all have to consider for the future, should be the base of any defence strategy and this way it will orientate the main security actions:

“If there's anything global turmoil of the past few years have taught all of us, it is to anticipate unexpected risk. That is why, at Bitdefender, we believe both threat prevention and detection, as well as response, are important in equal measure. It is important to prevent attacks from causing security incidents in the first place whenever possible, but it is equally important to have an effective detection and response strategy that takes into consideration the organization's risk tolerance.”

This way we have just arrived to the top of the World dramatical evolutions potential consequences, which, although we do not know exactly, we know how it is better to be approached: *anticipate unexpected risk*.

Another refined knowledge we have to consider in our “new normality” is to analyse our *risk tolerance* and then the best response strategy.

There is no doubt that both anticipation and tolerance, as complex and dynamic targets, are more and more difficult to define and reach, but it is also sure that, **for the World stage we are in, the alternatives become fewer and critical as we neglect or fail to see where we are going to.**

That is why, the man (HI), along with imagination and wisdom, using machine-controlled power (as AI), are the needed last resorts to find the expected alternatives for the World crises and decline, which actually ask more creativity from ICT, as an essential requirement.

Consequently, we have to use all these learned lessons and timely refine our knowledge, taking into account the complexity and the dynamic of World changes, which is clearly a continue process of analyses and actions, where man and machine have to be used in a synergic combination in ICT advances design and applications, including AI, robots and so on.

3. Conclusions

The geopolitical emerging crises show that behind the critical resources/materials and informational war, the information will be the supreme aim, as its potential to enable all other critical values, in such dynamic and complex processes, where information and communications technology (ICT) has the fundamental role, is and will be more and more used to obtain the desired targets.

Analysing the Earth ecosystem values evolution, still, it is also important and sad to observe that, today, the life value of a person tends, in fact but not recognized officially, to decrease, in some non-democratic countries, while Russia's aggression in Ukraine is the most awful example of disrespect for all human values and creations on Earth.

That is why the role of ICT in leveraging savings should be deeply conceived starting from the meaning of costs which must consider ALL the human values, starting with life, but including the quality of life and other human values like humankind evolution/transformation.

Evaluating the ICT role, we believe that the actual World crises represent a major risk for the Earth ecosystem and the humankind life, because of the unprecedented level and extent of the crises, where the lack of information or material/technological resources/progress is intended to be compensated by the use of brutal (military some time) force (or hybrid war), which rise other unprecedented existential dangers, for people and our planet.

We also consider that such major crises and challenges reveal, in fact, the complexity of World problems, long time misunderstood, along with the incapacity of incumbents to solve or prevent them, before reaching such dangerous levels or "points of no return".

One major implication of reaching such stage of critical World context is the risk, already proved by some visible trends, to lead the actual challenges of balance between democracy and authoritarian solutions to the point where only force could avoid the worst scenario.

On the other hand, this last stage should be analysed in the context generated by World crises, where the old problem of the balance between democracy and security, very much influenced by the prominent role of ICT potential, could degenerate to new dangers or even catastrophes, because of threats like the hybrid war (recalling, for example, infrastructures destructions/sabotages, fake news or ChatGBT vulnerabilities) or other geopolitical conflicts.

Consequently, some crucial links of the World dramatical context with a proper/optimal ICT development are necessary, but they should be timely analysed, for keeping the right role of ICT in IS on the way towards the KBS and also the accurate knowledge refining in order to leverage its influence on Earth ecosystem and humankind evolution, as we repeatedly expressed [3][11][13][16][24].

Beyond any pessimistic impressions, the role of a proper ICT development which should mitigate such risks is anyway very necessary and we have approached some concrete examples that show the potential of ICT, including the HI and AI synergy, to reach such aims.

Among the examples, the actual image of ICT potential is very well illustrated, as 2023 expected technology advances with substantial growing [1].

One of the actual most promising ICT advances is based on linking *physical and virtual* entities, as the *digital twin technology* does, being a suitable fit for the actual World crises, either materials or conceptual, but, although it may be seen, in a way, similar with the virtual reality technology, it is even much more productive and powerful, as it could bring solutions, using real time data, for many of the complicate challenges of the present and also for other that we cannot foresee.

Beyond all known advantages and expected benefits of electrical cars (another 2023 top growing technology), mainly around reducing carbon footprint and non-fossil consumption, we consider that it is worth to notice other two prominent potential benefits of this industry development, as leveraging the research for innovations to improve actual battery technologies (which is for long time on a saturation level) and also advances in the general striving for the intelligent storage and transportation of the different forms of energy, which are crucial for the Earth ecosystem. It is also well known and equally used the global feature of the automotive industry to leverage a plethora of subsequent industries/branches, which provide all the necessary parts and bring considerable economic and technological benefits for World progress.

Although it could appear much different from electrical cars, we believe that the future will rise another analysed example of similar industry: the *autonomous robot* [2].

The novelty rises from their penetration in the large industry of the airport services and further in restaurants economy, but, more than the actual economic benefit and context, it is important to notice the technological advances, while matching the restrictive environments (no *GPS access*) and combining the advance of *3-D lidars, cameras, and ultrasonic sensors*. We observe that the system is a relevant example of ICT potential to contribute to new solutions in adverse new environments, i.e., just the World new challenges could bring.

The challenges where ICT support is expected to help, in the dramatic evolutions and World crises context, becoming more complex and difficult to mitigate, could put complicate tasks for the ICT advances and this way the combination of HI and AI tends to be a critical factor for the World future and humankind safe evolution. Recalling just some prominent potential “odds” World have to face, from climate changes, Earth resources fading, social unbalances or geopolitical/security crises to earthquakes, consumption or changes in human behaviour/values, we could understand why it is necessary to optimize and obtain maximal efficacy and efficiency from the “team” HI-AI, which seems to be the main ingredient of ICT advances and eventually of the IS/KBS progress.

The analyse and identification of such challenges are, naturally, also more and more complicate and consequently some relevant examples were also considered.

The inherent secondary effects of the general technological progress are largely known and sometimes even expected, but, as World is becoming more complex, with ICT massive and fast proliferation in all industries or human activity fields, new and quite extremely dangerous threats appear, either naturally (because of the concrete technical reliability) or especially because of the ICT potential to be misused, in what is called cybercrime plethora.

Starting from the general case of defence, which is better known, where every new arm is generating the appearance of its counter-arm, but without detailing here the challenges induced this way for World crises context, it was interesting to observe the similitude with the case of ICT advances benefits versus the vulnerabilities and risks which are sooner or later exploited by the cybercrime and all other misused applications of ICT. It is relevant, including the above similitude, to also mention an observation, we have often revealed to our students, referring to an inherent vulnerability of ICT, but exceeding this time the IT processes and laying in the communications “garden”, as the vulnerability generated by any emission which could be exploited/intercepted by enemy, we also call it the “Achille’s heal” of the communications. This vulnerability was strongly mitigated by the implementation of defence applications of “spread spectrum systems” principles, we also presented in the early monograph in Romania we recalled in [22].

These observations show the complexity, diversity and the deepness of the potential vulnerabilities, considering just ICT “garden”, where “odds” and threats could appear and action (without neglecting other domains/factors).

More than these, our opinion is that, along with the general actions exploiting the ICT vulnerabilities, the complexity of ICT products, applications, services and systems, proliferated all over the World, a specific area of intrinsic or potentially dangerous threats could be generated, especially through the critical infrastructures they are built in, as IS/KBS tend to become more and more dependent of massive ICT presence/infrastructure. The actual debate on AI applications induced risks is just the “tip of the iceberg” we have repeatedly mentioned [11][13][16].

Consequently, the security domain became crucial in the context of IS/KBS, while ICT development must safely cover both positive and negative implications of progress.

The analysis of some relevant examples has detailed and confirmed the real dimensions of the above assertions, although the World context complexity and dynamic, along with ICT fast advances, rise inherent relativity/approximation and time sensitivity on any arguments.

Starting from one of the most credible safety level on Earth, as it is provided for the spatial systems, where NASA is the prominent centre of expertise and *software test automation* is an essential instrument of risks minimization[4], the needed combination of HI and AI could take a multitude of scenarios, from designing to configurate and exploit ICT in its worldwide products, services and applications, but we consider that modelling, designing and simulating are crucial for ICT development optimization, especially in the complex and complicate context of Earth ecosystem.

Although the NASA case of *software test automation to emulate complex user behaviours* is just one of the relevant scenarios, considering its critical importance, the HI component in the design phase was enforced with the highest level of human experience and expertise, while confirming, among

other benefits, our earlier opinions about the crucial role of analysis time versus the complexity and the fast development of ICT (and generally of high-tech applications) [16][24][26][27], because “*on the ground...you can take time to solve them*”. Among the main factors which could determine the capacity of the systems to reduce the risks, the prominent role of the communications, generally in mission-critical cases, was also revealed, based on their crucial importance on managing the remote spatial systems and platforms.

As we already pointed [6][9][22], learning, from the ICT techniques and algorithms of development and also of processing data, brings not only the natural benefits of use, but it could inspire the ways of thinking or acting for organizations, incumbents or individuals, in order to better face the actual and emergent World challenges/crises. The lessons would be even more valuable in the most complex and complicate scenarios, like the example of cyber resilience vast domain revealed [5].

This way we have just arrived to the top of the World dramatical evolutions potential consequences, which, although we do not know exactly, we know how it is better to be approached: *anticipate unexpected risk*. Another refined knowledge we have to consider in our “new normality” is to analyse our *risk tolerance* and then the best response strategy.

In conclusion, both anticipation and tolerance, as complex and dynamic targets, are more and more difficult to define and reach, but it is also sure that, **for the World stage we are in, the alternatives become fewer and critical as we neglect or fail to see where we are going to. This way, the man (HI), along with imagination and wisdom, using machine-controlled power (as AI), are the needed last resorts to find the expected alternatives for the World crises and decline, which actually ask more creativity from ICT, as an essential requirement.**

Consequently, we have to use all these learned lessons and timely refine our knowledge, taking into account the complexity and the dynamic of World changes, which is clearly a continue process of analyses and actions, where man and machine have to be used in a synergic combination in ICT advances design and applications, including AI, robots and so on.

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