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## Background

Technology and applications to learning are becoming ubiquitous. Virtual Reality, where a headset will allow one to be transported anywhere, to any period in history or place on earth (or beyond), has advanced in leaps and bounds in the past few years. Interactive learning, where technology is integrated into the fabric of the classroom, with Augmented Reality and Artificial Intelligence powered tutors responding to each individual learner's needs and queries in real time, can and will become the norm.

*"The inexorable shift from simple digitization to innovation based on combinations of technologies (the Fourth Industrial Revolution) is forcing companies to re-examine the way they do business... leaders and senior executives need to understand their changing environment, challenge the assumptions of their operating teams, and relentlessly and continuously innovate."*

Klaus Schwab, Founder and Executive Chairman, World Economic Forum

The steam engine heralded the first industrial revolution, changing the world irrevocably. Electricity, the production line and mass manufacturing were the drivers of the second industrial revolution. Computers and the digital age paved the way for the third industrial revolution. We are now on the brink of a Fourth Industrial Revolution brought forth by new technologies and innovations, with the opportunities and dangers of the previous three, an unknown and difficult to predict future.

The opportunities presented by this revolution will disrupt almost every industry, not just education and training. The availability of new technologies, and the spread of mobile technologies offer the potential for greatly expanded knowledge, prosperity and wellbeing, with automation and the analysis of large amounts of information (Big Data) allowing for far greater productivity and efficiency. At the same time, as with any drastic change, there are risks. The problem of being left behind by technological progress and automation may well pale into comparison with other dangers, of abuse and misuse of this technology. Regardless of the benefits or the dangers, this revolution is coming, the rise of big data and artificial intelligence is inevitable. All of these opportunities and challenges result in so called "frontier issues", defined as those "that have high impact on social, economic and environmental spheres whereby both intended and unintended consequences are likely to disrupt or reveal gaps related to current norms, institutions and structures/processes."<sup>1</sup> Put another way, these are dramatic changes in the day to day of the economy and society, which will impact everyone. This will involve new technologies and techniques which alter everything from how we interact with one another to the nature of work.

This short think piece will give an overview of what all of this means to UNITAR, how we are already using these technologies, and what potential uses some of these technologies will have. It will also highlight some of the risks and obstacles and, to put it simply, it will show a path to making UNITAR fit for purpose when it comes to frontier issues.

## What does this mean for UNITAR?

With all the talk of drastic change, the Fourth Industrial Revolution is more about working smarter, more efficiently, and in new fields; shifting what we do and how we do it. The end result will be the same however; more informed, better equipped beneficiaries of our programmes, all with a view to better implementing the 2030 Agenda. The change will come about in how UNITAR offers training, what we offer training in, how we implement and facilitate learning, what these programmes look like and what topics they cover, and ultimately the number of people these programmes reach. UNITAR

<sup>1</sup> UNITED NATIONS SYSTEM Secretariat of the Chief Executives Board for Coordination (CEB) Survey on Frontier Issues - Summary of Responses, 27/10/2017

may look very different, with automation and a focus very different to today, but the mission, in broad terms, will stay the same.

The Secretary General's strategy on New Technologies was announced on 18 September 2018, with commitment No.1 calling for the "deepening the UN's Internal Capacities and Exposure to New Technologies." The High-Level Panel on Digital Cooperation, which will present its report to the Secretary General by the middle of summer 2019, will look at many of these issues.

It is also in line with the UNITAR Strategic Framework 2018 – 2021, Strategic Objective 5.1, to "optimize the use of technologies, including geospatial technologies, for evidence-based decision making" and 5.3 to "equip institutions to improve the quality of learning opportunities", in particular.

There is a real mandate and a need for UNITAR to understand and to take advantage of these opportunities. UNITAR's vision is "a world in which individuals, institutions and organizations are equipped with the knowledge, skills and other capacities to overcome global challenges." As such, we must stay at the forefront of knowledge, maintain the ability to provide relevant and useful skills for the modern world, and make use of every means available to ensure everyone has the capacity to address the most pressing of issues. All our core functions are such that we must innovate, grow and continue to be the best at what we do.

Broadly speaking, by using new technologies, UNITAR will be able to offer far more effective training, which is completely tailored to the needs of each individual user. It will be possible to evaluate these trainings to a much more accurate degree, using data analysis to determine how the beneficiaries are interacting with the trainings themselves, and how they are integrating what they have learned into their day to day work. It will enable us to conduct better research, reach more people and forge new and exciting partnerships. All of this will allow us to better support and achieve the 2030 Agenda. Beyond the talk of necessity, risk and responsibility, the Fourth Industrial Revolution must be seen as a once in a generation opportunity. A gap has been opened for us. More the ever, there is a pressing need for an organization with the skills and means to train and build competency in member states to tackle the challenges of the future. With every new change to the social, environmental and economic structures, there is a need to train all on how to adapt and take advantage of these changes. UNITAR can be that organization.

## Supporting the 2030 Agenda

UNITAR's central role of supporting the 2030 Agenda and helping member states achieve the SDGs can be greatly enhanced by the use and adoption of many of the technologies discussed in this document. From building exciting new partnerships to providing education and training to ensure member states are equipped to tackle the challenges they face, harnessing new technologies, and being positioned to be able to train others in the use of these technologies, will allow UNITAR to fulfil the central objective of supporting the 2030 Agenda.

Across almost all the goals, UNITAR can offer added value by supporting and training practitioners in the use of new technologies. As the High-Level Panel on Digital Cooperation stated "*Digital technologies are transformational. Given their intrinsic nature, they expand the information base, lower information costs and create information goods. They are thus an unparalleled enabler for the realization of the 2030 Agenda for Sustainable Development*"

## Current UNITAR engagement with frontier issues

While many of the technologies and uses of technologies to be discussed in this document relate to strategic planning ensuring that UNITAR will be fit for purpose when these technologies come on stream, there are several ways UNITAR is already engaging with the Fourth Industrial Revolution,

using new and emerging technologies to offer a better service and improve the work that we do. The following are just a few examples of how UNITAR is engaging with these frontier issues.

## UNOSAT, machine learning and AI

UNOSAT, UNITAR's satellite imaging arm, is a prime example of how UNITAR is already on the cutting edge in many ways. UNOSAT has long analysed satellite imagery to determine a wide variety of humanitarian situations, from refugee shelters to the impact of natural disasters. While some automated methods for doing this have been available for some time, UNOSAT traditionally does analysis manually, with expert analysts pouring over huge amounts of satellite imagery. This is due to automated methods not being accurate enough for some of UNOSAT's humanitarian partners.

UNOSAT is revisiting automated methods as AI and machine learning offer some new possibilities, and they are working with several partners to develop algorithms for automated mapping from satellite imagery and for assessing the results of those methods. UNOSAT and Global Pulse, "a flagship innovation initiative of the United Nations Secretary-General on big data" recently published a research paper examining the use of machine learning and artificial intelligence to improve early warning and response mechanisms by humanitarian practitioners. It includes a case study of experiments using deep learning to count the number of structures in multiple refugee settlements.

The paper concluded that "that while there are many promising lines of research into humanitarian applications of machine learning on remote-sensing data, fully automated processing is not yet practical in the majority of cases. Structure counting in refugee settlements is an example, though one which also illustrates the possibilities of combined human-machine analysis, i.e. where human experts help to calibrate a model and to post-process the model's output. Augmentation of human capabilities is, therefore, a good strategy, to aim for human experts aided by machine learning systems to be able to carry out analysis with high throughput and yet maintaining the necessary levels of quality control." UNOSAT is also co-sponsoring a 'challenge' that uses crowdsourcing and AI methods to do something similar to the above settlement mapping. While the use of AI isn't fully integrated into the work UNOSAT does day to day yet, that day is not far off. Moreover, it is maintaining its position as a technology innovator, engaging with new technologies at the forefront of the Fourth Industrial Revolution.

## Cyber Resilience

The Social Development Programme unit of UNITAR has been working on a project proposal for a "Cyber Resilience Learning Platform for the Local Level" linking cyber resilience to frontier issues. The project is built on the premise that without a response to the challenges of cyber security and resilience, advances in other domains, including those towards the Agenda 2030 goals, remain susceptible. At present, governments – especially those of developing countries - have shown a limited ability to deal with the cascading effects of the specific challenges in catastrophes and crises in which cyber space is deeply embedded.

The project SDP has developed in response consists of three phases. Phase 1 deals with Knowledge Management and Networking, where existing material with have relevance in the context of cyber resilience is surfaced and provided at a central place and knowledge among partners exchange is facilitated. Phase 2 is the One UN Resilience Training Package, which has a common corporate look and may be used to support the organization of independent or in-house learning events or by individual learners. Phase 3 relates to Human Resources, Learning and Skills Development, providing support for developing and implementing National Cyber Resilience Learning Strategies. Such strategies identify actions to be taken in the short, medium and long-term to strengthen the human resource base to strategically increase cyber resilience. UN Cyber:Learn provides coordination and methodological support, ensuring that ownership remains with the country.

## VR technologies

UNITAR is also beginning to incorporate VR technology into our training, especially in the Green Development and Climate Change Programme unit. UNITAR is partnering with several corporations, to offer training for executives and even staff on environmental issues using VR. The partnership with Danone is a good example of this. GCP is also hoping to showcase the use of VR at the upcoming 24th Conference of the Parties to the United Nations Framework Convention on Climate Change in Poland.

What is VR?  
Virtually reality creates a believable, interactive 3D computer-created world that you can explore so you feel you really are there, both mentally and physically

These partnerships and projects are still in the planning and development stage but are indications of the kinds of uses currently being considered and implemented. UNOSAT is also developing content for VR for training and visualization purposes for the humanitarian community, while the Peacekeeping Training Programme is collaborating with various partners and has developed a peacebuilding game “Mission Zhubia”<sup>2</sup> using VR.

## Frontier Diplomacy

The MDP unit is looking to several exciting avenues to engage with frontier issues, looking specifically at what they term “frontier diplomacy.” This is then broken down into 6 pillars; Digital diplomacy, cyber diplomacy, cyber security, AI, Government 3.0, and Science Diplomacy.

The first stage is implementing an E: Learning course on these 6 pillars, both for diplomatic staff, as well as a broader civil society approach. The hope is to have the first of these trainings, looking at at least one of these pillars, before the end of the year. This is seen as a base on which to build further training and knowledge to implement more ambitious plans. Face-to-face trainings on this topic are also planned.

## Potential uses of technologies being considered

**Artificial Intelligence**, or AI, is one the most oft talked about aspects of the Fourth Industrial Revolution. Several of the units of UNITAR are actively looking into how AI can be used going forward. Perhaps the most exciting function of AI for UNITAR will be its use in training, allowing for cost-effective and optimized development of content for e-learning. AI will allow for content which is

AI is contributing to a transformation of society “happening ten times faster and at 300 times the scale or at roughly 3,000 times the impact” of the Industrial Revolution.  
The McKinsey Global Institute

customised for a particular location, translated into the local language, with case studies relevant to the local context. Faster and more accurate translation, as a result of AI and computer learning, will allow the translation of UNITAR materials into languages it has been unable to offer before, including localised languages, allowing much greater uptake of UNITAR trainings.

The training can be personalised and geared to the needs and interests of each student. The content can also constantly be updated, with new facts and research, in real time.

AI can recognise a student’s understanding of a concept automatically and suggest different paths of learning, allowing for a tailored approach and the automatic gamification of content. It would also be possible to respond

<sup>2</sup> UNITAR e-Newsletter, 3rd edition 2017

to queries in real time through an AI bot, and AI chat bots could potentially act as personal tutors. This means that every beneficiary would have their own, personal tutor, following and facilitating their learning in a much more personalised and effective manner.

Another outcome of the advances in AI, especially “deep learning,” a type of AI that allows computers and machines to learn from and then act on new situations, will allow for much greater automation. In the context of training, this will mean many of the toolboxes and trainings that UNITAR offers can be designed primarily by computers. The fear of automation and removing the human from the planning process entirely is unfounded however, as there will always be a need for the human touch.

AI also has a range of potential uses for the MDP unit, from equipping diplomats with specific knowledge in real time by being able to make enquires using AI, which would be of great help during negotiations, to uses of AI in consular services, allowing greater efficiencies and responses to requests from the public.

With General AI, machines are designed to complete any task which would normally require human intervention. The broad nature of General AI requires machines to “learn” as they encounter new tasks or situations. This need for a learned approach is what gave rise to modern Machine Learning and Deep Learning.

**Virtual Reality**, through its immersive and interactive

aspects, has been shown to be extremely effective in knowledge acquisition and retention. Learning content is memorised through a full body experience, with virtual interaction with the subject matter in real scale. The learner can virtually change locations, travel back in time, change roles and contexts. VR is an empathy machine: it affects human senses just like the real thing. VR technology is already at a place where it could be integrated into trainings, particularly in extreme conditions which can be useful in the context of the most climate and conflict vulnerable regions, with training of emergency personnel, peacekeepers and public servants.

There is a large body of evidence that VR that already exists is much more effective for recall, engagement and the likelihood someone will recommend content compared with more traditional media.<sup>3</sup> VR has a huge potential for storytelling and thus raising awareness on climate change, humanitarian issues and human rights abuses. There are some excellent campaigns that harness immersive storytelling. It can also present and explain abstract concepts that are impossible to show otherwise.

*“Virtual Reality promotes empathy by allowing you to be part of someone else’s story. The experiences have been known to change perceptions, allow young people to compare their lives with those across the globe, and give them a new way of visualizing their realities. The experiences can thus be used as a reference point for guided discussions”.*  
UN SDG Action Campaign

When considering Climate Change education for example, it’s hard to understand what’s really happening on the other side of the world through a TV footage alone. Immersive reality provides an opportunity to experience events and phenomena in real scale, from witnessing the bleaching of the coral reefs, to melting glaciers and deforestation. Reading about these phenomena are one thing; experiencing them up close is another.

VR content is not suitable for all trainings. It is however accessible now, with the necessary camera for creating VR content costing approximately €200, which can then be used with a headset which ranges from €10 in the

<sup>3</sup> IPD 2018 Lecture Series 2: Virtual Reality

form of Google Cardboard<sup>4</sup>, up to approximately €1000 for the most high-end equipment. One of the key trade-offs one must make with VR is between reach and immersion. The more financially and technologically accessible the content is, the more people it will reach but the lower the level of immersion. For this reason, content must be created which is suitable and designed specifically for the target audience. There is no one size fits all.

**Augmented reality** can present the most complicated concepts within the real environment: graphs, Earth layers etc, allowing the integration of virtual content into the real camera-based view. It can be a useful addition to already existing e-learning platforms, such as ARCore and ARKit. VR and AR will eventually merge and create an extremely powerful medium of Mixed Reality, a combination of the real world and virtual content that opens an entirely new chapter in human communication. A combination of AI with Mixed Reality would result in the ultimate learning tool. There is a need for the development of the right teaching methodologies and high-quality content to take advantage of this. The process will have to be done in co-operation with teachers, educators, VR experts and psychologists.

**5G mobile internet** will allow for unlimited amount of data transfer, allowing learners to download a full multimedia-packed e-course, from almost anywhere, in seconds. As access to 5G spreads to the “last mile” of remote and rural communities, it will allow UNITAR to reach operatives while they are on location, in the field, with training in real time. Any issues which may arise which are within the competencies of UNITAR can be dealt with in real time, wherever the person is. This allows for trainers to be “learning facilitators” more easily, assessing, evaluating and ensuring change in behaviour and results, or a level 3 and level 4 result on the Kirkpatrick model. This also allows for ongoing training after an event much more easily, bridging the gap between learning and behaviour change. It also allows UNITAR to reach the furthest behind first and help bridge some of the digital divides and inequalities so important for fulfilling the 2030 Agenda.

## Potential for Evaluation

New technologies and the Fourth Industrial Revolution will also have a huge impact on the ability of UNITAR to monitor and evaluate our trainings, ensuring constant improvement and the most efficient use of resources. At the recent European Evaluation Society conference, there was a focus on the use of big data, machine learning and mobile technologies as the future of evaluation.

As trainings integrate the use of technology, it will be possible to track how users are engaging with the training in real time, constantly feeding data which can be analysed using some of the machine learning techniques discussed above, giving a clear indication of the effectiveness of each individual part of the training. Some of these technologies will allow for longer term follow up, as contacting and monitoring how beneficiaries are integrating what they learn into their work will be much easier. Through expanded 5G access, the use of remote sensing and satellite imagery, it will be possible to track just how all beneficiaries, even in remote situations, are putting what they learn into practice. This in turn, in conjunction with AI technology, allows for constantly improving trainings and events. The use of these technologies for everything from the first steps of the training itself to the surveys and interviews in evaluation after the event, will allow for much more accurate and cost-effective monitoring and evaluation.

### Benefits of technology for M&E

- Cost reduction
- Increased accuracy
- Richer Data
- Greater outreach
- Better insights

<sup>4</sup> <https://vr.google.com/cardboard/>

This will have a particularly potent impact on trainings and events that are held in insecure environments, where independent evaluators cannot go or follow up. An example of this is a recent evaluation of the Afghan Fellowship Programme. Due to the security situation in Afghanistan, it was impossible for the independent evaluator to visit the country, preventing them from gathering some of the data they required. With 5G internet providing for much more effective video conferencing, it would be possible to conduct the interviews and focus groups more easily. Using VR, it would be possible for the evaluator to observe the training sessions and the course in general, remotely from their own location. This not only improves monitoring and evaluation but is also highly cost effective.

## Potential for Partnership

One of the most promising aspects on these new technologies being integrated into the work of UNITAR is that it opens up the possibility of new partnerships, with the private sector and academia. These partnerships may go some way to bridging the funding gap. There are a litany of new start-ups and companies focusing exclusively on the use of new technology for education and training, especially as it relates to AI, VR, and augmented reality, while larger established companies like Microsoft, Google and Apple are also investing heavily in these field and may be open to partnership. UNITAR already had a memorandum of understanding with both Microsoft and Google, and it would be worth developing these further. AI is seen as the greatest growth area in the tech sector today, so the possibilities for partnership are vast. There are organisations in Geneva, such as the World VR Forum, which would be able to help guide the development of VR content, in conjunction with other companies.

Many academic institutions and universities are conducting research on VR and training. Most top scientific universities have an AI programme, running some of the most high-end research into the different uses of AI. Making connections with these would certainly help further UNITAR's use of AI in our trainings, and across our programmes. UNITAR is already engaging with universities with the view to improving training and to accelerate the impact of the SDGs, through the APLU-UNITAR Partnership to accelerate impact on the Sustainable Development Goals through Higher Education Institutions and the Positive Education and Appreciative Inquiry to Accelerate Impact on the Sustainable Development Goals partnership with the Champlain College's Stiller School of Business.

These partnerships, which are in their infancy, hope to harness new techniques and research to improve trainings and support the 2030 Agenda. UNITAR has also signed a memorandum of understanding with Virtual Educa, an organisation created to promote sustainable and social development through education, especially in Latin America and the Caribbean. The partnership hopes to implement several courses and programmes using innovative techniques and tools, beginning in 2019.

Within the UN, there are several initiatives which aim to support organisations in using new technologies in how they work and in supporting the 2030 Agenda. Two of the most relevant to UNITAR are Global Pulse, which was discussed above in relation to UNOSAT, and UNVR, which seeks to incorporate VR technology in helping achieve the SDGs. Building partnerships with Global Pulse, which through its country labs has undertaken innovative approaches to using big data and AI to achieve the SDGs, UNITAR will be able to build strategic partnerships across all the pillars of our work. Likewise, UNVR is using virtual reality to tell stories, engage stakeholders and to work towards achieving the 2030 Agenda. The UN SDG Action Campaign is exploring opportunities to expand UNVR's use as an educational tool. Building a partnership with them, to help incorporate VR into our trainings, would serve us well.

## Obstacles, risks, unintended consequences

The greatest impediment to implementing and engaging with many of these technologies is the cost involved. The cost of much of the equipment necessary for VR, augmented reality, and AI computing is extremely high. While it is assumed that these costs will be reduced over time, as is the case with any new technology, especially technologies which are expected to be so prevalent in the future, currently it is still a serious obstacle. Much of the training UNITAR does is in developing and least developed countries, where the resources simply do not exist. This risks furthering the digital divide. Nevertheless, there are examples already, such as Google Cardboard, which may be able to expand the availability of these methods of training without prohibitive costs. As mentioned above, the costs of creating and delivering basic VR content is currently within UNITAR's means.

There has not been much good research on the effects that VR and augmented reality has on the human brain. This is an area of research in which there will be a lot of focus in the future, but as of now, the scientific community has not had the time to analyse this.

The problem of technological literacy is well known, defined in a 2014 RAND report as “the ability to use computer-based devices, software, and networks”, where “use” refers not only to operating the relevant devices, but also to “advanced abilities to learn, analyse, explore”.<sup>5</sup> Many of the applications discussed above require both trainer, but also beneficiary, to be technologically literate to a reasonably high degree. While people are becoming more and more assured in their uses of technology, this may create a new inequality, between those who are able to use and engage with these developments, and those who aren't.

There is a fear that AI and machine learning, by learning and modelling itself on human behaviour and relations, may in fact entrench and amplify existing inequalities, especially regarding minorities and women. It is important that any AI and machine learning is designed with this risk in mind, using a diverse range of participants in the original dataset to ensure this does not become a problem.

The issues of privacy, sensitivity and other ethical dilemmas, particularly related to the satellite imaging of UNOSAT, is also a concern. It is of utmost importance that privacy implications and the potential unintended consequences of sharing or using satellite imagery are considered. New methodologies should occur under agreed normative frameworks which follow ethical and responsible use principles.<sup>6</sup> The issue of privacy also relates to other AI uses, as a huge amount of personal data would inevitably be collected.

## Questions to Consider

YouTube and Twitter were both launched 12 years ago. It is hard to imagine now the internet without them, and a modern organization that does not engage with them. Smartphones did not exist 12 years ago. It is 12 years until 2030, and the pace of technological advancement is faster than ever.

1. **What will the world look like in 2030, and how can UNITAR ensure it is still relevant?**
2. **What can UNITAR do to ensure we stay true to our core functions, which stress the need to innovate?**
3. **How can UNITAR leverage the partnership potential offered by the Fourth Industrial Revolution?**

<sup>5</sup> <https://www.brookings.edu/blog/techtank/2016/09/01/is-virtual-reality-ready-for-school/>

<sup>6</sup> Quinn JA, NyhanMM, Navarro C, Coluccia D, Bromley L, Luengo-Oroz M. 2018 Humanitarian applications of machine learning with remote-sensing data: review and case study in refugee settlement mapping. *Phil. Trans. R. Soc. A* 376: 20170363

4. **How can UNITAR work around the obstacles and mitigate the risks presented by the Fourth Industrial Revolution?**
5. **How can UNITAR ensure the use of new technologies is viable for all, reaching the furthest behind?**
6. **What can UNITAR do to bridge the digital divides, in regions, between member states, within member states and regarding gender?**

## Conclusion

By integrating the technologies discussed into our programmes, UNITAR will be able to radically improve the way we work, the trainings we offer and the number of beneficiaries we reach. The use of AI and VR in particular can be central to how UNITAR develops content and offers training in the coming years, while expanded 5G internet access will help bridge the digital divide. UNITAR will be able to expand its competencies and expertise, growing to fill a gap created by the frontier issues of the day. The potential is there, we just need to seize the opportunity. By being willing to reform, to adapt and to innovate, UNITAR will be able to make use of the best the Fourth Industrial Revolution has to offer. The biggest challenge is in converting this potential into reality. This requires first understanding, then engagement, and ultimately commitment, of time and resources. This needs to begin immediately. There will be obstacles and difficulties, but with a concerted effort and a strong commitment, UNITAR can be fit for purpose in the coming Fourth Industrial Revolution.