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Dear Readers,

Welcome to the CMDR COE Proceedings 2018, where you can meet authors who have delivered special articles exclusively for the present issue. It is a pleasure for me to introduce you in a very personal way to get to know them and their thoughts on crisis management and disaster response.

Herewith I'd like to stress the importance we pay on such knowledge and cooperation through meeting opinions in the sphere of professional interests. I can assure you CMDR COE will continue supporting multinational activities that enable mutual understanding and interaction. I am convinced that only with common engagements we can develop civil and military capabilities in support of NATO and Partners crisis management systems.

Over the past years, the Crisis Management and Disaster Response Centre of Excellence participated, hosted and organized a number of key courses, seminars and conferences in the crisis management and disaster response domain. Among the leading events are the CMDR COE Annual conferences based on the themes of the importance of interagency interactions. Present book is a very good example of our efforts through the year 2018 to provide venue in support of mutual understanding and interaction in crisis management and disaster response.

*Vassil ROUSSINOV,
CMDR COE Director*

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Keynote speakers

MG William HICKMAN, Deputy Chief of Staff, Strategic Plans and Policy in Supreme Allied Command Transformation (SACT)



Major General William B. Hickman was assigned as the Director, Strategic Plans and Policy for the NATO Allied Transformation Command, Norfolk, VA in July 2017. His prior assignments include serving as the Deputy Commanding General, U.S. Army Central, Arifjan, Kuwait.

Hickman earned his bachelor's degree in Business Administration from Vanderbilt University in 1983 and was commissioned as a second lieutenant through the ROTC program. He later earned a Master's Degree in Business Administration from Vanderbilt University and a Master's Degree in National Security and Strategic Studies from the Naval War College. Hickman's awards and decorations include the Distinguished Service Medal, Defense Superior Service Medal (with oak leaf cluster), Legion of Merit (with Oak Leaf Cluster), Bronze Star Medal (with 3 Oak Leaf Clusters), Defense Meritorious Service Medal, Meritorious Service Medal (with 4 Oak Leaf Clusters), Joint Service Commendation Medal, Army Commendation Medal (with Oak Leaf Cluster), Army Achievement Medal (with 3 Oak Leaf Clusters), Combat Infantryman Badge, Expert Infantryman Badge, Master Parachutist Badge, Air Assault Badge, Ranger Tab.

It's great to be here, thanks for the opportunity. It's great to be back in Sofia, it's great to be here at this conference today. What I want to do is talk here today about the Strategic

Foresight Analysis and there are two documents that we are going to use today. We will have about 24-25 copies but you can also download the information. This is the Strategic Foresight Analysis 2017, published in October, that is a document ACT publishes and the other one is the Framework for Future Alliance Operations that was just published recently in 2018. That is BI-SC document. We in ACT are in lead but we work very close with SHAPE. This document is sent out to the forces across NATO as a guidance from the two strategic commanders on how they want the forces to operate in the future environment. I look forward to the next two days of discussions here. I will use these documents, as I said, to provide some insight to the future security environment we figure we will be facing as NATO goes forward. They also help provide the insight to long-term perspective on the future security environment as far as the NATO defense planning process.

So as a start, the SFA 2017 considers the risk developments in international security environment indicating the predominance of NATO had recently been challenged by emerging insurgent powers using conventional and unconventional means as part of a hybrid toolbox. Russia uses new weapons and weapon systems, these re advanced technologies, and is exploiting the grey zone, such as interfering with the elections in the Western countries, as well as conducting cyber-attacks. These are examples of potential adversaries using instruments not limited

to the military domain but which include social, technological, economic and other areas. The competition between major powers would intensify in economy and technology and is likely to become a race for global leadership, expanding the new frontiers and we are really oriented right now in space and artificial intelligence as two examples. These developments affect multiple domains in multiple regions and are expected to increase the likelihood of confrontation using hybrid warfare. But it can also lead to conflict including use of conventional weapons or even weapons of mass destruction.

And as you look to the South there are governmental challenges in the Middle East, North Africa and other parts of the developing world that would continue to drive migrations. Rapid advancement of technology and the increasing evidence of the impact of climate change would have compounding effects on both the developing and developed world resulting in some social unrest, etc., thus creating fractions in these countries, underlying unity and reducing cohesion. These challenges in society, the economy, the environment will reduce the trust between governments and the public to create effects such as fractions in societies, extremism, nationalism, isolationism and protectionism. Technology, in particular artificial intelligence, human-machine interface will increasingly shape the character of war. New emerging technologies and visualization will offer enormous opportunities but also present new vulnerabilities, challenges and future conflicts that will

follow much faster and in greater scale than ever before. The use of new technologies will also create ethical and legal concerns and will challenge decision making. On the other hand, our potential adversaries may not be constrained by Western policy and legal frameworks.

So given this summary, you might ask a couple of questions such as what is the most important point coming out of the Strategic Foresight Analysis. Well, in the document there themes and trends and implications. So what I think is important for NATO is to look across the different themes and trends, and these are political, economic, social, environmental and technological. The interaction and the intersection of different trends as they come together comes with a multiplication of effects. The outcomes may be very challenging to predict but should be considered nonetheless. So let me give you a couple of examples, such as the high North as a first example. The climate there is basically science. We should be able to predict climate change or at least to measure up in the next couple of years the effect of climate change on the high North. Resource there is also basically science. And we will continue to measure the resources which are available in the high North and which will become available as the climate continues to change. So as the climate changes and the resource competitions are converging in this specific region, and taking into account the political trends and political geostrategic power competition, an increased potential for

confrontation and conflict all come together in one area in specific time and space. You can measure and see the convergence of these trends and the complexity of the situation. With the stakeholders combined with the interconnected nature of international systems, the rate of change has continued to increase and could cause potential for disorder and insurgence. So this one area, the high North, for example, is not easy but it may be a little bit easier in other parts of the world because there is a lot of science involved vs observing.

So the second example is the example of North Africa. It is much harder to predict trends in this area but it is still worth the effort, so that we are better prepared for future challenges and opportunities. The countries in North Africa are very diverse in many respects – their political environment, their social demands, their economic opportunities and the resources available, the environmental challenges, just to name a few. But it's still important to stay in this region, considering the opportunities for NATO and the threats that come out of this region, in order to gain an understanding and to co-operate with our regional partner nations. Again, studying time and space there would be better understanding of the foresight of the future.

So what do these global trends really mean for NATO? First of all, the strength of the Alliance remains with the cohesion of the 29 Nations, as well as the trends reinforced by the desire to

extend these partnerships with our other NATO Nations and international organizations. The EU partnership is an important example of the need to work together in ever changing and complex world. There were two trends that were used as a framework for future Alliance operations. Before I go to the FFAO, I would like to discover where we going with the Strategic Foresight. Last April ACT hosted a workshop focused on the discussion of the convergence of trends, these are technology trends and application of other trends – political, human, economy, environmental domains. Most NATO Nations were there, as well as partner Nations. We had industry representatives there focusing on how computing power to be used for research and analysis and to validate our trend analysis as we look forward for implications. The SFA workshop was an attempt to share our ideas and elaborate on how we will finish 2018 and go into 2019. So in the next two years we will use this technique to look at convergence of technology trends and the application of other trends in specific areas and we will publish reports. We will publish regional reports from Russia, European, Eastern European threats with Russia, we will look at the Arctic, the Asian Pacific area, the Middle East and North Africa and provide outcomes and regional workshops.

It is worth using computing power for support in research and analysis, the development of scenarios to validate trend analyses, identification of implications to NATO and our Partner Nations. This process will provide example of using technology

and innovative approaches as we look at the trends across NATO in the future.

So to finish my talk today about the Framework for Future Alliance Operations we published just recently in 2018, let me note that the FFAO does not try to predict the future but it does try to indicate the type of forces that NATO requires for the future. We had to look to the future and identify the uncertain, to provide situational awareness and understanding.

As forces today accomplish the missions of today they must be really diligent to many challenges and many threats and opportunities in the way ahead. The role of the force in the future isn't easy and never has been, but the forces must maintain a military edge in future operations. In summary, what the document really says is that we need NATO forces that continually evolve, adapt and innovate. The FFAO really can help in several areas but I think it helps all of our Nations and the international security documents that they publish. At least they get our view from a NATO perspective, at least from the Strategic Command's perspective. It helps the education, training, the exercise and the evaluation of our forces. The FFAO talks about the types of forces we need in the future. It could help inform exercisers of other educational opportunities for our leaders. Also the Framework for Future Alliance Operations talks about the instability areas all forces have to work through. And these could be all, from work against terrorism, regular warfare to conventional warfare, all the way to

natural disasters. It also talks about those forces and how they operate in instability situations, the challenges they will have, as they go forward, primarily the ethical, legal challenges they will have. How they work against autonomous systems or a semi-autonomous systems or information environment, or human augmentation. These things are on the rise, so what is the policy, what are the legal implications?

And finally the FFAO talks about the types of forces we need and I'll summarize a couple of characteristics of these forces. We need incredible forces. So what does that mean? There are forces that are ready to demonstrate excellence, through exercises and other opportunities, they are ready to defend our Alliance. They need to build a network, they need to operate through interoperability, they need to be agile, and they need to be able to respond to different crises. From offence to defense operations, to going to stability operations, from crisis response to disaster response. And the last part talks about military applications, the interaction, and the use of our forces. We are prepared, we will project combat power whether it's coming from North America and Europe or from across Europe to defend our Nations, to defend the Alliance. And also to be able to engage, sustain and protect itself as it goes forward. So all of that was kind of laid out in that report.

The last couple of areas I would like to summarize and I think are worth discussing. We could be discussing the report, the risks to NATO, and in no way I am applying NATO is not strong

today, it has been incredibly strong. As you see the two commands work closer together than they ever have. I'm not implying that the risks are current now, but they are ones that we need to watch in the future. The first are the external threats, the second risk is the political economic factor. It could undermine international institutions. The third one is the operation structures and processes of NATO, our decision-making processes and civil-military frictions. The fourth risk is the technological advance, losing the innovation game to the private defense Industries and other non-state actors that could use technology advances against us. And finally, the threat against our core values that we stand firmly on, the values of NATO, stated in the Washington treaty, that maintain the cohesion of NATO. So for NATO to remain strong we must be aware of these risks. And finally I would like to summarize, we talked about some principles in the future and I think it's really important that we understand the threats that are facing us, that we work together, all 29 nations with our partner Nations and our other partners from international organizations, then with our values we are able to fight in all domains as we go forward.

Thanks for your attention! I am looking forward to discussion in the next two days.

Mr. Iain RICHMOND, NATO HQ, Brussels



Iain RICHMOND started his new role as an International Staff officer at NATO HQ in November 2016 upon leaving the Royal Navy. His last role in uniform was as the OF5 PJHQ/MoD Liaison Officer to the French Centre de Planification et de Conduite des Operations (CPCO) in Paris, a post he

held for nearly 4 years. He had the responsibility of facilitating UK/FR military cooperation on operations, the highlights of which were UK contributions to FR operations in Africa, multinational planning to counter Boko-Haram and the FR inclusion in UK's contribution to eFP. Prior to this appointment he attended the Centre des Hautes Etudes Militaires (CHEM – equivalent to the UK's HCSC) in Paris after spending 3 years in JFC Naples as the J3 Head of Maritime and Amphibious Operations. During his time in Naples he planned and conducted NATO's first counter-Piracy operation off the Horn of Africa, re-vamped the Alliance's Mediterranean defence against terrorism Operation ACTIVE ENDEAVOUR and became the JFC level planning lead for NATO's training mission in Iraq. Prior to this period, from 2005 to 2008 he worked in the equipment capability area of MoD, first on the future carrier as the liaison officer with French and American carrier programmes and then, on promotion to Captain RN, as the Deputy Director for Air Enablers. In this latter role he was in charge of meeting urgent operational requirements for all aircraft defensive aids suites and also for the introduction of a tri-service flying training system and other programmes such as aerial target provision. Before MoD he had spent an extended period at sea, first on the staff of Commander US Second Fleet/Striking Fleet Atlantic in USS MOUNT WHITNEY from 1999-2002 as the NATO Plans and Policy chief, followed by HMS OCEAN as the Commander (Air) from 2002-2004. The latter appointment included the ship's participation Gulf operations against Iraq in 2003. Previous appointments were

primarily in the naval domain, either as a helicopter pilot ashore and embarked, or at sea as a warfare officer. In 1995-96 he attended the Canadian Command and Staff Course in Toronto.

Good afternoon, ladies and gentlemen, I am Iain Richmond. What struck me is that I am the second Navy aviator in a row to brief you on crisis management, and reflecting on that I thought that flying an aircraft over the sea from a ship is a constant exercise in crisis management with the imminent respect to disaster response to take place. Perhaps we naval aviators are uniquely positioned to be able to consider this subject. You have had my CV, I have been in NATO now for 18 months and I have a particular area of expertise in running and developing crisis management exercises. I work within the Crisis Response System and the exercises part of the International Staff and our area is to try and make sure that NATO as a headquarters is structured and capable of taking difficult decisions in a timely manner, and learning the lessons from the exercises when we test those procedures and working with Nations to improve the process both at NATO HQ but also in the 29 Nations where the decisions ultimately take place. So lessons learnt, NATO and EU in a hybrid context, crisis management exercises those are the areas of discussions on those subjects. It is a great honour for me to be here in Sofia and to attend this conference. It is my first and it is an even bigger honour to be asked to deliver one of the introduction speeches to this audience, as the Crisis Management and Disaster Response Centre of Excellence is a

key player in the exchange of knowledge, and sharing the experiences on crisis management and disaster response issues.

So what is the Alliance's perspective in regards to the theme of this conference? Before I try to look into what is really a very fuzzy crystal ball, to define the future, it is worth having a quick tour de la maison, as the French say, to establish where we are now. The Alliance continues to be confronted with hybrid challenges, from the East and from the South. To the east Russia's aggressive actions and willingness to ignore established norms of international behaviour are a serious source of regional instability, fundamentally challenging the Alliance and endangering Euro-Atlantic security. While adapting to this new reality by ensuring that NATO has the readiness and responsiveness necessary to deter, the Alliance is also engaged in meaningful dialogue with Russia and that dual track of deterrence and dialogue is extremely important from the HQ perspective.

Meanwhile, terrorism emanating from the South remains at a high level of intensity, representing an immediate and direct threat to our Nations and populations. But nor are we immune to threats from a furtherer field, as North Korea's accelerated push towards incredible nuclear and ballistic missile capability demonstrated in 2017. A number of conclusions can be drawn from this. Firstly, the world has become more unpredictable, more uncertain. It is a more dangerous world, and therefore we

would need to invest more in our security. The investment needs to be 360 degrees in approach and multifaceted, able to address collective defence and deterrence in Europe, and at the same time address the issues of projecting stability, stabilizing our neighbours and fighting terrorism beyond our borders. It is also being more comprehensively joined up when dealing with hybrid threats and challenges. For the Alliance this means in particular a need to synchronise crisis management activities with the European Union when we face such a situation. These conclusions in turn provoke a number of areas that we need to work further on. Some of them have been covered by previous speakers, but I guess it is probably worth giving an HQ perspective on them. The fact that we need to be more resilient, the more we protect our soft targets such as the civilian population, critical infrastructures, cyber networks and essential government functions, the more difficult it is for an adversary or a terrorist to create their desired effect. In effect, resilience is the integral part of Article 3 of the Washington Treaty which obliges every Ally to develop its capacity to resist armed attack. Although this is first and foremost our national responsibility, NATO plays a driving role through setting baseline requirements and can support with global teams of experts, it can assess, advise, and supplement national efforts. Additionally, NATO can fund projects and activities through its Science for Peace and Security program (SPS). A recent example here is a collaborative project between SPS and France with the support of experts from Ukraine and South

Korea to develop and test a system for the detection of explosives and firearms in mass-transport environments. It's a good progress that we make there.

Cyber remains an area of strong focus for the Alliance. It is a challenging area since, although we see evidence of major cyber events almost on a daily basis, it is often difficult to know whether you have actually been attacked or whether it is a malfunction, and if attacked by whom. The fog of war is thickest in cyberspace. Low-cost high impact cyber-attacks have become a part of our lives. NATO which has designated cyber defence as a domain alongside land, sea and air, has three key roles to play here. Firstly, to drive progress across the Alliance, second, to act as a hub for information sharing, training and expertise, and thirdly fundamentally to protect Alliance networks. The Alliance's role as a hub links have been established through NATO Nations, the EU and the industry to exchange information on cyber threats. And the NATO cyber centre of excellence in Estonia leads on the search, education and training. We also need to be more agile. Our structures and procedures for decision-making in times of crisis are being adapted to become swifter and more responsive. The NATO Crisis Response System is evolving to become a cornerstone of the Alliance's ability to manage crises and responses to all situations demanding actions across the three Alliance core tasks of collective defence, crisis management and cooperative security. Many nations are adapting their national decision-

making to increase synchronisation with this process. We in the West also need to be more joined up. Those who wish us ill are constantly probing our weaknesses, exploiting scenes between Nations or scenes between international organisations as an obvious opportunity for an adversary. Solidarity among Nations and increased synchronisation of activity by international partners are vital. But we do stand together. For example, the international response to the recent Skripal attack in the UK must not have been a desired outcome from the perpetrator's perspective. We did stand together. From an international coordination's perspective NATO and EU have made great strides in better understanding what interaction could look like when faced with a complex hybrid crisis. In this regard, resilience along with warning, situational awareness, crisis prevention and response, cyber and strategic communications represent key areas of cooperation between NATO and the European Union.

NATO-EU dialogue in these areas has intensified and we have started exercising together, for example through CMX 17 that took place in October last year, which has helped to drive progress significantly. Although NATO has placed new emphasis on collective defence and its crisis management system and procedures, cooperative security remains one of the three essential core tasks of the Alliance. From a crisis management perspective the Euro-Atlantic Disaster Response Coordination Centre which just celebrated its 20th anniversary,

is NATO's principal consequence management mechanism in the Euro-Atlantic area. Operational 24/7 and involving NATO Allies and all partners, it functions as a clearing house system for coordinating both requests and offers of assistance in response to both natural and man-made disasters, including terrorism. Examples of this would be such as facilitating international assistance to Georgia in August and September 2017 to help contain major forest fires or the request from Serbia in 2016 for assistance in dealing with the migrant crisis.

As well as this core function, EADRCC organises major disaster response exercises to practice procedures, build interoperability and to harvest experience and lessons learnt for the benefit of all. An upcoming example of this is a consequence management field exercise which has been jointly organised between the EADRCC and Serbia which will be held near Belgrade in October 2018.

Climate change is another dimension with regard to environmental challenges. And here NATO has two roles to play. The first is environmental protection by helping to protect the environment from the harmful effects of military activities. And environmental security with the aim of addressing security challenges emanating from the environmental threats. Since the demand upon the military to act as first responder to natural disasters is likely to grow. For environmental security, as well as boosting emergency response through EADRCC, the Alliance has also supported co-operative activities that tackle

environmental security issues again through the Science Peace and Security programme that I mentioned earlier. As well as supporting capacity building, specific projects are undertaken with partners such as the Chernobyl dust model which developed a 3D model of radioactive dust leakages from the Chernobyl site. And so if I need to look at the future, although the security environment is becoming ever more complex and as I have just mentioned climate change has the possibility to add yet more risks on top of those that we already have from the existing instability, terrorism and migrant threats, the Alliance is adapting to face these challenges. I think that history repeatedly shows that democracies tend to be slow to react to threats but once those threats impinge on core democratic values, then democracies have the determination and the power to face down those threats.

It is vital that we maintain the momentum of internal adaptation and the improvement of multilateral cooperation as the Alliance is to exercise our crisis management decision-making processes in conjunction with relevant partners and international organisations done at our strategic level through our crisis management exercises. Another is to leverage the expertise of others and here the network of Centres of Excellence in general and this Centre in particular is key. This network provides us with opportunities to share best practices, lessons learnt and ideas. It is also a valuable platform for interagency coordination among national authorities, and for

building ties with external stakeholders such as partner nations and other international organisations. So in conclusion I thank you again for offering the opportunity to be here today and I am sure that during these two days we will have very interesting and fruitful discussions and I'm open to any questions that you might have. Thank you.

Mr. Dirk DUBOIS, Head of the European Security and Defence College



At the age of 18, Dirk Dubois joins the Belgian Army in 1981. He graduates from the Royal Military Academy after 4.5 years with a Master degree in Social and Military Sciences. The first part of his career he spends in operational units as a field artillery officer and as an instructor and staff officer at the Belgian Artillery School. During this part of his career, he is deployed abroad on several occasions. During

one of his operational deployments, he serves as a liaison officer with UN, EU and local civilian authorities. He learns first-hand how civilian and military efforts can supplement each other to achieve a better result than if they each operate independently. In 2004, Dirk Dubois starts a second phase in his career as he joins the Belgian Defence Headquarters and becomes a member of the team responsible for the development and follow-up of the strategic management objectives for the Belgian Defence. When this team is reorganised in 2007, he seizes the opportunity to apply for a position as training manager of the European Security and Defence College. During this time, he organises numerous courses and is actively engaged in the launching of the European initiative for the exchange of young officers, better known as Erasmus militaire. He occupies this function until 2012, when he returns to the Belgian Defence Headquarters in the Directorate-General for Education as head of the division responsible for external relations in the field of education, both on a national side and with relevant partner countries. This post allows him to take up the job of chairperson of the Implementation Group for the European initiative for the exchange of young officers, inspired by Erasmus in the summer of 2013. The experience gained with the initiative also enables him to further develop the recognition of the qualifications of the military personnel by the civilian authorities at a national level. In

2014 he applies for the position of Head of the European Security and Defence College and is appointed by the High Representative of the Union for Foreign Affairs and Security Policy to take up this position on April 1st 2015.

Thank you very much and first of all let me thank the commander of the CMDR Centre of Excellence for the invitation to come and talk to you. It's a pleasure to be here. As a keynote speaker, I have an obligation to you to make a more lecture-based presentation.

First of all, I will talk to you a little bit about the European Security and Defence College, I am going to talk a little bit about the Common Security and Defence Policy of the European Union, and where it is active and why it is active there, as well as the new Global Strategy of the European Union. I will then try to touch on the link between the crisis management operations of the EU and disaster management both from the historical perspective and in this way bridge a little bit the topics that will be covered during the conference.

Let's start with the college. It was created in 2005 as a network of training providers. First of all, we are not a military organisation, we are basically providing civilian and military training at the EU level. We consist of a network of partners, as of September 1, 2017 there are 136 of them, and 5 associate network partners. They are either military academies, defence colleges, they could be or they are police academies, diplomatic academies, but also universities, etc. We are also responsible

for a programme called European Institute for the Exchange of Young Officers inspired by Erasmus, and we are running a doctoral school initiative as well at the same time. We run approximately 100 training activities per year, and we train 5500 people per year currently.

I will try to highlight some of our objectives. First of all, to further enhance the common European security and defence culture within the Member States. What does that actually mean? We have heard people speaking during this conference mostly from Bulgaria and their focus is quite often towards the East. Understandably so. If you talk to a French officer or a Belgian officer, their focus would quite likely be on Africa. If you talk to somebody from the Baltic states it will be again looking towards Russia. But we in the European Union much like the Alliance, have some shared interests and we are trying to convince the people and people should understand that there are common interests both in Africa and on the Eastern side of the EU.

CSDP operations are executive military operations, which means that we replace the state where we are in with certain military powers. The missions can be either military or civilian. We call the military non-executive operations missions. But actually we call all civilian operations missions. So if they are executive or not, like in Kosovo which has been an executive mandate, it was called a mission. And we of course provide training responding to the training needs of the Member States and of the missions. Most recently on February 6 this year we

have been given additional responsibility to provide education and training exercises and evaluations in a newly created platform.

We are an independent organisation, we have our own budgets but we are embedded in the EEAS structures. All of my staff are succumbent not to the EEAS but to the European Security and Defence College. I report back to the 28 Member States. All of our curricula are certified, recognised by the 28 Member States. So where is the Common Security and Defence Policy actually active in terms of missions and operations and why?

The global peace index is a conglomerate of approximately 20 indicators indicating things like are the countries engaged in external conflict or internal conflict, what is the security situation at home, terrorist threats and so forth. If you look at Europe you can see it is highly peaceful. If you zoom out a little bit you'll see that we are surrounded by some countries that may not be as stable and peaceful as we are, to the South and to the East. So we are facing challenges on the East and South. These countries coincide to a huge extent with the places where the missions and operations are taking place. In the past people have tried to play the EU and NATO against each other talking about duplication, talking about even almost competing with each other. We should not think of it like that. I am convinced that there are places where the EU can go for political reasons where NATO cannot go. An example of that is Georgia. There are places where NATO can go and where NATO is far better

suited, especially when the situation becomes really hard, and there are places where we should work together and compliment each other like we should do in any case. So it is not a competition, we both have our headquarters in Brussels, it's virtually 5km away from one place to the other.

However, EU is a highly complex machinery, for the EU the military is a side event. In facts and figures the EU administration is 40000 people, and there are 600 military in the EU and that's it. EU has a connotation of being a large NGO and acting like a large NGO and up to a certain extent that was the case before the Lisbon Treaty. And to a certain extent DGECHO and OCHA behaved like NGOs. These 40000 people run the budget which is huge and they are not able to manage the budget themselves. Basically, they outsource almost everything. As a result of that they quite often give money to NGOs to do the work on the field. Since the Lisbon Treaty there is a far clearer link between why we are doing things in the region and our security interest. The reason why we are in the Sahara region is to create the conditions for people to remain there. The average age on the African continent is just above 20 years, the population of Africa will double by 2050. That is an almost scientific fact or at least a prognosis. Today the African continent does not have the resources to support its population. Now where will all those Africans go by 2050? If we do not create the security environment and therefore the development conditions for the African people, they will go

North. And the same goes for the East if you look at countries like Syria.

The New Global Strategy, when Federica Mogherini and her team started writing it from the premises that the world has become more connected. The internet is the proof of that, you can talk to somebody in Australia via tools like Skype any time of the day. It has also become more complex. This is the time when I usually take out my smartphone and I ask people how does it work, actually it works with chips. Chips are made of gold. 90% of world reserves of gold are owned by Chinese companies. Now, if we on both sides of the Atlantic are to remain working with these things isn't that a security concern? That the Chinese are monopolizing this?

Now, the Global Strategy as any strategy should give you a goal, should identify the way to reach that goal, should give you the priorities and give you the resources, and actually also ask who is on our side. Although the Global Strategy replied to those questions, not to all of them. So if you read the document, it actually identifies the interests and sets some priorities. And that's it. The rest is the implementation plan, and also part of the External Action Service is working on that but also we on the Commission side are working on the European Defence Action Plan.

As of the priorities of the External Action Service, first off we are talking of the security of our Union which is new. It does not mean that the EU starts competing with NATO. EU recognizes

all 22 nations that are also NATO members and that the Alliance has privacy in territorial defence. We do not want to change that at all. But we do take care of the security. We talk about state and societal resilience to our East and South. That is another trend lately, we are talking about things that we refused to define. You will not be able to find the definition of hybrid, find the definition of resilience, and even find a clear definition of cyber. An Integrated Approach to conflicts and crises, cooperative regional orders, we work with other organizations in South America, South East, the Pacific, and so forth. And we support a global governance for the 21st century, recognizing the main role of the United Nations.

Integrated approach, this is where the EU significantly differs from NATO. The EU is not a state but it has a lot of tools. NATO talks about Comprehensive Approach, but NATO apart from its command structures has nothing of its own and it depends on its nations. EU also depends on its Member States but it has at its own authority a lot of tools that it can use. These are diplomatic actions, it can also take economic sanctions, it can take conflict prevention measures, it can provide and is the biggest humanitarian assistance provider if you take the 28 Member States together, it can take actions in the field of justice and home affairs, trade and climate change. Climate change has also been on the agenda of the EU since 1990. And actually if all of those tools do not work, there is one tool that we can use as a last resort which is the Common Security

and Defence Policy. Again the CSDP is the last resort for the European Union. When we look at a crisis and how it is developing, throughout the cycle of the crisis, before it comes to an open conflict, and after it comes to an open conflict, EU is looking at a region and is trying to identify the tools and instruments we should use to try and avoid it coming to a conflict.

Now the link between CSDP and disaster management. Well many people do not remember that, but one of the first CSDP, at that time still European Security and Defence Policy, missions was in Banda Aceh. Banda Aceh was still a Dutch colony and it has always been a very difficult region to handle and the Dutch actually gave specific rights to the Sheik there to make a kind of a peace. The region has never fully accepted being integrated into Indonesia. They were actually having an open civil war. At around Christmas time 2004 there was a huge tsunami in the region and as a result of that, the EU and the Finnish representative programed to the peace treaty between Banda Aceh and the Indonesian government and went over there to monitor the peace treaty. So there is a very old link to that. More recent example, in 2014 the Mosul Dam was captured by ISIS, in that period the dam had become extremely unstable. It was very difficult to assess the situation, what was going on, we had no access on the ground. The EU Satellite Centre close to Madrid was monitoring the satellite imagery and made a simulation of what would happen if the dam breached.

It would have killed tens of thousands of people and reached all the way to Baghdad, flooding the area. It would have been a major disaster. Luckily, it didn't happen, but it could have been a major disaster.

Climate change, Europeans are very optimistic people, they think they will not be affected by climate change. There will be some regions that would be very badly struck. One of them is the Bay of Bengal. It is very vulnerable to the rise of sea levels. If you take a look at Bangladesh which is in the North part of the bay, it has a population of 161.5 million people. Already today due to the rise of sea levels, there are fields being over flooded by sea water leaving the rice valleys basically destroyed. It is not the only challenge. Most of the population of Bangladesh actually lives in the Delta but further up. As the glaciers on the Himalaya retreat, the fertile ground is being washed away into the sea. So they are having more and more problems feeding their population. If this stays as it is, as it is foreseen, 80% of their population would have to flee. The Sahara region, this part of the world very quickly becomes unable to sustain its own population. This is one of the main sources of instability in that region. Population pressure and inability to feed the population. And this is why Europe is there, trying to help to develop, to mitigate the consequences of climate change.

Thank you very much for your attention, again it was a pleasure being here.

CLIMATE CHANGE AND SECURITY – EDUCATION AND TRAINING AS AN IMPORTANT PART OF CLIMATE CHANGE AWARENESS ENHANCEMENT, AND ITS IMPACTS ON DEFENCE AND SECURITY

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Abstract: Climate Change serves as an accelerant of instability or a threat multiplier that makes already existing threats worse. Climate change is drawing unprecedented international attention because it impacts nearly all domains and is a compounding factor for other existing issues. One of the implications for military is the Education and Training. Definition of some requirements derived from possible future tasks concerning security impacts of climate change.

Key words: NATO, military, climate change, education and training, training requirements, capabilities.

Introduction

There is a trend of increased frequency and scale of natural disasters in many areas of the world. Climate change, population growth resulting in pressure on natural resources, together with urbanization, industrial activities and environmental misuse, combine to form the major root causes

of this phenomenon. The climate change implications are more obvious than ever before. At the same time, other challenges include a rising number of fragile states at risk of instability and civil conflicts and the looming threat of terrorist attacks. New conflicts along with protracted complex emergencies continue eroding the coping mechanisms of millions of vulnerable civilians leading to humanitarian crises. With this upsurge in natural disasters, and armed conflicts continuing in different regions of the world, military assets can have an important role in supporting the international community humanitarian assistance (HA) and disaster response (DR) efforts.

Crisis management is one of NATO's fundamental security tasks. It can involve military and non-military measures to address the full spectrum of crises – before, during and after conflicts. Alliance's role in crisis management goes beyond military operations aimed at deterring and defending against threats to Alliance territory and the safety and security of Allied populations. Despite NATO is not a major actor with respect to global climate policy, NATO considers that climate change will further shape the future security environment in areas of its concern and have the potential to significantly affect NATO planning and operations. The changes in climate bring challenges and opportunities, and are drawing unprecedented international attention because their impacts nearly all domains. There is no doubt that Climate Change serves as an accelerant of instability or a threat multiplier that makes already existing

threats worse and is a compounding factor for other existing issues.

Even though NATO's engagement on climate change in recent years has been limited, Alliance, and member states as well, are working on addressing the security aspects of climate change in order to anticipate the future crises, and ways to solve them. NATO's robust crisis management capabilities allow it to deal with a wide range of emerging crises in an increasingly complex security environment. What is more, training is one of the main activities of the pre-crisis phase, in strive to be ready for all of the potential catastrophes, and ensuring the right capabilities and materiel are on hand. However, currently there is no dedicated training course that covers climate change and Defence & Security.

CMDR COE Education & Training approach to climate change awareness enhancement and its impacts on defence and security

Education and Training is the Alliance enabler to collectively cope with the multitude of threats and challenges across the spectrum of conflict. Trained personnel are key for success and influence on the operational readiness and effective employment of forces.

Within the Global Programming Approach framework NATO are using the concept of training disciplines to unify and synchronise the efforts of the requirements generators and the E&T Solution Providers in the fulfillment of these requirements.

A discipline captures the E&T requirements across the education training and exercises in support of an existing or evolving capability.

Crisis Management is overarching task and it is multi-disciplined in nature in the Global Programming Approach framework. Crisis Management training and education is, and will continue to be, addressed through a variety of existing disciplines. Furthermore, the creation of one discipline would be detrimental to the comprehensive nature of this overarching topic. CMDR COE role and work is to support the whole process in NATO E&T within CMDR domain using its Training landscape and expertise, throughout all discipline of the Bi-Strategic Command Comprehensive List of Disciplines when/where applicable in close collaboration with their governance structure.

As a transformation hub of expertise in the crisis management and disaster response area, CMDR COE is engaged in the Climate Change and its implications on the military activities. The Center has held various events, seminars and workshops on the topic, to include NATO SPS Advanced Research Workshop¹. CMDR COE curriculum is reviewed, and where it is possible climate change and its implications on military activities awareness is integrated in the existing courses. In addition, this topic is always part of Center of Excellence conferences,

¹ Implications of Climate Change and Disasters on Military Activities: Building Resiliency and Mitigating Vulnerability in the Balkan region SPS: ARW.985136

workshops, analyses, etc. Moreover Center work on Modeling and Simulation Support for Crisis and Disaster Management Processes and Climate Change Implications within NATO Science and Technology Organization Modeling and Simulation Group 147 (MSG 147).

The CMDR COE works in close collaboration with various institutions in crisis management and disaster response area – national and international, military and civilian, governmental and non-governmental, etc. In a rapidly changing world, NATO and the European Union (EU) are faced with security challenges both in its immediate neighborhood and further afield. EU is a unique and essential partner for NATO and contributes to the overall security of the Euro-Atlantic area. In order to enhance knowledge and expertise in the crisis management and disaster response domain, Centre is devoting efforts for close cooperation with EU.

Following a “Framework Process for Managing CSDP Military Training Requirements noted by EUMC, CMDR COE is the EU Military training Discipline Leader (DL) for "Military contribution to EU Disaster Response (DR), Humanitarian Assistance (HA) and Civil Protection (CP)" military training discipline. CMDR COE, as an EU military training Discipline Leader, is EU recognized expert body in a specific training area; CMDR COE, in support of EUMTG, plays an important role throughout the process of managing CSDP military training requirements.

Furthermore, as a DL we are sharing experience in support of cooperation between EU and NATO within the agreed frameworks, in the E&T area. Along with all activities in the Centre's annual Programmes of Work (POW), CMDR COE, is permanently monitoring and considering new military training requirements in crisis management and disaster response area. We have to bear in mind new trends, level of ambitions and to try transforming requirements in proper training to meet these requirements.

Moreover, following these requirements, within the framework of the European Security and Defence College (ESDC), the Crisis Management and Disaster Response Centre of Excellence (CMDR COE) in cooperation with the Diplomatic Institute to the Minister of Foreign Affairs of the Republic of Bulgaria and G.S. Rakovski Defence College have organized and conducted, from 24 to 27 April 2018 a pilot course on *Climate Change and Security*, at CMDR COE premises (Sofia, Bulgaria). The course, which is the first of this kind under ESDC, aimed to enhance awareness of climate change security implications through acquisition of basic knowledge related to global warming as a phenomenon and a security threat multiplier, the main factors which affect the environment, and the impact of climate change on international peace and security in short, mid and long term period.

Climate Change and Security Training Requirements

However, the insufficient knowledge and understanding of climate change and its implications requires devoting more efforts by NATO Members and Partner Nations in that field. Having in mind, Climate change and security, in order to deliver the right training to the right people at the right time on the right place NATO training authorities and experts should answer also the question WHAT TO DO?

The new training requirements required new competencies to be developed and/or existing competencies to be improved.

Second, based on the analogy on the expected functional duties and the level they are performed, the Targeted Training Audience should be characterized.

Third, Analysis should be done, by matching the existing opportunities with the NATO specific requirements, leading to determination of training gaps, deficiencies and redundancies for the specific training audience.

Speaking about Climate Change & Security awareness we defined some requirements derived from possible future tasks concerning security impacts of climate change. As an illustration I can point out:

- 1) consideration of climate change in the analysis of crises;
- 2) assessment of countries and/or regions running the greatest risk of conflict and instability due to climate change;

3) improving the coping capacity in order to assist in building resilience to climate change;

4) planning, to include long-term (civilian and military) for climate change adaption.

To increase the knowledge about climate change and its impact on the military and the security as a whole we could divide training objective in three areas

1. Security sector vulnerabilities (e.g. understand vulnerabilities and asses them)
2. Climate change impacts in the Security sector (Understanding hazards and what impacts they could have; to consider (to refer) long-term impact of climate change to disaster risk management)
3. Climate change adaptation options (Define, plan, assess main categories of adaptation options; Adaptation options can generally be divided in vertical (e.g. adapting business models, design codes etc.) and horizontal options (e.g. capacity building, awareness raising, R&D, legal framework)

Understanding the relations between climate and security is essential for both decision-makers and experts (civilians and military). Climate-related risks are increasingly recognized as a key factor – and at times a key driver – of human insecurity and even conflict. Training requirements for the different levels and the associated training audience are the same, but the training

solutions and the depth of knowledge are different. For decision makers for example, training solution at least for Understanding of climate change and climate adaptation in general and in relations to extreme events in particular might needed.

As a result, these requirements will affect future military education and training. CMDR COE is exploring ways to increase the participation of the NATO military and civilians in raising awareness of the defence and security consequences of climate change. The COE is working to enhance the Climate Change Security Awareness through Crisis Management multi-disciplined nature within the Global Programming Approach framework.

CMDR COE support to the NATO Global Programming is as a 'solution provider' for NATO residential, mobile and exercise training , and by providing expertise and participating in the NATO Education & Training activities and events across all components of Global Programming - Governance Structure, Development Methodology and Production Planning Process, when/where applicable.

Conclusion

In conclusion, having considered all said, the trend of increased frequency and scale of physical and human induced disasters and complex emergencies in many areas of the world will continue. Climate change is a non-traditional threat that will shape the security environment in the twenty first century. Even

though, NATO is already engaged in developing policy and conducting operations responding to climate change impacts, the traditional threats are still its main concerns. Climate change is just one of many threats to which NATO must respond. Moreover, incorporating climate scenarios into existing NATO activities in the CMC domain and scientific research and cooperation is important and necessary.

Raising awareness, and sharing knowledge (i.e. articles, papers, and other documents) on an increase in the level of understanding and awareness of climate change and weather is essential. NATO militaries also need to integrate issues related to climate change risk into their training and exercise routines.

CMC COE, as a focal point for expertise in this domain, could use its experience concerning climate change and security in the EU framework in support of NATO education and training in the Global Programming framework. Education and training curricula will need to include along with climate change, as well as Military Considerations on Climate Change Impacts in order for NATO to have proper capabilities in pursuit of defined goals and objectives. The preparation of appropriate training audiences should bring them necessary knowledge, skills and attitude to operate, to communicate and, where appropriate, effectively interact with all actors involved in the disaster response and humanitarian assistance field.

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HOW CLIMATE CHANGE AFFECTS EUROPEAN SECURITY

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Abstract: This paper studies contemporary climate change as a human-induced phenomenon which will cause significant changes in global security environment. The main mitigation efforts of international community have uncertain results and their short, mid and long term period consequences are yet discussable. The future scenarios say that the climate system temperature is going to increase at unprecedented level which will cause significant stress to all forms of life on Planet Earth. Europe will be affected directly to global warming as extreme sudden and slow-onset weather events hit the continent. These impacts are more easily to be handled due to their nature and concrete features. On the other hand, people in specific regions of the globe will be much more affected by lack of vital resources and this will force them to move. In this regard, Europe is one and most probable option for those looking salvation and this will be a great challenge to policy and decision makers in the Union. Development of appropriate strategies, policies, programs and plans in timely manner for alleviation of future stressors could significantly contribute EU security and stability in the decays to come. The research paper pays more attention to some of the indirect impacts to European security and searches possible solutions – what immediate mitigation and adaptation measures to climate change impacts are necessary.

Keywords: security, climate, global warming, EU, European security

Introduction

It's been written a lot about climate change¹ - if it is real, if it is naturally evolving or it is a human-instigated process, and most important if it will cause significant changes to the future security environment at regional and global level. Climate change is a normal process that happens periodically in the latest thousands of years, but there are some significant differences to those changes happened so far and the variations of the climate happening now. The main discrepancy could be found in the leap in which the main causes occur and in the pace of the impacts arise. Global warming is one of the climate and environment change facets, and it is considered to be one of the most significant threats to human beings in the decades and centuries to come.

Establishing in 1988 the Intergovernmental Panel on Climate Change (IPCC), United Nations agreed that urgent measures are needed. All following UN strategic documents in respective field confirm global motivation for decisive measures in respective field. On the other hand, the results significantly differ to the preliminarily declared commitments, which

¹ "Climate change" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods, UNFCCC, 1992, Art. 1, para 2, available at https://unfccc.int/essential_background/convention/items/6036.php (accessed October 10, 2017).

undermines the Parties' efforts in regard to climate change. The main reason for this is hidden in the fact that the climate change is not only environmental problem but political, economic and ethical issue and in these three interconnected elements is the key of the problem solving. It has been repeatedly stressed by IPCC that temperature two degrees higher than pre-industrial levels would dramatically affect local and global ecosystems and will threaten their ability to adapt. In turn, this will jeopardize both biodiversity and livelihoods of millions of people and immediate mitigation and adaptation actions are needed. The impact on the security environment, how it would change, who is going to be the most affected and how all climate system elements will interact is far from clear. Rising temperatures and related to them negative effects are going to have not only physical but predominantly political dimension globally and in Europe². Global warming is distressing all regions in Europe, but the effects are not uniform. Ecosystems and human activities in the Arctic, Tropical and Sub-Tropical regions will be strongly affected due to the fast increase in air and sea temperatures and associated water stress. European Union (EU) is one of the main greenhouse gases (GHGs) contributors and should play leading role in both - mitigation of the effects and adaptation to the changing environment. The Union is doing so in regard to direct (first-order) impacts to its security

² For the research purpose 'Europe' refers predominantly the territory and policy of European Union (EU) and respectively its contemporary and future member countries.

and stability. Additionally, EU should develop comprehensive strategies in cooperation with all parties involved to how indirect (second-order) effects³ of the phenomenon could be addressed.

Climate Change

Background

The climate has been constantly changing since the Earth was formed 4.5 billion years ago, so such change of planet climate is normal and expected. In general, global climate depends on various factors which could be confined into two main groups – related to how the Earth interacts with the Sun (Milankovitch cycles) and what kind of processes occurred on the planet itself (Carbon Cycle). Going 800 000 years back, we could see that the climate has changed periodically following a relatively strict pattern including couple of global warmings and ice ages in periods of 125 000 years.⁴ A direct correlation between temperatures, CO₂, CH₄ and atmospheric dust could be observed which with some minor exceptions follows the above mentioned outline. Water vapor along with Carbon dioxide (CO₂)⁵, Methane (CH₄), Nitrous Oxide (NO₂) and the group of so called F-gases [Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF₆)] form the GHGs which

³ Refer to those impacts caused by lack of coping capacity (insufficient adaptation measures) in groups, society or country and causing tension, conflict, war, IDPs, humanitarian crisis, refugee and migrant flow.

⁴ Global Monitoring Division, National Oceanic and Atmospheric Administration, <https://www.esrl.noaa.gov/gmd/ccgg/trends/history.html> (accessed October 10, 2017).

⁵ Including CO₂ from Fossil Fuel Combustion, Industrial Processes and Forestry and Other Land Use (FOLU).

make the Earth so hospitable and maintain favorable living conditions on the planet. Nowadays, the global average surface temperature is 14°C (57°F), which is approximately 33°C (59°F) warmer than temperature would be without an atmosphere and GHGs.⁶

Climate changes all the time and discussing the latest variations we should define how it differs to those occurred so far. Firstly, we should take into account the *level* of the contemporary change. Never in the last almost one million years, GHGs rate have not been at such a high degree. Usually, CO₂ has varied from 180 to 280 ppm (parts per million) for the above-stated period. Secondly, according to the latest scientific results, now, CO₂ is at level 406 ppm and the *pace* of this increase is 2.5 ppm yearly⁷ which is an unprecedented growth so far.

Anthropogenic GHG emissions have dramatically increased since the beginning of Industrial era (1750) forced by enlarged population and economic growth. From 1870 to 2015 in the atmosphere were exuded more than 2100 GtCO₂-eq when 40% of them are still there. As the Climate change 2014 Synthesis Report⁸ posits, the effects, together with those of other anthropogenic drivers, have been detected throughout the

⁶ Global Monitoring Division, National Oceanic and Atmospheric Administration, <https://www.esrl.noaa.gov/gmd/ccgg/trends/history.html> (accessed October 10, 2017).

⁷ Global Monitoring Division, National Oceanic and Atmospheric Administration, <https://www.esrl.noaa.gov/gmd/ccgg/trends/global.html> (accessed October 10, 2017).

⁸ Climate Change 2014 Synthesis Report, IPCC, 2014, available at <http://www.ipcc.ch/report/ar5/syr/> (accessed October 10, 2017).

climate system and are *extremely likely* to have been the dominant cause of the observed warming since the mid-20th century.⁹ Furthermore, half of these GHG emissions were exuded in the latest 40 years as their amount exceeds 48 GtCO₂-eq/yearly¹⁰ in 2015 and has increased by 2.2% per year since 2000. In result of increasing GHGs level, the globally averaged combined land and ocean surface temperature shows a warming of 0.85°C since 1850.

In response to the unprecedented GHG levels, the UN Framework Convention on Climate Change (UNFCCC) was adopted in 1992. The main objective of the document is greenhouse gas concentrations to be stabilized at a level that would allow ecosystems to adapt naturally, ensure food production, and enable sustainable economic development to the Parties. In accordance with article 7 of the UNFCCC, Kyoto Protocol was signed in 1997 for the period 2008 – 2012 and in 2012 Doha Amendment to the document was agreed for the period 2013 – 2020. The Protocol places a heavier burden on developed countries under the principle of "common but differentiated responsibilities." It is important to be mentioned

⁹ Ibid, p. 4.

¹⁰ CO₂-equivalent per year is formed by CO₂ from Fossil Fuel Combustion and Industrial Processes; CO₂ from Forestry and Other Land Use (FOLU); Methane (CH₄); Nitrous Oxide (N₂O); Fluorinated gases covered under the Kyoto Protocol (F-gases). More information to FOLU is available at <http://www.fao.org/resources/infographics/infographics-details/en/c/218650/> (accessed October 11, 2017).

that neither China¹¹ nor U.S.¹², which contribute the most for the level of the exuded emissions, have any agreement bindings.

The following 'milestone' document of the Conference of the Parties (COP 21) was the Paris climate accord dated November 2015. It brought all Parties of the Convention in a shared basis to strengthen the global response and undertake ambitious action in mitigation of causes and adaption to the impacts of global warming. The document depicts the Parties intent to keep global temperature well below 2 degrees Celsius above pre-industrial levels as the most ambitious goal of the paper is to limit the global warming up to 1.5 degrees Celsius by the end of 21st century.¹³¹⁴ The document was seen as the most promising step by now in addressing the climate change as every Party put it proposal based on voluntary base how it is going to curb its GHGs and subsequently pressing each other to do so through [climate] diplomacy.

U.S. pulled out of Paris accord this year (2017), and doing so the U.S. President indicated that the country is not ready to make compromises to its economic interests. Under the accord,

¹¹ China GHGs for 2015 are estimated for 12.0 GtCO₂-eq/yearly or 25 % as the country has increased at 380% its GHGs since 1990, source: <http://climateactiontracker.org/about.html> (accessed October 10, 2017).

¹² United States GHGs for 2015 are estimated for 6.6 GtCO₂-eq/yearly or 7.7 % as the country maintain its 1990 GHGs level, source: http://di.unfccc.int/time_series (accessed October 10, 2017).

¹³ Paris Agreement, COP 21, Article 2, November 2015, p. 22, available at https://unfccc.int/paris_agreement/items/9485.php (accessed October 10, 2017).

¹⁴ This Research paper uses 1990 as a basic year and three different timeframes defined during the Conferences of the Parties: 2030 as period forming the trends in mitigation measures; 2050 as a strategic horizon for changes; 2100 as long-term prognostic and adaptation scope.

the United States had pledged to cut its greenhouse gas emissions from 26 to 28 percent below 2005 levels by 2025 and commit up to \$3 billion¹⁵ in aid for poorer countries by 2020.¹⁶

IPCC Scenarios by 2100

The Intergovernmental Panel on Climate Change (IPCC) was set up in 1988 by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP). It is the international body that through its Assessment, Methodology, and Special Reports provides policymakers in the parties with regular appraisal of the scientific basis of climate change, its impacts and future risks, options for adaptation and mitigation. IPCC is supported by more than 1300 experts/authors and it covers the full scientific, technical and socio-economic aspects of global warming and has a vital role in establishing a framework for common understanding and addressing of the anthropogenic changes in the climate. Based on the findings in the latest Fifth Assessment Report, the Parties agreed that the global mean temperature should not surpass 2.0 degrees Celsius (3.6°F). Two degrees Celsius is not a specific number that will ensure secure future but rather a goal to be pursued and achieved when taking into account contemporary situation and real climate related numbers. As

¹⁵ More information for Parties' funding commitments could be found at <http://www.greenclimate.fund/home>.

¹⁶ Michael D. Shear, "Trump Will Withdraw U.S. From Paris Climate Agreement", *New York Times*, June 1, 2017, available at <https://www.nytimes.com/2017/06/01/climate/trump-paris-climate-agreement.html> (accessed October 10, 2017).

higher climate system temperature increases as much environmental changes is going to occur and security level will decrease as of lack of adaptation time.

The mean surface temperature depends on CO₂-eq concentrations in the atmosphere. On the other hand, it is connected to cumulative anthropogenic CO₂ emissions to certain moment. Using individual model studies, we could say that the aimed 2°C could be achieved if the CO₂-eq concentrations is less than 500 ppm in 2100. It could be achieved through global GHGs reduction by 25-50% by 2050 and subsequent 85% decrease by 2100. If we continue to exude the exact same amount of emissions, the temperature will raise from 2.2 to 2.8°C by the end of 21st century. Furthermore, 25-50% increase of the emissions by 2050 is to inflict 3.2-3.6°C increase by 2100. Following the same trends of emissions escalation it is likely global mean surface temperature to increase from 3.8 to 4.6°C by 2100.¹⁷ The level of increasing of the climate system surface temperature depends on overall Parties' Intended Nationally Determined Contributions (INDCs) and at what extend they follow their obligations. As per the commitments, since 2015, only U.S. and EU, representing some of the most significant polluters, have announced their pledges - decrease in GHGs emissions

¹⁷ Climate Change 2014 Synthesis Report, IPCC, 2014, p. 78, available at <http://www.ipcc.ch/report/ar5/syr/> (accessed October 10, 2017).

compared to 1990 by 26-28% up to 2025¹⁸ and 40% by 2030¹⁹ respectively. It is vital to be mentioned that the efforts put in reduction of exuded gases by the Parties up to 2030 will define the possible pathways thereafter and could significantly reduce or increase the efforts needed in achieving the targets afterwards. On the other hand, China demonstrates it will to support international community efforts as its commitment in leashing global warming is to reach its peak of GHGs emission around 2030 and to make best efforts to peak early.²⁰ After U.S. President Trump announcement that the country will look for a new “fare” treatment, only EU has a concrete and ambitious obligation to Paris climate accord main goal achievement.

Based on 2015 INDCs communicated by 97% of the parties, the latest UNFCCC Synthesis Report depicts expected GHG emissions at about 55.0 Gt CO₂-eq in 2025 and 56.2 Gt CO₂-eq in 2030 or 8% increase to 2010.²¹ The facts above leads us to one of the unfavorable scenarios pointed hereinbefore and if the trends go in this way the temperature is to increase from 2.8 to 3.2°C by 2100 and most important it will continue to rise due to the cumulative features of the climate system.

¹⁸ United States Mid-Century Strategy for Deep Decarbonization, the White House, Washington, U.S., November 2016, p. 4.

¹⁹ Intended Nationally Determined Contribution of the EU and its Member States, EU Commission, March 6, 2015.

²⁰ Enhanced Actions on Climate Change: China's Intended Nationally Determined Contributions, July 2015, available at http://www.china.org.cn/environment/2015-06/30/content_35950951.htm (accessed October 12, 2017).

²¹ Aggregate effect of the Intended Nationally Determined Contributions: Synthesis report by the secretariat, UNFCCC – COP22, Marrakesh, Morocco, 2016, p. 43, available at <https://climateobserver.org/reports/aggregate-effect-intended-nationally-determined-contributions-update/> (accessed October 12, 2017).

Different level of the global mean surface temperature refers to diverse negative impacts to the security environment and respectively will require specific adaptation measures. Adaptation and mitigation are corresponding approaches for reducing threats and risks of climate change impacts and should interact with one another and reduce negative effects over different periods. Precise and preliminary analysis of the most probable and significant in their impact not only direct but second-order future threats could give to the European Union advantage in coping with the anticipated negative scenarios.

The most significant direct impacts of global warming pointed out in INDCs of the Parties and summarized in COP 22 Synthesis Report are: floods, droughts, higher temperatures, sea level rise, storms, change in precipitation patterns, vector-/water-borne diseases, desertification/land degradation, ocean acidification and coastal erosion. It is very likely in fragile countries that lack of stable governance, resources, adaptation measures and capacity to cope with the direct impacts specific groups or whole society to be affected causing tension, conflict, war, IDPs, humanitarian crisis, refugee and migrant flow.

Climate Change effects on European Security

Climate security should be considered as a part of a comprehensive approach to security taking into account all its dimensions and levels – individual, societal, state, regional and

global and how the main instruments of power, for those that possesses all of them (countries do, alliances not quite much), could be used in achieving the desired security levels. Additionally, climate security in broad security context should be considered as a dynamic condition in which the main interests and cherished values of a system i.e. person, group, country, union or humankind are guaranteed. In this regard, a *crisis*²² could be defined as a dynamic condition when the security level of a system is at undesired low level.

In common sense, climate security could not be closely related to militarization of the issue but as global warming is broadly viewed as a ‘threat multiplier’²³ use of military in case of crisis response²⁴ or disaster relief operations would not be an exception but rather trend which deteriorates.

European security is a delicate dynamic balance between all levels of internal security of the Union and those aspects related its external security. Addressing the main vulnerable elements and thus increasing their resiliency through proper and well-timed policies could maintain EU security at desired level. Now, the focus of EU activities is to fight crime, terrorism, and illegal trafficking, smuggling, improve the resiliency of critical infrastructures, border management strengthening,

²² In this paper the term is used from state and governmental perspective.

²³ National Security and the Threat of Climate Change, CNA, WG, 2007, p. 44, available at <https://www.cna.org/research/> (accessed October 10, 2017).

²⁴ As of October, 2017, EU conducts six military operations in the framework of a comprehensive approach, https://eeas.europa.eu/headquarters/headquarters-homepage_en/430/Military%20and%20civilian%20missions%20and%20operations, (accessed October 25, 2017).

cyber security improvement, better response to crises and disasters through common capabilities, enhanced standardization and interoperability of systems, strengthened external security policies and ensured personal freedom and privacy (including informational).

A. Direct. Climate change merges in specific manner physical and human instigated sudden or slow-onset disasters as anthropogenic changes blurs the line between different types of calamities. The observed increase in heat waves has had significant effects on human health, in particular in cities. In July 2003, France was hit by heat wave and more than 14 000 people have lost their lives due to the extreme weather. The latest forest fires in Portugal and Spain (October 2017) fanned by the hurricane Ophelia are example for a disaster caused by complex climate change reasons.

In its 2016 Report ²⁵, European Environment Agency points out the main observed and projected climate change impacts for the main biogeographical regions in Europe including Arctic, Mediterranean, Atlantic, Boreal, Continental, and Mountain regions as well as Coastal zones and regional seas as it is highly probable the main global warming effects on the continent to be as follows:

a. Arctic region: temperature rise much larger than global average, decrease in Arctic sea ice coverage, decrease in

²⁵ Climate Change, Impacts and Vulnerability in Europe 2016: An Indicator-based Report, EEA, 2017, available at <https://www.eea.europa.eu/publications/climate-change-impacts-and-vulnerability-2016> (accessed October 16, 2017).

Greenland ice sheet, decrease in permafrost areas, increasing risk of biodiversity loss, and risks to the livelihoods of indigenous peoples;

b. Coastal zones and regional seas: extreme weather events, sea level rise, increase in sea surface temperatures, increase in ocean acidity, northward migration of marine species, risks and some opportunities for fisheries, changes in phytoplankton communities, increasing number of marine dead zones, increasing risk of water-borne diseases;

c. Atlantic region: increase in heavy precipitation events, increase in river flow, increasing risk of river and coastal flooding, increasing damage risk from winter storms, decrease in energy demand for heating, increase in multiple climatic hazards;

d. Mountain regions: temperature rise larger than European average, decrease in glacier extent and volume, upward shift of plant and animal species, high risk of species extinctions, and changes in hydropower potential, decrease in winter tourism;

e. Continental region: increase in heat extremes, decrease in summer precipitation, increasing risk of river floods, increasing risk of forest fires, decrease in economic value of forests, and increase in energy demand for cooling;

f. Mediterranean region: large increase in heat extremes, increasing risk of droughts, increase in number of forest fires, decrease in precipitation and river flow, increasing risk of

biodiversity loss, increasing risk of forest fires, increased competition between different water users, increasing water demand for agriculture, decrease in crop yields, increasing risks for livestock production, increase in mortality from heat waves, expansion of habitats for southern disease vectors, decreasing potential for energy production, increase in energy demand for cooling, decrease in summer tourism and potential increase in other seasons, increase in multiple climatic hazards, most economic sectors negatively affected, and *high vulnerability to spillover effects of climate change from outside Europe*.²⁶

B. Indirect. The melting Arctic sea ice will affect biodiversity, permafrost, and will make more accessible the resources²⁷ in the region causing so called 'Arctic paradox'. The contradiction there comes from the efforts that are in place in order to preserve the region and the opportunities that melting ice give in mining, drilling and shipping²⁸ – as much fossil fuels and natural gas we use from there as much we increase the global warming. So far, it was a zone for a military confrontation between limited numbers of countries. Now, it becomes a place for economic interests in which not only Arctic states is to be

²⁶ Climate Change, Impacts and Vulnerability in Europe 2016: An Indicator-based Report, EEA, 2017, p. 25, available at <https://www.eea.europa.eu/publications/climate-change-impacts-and-vulnerability-2016> (accessed October 16, 2017).

²⁷ The Arctic environment European perspectives on a changing Arctic, EEA Report, 2017, available at <https://www.eea.europa.eu/publications/the-arctic-environment/> (accessed October 20, 2017).

²⁸ Cristine Russell, "The Arctic Paradox Poses Questions about Sustainable Development", Scientific American, November 5, 2015, available at <https://blogs.scientificamerican.com/guest-blog/the-arctic-paradox-poses-questions-about-sustainable-development/> (accessed October 17, 2017).

involved.²⁹ Russian claims on the Arctic continental shelf are clear and undoubtedly it will be the main player there using all available instruments to do so. In this regard, the threat we stare to the East is to be from the North.

EU should analyze negative effects are to come from the North and respectively look for sustainable solutions in various areas including environment degradation, vast resources of hydrocarbons minerals there and their output, and balanced fisheries. Thus a variety of measures are required, some of a joined and coherent nature, to meet multiple security needs. The threats that the Arctic poses to European security are more solvable due to their specifics. All mitigation and adaptation measures that the Union and the other Arctic Council member states take make them less threatening. Much more concerns EU should pay to the second-order impacts that climate change would have to European security and stability coming from the South – Tropical and Sub-tropical countries in Africa and Asia.

Climate change alone could not be a factor that causes a crisis in a certain region/country but should be considered from population growth, economic development, urbanization, industrialization, globalization³⁰ perspectives and related to them access to main resources. Additionally, the main two characteristics of the population that should be taken into

²⁹ China and the Arctic Polar Bearings, The Economist, July 12, 2014 available at <https://www.economist.com/news/china/21606898-china-pursues-its-interest-frozen-north-polar-bearings>, (accessed October 20, 2017).

³⁰ The term includes the main interrelated political, economic, informational, environmental, social, and technological aspects.

account are its *exposure* and *vulnerability/resiliency* to particular stressors, threats and risks. The state stability could be threatened not from climate change itself, but rather from how all factors above interact and the government ability in assuring of basic resources.³¹ If state administration is not able to balance between main factors, security drops below acceptable level and part of state independence, sovereignty and territorial integrity could be threatened and even lost - the threat could come both from state and non-state actors inside and outside the country. Deepening of the crisis could result in tension, conflict, war and related to them human suffering. On the other hand, the humanitarian crisis creates four distinct groups of people that have specific status and needs which should be addressed including: internally displaced persons (IDPs), asylum seekers, refugees, and migrants. Regarding the nature of movement of the affected people, five different scenarios, either individually or together, could drive people to leave their habitat: Sudden-Onset Disaster, Slow-Onset Disaster and Environmental Degradation, People displaced from Small Island States, Designation of High-Risk Zones, Climate Change-Induced Unrest, Violence and Armed Conflict.³²

³¹ Werrell, Caitlin E. and Francesco Femia. "Climate Change, the Erosion of State Sovereignty, and World Order." *The Brown Journal of World Affairs* 22, no. 2 (Spring, 2016): 221-235, available at <https://search.proquest.com/docview/1825596753?accountid=31553> (accessed October 16, 2017).

³² Jane McAdam et al., "Climate Change and Displacement", Hart Publishing, Portland, USA, 2012, 86-92.

In searching next threats to European security we should follow the same patterns but should be more progressive – in terms to widen our scope and world outlook in order to foreseen the main possible scenarios. In this regard, the most vulnerable to climate change, respectively with concrete implication to EU security, are the countries situated in Northern Africa and Middle East. To these regions is necessary to be added Eastern, Central and Western Africa as well as Southern Asia - from Morocco to Bangladesh and from Democratic Republic of Congo to Afghanistan.

European security could be threatened by instability in the periphery of the continent but not only. As of the changes that have occurred since mid-twentieth century - population and economic growth/decline combined with globalization, processes far from Europe could affect significantly our security landscape. Now, we are witnessing how seemingly stable countries could be destabilized by at prima facie not significant reasons and to cause dramatic changes in security environment. Tunisian Revolution in 2011 and followed Arab Spring are illustrative examples for such processes. The main indicators for upcoming tension could be long-standing and corrupted heads of state and/or government, dictatorial oppression, religious extremism, social inequalities, unemployment, political repression, and unbalanced population growth and economic development.

The ongoing Syrian civil war is an example for all of the above. For more than 50 year Assad family has governed the country. For this period of time the population has increased three times and most of it relied on agriculture and farming. The government, respectively, counted on oil export to form country budget. The Economic crisis in 2008 caused decline of oil price and forced the government to reduce its social spending. Additionally, four years of unprecedented droughts from 2007 to 2010 drove many farm families to flee to cities. Such a short period of time influx contributed to additional social tensions already created by refugees coming from Iraq. The drought also pushed up main product prices and exacerbated the crisis further more.³³ In this case, the water stress, which is very likely to be caused by global warming, is not the main reason for the war and connected to it humanitarian crisis, but it helped kick things over the edge into political-military crisis. The subsequent effects to European security could be seen in migrant influx, terrorism, radicalism, cybercrimes, organized crime, trafficking, smuggling, corruption³⁴, tension between EU countries, far-right parties are more distinctly represented in the governments, EU integrity is partially jeopardized, etc.

³³ Mark Fischetti, "Climate Change Hastened Syria's Civil War", Scientific American, March 2, 2015, available at <https://www.scientificamerican.com/article/climate-change-hastened-the-syrian-war/> (accessed October 17, 2017).

³⁴ The European Agenda on Security, European Commission, European Union, 2015, available at https://ec.europa.eu/home-affairs/what-we-do/policies/european-agenda-security_en (accessed October 18, 2017).

Nowadays, in Southern Asia and Northern Africa live more than 2 billion people with median age of total population 25 years and average rate of population change 1.35% and 2.0% yearly for Southern Asia and Northern Africa respectively.³⁵ Two countries from every region could be used as an example for emerging humanitarian crisis – Egypt and Bangladesh. In 2015, Egypt population was 94 million people and the average rate of population growth is 2.2% yearly with median age of 25 years. Population expectancy for 2030 is for about 115 million people. Egypt is extremely vulnerable to mean sea level rise. The capital city Cairo (20 million inhabitants) is to be significantly affected by expected increase of water level. Most of the Egyptians live along the Nile River and its delta and the longest river in the world is vital for their life. The country depends on agriculture production and oil export and every disturbance in climate patterns and world market will have a dramatic effect to country security and scenarios similar to this in Syria are highly probable.³⁶

On the other hand, as of 2015, the population of Bangladesh was 161 million people, the average rate of population change is 1.2% yearly and median age of total population 26 years. Country's location and topography make it exceptionally vulnerable to climate change. One meter sea level rise will

³⁵ 2017 World Population Prospects, Population Division, Department of Economic and Social Affairs, United Nations Secretariat, 2017, available at <https://esa.un.org/unpd/wpp/Download/Standard/Population/> (accessed October 16, 2017).

³⁶ Daniel Moran et al., "Climate Change and National Security: A Country-Level Analysis", Georgetown University Press, Washington, D.C., USA, 2011, 177-186.

submerge 20% of the country and such scenario is expected in the next decades. Additionally, the cyclones in the years to come are expected to be more often and intense which will affect the main great deal of people there.³⁷ In 2009 at Copenhagen climate summit (COP15), Bangladesh finance minister called on the wealthy countries to accept millions of displaced people as up to *20 million Bangladeshis* may be forced to leave the country in the next 40 years [as per 2009] because of climate change. Neighboring countries, India and Myanmar, are not an option as religious discrepancies and their own climate issues to deal with. Furthermore, sea level rise over the next 50 years would have profound effects on 1.5 billion people who presently live in coastal areas. In this regard, the Intergovernmental Panel on Climate Change (IPCC) has announced there could be *200 million climate change migrants by 2050*.³⁸

In 2010, the Conference of the Parties, on its sixteenth session (COP16), recognized the need of more efforts in understanding, coordination and cooperation with regard to climate change induced displacement, migration and planned relocation, where appropriate, at the national, regional and international levels³⁹

³⁷ Ibid, 103-112.

³⁸ Harriet Grant, James Randerson and John Vidal, "UK should open borders to climate refugees", The Guardian, November 5, 2009, available at <https://www.theguardian.com/environment/2009/nov/30/rich-west-climate-change> (accessed October 16, 2017).

³⁹ 2010 Cancun Adaptation Framework, United Nations Framework Convention on Climate Change (UNFCCC), 2010, Para 14 (f), available at <http://unfccc.int/adaptation/items/5852.php> (accessed October 06, 2017).

which was a response to growing in its importance issue to climate refugees and migrants.

Regarding the numbers, lack of substantive diversification of the economy, the reliance of agriculture, political instability, and deterioration in climate change effects, the *migrant influx* towards Europe will continue to fluctuate and deteriorate in the future and it will face the continent to deepening security challenges.

EU Policies

EU member states as a part of international community have obligation in decreasing of GHGs and they step up jointly to reduce the emissions through more efficient use of less polluting energy, transport, environmentally-friendly and sustainable agriculture, land use, and cities, and more climate-resilient societies. EU efforts in mitigation, adaptation, and international cooperation fields are posited in its strategies, policies, programs, plans, legislation, and different initiatives. All Union strategic documents are incited by member states and after broad discussions and consultations are unanimously adopted. Common decisions at union level plays role of a framework for the states and all of them are encouraged to align their national policies for achieving of high level of efficiency in persuading of shared goals.

Existing EU Policies

Mitigation. Along with UNFCCC, Kyoto Protocol, and Paris Accord, in 2015, UN agreed its 17 global Sustainable Development Goals (SDGs)⁴⁰. One of the priorities for sustainable development⁴¹ pointed there is immediate climate action. The most challenging in achieving of high level effectiveness in covering of 2030 agenda is finding the interconnection between the main goals as their complexity and intricacy.

In its *7th Environment Action Program (EAP)* 'Living well, within the limits of our planet', EU formulates a vision of the future by 2050 through a low-carbon society, a green economy and resilient ecosystems as the basis for citizens' well-being. The 7th EAP expresses that action to mitigate and adapt to climate change will increase the resilience of the EU's economy and society, while stimulating innovation and protecting the EU's natural resources.⁴²

Moreover, in set of decisions from 2007 to 2012, the Union adopted its *Climate and Energy Package*. Through the documents, EU aims to reduce emissions of greenhouse gases and sets ambitious targets to be fulfilled up to 2020 including: 1)

⁴⁰ 2030 Agenda for Sustainable Development, UN, 2015, available at <http://www.un.org/sustainabledevelopment/development-agenda/> (accessed October 20, 2017).

⁴¹ "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." – UN definition.

⁴² Environment Action Programme to 2020, European Commission, 2014, available at <http://ec.europa.eu/environment/action-programme/>, (accessed October 20, 2017).

decreasing greenhouse gases by at least 20% of 1990 levels; 2) cutting energy consumption by 20% through improving energy efficiency as the main Union document in this field is its Energy Strategy 2020⁴³ which main goals are reflected in consequently developed national Energy Strategies, and; 3) increasing use of renewable energy sources to 20% of total energy production. All of the aims is to be achieved through binding national targets and monitoring to their covering. The main benefits is to be: 1) contribution to combating climate change; 2) example to rest of the world; 3) more secure energy supplies and less expenses yearly for oil and gas imports; 4) competitive advantage through significant innovation in the European energy sector; 5) more jobs in environment-related industries; 6) and less air pollution.

EU Emissions Trading System (EU ETS) ⁴⁴ is vital part of Union's approach to harnessing GHGs and it works by putting a limit on overall emissions from covered installations which is reduced each year. Additionally, within imposed limits, companies can buy and sell emission allowances as needed. This 'cap-and-trade' approach gives companies the flexibility they need to cut their emissions in the most cost-effective way. EU ETS goes through four phases: 1st trading period (2005-2007) constituted a process of 'learning by doing'. In the 2nd

⁴³ Energy 2020: A strategy for competitive, sustainable and secure energy, EU, 2010, available at <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/2020-energy-strategy>, (accessed October 20, 2017).

⁴⁴ The EU Emissions Trading System (EU ETS), DG Climate Action, European Commission, available at https://ec.europa.eu/clima/policies/ets_en, (accessed October 23, 2017).

trading period (2008-2012), the number of allowances was reduced by 6.5%. It is worth to be mentioned that the aviation was brought into the system in 2012. Now, the 3rd trading period is into force (2013-2020) and the most significant challenge is an EU emission reduction by 1.74% each year. For the 4th trading period (2021-2030) a legislative proposal for the revision of the EU ETS was presented by the European Commission in July 2015 on *The 2030 Climate and Energy Policy Framework* and aims to achieve a 43 % reduction in EU ETS emissions compared to 2005 levels as overall number of allowances to decline at 2.2% yearly responding to important emissions reduction. Additionally, it sets two more targets for the year 2030: at least 27% share for renewable energy and at least 27% improvement in energy efficiency.

The last strategic EU document aiming to tackle the changing climate is its *2050 Low-Carbon Economy Roadmap* which suggests by 2050 greenhouse gas emissions to be cut to 80% below 1990 levels using as main milestone cuts at 60% by 2040. All EU targets are ambitious, bold and demanding but only through such measures the global mean surface temperature could be kept well below 2 degrees Celsius and further deterioration in climate system negative effects to be avoided.

Adaptation. *The EU White Paper*⁴⁵, adopted in 2009, sets out a framework to reduce the EU's vulnerability to the impact of climate change. The framework is set out to evolve as further signals become available. It will complement action by Member States and support wider international efforts to adapt to climate change, particularly in developing countries.

The EU Strategy on Adaptation to Climate Change, adopted 2013, establishes a framework and mechanisms for taking the EU's preparedness for current and future climate impacts to a new level as focuses on promoting action by Member States through revision of a comprehensive adaptation strategies and providing funding to help them build up their adaptation capacities.⁴⁶ Climate change adaptation practice is already happening across Europe. Most of the EU Member States have a national-level adaptation strategy in place that can guide regions, municipalities, cities, sectoral authorities such as those responsible for water management, public health, business and individuals to define their own way forward. To be successful, the planning process has to be based on a pure understanding of what is expected to happen in the future and how that can impact the people in respective region/state. Furthermore, it has to consider impacts and responses across a wide range of

⁴⁵ White Paper: Adapting to Climate Change: Towards a European framework for action, European Commission, 2017, available at <https://www.eea.europa.eu/policy-documents/white-paper-adapting-to-climate>, (accessed October 20, 2017).

⁴⁶ EU Strategy on Adaptation to Climate Change, European Commission, 2013, available at https://ec.europa.eu/clima/sites/clima/files/docs/eu_strategy_en.pdf, (accessed October 23, 2017).

policy sectors, such as *agriculture, forestry, health, water, biodiversity & ecosystems, infrastructure*, etc. Full engagement of the private sector and private finance is also a significant task for the future.⁴⁷

Additionally, climate change adaptation requires applying of disaster risk reduction (DRR) practices as a comprehensive approach in managing the risks of physical, technological, and human-induced disasters. The *Sendai Framework for Disaster Risk Reduction* calls for reduction of exposure and vulnerability at all levels, tackling disaster risk drivers, especially those consequences of poverty and inequality, climate change, urbanization, poor land management, demographic change, weak institutional regulations, limited availability of technology, unsustainable uses of natural resources. The framework postulates four main priorities regionally, nationally and globally applicable including understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster risk reduction for resilience, and enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction.^{48,49} Similarly to Climate Change Adaptation Strategies and Actions Plans, every

⁴⁷ Climate Change Adaptation Practice Across the EU, European Commission, 2013, available at <http://climate-adapt.eea.europa.eu/metadata/publications/climate-change-adaptation-practice-across-the-eu>, (accessed October 23, 2017).

⁴⁸ Climate change adaptation and disaster risk reduction in Europe Report, European Commission, 2017, available at <https://www.eea.europa.eu/publications/climate-change-adaptation-and-disaster>, (accessed October 16, 2017).

⁴⁹ Sendai Framework for Disaster Risk Reduction, UNISDR, 2017, available at <http://www.unisdr.org/we/coordinate/sendai-framework>, (accessed October 23, 2017).

country is encouraged to develop its own Disaster Risk Strategy, Programs and Plans for implementation amplifying national Disaster Risk Management Process. In regard to the Response capacity and Relief capabilities, every state develops its own. In 2001 EU, the Union established its own Civil Protection Mechanism and EU member state or any other country in the world can call on the EU for support through the Mechanism. Since its launch, the EU Civil Protection Mechanism has monitored over 300 disasters and has received more than 200 requests for assistance.⁵⁰ Likewise, NATO mechanism through Euro-Atlantic Disaster Response Coordination Center (EADRCC) has been established by member countries of the Alliance and has worked since 1998.

Climate change tackling activities are an integral part of the EU's foreign policy agenda. Through *climate diplomacy and cooperation initiatives*, the Union aims to build political will and trust to advance global action, establish effective cooperation in support of sustainable development, and build capacity in support partner countries adaptation efforts. Regarding some of the indirect impacts that affect EU security, the Union through the European Commission puts as its main priorities climate change and migration, along with jobs, growth and investment, justice and fundamental rights. Furthermore, the EU Foreign and Security Policy through the Union's Common Defense and

⁵⁰ More information is available at http://ec.europa.eu/echo/what/civil-protection/mechanism_en, (accessed October 23, 2017).

Security Policy addresses peace strengthening, international security and promotes international cooperation. On the other hand, through its European Neighborhood Policy (ENP), the EU works with its eastern and southern neighbors to foster stabilization, security and prosperity, in line with the *European Union Global Strategy* for the Foreign and Security Policy. Establishing EU-Africa Infrastructure Trust Fund, Africa-EU Energy Partnership⁵¹ and investing in empowering rural communities in Africa, the EU demonstrates its commitment in supporting sustainable development in Africa. Doing so, the Union tries to support development, prevent tension or to tackle with potential crises which are in its periphery in very early moment.

Due to the migrant influx and its unprecedented pressure over Member States' asylum systems, in the last couple of years, the EU put great deal of efforts in saving lives at sea, targeting criminal smuggling networks, responding to high-volumes of arrivals within the EU through relocation, and working in partnership with third countries to tackle migration upstream. Additionally, in 2015, the Union adopted its *Agenda on Migration*⁵² which is based on four main pillars which will facilitate in reducing the incentives for irregular migration,

⁵¹ In April 2014, the Commission announced grants of €95 million for 16 projects across nine African countries (Madagascar, Burkina Faso, Senegal, Cameroon, Liberia, Tanzania, Sierra Leone, Eritrea, Rwanda), available at https://ec.europa.eu/clima/policies/international/paris_protocol/energy_en, (accessed October 24, 2017).

⁵² European Agenda on Migration, European Commission, 2015, available at https://ec.europa.eu/home-affairs/what-we-do/policies/european-agenda-migration_en, (accessed October 24, 2017).

improve border management, apply stronger common asylum policies, and introduce new policy on legal migration. In support of fulfilment of its home policies, in 2015, the EU established *European Border and Coast Guard Agency* built from the Member States' authorities responsible for border management and Frontex, who will continue to exercise EU external border management. Doing this, the Union demonstrates its firm commitment in applying strict and consistent policies related to illegal migration which is highly probable to deteriorate in the years to come.

In regard to changing security environment in the Arctic, in 2016, EU adopted its *Integrated Arctic Policy* focusing its efforts in three priority areas - climate change and safeguarding the Arctic environment, sustainable development in and around the Arctic, and international cooperation on Arctic issues. In Arctic council format, the Union searches different adaptation approaches through development of strategies for protecting the environment, support for sustainable innovations, investments, secure maritime activities, scientific cooperation, fisheries management, and dialogue with Arctic indigenous peoples.⁵³

Evaluation. In the last fifteen years, EU set a solid basis of its climate change overall policy. The first main area in which the Union put a lot of efforts is reducing of GHGs emission for

⁵³ An integrated European Union policy for the Arctic, European Commission, April 27, 2016, available at <https://ec.europa.eu/jrc/en/news/integrated-eu-policy-arctic-adopted>, (accessed October 24, 2017).

mitigating of consequential impacts. Now, the Union, as one of the biggest pollutant, follows the contemporary adopted policies and the pace of the main targets covering and its future goals show that EU will be able to meet the requirements for maintaining the global mean surface temperature well below 2°C but, unfortunately, it is not an individual but rather that a global 'game' and every single player/state should contribute in the same manner. In regard to adaptation measures to direct impacts on the continent that the Union takes, as the second major component of EU efforts to tackle global warming, it could be decisively said that EU uses wide-ranging approach and analyzes the future environment and how it will affect the security and stability on the continent. Moreover, the Union makes amendments and develops capacities needed to respond to ever changing security matters. The third main component of mitigation and adaptation efforts that EU covers, in support of maintaining its own security and stability, is cooperation with its international partners in terms of support their endeavor in coping with the increasing global warming threats. Certainly, the Union is spending lots of resources but the results are unclear and unpredictable. More deep strategic foresight analysis and applying of a comprehensive policy in addressing the main causers of second-order threats is needed.

Further Policies

As the Union develops, adopts and timely amends main adaptation policies, procedures and capabilities and relatively

high level of resilience of the member countries to direct climate change impact, the EU should pay more attention to overcoming in very early stage of indirect threats that climate change places. A good example for EU flexibility is the latest proposal for a decision of the European Parliament and of the Council on the revision of Decision No. 1313/2013/EU for a fully-fledged European Union Civil Protection Mechanism with own operational capacities⁵⁴, provoked by the forest fires in Portugal and Spain in the mid-October 2017.

In order to address the future security challenges, risks and threats coming from outside, the EU, should support specific developing countries in their efforts to improved access to education, nutrition, health care, emergency medical services, energy, green technologies, housing and settlement structures as well as gender inequality and other forms of marginalization, access to and control of local resources. The Union should provide expertise in disaster risk reduction and disaster risk management field – through early warning systems, hazard/vulnerability mapping, household preparation, evacuation planning, road infrastructure improvements, monitoring, remote sensing, scenario development, assessments and communication. Additionally, funding of projects in better land-use planning, soil conservation, afforestation, deforestation, urban planning, applying of proper building codes, standards and practices. In response to the

⁵⁴ European Commission Work Programme 2018, *'An agenda for a more united, stronger and more democratic Europe'*, Annex I, p. 17, October 24, 2017.

second-order effects of global warming, the Union could provide support in efficient irrigation, water-saving, sanitation, diversifying water resources, desalinization, food storage, preservation facilities, food banks and distribution of food surplus through different water and food management programs. Due to its advanced common and national policies and programs, the EU must additionally support regional and local adaptation plans development, including climate change mainstreaming, to promote financial incentives, insurance practices, and public-private partnerships. Last but not least, using various educational options, the Union could raise awareness to climate change impacts and to encourage knowledge-sharing and creating and using of learning platforms.

The latest *EU-India Leaders' Joint Statement* is a testimony of highest political commitment to be conducted policies aligned with the common trend of reducing GHGs and tackling global warming impacts.⁵⁵

Conclusion

Warming of the climate system is unequivocal and human influence on recent climate change process is clear. Limiting

⁵⁵ India and EU strengthen partnership to implement the Paris Agreement and boost clean energy cooperation, European Commission, October 6, 2017, available at https://ec.europa.eu/clima/news/india-and-eu-strengthen-partnership-implement-paris-agreement_en, (accessed October 24, 2017).

global warming requires substantial and sustained reduction in GHG emissions. Climate change will continue in the decades to come even after decreasing or removal of GHGs emission, having further impacts on ecosystems and society. The future global warming and its impacts depend on the level of global climate mitigation efforts now and it can be significantly reduced by an ambitious global mitigation policy. The 2015 Paris Accord goals of limiting global average surface temperature to well below 2°C above pre-industrial levels is the only option humankind has. The climate projections provide further evidence that future warming will increase climate-related extremes globally which will be significant threat for humankind. Due to the main characteristics and features of the direct climate change threats, the EU will be able to cope with them much easier and they will not affect significantly European security. Second-order climate change effects is expected to increase in the coming decades and how EU would cope with the non-linear threats, especially those expected from the South, is far for clear.

Great deal of substantial and consistent efforts, including low-emission and climate-resilient strategies, policies, programs, and plans, in climate change mitigation and adaptation were developed and successfully implemented by European Union and further synergy between mitigation and adaptation as a part of EU overall goals should be pursued. Global warming mitigation, impacts, vulnerability, risk, and adaptation could be

enhanced through conducting profound risk management process and related activities – context establishment, assessment, implementation, communication and coordination, monitoring and reporting. Increased level of awareness and more knowledge on the costs and benefits of impact mitigation and adaptation options and their interdependency could play a vital role in programs and plans implementation. Evaluations confirm that innovations implied, increasing of energy efficiency and progress on renewable energy are the main drivers behind the emission reductions in recent years. The mainstreaming of them into other policies are evolving at all governance levels (Union, transnational, national and local level). Furthermore, activities for enhancing climate policy coherence across sectoral policies (*policy acclimatization*) should be taken. They could be supported by effective transnational cooperation, flexible governance, technological solutions, and involving the private sector as a vital element to long-lasting adaptation.

Global warming is not an issue that pertains the environment only but rather than it is a matter closely related to national and allied strategies, policy, planning, economy, financing which should reflect the international efforts in the field and EU should continue to play leading role in decreasing GHGs for mitigation of their negative consequences and applying of adaptation measures leading to sustainable development not only in the Union, but in its periphery as well.

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Disclaimer

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DESERTIFICATION – A WORLDWIDE PLIGHT – THE CASE FOR GREECE

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Abstract: Even though not a novelty, the scale of modern desertification is threatening the sustainable human development. Human activity on the other hand, is one of the main causes of this highly threatening phenomena impacting the socio-economic conditions of millions of people particularly those living in dry lands, which account for a significant proportion of the Earth's land. Desertification is a threat-multiplier for, if not a direct cause of, climate change. Furthermore, it affects the environment in ways which give rise to a decline in biodiversity, loss of livelihoods, ultimately mass migration. The case of the Mediterranean basin is a point of interest - while it represents a complex mosaic of different ecosystems, different cultures and consequently a different history of human intervention in the environment, it has as a common denominator, a number of factors contributing to desertification. Greece is facing considerable soil erosion and desertification problems seriously impacting on its ecosystems, human economy and society. The case of Greece is a good illustration of the absolute necessity for long-term planning of preventive and adaptation measures in tackling desertification. Furthermore, timely and adequate actions are to follow if negative impacts are to be curbed.

Keywords: Desertification; deforestation; climate change; migration; Greece.

Desertification is defined by the U.N. Convention to Combat Desertification as “land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities¹”. In other words, it is “the process by which a piece of land becomes dry, empty, and unsuitable for growing trees or crops on²”. Further, the interplay of a number of physical, biological, political, social, cultural, and economic factors lies at the core of a gradual and an unnoticed reduction in the productive capacity of land over a period of years.

Noteworthy, desertification is *not* the expansion of desert areas as a result of forces that have their starting point in the desert. Actually it is a combination of changes in a dry residential area, converted into uninhabited desert as a result of land-use practices and is likely to be accelerated by natural factors such as drought. The latter said points to a connection between desertification and climate change, the former being both a result and a cause of climate change.

Climate change is one of the main factors that may lead to desertification as a result of the draughts or other extreme climatic phenomena might cause. Similarly, the decertified land loses its capacity to stock carbon, so lower volumes of

¹ <https://www.e-ir.info/2014/04/30/united-nations-convention-to-combat-desertification-issues-and-challenges/>

² <https://www.collinsdictionary.com/dictionary/english/desertification>

greenhouse gas can be absorbed which further triggers climate changes closing a vicious circle of cause-effect.

Even though not a novelty, the scale of modern desertification is threatening the sustainable human development. Ancient philosophers like Solon, Plato, Kriton, Theophrastus and others, have described land degradation in their texts and were aware of unavoidable consequences thereafter. In his literary work “Critias” from 350 BC, Plato describes the bare hills of Attica - once a forest area:

“What now remains in comparison with what once, it looks like a skeleton of a sick man, all the thick and soft layer of the soil has disappeared and has been left only the bare frame mainland.”

In Ancient Greece, cutting off trees for the construction of fleet, as well as for trivial domestic use, caused extensive erosion, leaving a shallow surface layer of soil providing an explanation for the prevailing olive cultivation-related activities of Greeks.

Cases of mass migration and gradual disappearance of civilizations as a result of poor management of natural resources are not missing in ancient history, as with, for instance, the Sumerians in Mesopotamia. The intensive cultivation and irrational irrigation caused salt accumulation on the surface of the soil, making it gradually unsuitable for agriculture.

Nowadays, desertification occurs on all continents except Antarctica and affects the livelihoods of millions of people, including a large proportion of the poorest populations in drylands. It remains potentially the most threatening ecosystem change impacting the socio-economic conditions of millions of people living in the drylands, which account for a significant proportion of the Earth's land.

A total of 43.2 million kilometres, or 29.2 % of the entire Earth surface, fall within the four major degradation categories – of low, medium, large volume, and very high intensity desertification, putting the livelihoods of 1.4 billion people at risk.

Figure 1: Global Desertification Vulnerability Map³

The main causes of desertification could be divided into two main categories - natural and man-induced. Decreased rainfall; increased temperatures; lowering of groundwater table⁴, and the soil compaction (not solid soil) could be attributed to the first cause while overgrazing; deforestation; soil salinisation⁵; soil nitrification⁶, and excessive cultivation – to the latter.

Processes of desertification are either physical or chemical. The dominant physical process is soil erosion, which is activated by the destruction of the vegetative cover and affects marginal sloping lands. Soil salinisation and nitrification is the dominant

³ https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/hedc/training/soil/?cid=nrcs142p2_054003

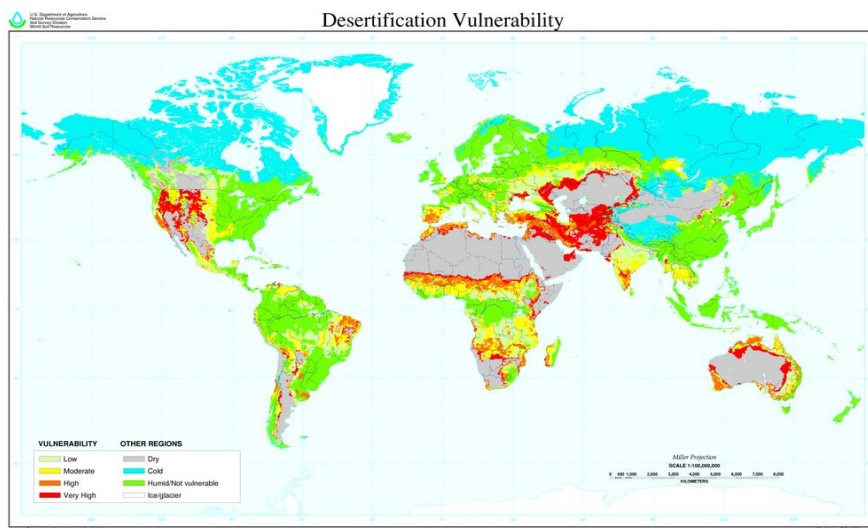
⁴ The reverse layers of the water under the ground.

⁵ As result of continuous irrigation.

⁶ As consequence of fertilizers usage

chemical process. Salinisation is generally localized but has wide-spread effects on valuable low lands.

Desertification is a threat-multiplier, if not a direct cause, for which testifies its aggravating impact on climate change, for instance, decreasing land natural resilience and thus impacting on food production and food security more broadly. Desertification damages vital economic sectors such as forestry, fisheries, agriculture causing poverty and increasing health problems. To top it all off, it affects the environment in ways which give rise to a decline in biodiversity, loss of



livelihoods, ultimately mass migration⁷.

In 2007, the UN General Assembly declared 2010-2020 as “The United Nations Decade for Deserts and the fight against Desertification”. The purpose of the Decade is to mobilize

⁷ http://www.who.int/globalchange/publications/reports/health_rioconventions.pdf

global action to fight land degradation, promote sustainable management of land resources and ensure long-term ability of drylands to support the livelihoods of local populations.⁸

The situation regarding the EU countries is serious. Thirteen EU Member States, not only in the Mediterranean region, but also in Central and Eastern Europe, have declared that they are affected by desertification.⁹ Vulnerable areas include large part of Spain, southern Portugal, southern Italy, south-eastern Greece, Cyprus, and areas of Bulgaria and Romania bordering the Black Sea. Research indicates that up to 44 per cent of Spain, 33 per cent of Portugal and Greece and nearly 20 per cent of Italy are at high risk of soil erosion. In Cyprus, according to their national action programme to combat desertification, 57 % of the territory is in a critical situation with regard to the risk of desertification.¹⁰ Desertification is considered as a major threat of degradation in the Mediterranean countries.

The case of the Mediterranean basin is a point of interest - while it represents a complex mosaic of different ecosystems, different cultures and consequently a different history of human intervention in the environment, it has as a common denominator, a number of factors contributing to desertification.

⁸ http://www.un.org/en/events/desertification_decade/background.shtml

⁹ https://www.eca.europa.eu/Lists/ECADocuments/BP_DESERTIFICATION/BP_DESERTIFICATION_EN.pdf

¹⁰ <https://www.eca.europa.eu/en/Pages/NewsItem.aspx?nid=9568>

These factors include the climate conditions¹¹ (s) and intense topographic relief¹². Hydrology is characterised by the scarcity of surface and ground waters and by the need to bring water from elsewhere to satisfy demand. In addition, several forest fires and four millenniums of irrational human action with frequent abuse of land, contribute to the spread of the phenomenon. The complex interplay of the afore-mentioned factors is often times a cause of desertification¹³. For instance, climatic factors cause heavy rains and/or draughts. The latter in concert with poor land management cause fires. Within this framework, these factors together with dominant characteristics of topography as well as social and economic factors cause loss of soil and vegetation which in its turn leads to desertification.

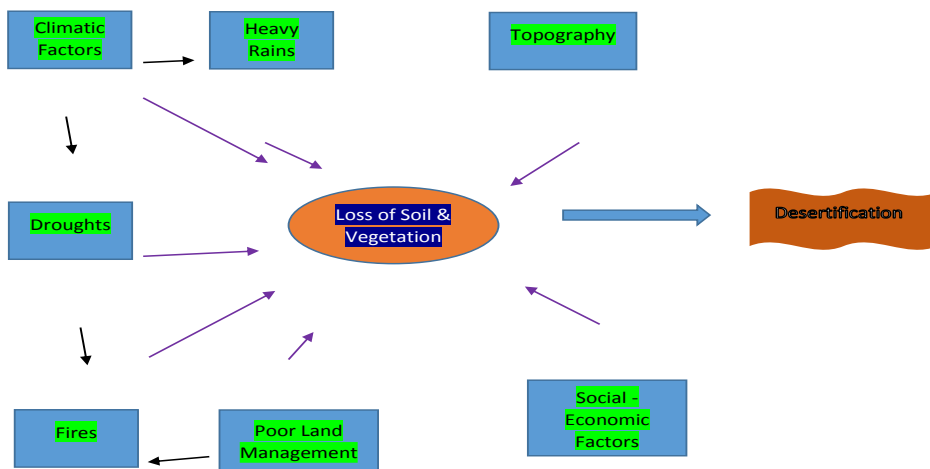
Figure 2: Interconnection between Causes of Desertification in Mediterranean Region¹⁴

¹¹ For instance, the Mediterranean climate and bio-climate are characterised by large moisture deficits, temporal variability, and frequent and high intensity rainfall or seasonal droughts. (<http://www.ekke.gr/estia/Cooper/Kin...5.../10%20kosmas-desertif.doc>)

¹² Landscapes are rugged, with steep slopes, large elevation differences and generally limited vegetation coverage. Surface geology favors formation of soils which are sensitive to drought and erosion. <http://www.ekke.gr/estia/Cooper/Kin...5.../10%20kosmas-desertif.doc>)

¹³ International Conference on Mediterranean desertification: Research results and policy implications (Report EUR 17782 EN))

¹⁴ Route of Desertification, International Conference on Mediterranean Desertification (Report EUR 17782 EN)



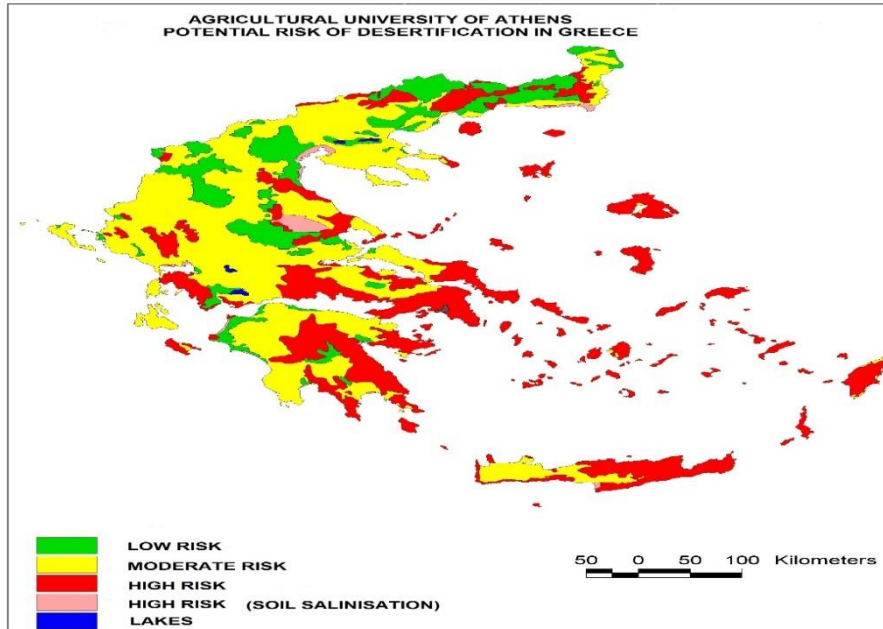
Numerous events are organized every year with the aim of placing the focus on climate change and its connection with other devastating phenomena. One such event was the May International conference on “***Climate Change in the Mediterranean and the Middle East: Challenges and Solutions***”, held in Nicosia, Cyprus. It looked into the *scientific basis of Climate Change in the region, its various impacts and challenges*¹⁵. As a result of the conference, a new international legally binding initiative emerged which aims at consolidating fundamental environmental principles that will apply to all countries. The initiative is called the “*Global Pact for the Environment*” and the ratification process is expected to be completed in the next two to three years.

¹⁵ Health, Water, Food, Tourism, and Migration, mitigation/adaptation strategies, policy challenges and governance.

Among the Mediterranean countries, Greece is facing considerable soil erosion and desertification problems seriously impacting on its ecosystems, human economy and society. About 50% of Greece consist of hilly areas with gradients of more than 10%. Its geographical position between three continents (Europe, Asia and Africa) renders the country as an ideal place where rich mixture of European, Asian and African species (plants and animals) are together with a considerable number of endemic species. Recent studies indicate that 34% of Greece is at high risk of desertification, while 49% is considered being at a moderate risk. The remnant 17% is considered as low risk. High risk areas include parts of Thessaly, East Sterea Hellas, Eastern Peloponnese, South East Crete as well as Aegean islands threatened by wind erosion as well.¹⁶

¹⁶ Agricultural University of Athens

Figure 3: Greece Desertification Vulnerability Map



An overarching problem for Greece is the forest fires that break out mainly during the summer months with an ever-increasing frequency of occurrence over the last decade and an intensity which allows the result to be characterised as a *biblical disaster*. The intensity and scope of deforestation is evident provided the fact that when Greece was detached from the Ottoman Empire in 1830, 48% of its land was forest areas. Currently, and despite the spatial expansion of Greece, the number stands at 19% of the country's total area.

Desertification reduces the soil productivity and, by extension, rural income, shifting the population seeking more employment opportunities. Thus, the main consequence of desertification is the abandonment of land via mass migration. People leave for urban areas in order to ensure a better quality of life but rapid

over-population and expansion of cities could be overwhelming potentially triggering wide social and economic pressure¹⁷, pollution and other environmental problems.

Similar to that, land degradation may cause migration and vice versa; sometimes the two take place simultaneously. Land degradation and migration are thus often closely interconnected, and also influenced by population growth. However, there are currently no reliable statistics about the number of people globally who may have been induced directly or indirectly to migrate because of land degradation. Rough estimates suggest that as many as 300 million people will be displaced for environmental reasons by 2050¹⁸.

Taking into consideration the serious migration problems Greece, other Mediterranean countries and Europe as a whole¹⁹, are facing in the last few years, desertification adds yet another trigger of big population movements.

Greece has been exerting some serious efforts to coordinate scientific and other bodies and to address desertification. In regard, the National Commission for the Prevention of Desertification was established under the Ministry of Agriculture having as objectives the:

¹⁷ Increased unemployment, stress on the public health care system, criminality and general discontent.

¹⁸

<https://www.sciencedirect.com/science/article/pii/S0959378011001403?via%3Dihub>

¹⁹ Since 2016, more 650 000 migrants have arrived to Europe.(390.432 in 2016, 186.768 in 2017, 77.483 in 2018, total 654.683) updated : 22/08/2018 . <http://migration.iom.int/europe/>

- Promotion of soil and water protection research and assistance in the implementation of the results/requirements;
- Coordination and monitoring of the implementation of national and local action measures;
- Cooperation with the EU and other international organisations, and
- Promotion of population awareness programmes.²⁰

Greece has ratified the United Nations Convention to Combat Desertification and has signed the main international conventions on environmental conservation and protection, while as a member of the European Union, it has adopted into its legislation all relevant Community legislation.

A growing body of research studying the problem has generated useful data on affected or potentially desertification-prone areas²¹. Therefore, and as a next step, coordinating actions based on the findings of researches is to what efforts should be dedicated.

Greece has been committed to adapting its coping mechanisms to fight desertification rather than paying the price for inaction²². In this regard, the country's Desertification Action Plan²³ serves as the basis for targeted and effective activities in the protection

²⁰ Decision of the Hellenic Minister of Agriculture no. 96990/9361/11.12.1996

²¹ Greek National Committee for Combating Desertification (National Report, March 2000)

²² According to the report of the Greek Central Bank, the estimated cost of avoiding adaptation to climate change, up to the year 2100, amounts to about 700 billion euro.

²³ National Action Plan, Hellenic Committee to Combat Desertification, July 2001

of ecosystems, promotion of innovative agricultural and land exploitation practices and techniques, increasing public awareness on risks and coping mechanism, and sustaining productive international cooperation. The Action Plan includes action areas tailored to protection of forest ecosystem and encouraging reforestation by:

- Encouraging reforestation by planting appropriate plants and forest species which are resistant to certain territorial adverse conditions;
- Promotion of new techniques and practices;
- Increased attention to irrigation systems in conjunction with the type of vegetation and soil composition;
- Developing new practices of irrigation water use by promoting management plans and re-using water produced by wasted water treatment plants for agricultural purposes, to areas with severe irrigation problems;
- Delimitation of threatened areas;
- Informing all stakeholders for the risks and effects;
- Ensuring adequacy of water resources of the country by reducing losses and waste of irrigation water;
- Protection of agricultural grounds from erosion and salinization with the application of sustainable farming systems;

- Protection of forest ecosystems;
- Improvement of the land degradation;
- Encouragement of international collaborations, researches and studies.

Desertification is a multi-dimensional, multi-faceted problem which should be approach, respectively, in a multidisciplinary manner. The scope and intensity of desertification have greatly increased in recent years.²⁴ Inaction threatens the well-being of more than 1.4 billion people and has wide spread global repercussions. Therefore, targeted and effective measures on prevention and adaptation are high on the agenda of both national governments and international organisations. Soil erosion is considered to be the major and most prevalent form of land degradation that affects the sustainable use of agricultural land

The case of Greece is a good illustration of the absolute necessity for long-term planning of preventive and adaptation measures in tackling desertification. Furthermore, timely and adequate actions are to follow if negative impacts are to be curbed. The role of education as well as constructive international cooperation are fundamental to the fight against desertification. We need a unity of efforts joining forces such as policy makers, the scientific community and civil society.

²⁴ More data are available on
http://www.un.org/en/events/desertification_decade/whynow.shtml

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CREATIVE THINKING – TRANSLATING INCLUSIVE IDEAS INTO INTEGRATED ACTIONS

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Abstract: A Comprehensive approach to peace and security enables a modus operandi consistent with the continuous need for timely cooperative and inclusive adaptation to the changing nature of conflicts and crises. The shift from traditional state (structure) security paradigm to human (agent) security places the primacy on the people and puts to the fore people-centred activities such as the protection of civilians (PoC), the establishment of order, and the prevention of sexual- and gender-based violence (SGBV). Military and civilian personnel is operating side by side in a complex and uncertain security environment, and this is to be premised on complementary and mutual assistance. The overview of the main elements defining a CA to current crisis/conflict operations and the experience of the European Union (EU) and the North Atlantic Treaty Organisation (NATO) in operating within the framework a gender-sensitive CA will be the focus of the present paper. The EU and NATO examples showcase, respectively, a largely civilian and internally-oriented perspective as opposed to a more prominent and strongly manifested military, and externally-primed, approach. Gender mainstreaming is the tread tying together societal awareness with adequate and efficient responses to the specific security needs of women, men, boys, and girls.

Key words: Comprehensive approach; crisis / conflict management; European Union; NATO; gender.

Multiplicity of actors; complementing, often times – competing, tasks;unprecedented interconnectedness and interdependence. The latter description serves to depict the current security environment and to draw the attention to the requirement, and necessity, of innovative creative thinking, and coordination in a framework of as inclusive as possible an approach to peace and security.

As per the military, the afore-mentioned translates into fundamental changes in the direction of interaction¹, as well as in the nature of goals and tasks – from the pursuit of concrete strategic military objectives to the establishment of ripe conditions from which wide political outcomes to be brought to bear. The creation of broader sustainable development effects necessitates activities aimed at achieving far-reaching political goals of stabilisation, democratisation, economic growth, respect for human rights, and rule of law. The shift from the traditional state (structure) security paradigm to human (agent) security places the primacy on *the people* and on people-centred activities such as the protection of civilians (PoC), the establishment of order, and the prevention of sexual- and gender-based violence (SGBV). Broad and nuanced situational and socio-cultural awareness are key to adequate needs- and

¹ From predominantly military-military to increasingly civil-military interaction.

risk-identification, alongside accurate resilience and coping capacity assessments. Inevitably, this broad and comprehensive spectrum of tasks increases significantly the duration of engagement, expanding timelines of crisis management across the life-cycle of a conflict/crisis. Noteworthy, this spatial system of actors, tasks, timelines, interaction and communication requires diligent planning and coordination of activities/actions and definition of main objectives, strict management and even stricter evaluation.

Importantly, the multiplicity of agents invariably involves an augmentation in the sample of worldviews² presented, and entering into direct contact, on the ground. Crisis and conflict managers internalise, continuously foster and ultimately replicate the dominant “modes of operation” (Autesserre 2014) of their home organisation. Standard operating procedures consist of “actions, behaviours, and discourses based on prevailing practices, habits, and narratives.” (Autesserre 2014, 6). These lie at the core of specific (and diverging across organisations) worldviews, which influence personal and professional perceptions further translating into concrete policies, programmes, projects. For the military, it further

² A worldview “can be understood as the “lenses” through which a group looks at, and interprets the world.” (Baumann 2017, 3). In an area of a conflict/crisis response operation the worldviews of the locals – both at governmental, non-governmental, and grass-root levels, and those of the external agents (both military and civilian) often diverge significantly. As Autesserre (2014) points, local knowledge and experience are often by default considered inferior to international (external) expertise disconnecting actions, and the effects these create, from beneficiaries.

includes elaborating mission objectives on the basis of civilian guidance³.

Brief, military and civilian personnel is operating side by side, and this is to be premised on complementary and mutual assistance, in an environment which, “in terms of tasks and timelines and the increasing number of actors involved [has] made effective coordination of activities and instruments an urgent priority” (Mölling 2008). This environment has ushered the prominence of the Comprehensive Approach (CA) which, in response to crisis/conflict situations, aims at establishing a coherent system of coordination and cooperation of both actors and actions thus, minimising duplications and balancing the cost-benefit, and effectiveness, equation. Flexibility is key to a such a process⁴, in which knowing who the agents are, within what structures (organisations) they operate and on what dominant modes of operation; what relationships lie at the heart of power and distribution mechanisms (specifically for local agents) allows for coherence and effective use of resources. Broad large-scale high magnitude crisis and conflict situations have made it crystal clear that “no single agency, government or international organization can manage” (Williams 2010) alone their inherent complexities. Nor can the necessity for a

³ Adapted from Autesserre (2014), p.25.

⁴ The European Union defines the CA as an “ambition” (European Commission 2013, 2), which leads to significant confusion once embarking on measuring effectiveness. There further is a tendency (European Union 2016) to substitute the CA with an “integrated approach”. The author argues that the CA is rather a process of integration on ideational and action levels among a variety of actors, starting internally – i.e. interagency coordination, and then sequentially moving outwards, and therefore the terminological choice between a *comprehensive* or an *integrated* in combination with approach is rather a matter of linguistic preference and meaning than of a difference in substance.

broad spectrum of political, economic, and civil instruments be disregarded. A high level of multidimensional interoperability at all levels – from local, through national to international (organisations, institutions, NGOs) is what a CA dictates. Furthermore, the CA is the premise on which the integration, and creative potential, of a nuanced inclusive perspective – gender perspective, receives traction and prominence.

With all of the above in mind, the present paper has as an objective to provide an overview of the main elements defining a CA to crisis/conflict operations and to briefly discuss (compare) experience of the European Union (EU) and the North Atlantic Treaty Organisation (NATO) in operating within the framework a gender-sensitive CA. The cases of the EU and NATO's have been selected for reasons of presenting, respectively, a largely civilian and internally-oriented perspective as opposed to a more prominent and strongly manifested military, and externally-primed, one. Additionally, and due to the existing conceptual ambiguity and implementation disparity among states, international organisations (IOs) and non-governmental organisations (NGOs) of the CA and, as a corollary, of the understanding for collective endeavour, there exists a number of (structural, organisational, administrative, political) challenges and setbacks, hampering the realisation of the CA, which will be briefly touched upon.

The CA applies to two levels: internal (employing own capacities) and external (combining strengths). Accordingly, the former, often characterised as a *Whole-On-Government approach*, aims at enhancing internal (inter-agency; inter-institutional) cooperation – both vertically and horizontally, whereas the latter deals with inter- and intra-organisational/structural cooperation and coherence⁵. Irrespective of the level, the CA is “expected to enhance both the efficiency and the legitimacy of crisis management by harmonizing the interaction and interdependence of tasks and actors involved” (Mölling 2008). The latter implies de-conflicting tradition and reality in reconsidering the viability of “good old remedies”, “quick fixes”, and mostly – “one-size-fits-all”⁶ against the imperatives of time. Traditional conflict/crisis operations used to focus on (military) containment and de-escalation. It was so for conflicts and crises were predominantly inter- rather than, and what is currently the tendency, intra-state.

At present, inequality, underdevelopment and poverty, often lead to competing worldviews within states and provide a fertile breeding ground for conflicts with wide-spread (global) repercussions. Managing contemporary crisis/conflict situations thus requires inclusive and transformative response in social, political, economic, and legal terms. Until a precise human terrain picture is depicted, crisis and conflict managers risk

⁵ The main CA ‘providers’, having developed respective concepts, are the UN, the EU, and NATO

⁶ As Autesserre (2014) explains, such responses are produced in order to manage and overcome the “cognitive overload” and “severe time restraints” faced by practitioners.

failure providing off-target services and assistance. Sound gender analysis⁷ enables needs assessment and respective priority identification, while at the same time addressing factors which may hinder efforts.

Women, men, boys, and girls experience conflict and security differently, as they have diverse vulnerabilities, degrees of resilience, and consequently - varying coping mechanisms. Despite seemingly intuitive, this knowledge is built through dedicated awareness – gender mainstreaming. Gender mainstreaming is the strategy to acquaint with gender – with the social construction of the self, built through cultural, political and social practices defining the roles of women, girls, men and boys, and at the same time placing relative value on these roles. Gender roles are social attributes and give rise to social status, hence preclude opportunities, responsibilities and relations, and as a corollary – the access to and control over (societal, power) resources. Roles are taught, learned and internalised, defining the duties and responsibilities expected of women, girls, men and boys at any given time of their lives and sets some of the barriers they may face or opportunities and privileges they may enjoy throughout their lives.

In line with the ambition to think creative abandoning ready-made solutions, gender considerations throughout all crisis and conflict management planning and execution activities,

⁷ Gender analysis is the technique of collecting, collating, and assessing sex-disaggregated data, i.e. data based on age, gender, social and economic status, cultural, ethnic differentials, against baseline indicators, typically derived from gender mainstreaming/equality literature and practice.

therefore, are a powerful means to accurately identify the rights, needs, priorities and capacities of all crisis-affected populations. In times of a crisis, practitioners are to look at the different security needs, experiences, and interests of women, men, boys, and girls by applying a gender perspective to any security situation in order to provide adequate and targeted responses while optimising available resources. In this sense, gender is a direct result of operational necessities, a response to the complexity of the security environment and the multiplicity of stakeholders involved in the security and development domain. Accounting for the gender dimensions of every activity improves the added value, ultimately increases the effectiveness of meeting the needs of all crisis-affected populations.

As crises/conflicts disrupt existing (social) structures and mechanisms, pre-existing inequalities tend to surface to a greater degree exacerbating already a dire situation. However, such a disruption also carries a transformative potential to challenge and change unequal and outright harmful societal dynamics. This window of opportunity, nevertheless, requires a delicate balance between assistance and support, and (local) ownership and empowerment of the processes. In the NATO Framework for Future Alliance Operations (FFAO) it is clearly stated that “[a]s the force achieves its military objectives, there is an opportunity to begin influencing wider issues.” (NATO - Strategic Plans and Policy 2018, 28). At the same time, it is critical that the facilitation of any transformative change be

informed by the improvements women, men, boys and girls seek and would support in the form of empowered local ownership.

The creative capacity to pre-empt crises or to smoothly transition, when the situation already evolves, from crisis management and stabilisation to an “inclusive locally-owned political process” (Tardy 2017) by conducting adequate analysis is what increases “the correlation between early warning and early action” (Tardy 2017). The NATO FFAO outlines *creativity* as central to one of the strategic military perspectives – that of awareness, as it enable moving away from simply “scratching the surface by only treating the symptoms” and closer to addressing root causes of crises and conflicts.

Thus, creative thinking ventures out of rigid categories, routines, structural and organisational biases and into a mind-set capitalising on comprehensive potential. The utility of adopting a CA in the analysis, planning, conduct and evaluation of crisis/conflict operations and missions has received a broad recognition and the CA principles have subsequently been adopted by many states and international organisations.

Since 2010 (Lisbon Summit – Strategic Concept) NATO has been steadily working on enhancing its contribution to a CA⁸ in

⁸ The Alliance has a dedicated Action Plan and a civilian-military task force that involves all relevant NATO bodies and commands. The comprehensive approach is addressed in the Alliance’s Strategic Foresight Analysis (2017) and in the FFAO (2018).

crisis management and on developing its civilian capabilities⁹, simultaneously making sure that the civil-military cooperation runs invariably and smoothly. Approximately since around the same period, starting 2007, the Alliance has been actively promoting the role of women in peace and security thus fulfilling the imperatives of inclusive security. NATO has elaborated a policy framework which to translate the principles of the United Nations Security Council Resolution (UNSCR) 1325 on Women, Peace and Security (WPS) and related Resolutions, into practical tools and tractable objectives. The Alliance has recognised that, although essential, particularly in terms of its *modus vivendi*, military means alone do not suffice to effectively respond to the many complex challenges to Euro-Atlantic and international security, and that the right mixture of sequenced political, civilian, and military approaches is critical to the success of any NATO operation and activity. Additionally:

The effective implementation of a comprehensive approach requires all actors to contribute in a concerted effort, based on a shared sense of responsibility, openness and determination, taking into account their respective strengths, mandates and roles, as well as their decision-making autonomy. (NATO 2015)

⁹ NATO Allies have agreed (Chicago Summit 2012) to establish “an appropriate but modest” civilian crisis-management capability at NATO HQ and within Allied Command Operations (SHAPE) (NATO Official Website). To this end, there have been structural (establishment on new sections -> Civil-Military Planning and Support (CMPS)) and operational reforms.

The CA has turned into a permanent feature of the Alliance. In its planning and conduct of operations NATO takes full account that crisis management has both military and non-military aspects. In that sense, the Alliance is working to improve practical cooperation with relevant external stakeholders (international organisations and other relevant actors). Such cooperation is conditioned upon relevant and appropriate distribution of tasks based on respective expertise, mandate, and competences. Clearly, experience is key when it comes to managing crises and conflicts throughout their entire life-cycle. In this regard, NATO has repeatedly emphasised the paramount importance of lessons learned, training, education and exercises. Joint civil-military activities enable trust-building and enhance cooperation. NATO is “actively building closer links with other organisations”, such as the UN, the OSCE, the EU, the African Union, Interpol, World Bank, “and actors on a regular basis”, and at various levels “while respecting the autonomy of decision making of each organisation” (NATO 2011). Communication is key in the coordination of the differing strategies and objectives between the (multitude of) actors and stakeholders operating in a crisis or conflict environment. Therefore, effective public messaging both individual (done by each, for instance, international organisation involved) and coordinated - between the different actors in the field, further adds to the effectiveness of the CA.

While, and as noted in the European Commission Joint Communication to the EU Parliament and the Council, the idea of a CA to “external conflicts and crises” is not a novelty, the principles “governing the comprehensive approach have yet to become, systematically, the guiding principles for EU external action across all areas” and particularly with regard to “conflict prevention and crisis resolution” (European Commission 2013). Despite the work remaining to be done in fulfilling this commitment, the EU is exerting dedicated efforts in strengthening and coordinating its CA¹⁰ capabilities making full use of its available policies, instruments and tools ranging from “diplomatic, security, defence, financial, trade, development cooperation and humanitarian aid fields” (European Commission 2013). Having at its disposal such an array of means for external action, the EU strictly observes that the rule of subsidiarity and shared competences, as well as gender balance and equality¹¹, is respected and that each actor at any EU level, be it in Brussels, in Members States or in the field in

¹⁰ In its 2016 Strategy, the EU shifts the focus from a comprehensive to an integrated approach to peace and security with the argument that, essentially, the integrated approach is “more ‘vertical’ in the sense that it aims at placing various components of the EU response under a single authority, whereas the CA [is] more ‘horizontal’, i.e. mobilising and synchronising a wide range of instruments.” (Tardy 2017, 3). Further discussing the validity of the latter argumentation in conceptual and operational terms is beyond the scope of this paper, which aims at looking into the process of inclusive crisis/conflict management rather than concerning itself with terminological technicalities. Therefore, the author continuously refers to a Comprehensive approach when discussing the EU’s approach to crises/conflicts.

¹¹ The EU has a well-developed gender mainstreaming framework, including guidelines, toolkits, action plans in various domains, for instance see Gender equality and women’s empowerment: transforming the lives of girls and women through EU external relations 2016-2020 (https://ec.europa.eu/europeaid/sites/devco/files/staff-working-document-gender-2016-2020-20150922_en.pdf), alongside gender equality indicators and markers allowing for assessing integration and implementation of gender-related policies. The Union also has a dedicated research centre – The European Gender Equality Institute, extensively analysing and providing

third countries has clearly defined responsibilities and duties regarding the application of the CA. All with the aim of avoiding duplications and of ensuring smooth coordination across all actions and activities.

The EU explicitly highlights the link between development and security¹² as a key principle of its CA to crisis management and conflict resolution alongside the principles of local ownership, of cooperation with local and international partners, with the civil society, and the private sector. Additionally, the Union stresses the importance of the rights-based approach “encompassing all human rights”, the protection of civilians, women and children “in armed conflict and the fight against sexual violence in armed conflict” (Council of the European Union 2014). Complementary to its guiding CA principles, the EU, similarly to NATO, has identified key areas of work. Given its complex organisational structure and even more cumbersome decision-making procedure, early coordinated and shared joint country/region analysis is critical for the timely and proper mobilisation of available resources, policies, instruments, and tools. As the name suggest, this analysis is conducted by, and at the same time to the benefit of all relevant EU institutions, bodies and actors concerned. After gaining knowledge about and understanding of concrete operating environment, a common strategic vision, which to inform about the EU’s and its Member States’ collective objectives and principles (for a particular

¹² Conflicts and crises, general fragility, hamper sustainable development and open ground for instability.

country/region) and guide actions on the ground, is to be defined. Undoubtedly, preventing the emergence of conflicts and crises is the best security measure, and a preferred course of action in the framework of the CA. Being pro-active also implies that, should a crisis erupt, an inclusive and gender-sensitive account of available resources, “strengths, capacities, competencies and relationships of EU institutions and Member States” (European Commission 2013) must be taken immediately so as to enable rapid mobilisation. As the CA applies to all phases of the conflict cycle¹³ “[i]ts results are often only reached and sustained in the long term” (Council of the European Union 2014) and therefore the EU is committed to long-term engagement with the ultimate goal of building resilient societies as these are the first firewall against contemporary threats to security. In that sense, EU’s external policies may affect internal dynamics and vice versa. Therefore, linking internal and external action is essential for the EU. It is essential also because the Union is not operating in a vacuum and because the operating environment and the complexities of contemporary crises and conflicts necessitate cooperation and partnership. Interdependencies and interconnections defy individual actions and dictate the need to use available resources and expertise with the aim eliminating duplication of efforts.

¹³ Also in prevention, early warning, crisis management, stabilisation and longer-term peace-building and development cooperation (Ibid)

The comprehensive approach to security bridges ambition and reality, needs and capacities, actors and tools, carrying a positive potential for transformative change towards lasting solutions. Gender is the litmus test for the success of these solutions and for any commitment aiming at long-lasting security. The comprehensive approach requires collaborative and inclusive approaches benefiting from the potential of everyone which means breaking rigid categories and opening up to inclusive perspectives. The added value of the CA could not be easily contested. Nevertheless, the CA to crisis / conflict management is not without flaws and far from being a novelty, still many practitioners fall by the wayside in managing its paraphernalia.

The baseline is the lack of a single, coherent and commonly approved and adopted model – instead there exists “a multitude of different and partly contradictory concepts for a Comprehensive Approach” (Mölling 2008). Moreover, terminological and linguist differences as per what word best captures the definition of an inclusive, transformative, and collaborative *process* add (unnecessary) ambiguity. Building on this premises, concomitant obstacles connected with the application of a CA to a crisis/conflict situations concern the enmeshment of coordinating and reconciling objectives; compromising on (national) interests and priorities; delegating tasks (civilian and military side); interacting both horizontally and vertically (civilian and military side), which is very much

conditioned by differing organisational cultures (worldviews and modes of operation); aligning national rules of engagement; overcoming interagency struggles over ownership and authority; de-conflicting effectiveness and political legitimacy, et cetera. The list is far from exhaustive but it certainly does make the point that complexity is not only a feature of crises and conflicts. What comes to the fore is the utility of conceiving the CA as a process of translating ambition into an inclusive practice integrated and collaborative contemporary crisis / conflict management.

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INFORMATION TECHNOLOGY IMPACT OVER SECURITY ENVIRONMENT

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Abstract: In spite of the peace efforts on all possible levels, the world in 21st century is remaining one dangerous place. Information technologies in general, could help/contribute for effective crisis management in almost all functional areas, and professional fields such as education, healthcare, social policies and military actions. In disaster-stricken areas, the technologies can be used for situational awareness, deep understanding of the genesis of the catastrophes, early warning, management, prevention, evacuation and recovery. Some of the serious possible technical solutions for early warning, crisis management and disaster response might be wide usage of systematic observation and analysis of big data collected by stationary and mobile sensor systems.

Keywords: Information technology, Security environment, Natural disasters, Crisis management, Symbiosis, Nanorobotics, Biotechnology.

General overview of the security environment and the technologies

In spite of the peace efforts on all possible levels, the world in the 21st century is remaining one extremely dangerous place with many active and potential points of conflict.

The contemporary security environment is influenced not only by military factors, but also by others, such as poverty, inequality, poor healthcare, educational deficits, dramatic climate change and scarcity of natural resources which lead to problems in local social policies, and in the final aftermath result in long-term geopolitical tension and conflicts.

These issues need a complete package of complex and persistent efforts in every field and any stage in the development of human society, with use of comprehensive tools and approaches.

Unlike previous times, when communications were limited due to economic, technological and spatial factors, nowadays the transfer of a huge volume of data can be achieved easily, cheaply and effectively over long distances in real time. On all levels, starting from the daily routine of the ordinary people, through activities of local communities, national societies, and multinational corporations, to the regional and world policies – all this is influenced by information technologies and the planet would never be the same again.

Social networks impact

One advanced and useful tool could be the information technology and especially social technologies presented by **social networks**.

The brands like Facebook and Twitter claim the lion's share of registered users in Europe and USA and shaping not only the

communications but even the new cultural identity of the Western civilization. As a consequence of these facts, comes the conclusion that these two brands and the similar ones are a mostly Western phenomenon because in countries like China, India, and Russia other locally based applications are also popular.

Owing to the widespread of mobile devices and the relevant technology, one huge part of present-day information flows on Internet belongs to social networks browsing. The following two examples illustrate how huge and fast-growing the Internet content is:

- More than 500 hours of video are uploaded on YouTube every second;
- It will take around 158 years to watch all daily stories in SnapChat.

1.28 billion people are active in Facebook each month – it is almost as many as the population of India¹.

This tremendous amount of information requires data centers with gigantic infrastructure, heavy energy consumption and thousands of people personnel. The goal is a high level of wide accessibility to be reached. That connectivity to the virtual environment is cutting both ways – on the one hand, there is a broad and immediate "bond" with almost any kind of

¹ Hicomm magazine (www.hicomm.bg) , ed.203, Sofia , May 2018

information and enhanced social interaction, on the other hand, there are heavy and unpredictable threats and risks.

At first sight the availability of information technologies should lead to deep satisfaction of individuals and groups, yet, in fact, it might result in dangerous antisocial activities.

Some negative side-effects may include radicalization and marginalization. For example, many members of various terrorist organizations were recruited from countries with high living standard, without any real-life contacts with terrorists.

Unfair usage of the social media could also be a fertile soil for discrimination, xenophobia, and racism.

Due to behavioral and existential deficits in the interpersonal domain based on lack of normal human interaction, many people are using the electronic and virtual content as a substitute and they become reluctant recipients of detrimental impact from the virtual environment.

Alongside the serious negative side-effects, it should be acknowledged that social media technology has shaped the world of communications in a most progressive and perspective way.

In general, information technologies could contribute to effective crisis management in almost all functional areas and professional fields, such as education, healthcare, social policies and military science.

In disaster-stricken areas, the technologies could be used for critical situational awareness, deep understanding of the genesis of the catastrophes, early warning, management, prevention, evacuation, and recovery. For example, the earlier stage of developing tsunami could be streamed in real-time videos through social networks by any witnesses in the area, and this could inform and protect people who are watching it in the nearby areas, where the tsunami has not arrived yet.

Symbiotic technical solutions of the future

Some of the serious possible technical solutions for early warning, crisis management, and disaster response might be wide the usage of systematic observations and analysis of big data collected by stationary and mobile sensor systems. These systems can include also geo-data (GPS) sub-systems, satellite communications and can be used also for surveillance, exploration, and cartography of the ocean floor. Light, sound and seismic sensors and drones as well as indications from elements of biological systems, could be used for observation of dangerous mountainous areas and volcanos. For example, certain plants and animal possess specific sensitivity towards primary seismic activity and other phenomena preceding natural disasters. This is the case with one particular plant that can be used as an indicator of volcanic eruptions, as it is described in the popular science book "Patents of live nature":

On the slopes of the volcanic heights in Indonesia grows a strange primrose, also called a royal pride, which in its

predictions does not know the mistake. Every time it blossoms and its buds open, the people at the foot of the volcanoes leave their homes because they know that volcano eruption will follow shortly. Because of this, the inhabitants of the island of Java call it a "flower of the volcano", which unmistakably serves them as a seismograph. The phenomenon can be explained by the discovery of the Soviet scientist E. Konovalov, called the "Konovalov effect". According to him, if a porous substance is immersed in a liquid, the liquid rises on its pores up to a certain level. However, if the porous substance is subjected to ultrasound waves, the liquid rises on the capillaries at a considerably higher level. The royal primula plant is distinguished by its porosity. Before the powerful volcanic eruption, ultrasonic waves are usually transmitted from the epicenter. The "Konovalov Effect" increases the level of nutrients in the capillaries of the plant, it feeds significantly better and grows faster. Examples of actual occurrences of living nature could be many. The abnormal behavior of animals a few days, hours or minutes before the recording of underground earthquakes or volcanic eruptions witnessed many observations in Japan, Turkey, China, Italy and other countries"².

The causes are not examined in detail, but such a relevant relationship has been proved statistically. For complete

² Denkov V.M., PhD, „Patents of the live nature”, Sofia 1980;

lifesaving solutions advanced symbiotic systems of both technical and bio-technological components, including nanorobotics, should be used. According to the concepts of a future, nanorobotics should be applied mainly in warfare and medical science, because of its abilities to cover, camouflage and create a high density in certain volume for specific purposes, but it must also be used in the field of crisis management and disaster response.

Biotechnology could also help in fighting global pollution of the oceans with plastic waste, which threatens to become more than fish in the oceans till 2050. Probably after years, some kind of bacteria, or some similar biotech invention would be selected and could be used for disintegration or decomposition of the plastic waste.

Conclusion

All mentioned above is just technical solutions, based on some information flows, based on information, and expose the impact of information technologies on security environment, and biosphere in general.

The general principles to relieve world's geopolitical and military tension could be :

- Accessible and high-quality education;
- Tolerance;
- Improved healthcare and disease prevention;

- Using the social and emotional intelligence as a tool for threat resistance.

All these and many other approaches are just small steps toward the great goal of saving the planet for the generations to come. The human spirit and faith must lead humanity to survival and evolution on the road to its civilizational development.

THE CAPABILITY QUOTIENT

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Abstract: This paper introduces the concept of “Capability Quotient” (CQ) in the contexts of emergency preparedness and response. The Capability Quotient has been studied in other research fields such as health and psychology, but never before has the Capability Quotient been used in the emergency preparedness and response fields. This paper will delve into what research already exists on the Capability Quotient, and how it relates and/or differs from the definitions and examples presented in this paper.

This body of work will define the Capability Quotient and link it to the science behind the Intelligence Quotient (IQ) and the Emotional Quotient (EQ). Additionally, the authors will discuss why CQ is an important measurement for the emergency preparedness and response community, highlighting why the concept holds great value as a new and emerging paradigm. This research will cover CQ usage and outline key ways it can be utilized to inform emergency preparedness and response efforts.

This research makes the case for measuring the Capability Quotient of responders, and focuses on the mission, value proposition, saving lives and property and the economy of resources. Furthermore, the authors include a summary of the current state of responder capabilities and make the case that maturity is an area that requires development. Emergency response providers include, “federal, state, and local public safety, law enforcement, emergency response,

emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities,” as defined by the Homeland Security Act of 2002. The full scope of the responder community could be as many as nine to ten million individuals (Carafano, 2003).

A case study will be presented on assessing the Capability Quotient using the Incident Management Information Sharing (IMIS) Capability Maturity Model (CMM), developed by the U.S. Department of Homeland Security (DHS) Science and Technology (S&T), to help organizations measure the maturity of their IMIS capabilities based on the five interdependent elements of the SAFECOM Interoperability Continuum (Governance, Standard Operating Procedures, Technology, Training & Exercises, and Usage). The assessment methodology will be presented, as well as ResponderCQ.com, the assessment service used to streamline this assessment and make it easily accessible to organizations. ResponderCQ.com includes online assessments, progress tracking, a set of next steps and the Training and Implementation Toolkit, first introduced in the Crisis Information Management Framework for Regional Disaster Resiliency. The Capability Quotient of responders needs to be assessed in order to make the best use of resources, time, finances, personnel and ultimately the lives of individuals worldwide.

Keywords: Assessment, Capabilities, Capability Quotient, Emergency, ResponderCQ.com

Introduction

The following definition is used for the Capability Quotient in the

contexts of this research: (CQ) *Assesses the readiness posture and relative responsiveness of personnel and assets to perform a mission.* How well one performs in their career and personal life is influenced by both IQ and EQ, how ready one is to succeed is influenced by CQ. An individual may be the most intelligent person in the world, quick to identify patterns and assess problems, and they might even have the greatest ability to successfully navigate intense conflict and make the right decisions, but if they have no capability and are not postured to do anything about it, then they are no better off. The good news is that CQ can be developed and improved.

To break down the definition of CQ further to understand its components, some attention will be given to the term, “readiness posture.” Readiness is defined as the state of being fully prepared for something; capability and willingness to do something. Posture is defined as a particular way of dealing with or considering something; an approach or attitude. According to the Federal Emergency Management Agency (FEMA), a robust readiness posture allows organizations to respond to large-scale, complex, presidentially declared major disasters instead of waiting for disasters to occur and reacting with costly and inefficient response actions.

How timely and efficiently can personnel and assets be deployed to perform a mission? The relative responsiveness of personnel and assets explains how timely and efficiently personnel and assets can be deployed to perform a particular

mission. Perform is defined as: Carry out, accomplish, or fulfill (an action, task, or function). Mission is defined as: An important assignment or response carried out by the organization.

The Capability Quotient self-assessment is available to the emergency preparedness and response community on the assessment service, ResponderCQ.com, which was developed with funding from the *U.S. Department of Homeland Security Science and Technology Directorate*. The model is based on the IMIS CMM and the DHS SAFECOM Interoperability Continuum. The model has been developed and piloted with dozens of organizations throughout the United States and in partnership with the North Atlantic Treaty Organization (NATO) Advanced Regional Civil Emergency Coordination Pilot (ARCECP) with twenty-three organizations in Bosnia & Herzegovina, Croatia, Macedonia and Montenegro. It is also being tested and evaluated in partnership with the National Association for Public Safety Geographic Information Systems (NAPSG) pilots in Charleston, South Carolina and Boulder, Colorado.

The intended effect of the model implementation is to enable communities to answer two key questions: “Have we measurably improved crisis information management capabilities as a result of this effort? And, “As a result, are we more resilient?”

Linkage to the Science of IQ and EQ

Linkage to the Science of IQ

Intelligence Quotient (IQ) is defined as an assessment of human intelligence. IQ is a number used to express the apparent relative intelligence of a person such as: the ratio of the mental age (as reported on a standardized test) to the chronological age multiplied by 100; a score determined by one's performance on a standardized intelligence test relative to the average performance of others the same age. A study conducted by Angela Lee Duckworth and her team found that IQ tests measure much more than just raw intelligence. They also measure how badly subjects want to succeed both on the test and later in life (Balter, 2011).

Earning a high IQ score requires high intelligence in addition to high motivation. This study has important social policy implications. Duckworth stated, "I hope that social scientists, educators, and policy makers turn a more critical eye to any kind of measure, intelligence or otherwise." She also noted how hard people try "could be as important to success in life as intellectual ability itself." The study states that motivation and self-discipline are crucial. Both intelligence and personality matter, and even if native intelligence can not be increased, there might be other routes to success (Balter, 2011).

Duckworth's study states that self-discipline measured accounted for more than twice as much variance as IQ in final

It is vital to for organizations to have a baseline starting point in order to know how to make the most logical improvements and best leverage existing resources, personnel and assets.

grades and even held when controlling for first-marking period grades, achievement test scores and measured IQ (Balter, 2011). These findings suggest a major reason for students falling short on their intellectual potential: their failure to exercise self-discipline.

This study brings to surface how one's actions and motivations play a major role in what outcomes are achieved. Relating back to CQ, in theory, a person could be brilliant, but failure to act, prepare and be ready can lead to a waste of resources and underachievement when it comes time to perform a mission. Once an individual or organization takes the initiative to measure their CQ, they are already on the path forward to improve their capabilities and readiness posture. It is vital to have a baseline starting point for organizations in order to know how to make the most logical improvements and best leverage existing resources, personnel and assets.

Linkage to the Science of EQ

The EQ-i^{2.0} Model



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Based on the original BarOn EQ-i authored by Reuven Bar-On, copyright 1997.

Emotional Quotient (EQ) measures the ability to identify and manage emotions and their impact on decision making. EQ is a notional measure of a person's adequacy in such areas as self-awareness, empathy and dealing sensitively with other people. The EQ-i^{2.0} model created by *Multi-Health Systems Inc. MHS Assessments* includes self-perception, self-expression, emotional expression and decision making. The EQ-i^{2.0} model features one Emotional Intelligence (EI) score broken down into five scores, which are then broken down into 15 subscales (MHS Assessments, 2011).

According to an article written by John Staughton, EQ measures how individuals learn, understand and apply emotional knowledge, and reflects how well a person can understand their own and other's emotions, to differentiate between them, and to use that knowledge to guide actions and

behaviors. Another study finds that the following five areas define one's emotional intelligence: Self-awareness, self-regulation, empathy, social skills and motivation. The research notes that much like CQ, EQ can be changed and improved. If the aforementioned areas improve, so will EI and EQ (Staughton, 2016).

Staughton states that the ability to understand, control and utilize emotions plays a vital role in success at work, in relationships, family matters and personal health. Similar to IQ, motivation also plays a major role in EQ (Staughton, 2016). The linkage between EQ and CQ can be made by the ability to improve upon past assessments for future success. Decision making, interpersonal, stress management, and self-perception skills as well as intelligence play a role in how one will perform a mission. These skill sets of IQ and EQ, coupled with one's CQ play a major role in either the success or failure during performance of a mission. Being fully prepared and willing to perform relates to the motivation and self-discipline studied in both IQ and EQ.

The Importance of CQ

Possessing the knowledge of what to do in an emergency is important, as is maintaining decision-making skills in an emergency. Paramount to both skill sets is the ability to have a robust readiness posture, to be prepared and willing to react as efficiently as possible, and by making the best use of resources available. Without a strong and defensible CQ, knowledge

capital and decision-making skills provide little practical efficiency. Assessing the Capability Quotient of individuals in the responder community provides a baseline from which to understand their current capabilities, allowing them to create a path forward for improvement.

Without baseline awareness, improvement of responders' readiness posture and relative responsiveness of personnel and assets to perform a mission will be difficult, if not impossible. Once CQ is assessed, responders are in the position to act, train, improve, mitigate and respond.

Characteristics of Effective Disaster Responders and Leaders: A Survey of Disaster Medical Practitioners, focused on identifying key attributes of effective disaster/mass casualty first responders and leaders, thereby informing the ongoing development of a capable disaster health workforce. This survey found that important characteristics of disaster responders and leaders are not limited to the knowledge and skills typically included in disaster training, and that further research should examine the extent to which these characteristics are consistently associated with actual effective performance of disaster response personnel and determine how best to incorporate these attributes into competency models, process, and tools for the development of an effective disaster response workforce (Characteristics of Effective Disaster Responders and Leaders: A Survey of Disaster Medical Practitioners, 2016). The Capability Quotient could

potentially answer part of this call for effective performance of responders in emergency response.

Existing Research on CQ

Capability Quotient is a term that has been used before, but outside of the responder community and emergency preparedness space. This section will outline existing research that exists on the Capability Quotient, illustrating both linkages and uniqueness CQ holds when applied to the responder community.

Paul Netman of *Fauceir Blog* reviewed a recent paper *A Mathematical Model of Democratic Elections*, where Capability Quotient was used in mathematical calculations instead of the traditional IQ. The authors of this article define a scale of leadership qualities in analogy to intelligence. They assume that for each individual a Capability Quotient can be determined, which they define as the sum of all an individual's leadership qualities divided by the average sum of such qualities. The quotient is multiplied by 100, and the better-than-average leader possesses a CQ greater than 100. People with a CQ below 100 are not recommended to be a leader at all. Next the

*Without a strong and defensible CQ,
knowledge capital and decision-making
skills provide little practical efficiency.*

authors assume that the distribution of CQ is the same as IQ (A Mathematical Model of Democratic Elections, 2010).

They state that the capability to successfully lead a group of present-day humans is a trait closely related to intelligence, therefore it is possible to assume a normal distribution of CQ to begin with. The authors conclude that substantial and lasting improvements in leadership can be achieved only by improving the average CQ of the entire compound. This article demonstrates how Capability Quotient has been used, but not in the contexts of emergency preparedness and response (A Mathematical Model of Democratic Elections, 2010).

Another way CQ has been defined has been in the contexts for cross-cultural success, as mentioned in an article by David Livermore with *Forbes*. "People have long understood that success in today's globalized economy requires cultural awareness and an ability to adapt to different cultures. Now research indicates that those kinds of awareness and abilities can be measured and evaluated. They are quantified as your cultural intelligence quotient, or CQ (Livermore, 2010)." According to this article, the cultural intelligence quotient measures the capability to function effectively in a variety of national, ethnic and organizational settings, and is a form of intelligence that has been tested by academic researchers in more than 30 countries over nearly a decade (Livermore, 2010). The authors state that the cultural intelligence quotient is similar to IQ and EQ in that it quantifies a set of capabilities believed to

be important to both personal and professional success. It focuses specifically on the skills needed for success in unfamiliar cultures, and everyone has a specific cultural intelligence quotient that can be assessed and enhanced. The cultural intelligence quotient concept in this context was first introduced by Christopher Earley and Soon Ang in their 2003 book, *Cultural Intelligence: Individual Interactions Across Cultures*. As Livermore describes, they originally wrote the book for an academic audience, but a report in the Harvard Business Review described cultural intelligence as a core capability essential for success in business (Livermore, 2010).

A majority of the research has examined what gives rise to cultural intelligence and looked at testing strategies that may lead to enhancing the cultural intelligence quotient. Livermore describes that increasing a person's cultural intelligence quotient begins by assessing that person in terms of four distinct cultural intelligence capabilities, which are similar to those measured by emotional and social intelligence but are specifically related to cultural challenges. They are as follows: CQ Drive (motivation), CQ Knowledge (cognition), CQ Strategy (meta-cognition) and CQ Action (behavior). An online assessment (cq-portal.com) provides an overall cultural intelligence quotient score as well as a score for each of the four capabilities. It makes use of the Cultural Intelligence Scale, which is the first academically validated measure of cultural intelligence quotient (Livermore, 2010).

CQ has also been studied as a “Consciousness Quotient.” By Ovidiu Brazdau and Christian Mihai in their article, *The consciousness quotient: a new predictor of the students’ academic performance*. This study seeks to establish the practical usage of Consciousness Quotient in the educational psychology field. The hypothesis was to determine the incremental validity brought by the Consciousness Quotient in the prediction of academic performance. The study *uses* the “Consciousness Quotient Inventory” (CQI) and the “General Ability to Measure for Adults” (GAMA) to evaluate the Consciousness Quotient and the intelligence levels. The results

BETTER
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PTs

Organisation systems and structures	Raw Scores				
	Current Year	Last Year	Year 3	Year 4	Year 5
Governance	10	20			
Systems approach to improvement	10	40			
Strategic alignment	10	60			
Framework for Improvement	10				
Prioritisation of improvement activities	10	40			
People development	10	40			
Measurement system	10	50			
Knowledge management	10	20			
TOTAL	80	230	0	0	0
Workforce skills and knowledge	Raw Scores				
	Current Year	Last Year	Year 3	Year 4	Year 5
Breadth of improvement skills and knowledge	10	10			
Depth of skills and knowledge of improvement	10	20			
Training and professional development in improvement	10	10			
TOTAL	30	40	0	0	0
Results and system impact	Raw Scores				
	Current Year	Last Year	Year 3	Year 4	Year 5
Impact on organisational KPIs	10	50			
Analysis of Operational Metrics	10				
Improvement outcomes	10	30			
TOTAL	30	80	0	0	0
Culture and behaviours	Raw Scores				
	Current Year	Last Year	Year 3	Year 4	Year 5
Business improvement approach	10	20			
Spread of best practice (solutions/interventions)	10	10			
Leadership	10	40			
Reward and recognition	10	20			
Staff Engagement & Improvement	10				
Staff role in improvement	10	20			
TOTAL	60	110	0	0	0
Current Score					
▶ Title Document Control PTs Instructions Summary Framework for Improvement People					

of the study confirm the influence of consciousness quotient in the academic performance evaluation (Brazdău and Mihai, 2011).

To explore one further study, in the health field exists the *Health Improvement Capability Quotient guide to Define, Measure and Create Capability for Improvement*. The Health Improvement Capability Quotient Tool (Health ICQ) has been developed to enable health services to assess and monitor their capability to instigate, drive and sustain an improvement approach as a fundamental step of operational excellence. The document defines organizational capability as an organizational ability to perform a coordinated task, utilizing organizational resources, for achieving a particular end result. It explores the relationship between individuals, organizational systems and the strategic intent of the organization to maximize the organization's ability to achieve the strategic goal (State of Victoria, 2014).

Capability Quotient in Practice

The Capability Quotient is trademarked under SPIN Global and is used in this research in the contexts of emergency preparedness. Responders can assess their Capability Quotient to gain an understanding of their current readiness posture, allowing them to better perform their missions and duties. The Capability Quotient presents a model to assess the readiness posture and relative responsiveness and assets to perform a mission in the contexts of emergency preparedness and response. In action, the Capability Quotient allows participating individuals to assess their capabilities for numerous areas applicable to their work.

The first example accessible to the responder community is the information sharing assessment, where responder personnel and organizations can assess their CQ based on the results of

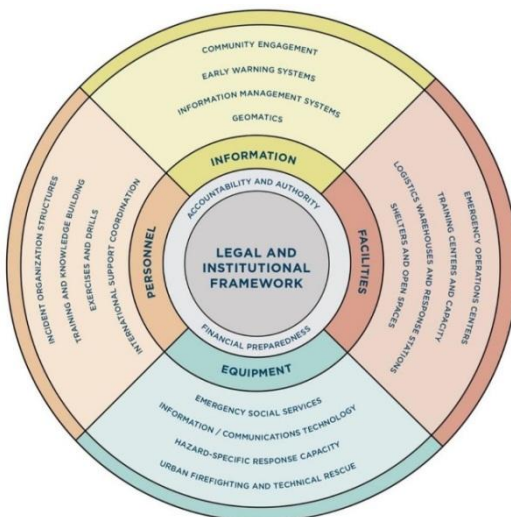
“Most of the current approaches to preparedness measurement are missing a way to answer the following question about preparedness systems: How confident should we be that the response system will perform as expected when the next large-scale incident or disaster occurs?” - RAND Corporation

their assessments. Currently, members from emergency preparedness organizations and the first responder community are utilizing the Capability Quotient in practice by assessing their current capabilities. It is recommended that the technical lead for the organization, as well as a program manager collaborate together to complete the assessment. Additionally, questions that apply to a specific department or person can be forwarded to that individual.

Making the Case for Measuring the Capability Quotient of The Responder Community

Mission, Value Proposition, Saving Lives, Property and Economy of Resources

Effective, efficient and coordinated response versus inefficient, costly and sporadic response could mean the difference between life and death. Looking back to hurricane Katrina, DisastersUS.org states that four factors contributed to the failures that occurred during and after the storm: long-term warnings went unheeded and government officials neglected their duties to prepare for a forewarned catastrophe; government officials took insufficient actions or made poor decisions in the days immediately before and after landfall; systems on which officials relied to support their response efforts failed, and; government officials at all levels failed to provide effective leadership. Key officials were not able to act on less-than-complete information that is to be expected in a disaster. The response failure was marked by problems with



obtaining, communicating and managing information (Disasterus.org, n.d.).

This example from Katrina sheds light on the importance of effective, efficient, timely and coordinated

response, with an emphasis on information sharing. Had the readiness posture and relative responsiveness of personnel and assets to perform a mission been assessed (CQ) and improved prior to Katrina, the response actions could have been different. Many times, the most difficult component of any task is knowing where to begin. By assessing CQ beforehand, responders already know where to start, where they need to go and how they can get there. As demonstrated in the Ready2Respond Framework by the World Bank, the components of emergency preparedness and response are as follows: personnel, equipment, facilities, and information revolve around a legal and institutional framework. Ensuring those involved in response are fully capable on all these fronts requires continual assessment of responder capabilities.

Individuals that comprise the responder community, whether they are first responders, private sector, or government officials involved in emergency preparedness and response, these public servants are tasked with the ultimate duty of saving the lives of others. They dispatch employees to the scene, direct them on what to do, share information and coordinate response actions. Each of these duties requires interoperability, intelligence, self-discipline, motivation and capability. Within an hour of time, responders can assess their current Capability Quotient, be provided a set of next steps to improve their CQ and resources, templates, and job aides in order to act on these next steps. There is no reason not to engage the CQ when it

comes to improving the ability to save time, finances and most importantly, lives.

Current State of Responder Capabilities; Making the Case for Developing Maturity

According to a report by James Carafano, *Preparing Responders to Respond: The Challenges to Emergency Preparedness in the 21st Century*, the requirements of support groups outside of fire, police and emergency medical personnel are often overlooked. Carafano notes that public health systems and national urban search are both components regarded as essential to emergency response, yet they both lack sufficient assets to respond to national emergencies. Responders in the private sector as well as volunteer organizations active in disaster (VOAD) have received even less attention, and needs assessments often overlook response assets required to deal

Without timely and efficient information sharing, responders are not postured to complete their missions to the best of their ability. The Capability Quotient addresses this challenge by assessing individuals and organizations on their capabilities, allowing for percentage rollups on competencies.

with agricultural emergencies that could damage food supplies or as a source of infectious disease (Carafano, 2003).

As Carafano notes, emergency response operations are frequently plagued by a lack of information sharing and confusion over responsibilities among policymakers, law enforcement, emergency managers, first responders, etc. He states that effectively negating threats requires a rapid response capability, and with little time to spare leaves no room for coordination errors (Carafano, 2003). This information alone demonstrates the necessity for increased capabilities among the responder community. Without timely and efficient information sharing, responders are not postured to complete their missions to the best of their ability. The Capability Quotient addresses this challenge by assessing individuals and organizations on their capabilities, allowing for percentage rollups on competencies.

Another issue found within the American Red Cross report, *From Challenge to Action: American Red Cross Actions to Improve and Enhance its Disaster Response and Related Capabilities for the 2006 Hurricane Season and Beyond*, was the lack of “cultural competence.” The Red Cross also faced technology limitations regarding financial services and processing many cases within a short time frame (American Red Cross, 2006). Robust technology assessments, stress-testing and modifications could have been a potential solution to technology failures.

As mentioned in the RAND Corporation report, *Evaluating the Reliability of Emergency Response Systems for Large-Scale Incident Operations*, a variety of efforts to assess preparedness have been made over the years, but none of them focus on measuring what we would label the capacity of preparedness organizations. For example, counting how many responders are available and how much equipment is on hand, asking if planning activities or exercises have been held and comparing that capacity to the assumed requirements of incidents or scenarios of concern. These approaches effectively evaluate the inputs needed for response operations (RAND Corporation, 2010, 3).

The report notes that failures could occur because the response organizations involved cannot successfully deliver and utilize the capacity that is available. Additionally, RAND Cooperation mentions how most of the current approaches to preparedness measurement are missing a way to answer the following question about preparedness systems: How confident should we be that the response system will perform as expected when the next large-scale incident or disaster occurs? (RAND Corporation, 2010). The Capability Quotient addresses these preparedness deficiencies noted in the RAND Report, by assessing the readiness posture and relative responsiveness of personnel and assets to perform a mission.

Governance	Individual Organizations Working Independently	Informal Coordination Between Organizations	Key Multi-Discipline Staff Collaboration on a Regular Basis	Regional Committee Working within an Evolving Regional Disaster Resiliency Framework
Standard Operating Procedure	Individual Agency SOPs	Joint SOPs for Planned Events	Joint SOPs for Emergencies	Regional Crisis Information Management SOPs
Technology	Technical Interoperability Bits and bytes exchanged	Syntactic Interoperability Common data formats	Semantic Interoperability Shared content is understood	Dynamic Interoperability Integrate foreign APIs to native APIs dynamically
Trainings & Exercises	General Orientation on Equipment and Applications	Single Agency Tabletop Exercises for Key Field and Support Staff	Multi-Agency Tabletop Exercises for Key Field and Support Staff	Multi-Agency Full Functional Exercises Involving All Staff
Usage	General Orientation on Equipment and Applications	Single Agency Tabletop Exercises for Key Field and Support Staff	Multi-Agency Tabletop Exercises for Key Field and Support Staff	Multi-Agency Full Functional Exercises Involving All Staff
	Planned Events	Localized Emergency Incidents	Regional Crisis Management	Daily Use Throughout Region
	Routine System Usage and Performance Surveys	System Usability and Workload Measured During Training and Exercises	System Usability and Workload Evaluated After Real-World Events	Regional Evaluation of Usability and Workload

The Gap in Responder Capabilities

Figure 4: Interoperability Continuum 2.0

The Capability Quotient addresses the gap and lack of robust core capability assessments in the industry. The Capability Quotient is multifaceted and begins to scratch the surface on providing a solution to the lack of assessments for responder capabilities.

The Capability Quotient of responders needs to be assessed in order to make the best use of resources, time, finances, personnel and ultimately the lives of individuals worldwide. In order to measure core capabilities, assessment methodologies to properly measure and track progress can be leveraged to mature the performance of the responder community.

Case Study: IMIS CMM

Assessment Methodology

The assessment methodology used for ResponderCQ.com, which measures the capability quotient is based on the U.S. Department (DHS) Science and Technology Directorate (S&T) Incident Management Information Sharing (IMIS) Capability Maturity Model (CMM) and the DHS SAFECOM Interoperability Continuum. Core Elements, adopted from the DHS SAFECOM Interoperability Continuum divide the overall crisis information management mission into five manageable forms of capital (i.e. governance, standard operating procedures, technology, training & exercise, and usage).

Furthermore, the maturity levels provide a simplistic tool for measuring maturity through the details presented within the attributes. The maturity levels include Level 1 Assessment, Level 2 Planning and Development, Level 3 Limited Operational Capability, Level 4 Extended Operational Capability, and Level 5 Mature Operating Capability. The assessment includes a list of attributes, which are statements that describe aspects of capability maturity. Each attribute is designed to expand upon the core elements within each of the five maturity levels to convey a means to measure the current status and progress within the context of the assessment. Each attribute is weighted based on level of difficulty.

ResponderCQ.com

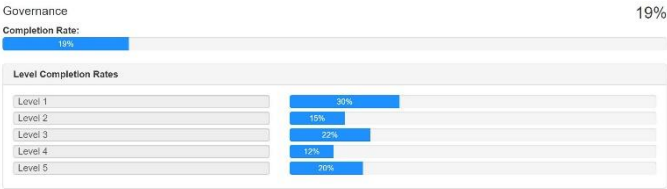
ResponderCQ.com is a self-assessment service for governments, businesses and humanitarian organizations with a commitment to emergency preparedness and response. ResponderCQ.com was developed by SPIN Global with funding through the U.S. Department of Homeland Security.



Figure 5: Quotient Interplay

Figure 5 represents the interplay between EQ, IQ and CQ. This nexus forms the foundation of ResponderCQ.com. This model represents how each quotient, which has the ability to be measured and improved, comes together to orchestrate ResponderCQ. Together, these competencies can be assessed and improved to achieve a robust readiness posture. Organizations with a robust readiness posture will be prepared to carry out their missions as quickly and efficiently as possible,

making the best use out of their resources.



1) Assessment Service

Assessments may be conducted internal to an organization, or

Figure 6: ResponderCQ Assessment Results

with a group of organizations that seek to improve their ability to work together at local, regional, national or multinational levels. In approximately one to two hours users will: Complete the ResponderCQ self-assessment; review a report with customized CQ analysis of results and recommendations; and access tools, job aides and resources to improve CQ.

The scoring system falls on a 0-100 scale. A below average score is 0-20, an average score is between 21-50, an above average score is 51-80, and an excellent score is between 81-100. Score will improve when recommended actions are complete. This is not a static assessment, but is intended to help baseline and monitor progress over a period of 2-5 years. The ResponderCQ self-assessment is the first of its kind in the emergency management realm.

2) *Training and Implementation Toolkit*

Included on ResponderCQ.com as part of the assessment process is a Training and Implementation Toolkit which includes templates, resources and job aids to help responders move to the next level and increase their Capability Quotient self-assessment scores.

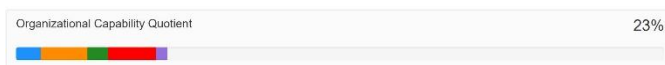


Figure 7: Snapshot of Capability Quotient

3) *Progress Tracking*

Entities that complete the online assessment will immediately gain access to an easy to digest roll-up of their assessment scores for each of the five core elements. Groups are encouraged to follow the individualized plan forward and recommended steps in order to develop and improve their CQ. Responders will be provided with resources to sufficiently track their progress.

Next Steps

To begin a path forward, the authors urge responders to complete the self-assessment to begin the measurement and improvement of their Capability Quotients. ResponderCQ.com can be utilized for more than just the information sharing assessment.

Conclusion

This paper introduced the Capability Quotient in the contexts of disaster and emergency preparedness for the purposes of enhancing responder capabilities. This research links the science behind IQ and EQ to CQ and offers insights on how the three assessments compliment and different from one other. Furthermore, the research stresses the importance of the ability to have a robust readiness posture, to be prepared and willing to react as efficiently as possible, and by making the best use of resources available.

Without a strong and defensible CQ, the knowledge capital and decision-making skills provide little practical efficiency. By

assessing the Capability Quotient of individuals in the responder community, they are provided a baseline from which to understand their current capabilities, and therefore are postured to create a path forward for improvement. This paper reviews any existing research on CQ, the capability quotient in practice and makes the case for measuring the Capability Quotient of the responder community.

Finally, the paper presented the IMIS CMM as a case study, and presented a path forward using ResponderCQ.com, the Capability Quotient and the FEMA core capabilities list and objectives. The authors will continue to develop ResponderCQ.com and move forward with the vision of a culture of readiness.

Acknowledgment

This paper was informed by research conducted for the U.S. DHS S&T. We thank the NATO Science for Peace and Security (SPS) Programme and participants in Bosnia and Herzegovina, Croatia, Macedonia and Montenegro for their participation in the first-ever international IMIS CMM baseline assessment process. We would like to express gratitude to our reviewers for their insights on this paper.

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PROJECT WATER BEAR: ADAPTATION MODEL FOR DECISION-MAKERS IN EXTREME SITUATIONS

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Abstract :The following article will address the characteristics of challenges to decision-makers in extreme conditions and ways to provide solutions improving adaptation to disasters. A model based on the Water Bear's adaptation to extreme conditions will be proposed to recognize ways to improve performance and outcomes of response. Within a modular design, simulation will be run to recognize the human dimension in crisis and disaster response. The purpose of this research is to provide military Commander or civilian equivalent with both experience and information that will be useful in real-life situation.

Water Bear¹ is scientifically proven to be the most resilient creature on Earth. Scientists have run the most apocalyptic scenarios: killer asteroids, supernovae and gamma ray-bursts to see if there is an

¹ Read further about modelling in reference to animal traits in: Matthew Crosston, "Bridging Non-Western Cultures and Conditions into Comparative Intelligence Perspectives: India, Russia and China." International Journal of Intelligence and Counterintelligence, 29: 110-131, 2016.

organism that can survive all.² Despite the name, Water Bear, is not significant in size – it is a microscopic (under 1mm) - organism residing in water.



Picture 1. Water Bear.

Introduction

This project originates from the 2018 Crisis Management Disaster Response (CMDR) Interagency Cooperation Conference which took place in Sofia. In spirit of the conference, a Working Group has attempted to initiate a solution which could address several requirements from different functional areas with one modular design. To maximize

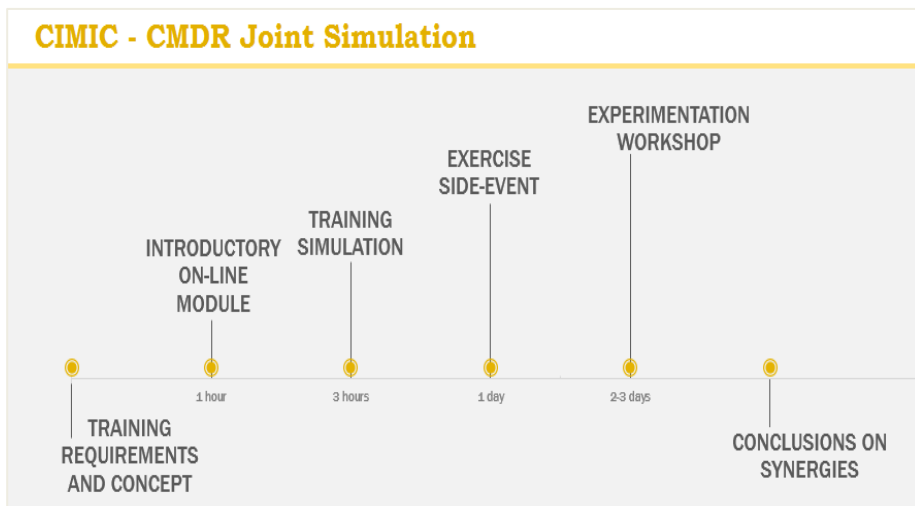
² Several articles were published based on the research of Harvard University astrophysicist, Avi Loeb (on survival of catastrophic event in universe), biologist of University of North Carolina, Thomas Boothby (on shields proteins) and Japanese researchers that have tested immunity to radiation and DNA properties

the benefit from two institutes working together, the complementary effects are assessed and synergies summarized. Project Water Bear is at its initial phase, therefore this article outlines the model, scope, training audience, desired end-state and envisioned application of developed solutions. It is the intention of the author to share the modular set-up with all the community responsible for improving the performance of CIMIC and CMDR, and in broader sense response to disaster. It can also serve as a precedent of cooperative work methodology which saves personnel capacity and adds value.

Modular Design

The basis of the modular design is the building-block principle. This principle means that all steps of the project add another level of expertise. The Depth of Knowledge (DOK) ranges from 100 until 500, reflecting awareness at the lowest level and mastery at the end of the road. Starting with basic level (online module), advancing to training simulation (use in course) and exercises. Those main actions will be supplemented by requirements analysis and following conclusions to be carried

on³. If time and capacity permits, additional experimentation workshop can be executed. For the overview of actions, outcomes and timelines, see the table on page 10. The modular design extends along the Experimentation, Education, Training and Exercises (EETE) spectrum and aims at completing full cycle of personnel development and decision-making support.



Pic 1. Proposed modular design – 4 main actions and supporting steps.

Scope

A joint simulation is planned to improve the knowledge, performance and practical cooperation, in support of the Experimentation, Education, Training and Exercises (EETE). It

³ To allow observations to be translated to lessons identified and consequently learned, evaluation will be requested from Lessons Learned Branch.

is aimed at supplementing existing solutions with understanding of civil environment and response mechanisms. The main goals include:

- **Knowledge base of CIMIC-CMDR synergies;**
- **Training and Education – Joint Simulation available to courses, exercises and NATO events;**
- **Cooperation within COEs cluster build around practical solutions.**

As this is an initial stage of the project, those goals will be reviewed with prioritization when timelines will allow to associate the presentation of outcomes with specific events.

Training Audience

Within the scope of the joint simulation, the main effort will be dedicated to operational level Training Audience, providing military Commander or civilian equivalent with both experience and information that will be useful in real-life situation.⁴ One of the main challenges in case of intersection of CIMIC and CMDR is joint planning and alignment of processes with all relevant

⁴ Francis J. McHugh, "Fundamentals of War Gaming." The United States Naval War College, 3rd Edition, 1966, p.16.

parties⁵. Due to the practical focus of this project, priority will be given to the Training Audience of both centers and extended if required⁶.

Desired End-State

The desired-end state is the increased level of expertise and performance in situation requiring adaptation. In the simplest of terms, the Working Group has considered not only what do we want to achieve but also who we want to achieve. Water Bear designated as the most resilient creature on earth can provide a lot of insights into handling crisis and disasters. What makes it the ultimate survival creature and how does he adapt to adverse conditions? How can we use characteristics of nature to improve decision-makers performance?

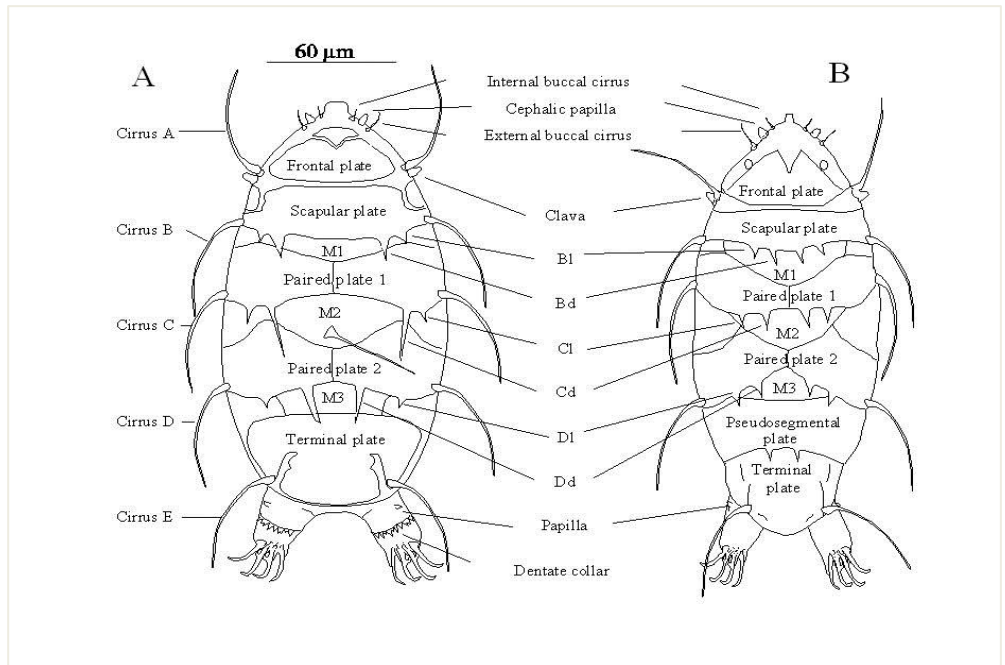
The Water Bear possess specific traits that allow him to become the master of response to stress:

⁵ By relevant parties, the author means two aspects of human dimension: performance of people responsible for responding to certain event and the people that require this response to be successful.

⁶ If you or your organization have interest in being involved/updated on this project please contact Ms. Natalia Wojtowicz (Wojtowicz.n@cimic-coe.org). As this is a cooperative project aimed at complementary effects and synergies, new contributions are welcomed.

- 1) Shields – protecting the organism from too high or too low temperatures and damage;
- 2) Immunity to radiation;
- 3) Extremophile – Water Bear can thrive in extremely different conditions, ranging from crushing pressures of the deepest oceans to frigid vacuum of space. The only deadly weakness is its environment – if all oceans are wiped out, it can't exist⁷.
- 4) No dependency on sun - most organisms can stand bad weather, but die if deprived of sun in the long-term.
- 5) Crypto-biosis – ability to slow down metabolism and suspend into hibernation; If Water Bear meets adverse conditions in his environment, it retracts its limbs and accumulates remaining water.

⁷ This also applies to most life on Earth.



Picture 2. Water Bear anatomy and elements which determine his survivability.

Those traits allows the Water Bear to live through apocalyptic scenario. Can we use this to design a model of a resilient and adaptable decision-maker? What would he/she need in terms of information and experience?

The human who is responsible for responding to the adverse conditions in its extreme form requires a specific set of tools. Following the Maslow's Frontrunner methodology⁸, this project

⁸ Frontrunner methodology has been based on the premise that average of human population does not provide fundamental understanding of its needs. To

aims at identifying the factors that allow successful decision-making under extreme conditions complementing existing processes with human dimension.

Looking at practical use of this model (Graph 1), the following traits⁹ of the decision-maker could be proposed:

- resilience to extremes - finding the right balance of action and analysis,
- adaptation to different environments – recognizing best ways to improve the particular situation,
- ability to defend course of action and motivate subordinates – taking calculated risk in case of changing conditions – resembling “building” shields against temperature,
- immunity to distractions – the decision-maker receives abundance of information and has to be able to filter actionable data,

investigate how to reach full potential, Maslow has recognized over 100 people who were most successful – professors, surgeons, directors etc. Mapping their inputs into a pyramid, he has identified what is essential in terms of needs (and therefore universal in all of the population), but also what is a higher level need which has not been otherwise visible. The same path will be followed within this research, in order to build on the existing baseline and add the human dimension into understanding of decision-making in extreme circumstances.

⁹ Related to the human dimension;

- reversed hibernation¹⁰ – within the area of disaster, the responders are usually not activated until it emerges. This requires ability to provide “sleeper cell” which can be hibernated when not needed. It has to be able to be restored in minimum time when the circumstances are worsening. This requires the decision-maker to have clear criteria for mobilization.

To achieve mastery in those traits, the focus will be drawn towards competences of the participants of the simulation (or other activities enumerated in the modular design). Initially, three competences are targeted:

- Planning;
- Assessment;
- Coordination;
- Translating policies into practice.

Due to the interest in cooperation between NATO and EU, interoperability will be considered alongside this project. If limitations are identified, they will be included in the observations. If synergies will arise, they will be captured in the

¹⁰ Reversed hibernation reflects the crypto-biosis from Water Bear characteristics.

summary of the project. In support of the human dimension, the following factors will be mapped:

- 1) Initiative – decisiveness within high-pressure, high-tempo circumstances;
- 2) Adaptation – changing the way of approaching problem based on conditions;
- 3) Prediction – understanding of the human communities and their needs;
- 4) Resourcefulness – doing more with less;
- 5) End-state – clearly defined outcome of the activities.

The desired end-state is, in short, to provide the highest level of expertise in decision-making in extreme circumstances. To this ends, application of the developing simulation will enable improvement of performance of decision-makers and recognize the reception of the response measures by population affected by adverse events.

Application

M&S is the proposed solution to support decision-making in case of an event, scenario or training that requires expertise on both CIMIC and CMDR. That narrows down the circumstances

that will be presented to the decision-makers to historically-based, current or hypothetical disasters. The scenario will be further determined to be easily used¹¹ in existing Training and Education solutions.

Courses:

- CMDR – Strategic Decision Making for Crisis Response Operations Course;
- CCOE – NATO CIMIC Higher Command Course;

Exercises:

- Balkan Bridge 2019;

Further use of the developments can be added based on requirements review in 2018/2019¹². The detailed overview of each step of the project can be seen in the table.

¹¹ The outcomes will be presented to the institutes and Course Directors to determine their usability.

¹² CIMIC and CMI discipline Training Requirements Analysis is planned for end of 2018. CMDR is updating their requirements with NATO Command Structure.

ACTION		LEAD	OUTCOME	DOK*	TIMELINE
1	Training Requirements and Concept	Joint	Input for Requirement Authority – SHAPE J9 – regarding synergies between functional areas and their application. (Will be connected with Training Requirements Analysis process in CCOE and CMDR)	X	Q4 2018
2	Introductory on-line module	Joint	Knowledge base for participants. Provides preparation/ read-ahead material.	100-200	Q1 2019
3	Training Simulation	CCOE	Facilitated exercised aiming at improving performance of Training Audience.	300-400	Q2 2019
4	Exercise side-event	CMDR	Side-event during an exercise, which will showcase impact of CIMIC-CMDR on military operation. This can be combined with facilitated exercise, but will feature Computer Assisted Solutions.	400-500	Q3 2019 (indicated readiness - depends on exercise schedule)
5	Experimentation on Workshop	Only if needed	IF needed, these tools can be used to support an experimentation workshop of a chosen objective.	X	Based on needs
6	Conclusions on synergies	Joint	Report from the simulation which provides conclusions on CIMIC-CMDR synergies and their impact on military operations.	X	Q4 2019

Validation

Validation of the model will be based on: executing a simulation of the model during courses and exercises, interviews with practitioners and population. This will be paired with case studies that support the developing model¹.

Conclusions

Project Water Bear has been established at the CMDR Interagency Cooperation Conference in 2018. It is aimed at practical solutions addressing support to decision making from CIMIC and CMDR. To this end, a modular design of simulation and associated findings was proposed. Water Bear represents the resilience, adaptation, recovery, readiness and ever-lasting existence. It embodies the goals of joint CIMIC-CMDR simulation and the spirit of the decision-makers that will be responsible for responding to extreme cases of disasters and crisis. Water Bear is the way to improve performance by providing experience and information to the Military Commander and Civilian decision-makers.

¹³ Read further about development in prototyping mode in: Paul K. Davis, "Illustrating a Model-Game-Model Paradigm for Using Human Wargames in Analysis", RAND, 2017.

The results of the Water Bear project will be presented during the next conference, allowing for validation of the proposed model and revision of applicability of the modular design of the joint CIMIC-CMDR simulation. Additional reports can be found on the CCOE (www.cimic-coe.org) and CMDR (www.cmdrcoe.org) websites.

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ENHANCING THE RESILIENCE OF CRITICAL INFRASTRUCTURES IN THE REPUBLIC OF BULGARIA AND THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA: THE ROLE OF THE LEGAL AND STRATEGIC FRAMEWORK¹

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Abstract: The article analyzes the legal and strategic framework for the protection of critical infrastructure in the Republic of Bulgaria and the Former Yugoslav Republic of Macedonia. The paper's focus is on the role of the legal and strategic framework for enhancing the resilience of critical infrastructures in two neighboring South-East European countries – one of them a new EU Member States and the other an applicant for the EU and NATO. The research problem is important because the protection of critical infrastructure is an essential element of national and regional security policy and ultimately allows effective exercise of the rights and freedoms of citizens in the two friendly states. The disruption or destruction of critical infrastructure systems / sectors / subsectors may lead to a

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collapse in the state and society and stop their normal functioning. Critical infrastructure protection is an administrative-managerial and operational activity that enables active bilateral cooperation, especially in the context of the accession of the Former Yugoslav Republic of Macedonia to the European Union and NATO.

Key words: critical infrastructure protection; resilience; disaster risk management

Introduction

We live in an era of computers, digitization and, above all, an era of Internet. The world, as we know today, has evolved into global, interconnected network of systems and information that has transformed the needs of governments, businesses, citizens and opened up new markets with unlimited opportunities for promotion and trading. Globalization, in the light of rapid development and dissemination of information technology, very quickly changes the international security environment. Through many successful attempts, modern terrorism has managed to substantially challenge the modern way of life. In some countries this has affected changing political decisions, and in others, it has caused serious debates about the methods and necessity of the measures taken in the direction of the suppression of modern terrorism. The traditional concept is changing and it is no longer a key instrument for resolving security issues. The national critical infrastructure is the backbone of every country. It is associated with national

security, economy, industry and economic development. Critical infrastructure is means, systems and networks, whether physical or virtual, that are vital to the state and their disability and destruction will cause a debilitating effect on the security of the state, national economic security, public health and public safety.

As this document presents an analysis of the current situation in the Republic of Bulgaria and the Former Yugoslav Republic of Macedonia related to the critical infrastructure, we will put special emphasis on the modern terrorism and natural disasters as a threat on critical infrastructure, analyzing the existing legal framework we will give suggestion for new policies and strategies for protection of the critical infrastructure. The global environmental changes in recent years and the natural disasters around the world have highlighted the urgency of the need for a serious re-examination of the security of critical infrastructure in both countries.

The article concludes with the list of joint activities both at the central and local level that could be carried out in order to enhance the protection of critical infrastructure in both countries.

Legal and strategic framework for the protection of European and national critical infrastructures in Bulgaria

In the recent years there have been significant changes in the development of the legal and strategic framework for the

protection of European and national critical infrastructures in Bulgaria. In 2006 a new Disaster Protection Act was adopted to regulate the protection of the population and critical infrastructures against natural and man-made disasters.² At the European level a Directive on the identification and designation of European Critical Infrastructures and an assessment of the need to improve their protection was adopted in 2008³. The Directive gives legal definitions of basic concepts such as "Critical Infrastructure", "European Critical Infrastructures", "Risk Analysis," etc. The Directive establishes the following list of European critical infrastructure sectors in the energy and transport sectors:

SECTOR	SUBSECTOR
I. ENERGY	1. Electricity 2. Oil 3. Natural Gas
II. Transport	1. Road transport 2. Railway transport 3. Air transport 4. Inland waterway transport 5. Long-distance ocean freight and short sea shipping

² Disaster Protection Act (State Gazette no.102, 19/12/2006)

³ Council Directive 2008/114 / EC on the identification and designation of European Critical Infrastructures and the assessment of the need to improve their protection, Official Journal of the European Union, L345 / 75 of 23.12.2008

Table 1: List of European critical infrastructure sectors in the energy and transport sectors (according to the EU Directive)

In 2012 in Bulgaria a special Ordinance was adopted on the order, the way and the competent authorities for establishing the critical infrastructures and their sites and the risk assessment for them⁴. The Ordinance deals with national critical infrastructures. A list of 19 sectors of critical infrastructures in the Republic of Bulgaria has been officially adopted, as shown in Table 2:

List of Critical Infrastructure Sectors in the Republic of Bulgaria		
Sector	Subsector	Authority
I. Energy	1. Electricity	MEET
	2. Oil	MEET
	3. Natural Gas	MEET
	4. Heat Energy	MEET
II. Transport	1. Road transport	MRDP
	And road infrastructure	MTITC
	2. Railway transport and railway infrastructure	MTITC

⁴ Ordinance (Regulation) on the procedure, the way and the competent authorities for establishing the critical infrastructures and their sites and risk assessment for them, adopted by Decree of the Council of Ministers № 256 of 17.10.2012. SG. No. 81 of 23 October 2012, amend. and dop. SG. issue 19 of February 26, 2013

	3. Air transport and airports	MTITC
	4. Water transport and ports (harbors)	MTITC
III. Information and Communication Technologies	1. Electronic communications networks	MTITC
	2. Information and Communication Infrastructure	MTITC
IV. Post and courier services		MTITC
V. Environment	1. Environment	MEW
	2. Water, water supply and sewerage	MEW
		MRDP
VI. Agriculture and food	1. Agriculture	MAF
	2. Food	MAF
	3. Forests and hunting grounds	MAF
VII. Health	1. Medical and hospital care	MH
	2. Drugs	MH
VIII. Finance		MF
IX. Economy		MEET
X. Sports facilities		MPES

XI. Education, science and technology		MOMH
XII. Natural Resources		MEET
		MEW
XIII. Tourism		MEET
XIV. Regional Development and Urban Development		MRDP
XV. Defense	1. Defense Industry	MD
	2. Military infrastructure and military formations	MD
XVI. Justice, public order and security		DJ
		MI
		SANS
XVII. Government and social governance		MI
		MLSP
XVIII. Disaster protection		MI
XIX. Cultural Heritage	1. Real Cultural Values	MC
	2. Movable cultural values	MC

Table 1: List of Critical Infrastructure Sectors in the Republic of Bulgaria

List of abbreviations:

MEET – Ministry of Economy, Energy and Tourism

MRDP – Ministry of Regional Development and Policy
MTITC – Ministry of Transport, Information Technology and Communications
MEW – Ministry of Environment and Water
MAF – Ministry of Agriculture and Food
MH – Ministry of Health
MF – Ministry of Finance
MPES – Ministry of Youth and Sports
MOMH – Ministry of Education and Science
MD – Ministry of Defense
DJ – Directorate of Justice
MI – Ministry of Interior
SANS – State Agency for National Security
MLSP – Ministry of Labor and Social Policy
MC – Ministry of Culture

In accordance with the 2012 Ordinance lists of critical infrastructure assets in the different sectors have been drafted by the relevant ministries. Specifically, in the ICT sector a Cyber Security Strategy was adopted by the Council of Ministers in 2016.

The strategic framework for critical infrastructure protection in the Republic of Bulgaria is developed on three hierarchical levels as follows:

- Strategy for disaster risk reduction 2014 – 2020
- National Programme for the protection against disasters 2014 – 2018
- Annual Plans for the implementation of the National Programme for the protection against disasters

As a positive aspect the strategic framework clearly defines the policy objectives, priorities, the classification of disasters and measures for the protection of the population. On the other

hand, the strategic framework has certain shortcomings. Overall, the protection of critical infrastructures is not sufficiently elaborated in all the three strategic documents. As a matter of fact the Strategy and the National Programme are not fully coherent and they have differing life spans. The issue of formalism in strategic planning and coordination is not adequately addressed. The focus on prevention is widely declared but it is not substantiated, especially with regard to the protection of critical infrastructures. The financial assurance of the Plans for protection has not been provided. In addition, the role of local authorities in the protection of critical infrastructures is underestimated. To great extent the strategic documents are dominated by wishful thinking. In this context the strategic framework in the Republic of Bulgaria is still an unfinished business.

The Disaster Protection Act, the European Directive and the Ordinance are the main legal acts regulating the protection of critical infrastructures in the Republic of Bulgaria. These acts can be considered as a satisfactory legal framework which could be further developed in areas such as preventive measures for the protection of critical infrastructures, civil society involvement etc. An important step for enhancing the national policy in this respect would be stepping up cooperation with the neighboring countries and, especially with the Republic of Macedonia in the light of the recently signed Agreement on friendship between the two countries dated 01.08.2017.

Critical infrastructure regulation in the Former Yugoslav Republic of Macedonia

Global challenges affected the Former Yugoslav Republic of Macedonia and most of the post-communist countries in unique way. The Former Yugoslav Republic of Macedonia has a fairly safe geographical position in relation to the danger of tsunamis or hurricanes, danger of elementary disasters. Although climate change has been evident over the past few years, it has begun to pose a serious threat to biodiversity and to a considerable extent reflect the number of floods and, of course, the emergence of earthquakes. The occurrence of elementary disasters can seriously threaten critical infrastructure and thus threaten security of the country. The Former Yugoslav Republic of Macedonia has the Crisis Management Center, the principal institution which is responsible for strategic level of decision making and interagency, international coordination and coordination among the local authorities, and it is the 11th country in the world that has adopted a strategy to reduce the risk of disasters, including Law on crisis management⁵, Law on amendment of the Law on crisis management⁶, and Law on amendment of the Law on crisis management⁷. Risks and threats according to the Law on crisis management are national security threats (terrorism, organised crime, corruption, etc.), natural catastrophes (flood, earthquakes, wildfires, etc.),

⁵ "Official Journal of Republic of Macedonia" No.29/2005

⁶ "Official Journal of the Republic of Macedonia" no. 41/2014

⁷ "Official Journal of the Republic of Macedonia" no. 104/2015

epidemic, episodes, etc., environmental hazards (technical, etc.) It continues to complete the legal framework with Law on Protection and Rescue⁸ with all later changes and amendments. The Law on Protection and Rescue operates with several strategic documents which are the pillars of the protection and rescue system – National Strategy for rescue and protection, National risk assessment, and National plan for rescue and protection.

However, it requires further legislative changes, because most of the countries in the SEE region, including the Former Yugoslav Republic of Macedonia have not even established a list of critical infrastructure sectors. In its efforts to achieve complete compatibility and interoperability with collective safety systems as are NATO, EU and UN, the Former Yugoslav Republic of Macedonia has undertaken concrete measures and activities aimed at building of institutional capacities for resistance and reduction of risk pertaining to disasters and catastrophes. The network of subjects regarding the critical infrastructure protection gravitate over the, Ministry of Interior, Ministry of Foreign Affairs, Ministry of Defense, Ministry of Finance, Ministry of Transport and Communication, Ministry of Health, Ministry of Agriculture, Forestry and Water Management, Ministry of Environment and Planning, Ministry of Economy, Ministry of Local Government, Municipalities, Public and private enterprises and agencies engaged in Crisis

⁸ “Official Journal of Republic of Macedonia” No.36/2004

Management Directorate for Security of Classified Information, Protection and Rescue Directorate, all coordinated by the Crisis Management Center. Crisis Management Center is an independent state administrative body, having the status of a directorate, which operates in accordance of the Law of Crisis management and is composed of 34 regional crisis management centers with headquarters in certain municipalities and one Center for crisis management of the city of Skopje. For the first time since the establishment of the Former Yugoslav Republic of Macedonia, organized and coordinated measures and activities were undertaken for handling the large-scale fires in the period July – August 2007 from the Crisis Management Centre who initiated a procedure for declaring a crisis situation on the entire territory of RM.

Since there is no clear dedicated list of critical infrastructure, further legal segmentation follows regarding the anticipated roles and service support for successful critical infrastructure protection. Today, the infrastructure gets a crucial role for the functioning of society, providing a fast flow of information and services, keeping pace with the changes imposed by the technological revolution.

Critical infrastructure protection continues to be a significant issue for many countries around the world requiring not just dedicated institution/s but also appropriate strategy that can enable this protection. The Former Yugoslav Republic of Macedonia still needs to extend the national legal policy

regarding critical infrastructure protection. Even though there is significant improvement in legal context, in order to protect the critical infrastructure, a comprehensive public debate is needed, to create a legal regulation of the protection of critical infrastructure with a special Law on Protection of critical infrastructure as *lex specialis* or to upgrade the existing legal regulation, in the context of the analyzed EU countries and countries from the environment. The effective regulation should provide an effective risk assessment and an appropriate framework for action.

The enormous technological expansion and the increasing dependence on the latest technological advancements despite the security measures taken during their designing, certain "weak points" will always be found which can be misused. At a time when national security is a daily public topic across Europe and the world, cyber security becomes one of the key threats of a country's defense system. The Former Yugoslav Republic of Macedonia, like the other European countries, is not immune to the more frequent and big threats that lurk cyber space, and accordingly, state institutions are obliged to prepare an appropriate strategy for dealing with this type of threats.

With the ever-increasing number of cyber-attacks on critical infrastructure, security experts have determined that their job is to be in constant struggle with invaders. Providing cyber space against cyber-attacks has become a challenge for countries around the world. Finding legal solutions and regulations to deal

with cyber-threats, anticipating and preventing attacks on cyberspace, co-operating with the private sector and security experts, finding an appropriate response to attacks, and quickly restoring attackers to systems and networks are priority tasks for national governments. Preserving and promoting the security of state systems has made cyber security the number one priority in states' states around the world at this time.

Governmental authorities directly involved in Macedonian critical infrastructure protection (CIP) include Ministry of interior, Ministry of defense, Ministry of transport and communication, Crisis management center, Directorate for protection of classified information, and Protection and rescue directorate. There is no legal document in the Former Yugoslav Republic of Macedonia that contains summarized list of critical infrastructures. Moreover, Macedonian legislation for CIP does not centralize responsibility only in one governmental authority. The legislation consists of provisions that, first, locate responsibility and the leading role of specific agency and, second, imply responsibility regarding the bilateral agreements and corporate security.

Conclusion

In terms of enhancing bilateral cooperation between the Republic of Bulgaria and the Former Yugoslav Republic of Macedonia it is recommendable that cooperation would be

developed both at the central and the local level. On the one hand, in the process of accession of the Former Yugoslav Republic of Macedonia in the EU it is expected that EU legislation and, specifically, the relevant EU Directive would be adopted. Harmonizing the legislation in both countries would be conducive to closer cooperation between the competent authorities. Secondly, a positive step at the local level would be harmonizing the Disaster Response Plans of the bordering municipalities with a view to enhancing critical infrastructure protection in both countries.

For example, the following activities could be carried out:

- Creating opportunities for organizing protection and early warning of disasters and accidents in the cross-border region;
- Actions to establish cooperation networks for the legal and safe passage of people and services;
- Activation of civic participation in public structures for security and order in cross-border areas;
- Improving the coordination of work and holding regular meetings between the Bulgarian and Macedonian authorities in the cross-border regions;
- Joint participation in international grant programs for cross-border cooperation between the respective municipalities in the fields of critical infrastructure protection and disaster risk management.

THE OSCE'S CRISIS RESPONSE AND DISASTER MANAGEMENT CAPABILITIES

*Tarik NDIFI,
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The OSCE's comprehensive approach to security

The Organisation for Security and Co-operation in Europe (OSCE) was established to foster peace, stability and security in Europe. The OSCE provides assistance and expertise in a range of conflict-related areas, including crisis response and disaster management. As a consensus-based organisation, the OSCE ensures that any decision taken, including political declarations, receives the full political support of all its 57 participating States¹.

As of its inception, the OSCE has been promoting a comprehensive approach to security, working on three so-called "dimensions" or "baskets", to ensure that different perspectives are taken into account when it comes to setting its working agenda. These dimensions comprise not only political and military, but also economic, environmental, and human rights

¹ The "Organisation for Security and Co-operation in Europe" emerged from the "Conference for Security and Co-operation in Europe". Therefore, the States forming the core of the Organisation are still called "participating States", also after the Organisation changed its name on 1 January 1995.

matters when working on conflict prevention.² This inclusive understanding helped the Organisation become one of the most flexible security arrangements under Chapter VIII of the United Nations Charter as its mechanisms can be applied in a variety of contexts.

Besides the well-known limiting factors of mission planning and crisis response options, such as restrictions in budget and human resources, available planning capacities, or simply very short notice to react, other security aspects are also fundamental to the OSCE's work on sustaining peace and security. Integral parts of the OSCE's work in conflict prevention and – even more so – in post-conflict situations, are, from a purely military perspective, rather soft aspects, nevertheless they are key to achieving long-lasting peace: investment in educational reform; the consideration of gender perspectives; the reform of governmental structures, and the establishment of Ombudsperson institutions.

The need to educate young generations at an early stage on how violent conflicts can be avoided, including through the provision of platforms for dialogue, is an item high on the OSCE's agenda. These educational efforts go hand in hand with addressing youth in general as the OSCE is not only committed to youth protection, promotion and participation in peacebuilding, but also takes young people's views into

² <https://www.osce.org/whatistheosce/factsheet>

consideration in decision-making processes, i.e. through the positioning of the Focal Point on Youth and Security in the Office of the Secretary General.³

In addition, the OSCE has committed itself to the promotion of gender mainstreaming which foresees the integration of gender aspects into the OSCE's policies and practices in order to foster peace, sustainable democracy and economic development.⁴ Both youth and gender advisors enjoy a prominent role in the OSCE's work when it comes to advising on how to support peacebuilding initiatives.

Turning to the developments that define the OSCE's role in crisis management, a key document, that outlines the thematic areas in which the OSCE is supposed to engage, is the 1992 "Helsinki Document"⁵. It presents the first overarching description of how the OSCE's participating States considered using the Organisation to achieve political goals, including how they wanted to approach new political, environmental, and human security challenges.

As a regional security arrangement, it was obvious that the OSCE's work should, from the outset, focus on co-operation and co-ordination with other players in the international arena. Therefore, already back in 1992, participating States approved the enhancement of the Organisation's "capabilities for

³ <https://www.osce.org/cio/207266>

⁴ <https://www.osce.org/mc/23295>

⁵ <https://www.osce.org/mc/58336>

concerted action"⁶. This explicitly included close co-operation with other international organisations, such as the United Nations (UN) and the European Community. Another key partner for the OSCE's work in the human dimension has been the Council of Europe (CoE), with which the OSCE co-operates, especially in the areas of democracy- and state-building, whereas co-operation with the European Community/Union (EU) has mainly been on political and economic development. The North Atlantic Treaty Organisation (NATO), on the other hand, has been considered to be "one of the essential transatlantic links"⁷.

In 1999, the Charter for European Security⁸, also known as the "Istanbul Document", was adopted, reiterating the OSCE's commitment to work with other organisations and institutions to foster co-ordinated approaches and, thereby, avoiding duplication of efforts. While, in fact, compared to the EU's budget for 2018⁹, the OSCE's Unified Budget¹⁰ comprises less than 1% of the EU's budget, and only about 75% of the budget for NATO's civilian staff¹¹, of course, funding is not the only aspect that drives the will for co-operation. Instead, using resources in a reasonable and efficient way is a general understanding for all international organisations. Therefore,

⁶ Ibid., point 4

⁷ Ibid. point 10

⁸ <https://www.osce.org/mc/17502>

⁹ <http://www.consilium.europa.eu/en/press/press-releases/2017/11/30/2018-eu-budget-adopted/>

¹⁰ <https://www.osce.org/permanent-council/373016?download=true>

¹¹ https://www.nato.int/cps/ie/natohq/topics_67655.htm

increased co-operation helps taking advantage of distinctive capacities that complement the ones the OSCE provides.

Adapting and developing crisis response capacities

Based on over 25 years of experience and lessons-learned from the OSCE's engagement in crisis and conflict contexts from 34 field operations, of which 16 are currently operating^{12,13}, and with the aim of supporting continuous development, the OSCE took several steps to increase its capacities in planning and deploying field operations. One example is the creation of the "Rapid Expert Assistance and Co-operation Teams" (REACT).¹⁴ REACT provides a pool of trained civilians in participating States with peace monitoring and police expertise who could be quickly deployed to OSCE field operations. The system's establishment became necessary after experience demonstrated a lack of rapidly deployable staff capable of verifying ceasefire compliance in some of the first OSCE monitoring and verification missions. The system not only allows the OSCE to have a registry at hand, which enhances the OSCE's capability to respond quickly to crises, but also demonstrates the willingness of participating States to practically react to such situations on short notice. Later, the REACT system was complemented by a rapid deployment roster of first responders who consisted, different from REACT, of active OSCE staff members willing to deploy from the

¹² <https://www.osce.org/where-we-are>

¹³ <https://www.osce.org/cpc/74783>

¹⁴ <https://www.osce.org/eea/53422>

Secretariat or an ongoing OSCE field operation to another location where a new OSCE presence needs to be quickly established.¹⁵

Migration Crisis

The abilities of governments and international organisations to cope with challenging or even critical phenomena, such as violent extremism, terrorism, cyber threats, or large flows of refugees and migrants – as Europe experienced especially in 2015 and 2016 – are significantly different from those challenges the founders of the OSCE faced.

The flow of refugees and irregular migrants into and through the OSCE region is one of the most debated humanitarian crisis situations the OSCE has ever experienced. Since irregular migration has only made it to the high-level agenda of the OSCE in the past few years, the respective response options form a niche in the Organisation's work. However, the implications that the phenomenon of mass migration has on the security perceptions in the OSCE region were considered serious enough to be addressed in the Organisation's different fora.

The establishment of an informal working group in March 2016 to discuss the topic of large movements of migrants with representatives of all 57 participating States, also including several of those who have been most affected by the crisis

¹⁵ <https://www.osce.org/secretariat/125375>

themselves, allowed the Organisation to get a better understanding of each State's perspective, perception, and needs in the on-going crisis situation. Notwithstanding the OSCE is not a disaster-relief agency, the provision of a platform for dialogue, such as the informal working group, allowed the Organisation to frankly address several aspects of the migration crisis and its implications for the OSCE region. The Ministerial Council Decision about the OSCE's role in the governance of large movements of migrants and refugees¹⁶ shows how controversially the topic is. At the same time, a compromise in following up with the topic could be reached, despite the partially opposing views on how to approach the crisis from national perspectives.

In order to address migration in a cross-dimensional way, and to include the impact irregular migration has on the security of its participating States, the OSCE provides capacity-building and policy advice to participating States, most often in countries which host an OSCE field operation.¹⁷ Having said that, it should be noted that there are, without a doubt, other organisations in Europe and the wider region which are better placed and more qualified to address the topic of (irregular) migration and displacement, underlining the migration-security nexus. These include, among others, the United Nations High Commissioner for Refugees (UNHCR), the International

¹⁶ <https://www.osce.org/cio/289491?download=true>

¹⁷ <https://www.osce.org/sg/231526>

Organisation for Migration (IOM), and the CoE. However, since several of the OSCE's field operations are located in regions that have been most affected by the recent migration crisis, the Organisation can play a supportive role, within its mandate and within its limited capacities as well.

Supportive roles cover, for instance, the live-simulation exercise "Combating Trafficking along Migration Routes", as one of the capacity-building measures that the OSCE applies to increase its participating States' responsiveness¹⁸. In this exercise, the OSCE, together with several partners, such as the IOM, UNHCR, UNODC, INTERPOL, EUROPOL and CEPOL, conducts real-life simulations since 2016 which attract great attention and interest from civil society organisations, non-governmental organisations (NGOs), and governmental institutions all over Europe

The scenarios simulated cases of labour and sexual exploitation among migrants with the aim of enhancing the capacity of interested OSCE participating States and expert staff to identify victims of trafficking in human beings in a timely fashion, and to effectively prosecute traffickers, in order to strengthen the overall criminal justice and civil society response along migration routes.

¹⁸ <https://www.osce.org/projects/cthbivex>

The OSCE's work addressing the 'conflict cycle'

Following the terrorist attacks in the United States in 2001, the OSCE started discussing its new "OSCE Strategy to Address Threats to Security and Stability in the Twenty-First Century"¹⁹. The Strategy was adopted during the Ministerial Council in 2003, and not only addresses States' need to prepare themselves for international terrorism, but it also underlines the requirement to build confidence among people within and co-operation between States.

The Ministerial Council Decision adopted in 2011 on "Elements of the conflict cycle"²⁰, takes up these ideas and follows the commitments agreed twelve years before in the Charter for European Security at the 1999 Istanbul Summit²¹. Both decisions, the first one taken in 1999, and that of 2011, reaffirm the OSCE's commitment "as a key instrument for early warning, conflict prevention, crisis management and post-conflict rehabilitation"²². The 2011 Decision additionally defines the OSCE as the "primary organization for the peaceful settlement of disputes within its region"²³. This Decision also emphasises that mediation should be applied in conflict prevention and resolution.

¹⁹ <https://www.osce.org/mc/40533>

²⁰ <https://www.osce.org/mc/86621>

²¹ <https://www.osce.org/mc/17502?download=true>

²² Ibid, point 7

²³ MC. Decision 3/2011, page 1

Overall, the Decision from 2011 aims "to enable timely and preventive responses to crises and conflicts"²⁴. That includes the tasking of the Secretary General to not only consolidate the OSCE's early-warning capacity in a comprehensive and cross-dimensional manner, but also to propose how the OSCE can enhance its fact-finding capacities. The Decision further encourages the Permanent Council, the OSCE's decision-making body, to "seek input of other international and regional organisations"²⁵ in the matter of early-warning and possible response options. This is a well-known approach from previous decisions, such as the 1994 Budapest Summit Declaration²⁶ which decided "to pursue more systematic and practical co-operation between the CSCE and European and other regional and transatlantic organizations and institutions"²⁷, as well as the OSCE's Declaration on Co-Operation with the UN from 2006²⁸ that suggests to take steps to further strengthen co-operation between the two organisations. The basis for close co-operation with other actors in emerging crisis situations and conflict-affected areas is, therefore, not only considered an asset but an operational requirement.

With the adoption of the Charter for European Security in 1999 and the 2011 Decision on Elements of the Conflict Cycle, the Organisation underlined the need to be better prepared for

²⁴ Ibid.

²⁵ Ibid, point 6

²⁶ <https://www.osce.org/mc/39554?download=true>

²⁷ Ibid, point 8

²⁸ <https://www.osce.org/pc/18525?download=true>

emerging crisis situations, which require rapid responses. As a practical tool, the establishment of a virtual pool of equipment, consisting of inventory lists of material that might be needed in an immediate crisis situation, was a first step in this direction. The lists provide an overview of where required items are in use or stored in field operations. Thus, the objects can be transferred from a nearby field operation to another location, meaning that items that are difficult or time-consuming to procure, such as armoured vehicles or personal protective equipment, can be made available on short notice. The usefulness of such inventory list was evident in the Ukrainian crisis situation that is going to be discussed in the next chapter.

The OSCE's crisis response in Ukraine

The OSCE's Special Monitoring Mission to Ukraine (SMM) provides a practical example on how challenges in the current security environment can be overcome, and how the paradigms in conducting operations are changing.

One of the key lessons identified in the OSCE's response to the crisis in and around Ukraine is that there still remains a discrepancy between the Organisation's current operational capabilities and those required to conduct missions in high-risk security environments on an ad hoc basis.

However, when looking at the current situation in parts of Ukraine, it should be acknowledged that the SMM's initial

mandate²⁹ was adopted in March 2014 when there was no ongoing fighting in certain areas of the Donbas. The Mission was established under the impression of the annexation of the Crimean Peninsula by the Russian Federation. Hence, the mandate and the capacities which were foreseen for the Mission's establishment only took into account the then existing requirements, i.e. a tense but, at least, from a political-military security perspective, a largely non-violent area of operation. Timewise, there is no doubt that, without the prior existence of another OSCE field operation in Ukraine³⁰ – despite the above-mentioned virtual rosters of personnel and material assets – the establishment and operational readiness of the SMM would have not been achieved as quickly as it was.

The SMM has grown into the OSCE's largest field operation and currently consists of more than 1,200 staff members, including about 700 monitoring officers. The Mission's development from initially only 100 staff, who were deployed within a week's time of the decision to launch the Mission, shows how the OSCE was able to respond on short notice. At the same time, it should be mentioned that such an ambitious establishment required the full support and commitment of all OSCE Secretariat departments and staff, in order to cope with the tremendous workload, including recruitment, procurement, and operations management.

²⁹ <https://www.osce.org/pc/116747>

³⁰ <https://www.osce.org/project-coordinator-in-ukraine>

The SMM's mandate, which has not changed since 2014, tasks the Mission to:

1. gather information about and reports on the security situation in the host country;
2. establish and report facts in response to incidents concerning alleged violations of fundamental OSCE principles and commitments;
3. monitor and support respect for human rights and fundamental freedoms;
4. establish contact with local, regional and national authorities, civil society, ethnic and religious groups, and members of the local population;
5. facilitate dialogue to reduce tensions and to promote normalisation of the situation;
6. report on freedom of movement restrictions for its staff; and
7. co-ordinate its work with the United Nations, the Council of Europe and other actors of the international community.

The last point directly falls into the topic of collaboration with different international organisations as mentioned above, which is applied in Ukraine as much as in other countries that host OSCE field operations.

Besides these already quite comprehensive tasks, the political developments in Ukraine – namely, the Minsk Protocol³¹ and its subsequent agreements – made it necessary to add some points to the Mission's tasking. The agreements were reached through close co-operation of the so-called "Normandy Format", consisting of France, Germany, the Russian Federation, and Ukraine, which made the SMM the key monitoring entity for ceasefire violations by either conflict party.

While the mandated task was in parts similar to that of the OSCE's "Assistance Group to Chechnya"³² (operated between April 1995 and December 1998), which was also tasked to promote dialogue and to seek peaceful resolution of the crisis, the situation in 2014 was quite different. Also, the Mission requirements stretched the OSCE's capacities much more than any previous engagement, highlighting the need to further improve the Organisation's capacities even when the political and financial environment might not be conducive to such efforts.

The OSCE's experience in Ukraine demonstrates the constant need to adapt and enhance crisis response capacities to be able to conduct missions in high-risk and complex security environments, especially if additional tasks are assigned, such as through the Minsk agreements. Therefore, and in order to be better prepared for future operations of similar complexity, a

³¹ <https://www.osce.org/home/123257>

³² <https://www.osce.org/pc/20251>

collaborative and comprehensive approach to crisis situations among leading international organisations would not only be useful but might become paramount to achieving the set objectives in any larger crisis response scenario. The operational demands of today's crises are of such a vast range that it is increasingly difficult, if not impossible, for one organisation alone to cope with all of them.³³ Co-operation with other actors working on security in Europe is very much needed.

OSCE's experience in disaster response

Regarding the OSCE's engagement in disaster response, there are several instances in which the SMM acted as a vivid example of how the Organisation supports actions in this field in practice.

During the fighting in the conflict zone in eastern Ukraine, a governmental repair team for critical infrastructure came under mortar fire. The SMM was then asked, based on the task to "facilitate dialogue to reduce tensions and to promote normalisation of the situation"³⁴, to facilitate a local ceasefire, allowing the repair team to resume their work. A second example of successful dialogue facilitation by the SMM was the monitoring of demining efforts in preparation for repairs of a major water pipeline along the line of contact between

³³ <https://www.osce.org/cpc/39621>

³⁴ <https://www.osce.org/pc/116747>

government-controlled and non-government-controlled territory after a ceasefire was enabled.³⁵

The importance of being well-connected with the host state, i.e. through a temporary or permanent presence on the ground, has also been showcased in 2014. Back then, large parts of South-Eastern Europe, including Bosnia and Herzegovina and Serbia, which both host an OSCE field operation, were affected by severe flooding, leaving many cities and villages completely under water, and hundreds of thousands of people without shelter, with no electricity and very limited drinking water.

The immediate question for the OSCE's field operations was whether they had, according to their mandate, a role to play in engaging in such a disaster situation, and if so, which one that would be. Since the OSCE supported local government structures in dealing with capacity-building in the area of crisis management co-operation and collaboration, the missions looked for available resources that could be quickly mobilised. In the case of the Mission to Bosnia and Herzegovina, an internal working group was set up to make proposals for a programmatic response.

Based on these proposals and in coordination with the host country, the Mission opened five temporary premises in Bijeljina, Maglaj, Orašje, Prijedor and Šamac municipalities which had all been heavily hit by the flooding. The purpose of

³⁵ <https://www.osce.org/ukraine-smm/183151?download=true>

the field offices was to monitor political, economic and social developments in flood-affected areas and to provide logistical and technical assistance to support coordination between local authorities, donors, and international relief organisations and agencies.

In view of the gender-sensitive approach the OSCE takes in its work, it should be mentioned that, in parallel, the Missions' gender units in Serbia and Bosnia and Herzegovina helped local authorities develop gender-sensitive disaster response plans and assisted local media to better cover the gender aspects of natural disasters. The results of these efforts are the publication "Media, Gender and the Reporting of Emergencies"³⁶, issued by the OSCE Mission to Serbia³⁷, as well as a case study produced by the Mission to Bosnia and Herzegovina upon request of the Municipality of Maglaj. The case study aimed to ensure an objective assessment of the situation and the Municipality's response to the flood³⁸, in order to help prepare for similar disasters in the future.

³⁶ <https://www.osce.org/mission-to-serbia/314756?download=true>

³⁷ The floods, in addition to straining the livelihoods of many persons in affected municipalities, have also increased the risk of domestic violence through incurred trauma and altered gender roles in affected families. Furthermore, violent incidents occur more frequently in a period after the immediate threat to human security has ceased. This kind of challenges may reverse all the earlier efforts made to fight domestic violence and gender-based discrimination.

³⁸ <https://www.osce.org/pc/183376?download=true>

Overall, the two Missions' efforts were well-received by the local communities, the higher government authorities, and other international organisations and donors.

Besides, the OSCE Secretary General authorised EUR 50,000 for immediate assistance to the most affected people in both countries. In co-ordination, partly supported by the Red Cross, the assistance was delivered through the OSCE Missions. The Mission to Serbia, supported by the Swedish development agency, also procured water pumping equipment for another EUR 20,000. These modest funds helped people who were directly affected by the floods and subsequent landslides.

From a peacebuilding perspective, it is important to understand one of the long-term effects of the disaster and disaster relief: communities which had not co-operated with one another prior to the flooding opened up and approached the challenge from a humanitarian perspective, rather than from the largely prevailing ethnic perspective. This illustrates best what the OSCE understands as a comprehensive approach to security, including in disaster management.

In the aftermath of the immediate response to the flooding, a regional conference was organised to discuss the lessons from the disaster and its management, and how the international community could improve its co-operation in disaster management.³⁹ In addition to the OSCE Mission to Bosnia and

³⁹ <https://www.osce.org/mission-to-bosnia-and-herzegovina/156266>

Herzegovina, the conference brought together the Ministry of Security of Bosnia and Herzegovina, the Centre for Security Cooperation Racviac from Croatia, and UNDP.

In conclusion, the OSCE, as a regional security organisation, provides for a very collaborative and comprehensive approach to security in Europe. The OSCE's long-lasting experience in deploying field operations with various mandated tasks, ranging from crisis response and economic and environmental reform, to ceasefire verification and advisory roles, continues to contribute to sustaining peace in Europe. However, as outlined above, current, as well as new challenges do and will continue to require closer co-operation with other actors who are either more specialised, or have complementary capacities or mandates. In this regard, platforms that address and promote interagency co-operation in crisis management and disaster response are a great opportunity to exchange experiences and lessons, in order to learn from each other across existing mandates and areas of operation.

THE APPLICATION OF SATELLITES IN MODERN CRISIS MANAGEMENT, MONITORING AND DISASTER RELIEF EFFORTS

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Abstract: Today humanity is intertwined with modern technology on a level never seen before. As environmental and anthropogenic disasters remain one of the biggest threats to the existence of humans as species, the nations of our planet started using greater amount of modern technologies such as satellites for monitoring harmful events, early warning and for the reduction of negative influences of the abovementioned on modern society and everyday life.

Key words: satellites, crisis, relief, management, disaster, surveillance, data, information, systems

Nowadays many life-threatening events gloom the bright future of mankind. In the last decades, due to the anthropogenic influences on the nature of our home – the planet Earth – the rate of disasters happening is increasing on a yearly basis. Thanks to human activity the normal circle of life on the planet is destabilized, thus leading with itself different types of disasters classified in two big groups:

Environmental – this type of disasters is usually connected with abnormal changes in nature's behavior, with disasters such as floods, earthquakes, volcanic eruptions, avalanches etc. included.[1] They can be indirectly influenced by human actions (such is the case of deforestation as a leading factor for flash floods of all sizes);

Anthropogenic – here the main reason for this type of event to be triggered is either a human error, a failure of any man-made structure or object or the event's happening is directly connected with man's activities on the environmental balance. Here we can list industrial catastrophes, the pollution of Earth's nature and the mass extinction of species caused by the actions of man.[6,7,8]

In an attempt to combat the future risk of disasters triggering and to reduce the impact of such on modern society, our species have successfully implemented modern technologies to our advantage in reducing the danger for ourselves. The big jump in high-technology invention that came in the second half of the 20th century with technologies such as modern computer and electronic devices, composite materials, navigation systems and astrotechnologies paved the way for implementing the usage of UAVs, long range radars and scanning devices and most importantly – satellites – for countering disasters and early warning the population of any chance of such events to happen. [5, 7]

Satellite remote sensing can provide irreplaceable information in the phases of the disaster risk management cycle and help any crisis management – related structures make decisions and take a course of action. Satellite surveillance can contribute in the damage assessment process and the recovery operations executed immediately after a hazardous event. Due to the fastest rate of information collection and transfer found in the modern satellite technology, artificial object orbiting the planet have become a valuable asset in crisis management thanks to their remote sensing ability. [1, 2, 3]

As of the year 2017 there are 1738 active artificial objects orbiting our planet, excluding debris from derelict spacecraft. From this number over 500 are used exclusively for observing the landscape of our planet. In the field of crisis management and monitoring satellites are commonly used as components of either early-warning or disaster aftermath surveillance systems. Their important role in crisis management, disaster relief efforts and hazard management and preparedness comes from the diversity of roles the orbital craft can take and the comprehensive number of hardware and software that can be installed on each satellite in order to function in a pre-planned mission or to execute tasks when disaster strikes.[2, 4]

There are many advantages that give satellites an overall edge over other methods used for disaster preparedness and prevention and crisis and hazard management. First of all, artificially-created spacecraft orbiting our planet are very

versatile due to the fact that they can be used for a great number of activities in any given area – such is the case for early warning about negative man-made or environmental threats. Single systems or clusters of satellites can handle an exponential number of duties such as monitoring the landscape of preselected areas, collecting, analysing, storing and transferring data between different entities, calculating algorithms and remote sensing various risks for the environment. [5, 6]

Due to the large area they cover and the diversification in their process of usage, operating satellites for such assignments is a cost-effective way to combat hazards. Nowadays most of the natural disasters that are being monitored are connected with rapid and sudden changes in global or local climates, rising sea levels or dangerous movements of the tectonic plates under the Earth's crust. By creating multi-level entities, consisting of space and land segments (a satellite/cluster and a land station, used for analysis and storage of information) dangers such as the abovementioned can easily be tracked and prevented.[3,4,5]

In the last decade a large number of sovereign states, government-controlled entities and NGOs took part in the usage of artificial objects used for monitoring from our planet's orbit and creating GIS systems in which satellites are the main data collection device. Different states put priority on disaster monitoring of the events that can hamper the national economy,

critical infrastructure, concentrations of population and their habited territories as a whole. For example the nations of Africa, to be precise the ones situated in the Saharan or Sub-Saharan regions use satellite surveillance mostly for monitoring droughts, sandstorms, oasis water levels and the terraforming of the local landscape and environment influenced by such processes.

Systems like ARTEMIS (African Real Time Monitoring and Information System), operated by the National Space Agency of the USA is responsible for tracking patterns of rainfall and changes in areas covered by vegetation in areas susceptible to drought and related events. In East and Southeast Asia ,where the gravest dangers facing the population are abnormal wind movements such as hurricanes, floods and rapid changes in the sea-level the main focus in using satellites to prevent crisis and hamper negative effects and influences post-crisis is connected with monitoring water levels and movements.

After a propose in 2005, a group of Asian states created the Sentinel Asia GIS, integrating satellites and modern web technologies in order to counter the increasing threats to humanity in this part of the globe. [6, 7]

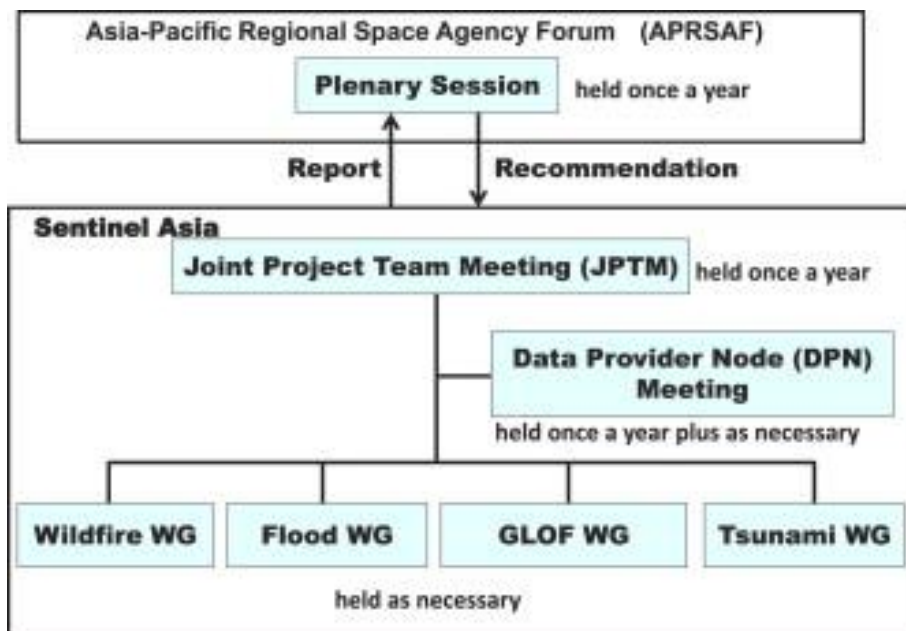


Figure 1 Structure of the Sentinel Asia GIS system[6,7]

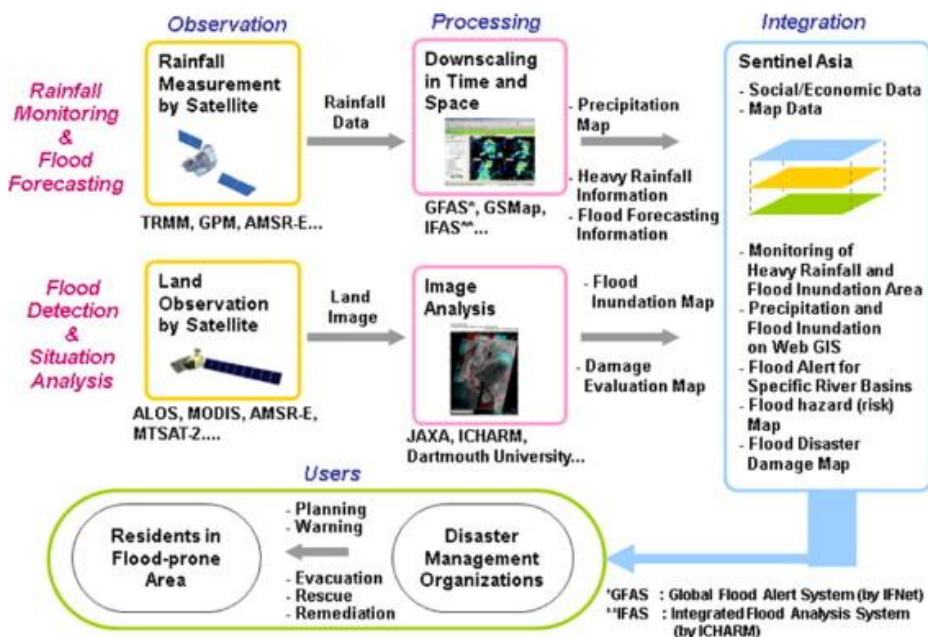


Figure 2 Sentinel Asia cluster usage for monitoring floods and rise in water levels [6,7]

As being a project with a high number of participants, Sentinel Asia has proven its reliability and effectiveness due to the share of crucial data, flexibility of the actions of the members of the joint group and the usage of highly-mobile cluster of satellites called the „Sentinel Asia Constellation“. The direction of various task to the working groups of the project make the threat analysis and assessment an effective process which can simultaneously analyse different hazards to the region covered by the cluster. [6, 7]

On the other hand, the high level of reliance upon satellite remote sensing can threaten the national security of sovereign states and the global security overall. Today the frontier between the civilians and the military personnel in a conflict or a crisis is close to non-existent in many hotspots on the different continents. Satellite use high – resolution and quality images that are in most cases freely distributed through the different users of the technology, thus ending in the hands of non-state actors like terrorist organisations and other fundamentalist and extremist groups operating around the globe.

In the last decades insurgent groups in regions like the Middle East have used GIS systems and satellite images in their efforts to combat the security apparatus of the legal governments of different political entities and international organisations forces indiscriminately. [2, 3, 4]

As a result, states like the United Kingdom and the USA took countermeasures in the geospatial imagery availability, the

quality of pictures taken by systems used by non-governmental entities and even falsifying terrain and structure images that can hamper the security system of the state. These actions rose sharply especially after the beginning of the War on Terror in the early 00's of the second millennium. Usage of GIS systems based on data gathered by satellites proved crucial to the planning and executing various operations by analysing collected terrain information, thus calculating the terrain factor on the actions of the friendly and hostile troops, vehicles and equipment involved.

Prognosis made by scientists and state officials tend to give a broader responsibility for crisis management on orbital surveillance systems. GIS systems that rely primary on satellite data collection have proven themselves as worthy for conducting tasks in this field of action. In addition, by usage of state – of – the – art hardware like cameras, high-zooming lens and different software for accessing damage and casualties after destructive events, satellites can be used as a method of scaling levels of sustained damage and add to the search and rescue efforts post – happening.

Especially in areas affected by events connected with water such as flash floods or tsunamis, one of the most accurate way to calculate the water levels is by taking imagery from orbit, analysing the collected data either by a software installed on the satellite or on hardware located in the ground segment of such disaster monitoring missions.

With the advent of newer and newer technologies implemented in hazard monitoring, negative event management and risk elimination, satellites are beginning to phase out older and cumbersome apparatus, methods and systems operating in the fields mentioned above.

Also, in recent years spacecraft became more cheap, sturdy and even more economically efficient and entities that use satellites for monitoring are not only entitled to the government or military – operated machines now require far less funding to efficiently run a monitoring mission. In addition, data is gathered and transferred easily between different users when collected by orbital remote controlled crafts and now one gathering cluster can supply a high number of users like educational entities and organisations, international or state structures and NGOs and individuals alike.

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RISK AND VULNERABILITY ASSESSMENT APPROACHES FOR REGIONAL & NATIONAL DISASTER RISK REDUCTION PLANNING

Joseph GREEN, PhD

Steve RECCA

Abstract: This paper provides an overview of proposed content for the Disaster Management Course 2018, 28 May – 01 June. The briefing module (40 minutes) will focus on describing the application of risk assessments, successfully employed in a disaster risk reduction environment, for decision support in a broad array of regional, national, and subnational natural and man-made security challenges. A risk assessment, as defined by the United Nations Office for Disaster Risk Reduction (UNISDR), is: “A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.” The module will provide an overview of the Pacific Disaster Center’s (PDC) risk assessment approach that has been validated at global, regional, national and sub-national levels and used by governments and regional organizations in Asia, the Americas, and in Africa. The practical application (1.5-2 hours) will demonstrate and exercise the risk assessment approach that conceptualizes disaster risk as a function of Multi-Hazard Exposure (MHE), Vulnerability (V) and Coping

Capacity (CC). Each risk component (MHE, V, CC), as well as the sub-component themes and sample datasets that can be used to describe them, are discussed. Examples of the application of the approach and the new emergency application of the data and method to support the role of NATO are outlined.

Key objectives of the methods and applications that will be presented in the module include how to:

- *Strengthen NATO capabilities by providing the necessary information and data for evidence-based decision making;*
- *Provide an alternative view for examining the relationship between each actor and a repeatable approach to understanding the complex relationships towards commonly prioritized disruptors (threats/challenges);*
- *Enable the partner/friendly nation governments and security forces by identifying opportunities to reduce institutional fragility through building resilience against threat networks; and*
- *Empower civil society – citizens, the private sector and non-governmental organizations – by reducing vulnerability to natural hazards and influences of threat networks in a cooperative, multi-sector operating environment.*

Background

Nations face a wide variety of risks. Natural hazards and human-created disruptions to normal function can have lasting impacts on the economy, society and neighboring nations. Therefore, it is important to have a systematic method for evaluating the likelihood of potential disruptions. Utilization of such a method allows for a common understanding and communication of risk.

Risks to disruption of normal function occur at the interface between the potential disrupting event (e.g. natural or technological hazards; human actions) and the established human-environment system within a given geography. It is at this interface that the collective characteristics of a region (example: governance, poverty, infrastructure, etc.) influences the extent of the disruption. A model of the interface between the event and human-environment system can best describe the level of disruption beyond the ability to cope (Figure 1).

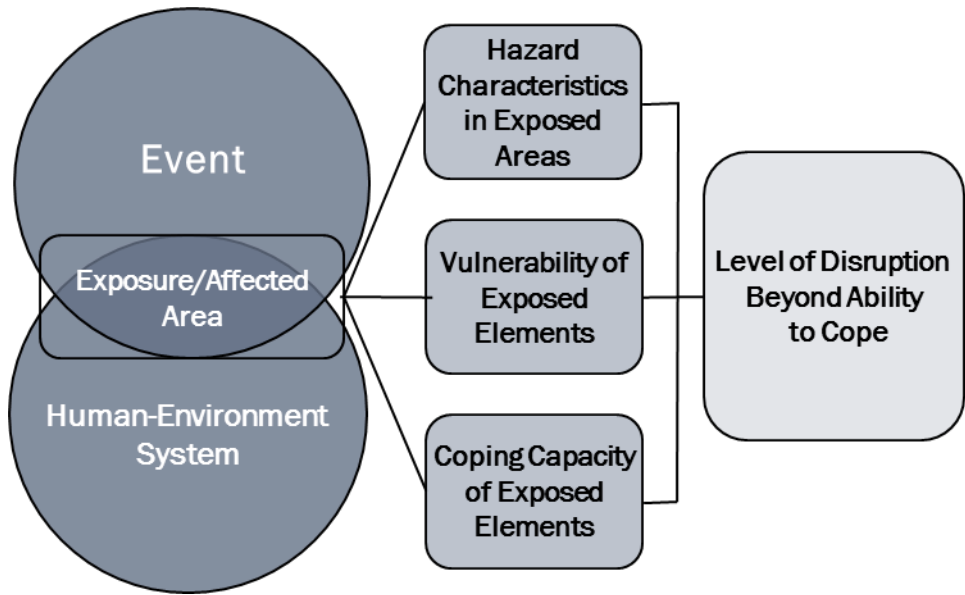


Figure 3 Theoretical framework for conceptualizing Risk and Vulnerability Assessments¹

Risk can be modeled as a combination of an exposure to the potential disruptor, vulnerability to disruption, the capacity to prevent, manage, recover from a disruption. PDC's RVA has utilized this theoretical framework to assess a country's likelihood of disruption of normal function due to natural hazards. The RVA models Multi-Hazard Risk (MHR) as the average of a country's exposure to multiple hazards or Multi-Hazard Exposure (MHE), Vulnerability (V) and *lack of* Coping Capacity (CC). The combination of these results is a robust decision support metric that can be leveraged to:

- Better understand risk;

¹ Pacific Disaster Center (2017) National Disaster Preparedness Baseline Assessment: Risk and Vulnerability Assessment (RVA) Data Sharing Handbook.

- Identify where resources may be needed;
- Prioritize action;
- Anticipate potential leverage points to support sustainability;
- Improve understanding of the temporal and spatial elements contributing to disruption;
- Provide the necessary justification to support policy decisions to protect lives and reduce losses; and
- Establish the foundation for monitoring risk and vulnerability to disruption over time.

Risk and Vulnerability Assessments (RVA)

Global Application: PDC Global Risk and Vulnerability Assessment (RVA)

PDC's Global RVA, originally published in 2010, is constructed as a composite index where indicators measuring the economic, social, demographic, environmental and governmental status of a country are combined to measure sub-component themes that are difficult to directly gauge. The individual variables, or *indicators*, are scaled to a standardized value range so they can be mathematically combined into a relative measure of the theme of interest. These measures can then be combined to represent more complex multi-dimensional concepts. For example, adult literacy, school enrollment rates, average years of school, and internet users per 100 people combine to provide a measure of a population's overall ability to

access and understand information. These sub-component themes are then averaged into the larger components of V and CC.

The V and CC components can be combined to represent Resilience (R). These components are conceptualized as independent of the exposure, meaning that they could represent the resilience to *any* disruption to normal function. Moreover, the RVA can be scaled to regional, subnational or lower geographic dimensions. The geographic extent of the risk assessment is solely limited by data availability. This allows for a high degree of flexibility in the application of the RVA. This flexibility has been utilized in an increasing number of settings as outlined below.

For global application, PDC conceptualizes Risk as a function of Multi-Hazard Exposure (MHE), Vulnerability (V) and Coping Capacity (CC). PDCs Global RVA considers exposure to multiple hazards (flooding, tropical cyclone winds, earthquakes and tsunamis). Vulnerability and Coping Capacity are considered hazard independent. The basic model for the Multi-Hazard Risk Index is $R = [MHE + V + (1-C)] / 3$. The Resilience Index, which can be used to represent a country's ability to prepare for, respond to and recover from a disaster, is calculated as $R = [(1-V) + (C)] / 2$.

It is important to note that the utility of indices depends heavily on how well the indicators and thematic sub-indices represent the concepts they are intended to capture and on how well the

conceptual model captures the relevant dimensions of a complex problem and potential interventions. For PDC, the Global RVA approach has been tested, refined and validated over a ten-year period. Thematic data supporting the assessment is obtained from recognized international sources such as United Nations organizations, World Bank, respected university programs like the Uppsala Conflict Data Program and University of Maryland's Minorities at Risk Project, and international non-profits and organizations such as the Centre for Research on the Epidemiology of Disasters. A total of 251 administrative units are included in the analysis with 170 countries and territories having sufficient data to be included in the final risk index².

Subnational Application: National Disaster Preparedness Baseline Assessment (NDPBA)

The National Disaster Preparedness Baseline Assessment (NDPBA) is a PDC program focused on subnational disaster management assessments. The intent of the NDPBA is to document disaster risk reduction (DRR) initiatives being undertaken in the selected country and its communities to help highlight challenges and successes. The project applies a repeatable and measurable approach to examining key elements of DRR, specifically Comprehensive Disaster

² Pacific Disaster Center (2013) Global Risk and Vulnerability Assessment Technical Annex.

Management (CDM)³ and Risk and Vulnerability (RVA). Through this approach, stakeholders receive the necessary information and data to support their efforts to target and prioritize programs and investments designed to improve DRR capacity and capability to build more resilient communities. The overarching objective of the baseline assessment is to identify the conditions throughout the country that make regions more or less prepared and capable of effectively responding to and recovering from disasters.

Designed to provide a comprehensive understanding of risk and disaster management capabilities, the program supports evidence-based decision making to enhance disaster risk reduction (DRR) through focused capacity and capability building. Using a stakeholder-driven approach, the NDPBA program facilitates the integration of national DRR goals into the Risk and Vulnerability Assessment (RVA) and Comprehensive Disaster Management (CDM) methodologies.

The goal of the project is to enhance disaster resilience by:

- Scientifically capturing disaster risk within the environmental, social, and economic context of a country;
- Documenting and assessing disaster risk governance with the goal of providing actionable information that can

³ Hughey, Erin (2003). Community Size and Response to Hazards: A Case Study of Falmouth, Kentucky.

be used to strengthen disaster management and manage disaster risk;

- Better understanding the disaster management capabilities in a country to manage, prepare for, and respond to disaster events;
- Analyzing multi-hazard risk to provide actionable information to guide investments to strengthen resilience; and
- Providing a forum for all vested stakeholders to share and communicate successes and challenges encountered in the understanding and management of disaster risk.

The NDPBA provides a repeatable and measurable approach to examining key elements of DRR. The approach consists of four distinct yet complimentary components, including: 1) focused stakeholder engagements in the form of facilitated knowledge exchanges; 2) a RVA conducted at the subnational level; 3) a CDM assessment carried out at national and subnational levels; and 4) the creation and promotion of a common foundation for data gathering and sharing.

NDPBA components are uniformly undertaken to provide the foundation for short- and long-term preparedness activities through the development of:

- A detailed subnational risk and vulnerability assessment that includes: multi-hazard exposure, vulnerability, coping capacity, resilience, and multi-hazard risk;
- A review of national and subnational CDM capabilities to include the following elements: good leadership by professionally trained officials, foundation of supportive values for government action, legal authority to act, advocacy supporting action, and necessary institutional resources as they apply to the different phases of disaster management (preparedness, mitigation, response and recovery);
- A proposed five-year plan including recommendations to build capacity and capability; and
- Data integration and information sharing.

While the NDPBA comprises both CDM and RVA, and the overall value of the assessment process is a function of the integration of the CDM and RVA results, this paper focuses on exploring the use of PDC's RVA approaches to support NATO member disaster management. Risk, Vulnerability and the related sub-elements described below, provide the necessary temporal and spatial data to serve as the underpinning of effective DRR decision-making. Furthermore, the PDC approach ensures that all analyzed data (tabular and spatial) are provided to stakeholders in easy to access formats. The net

result is a necessary common foundation (baseline) for data gathering and evaluation to help support:

- Identification of targeted intervention programs;
- Program monitoring and evaluation;
- Robust data holdings to examine trending and develop projections; and
- Development of repeatable metrics for progress.

RVA Framework

Regardless of scale, PDC's conceptualized approach to risk and vulnerability is flexible enough to apply if uniform data is available. To better understand how NATO could benefit from PDCs approach, the core components are detailed below.

Multi Hazard Exposure

Exposure information characterizes the hazards that are likely to occur within a given study area, and provides some quantification of the people and assets that could be affected by those hazards. Figure 2 provides a simplistic example of how hazard information and asset data can be combined to help characterize exposure. Five colored *hazard* zones representing different levels of intensity are shown along with satellite imagery of building *assets*. When asset information is overlaid with the hazard zones, it is possible to see what may be subject to varying degrees of potential impacts, and from this information the level of *exposure* can be estimated.

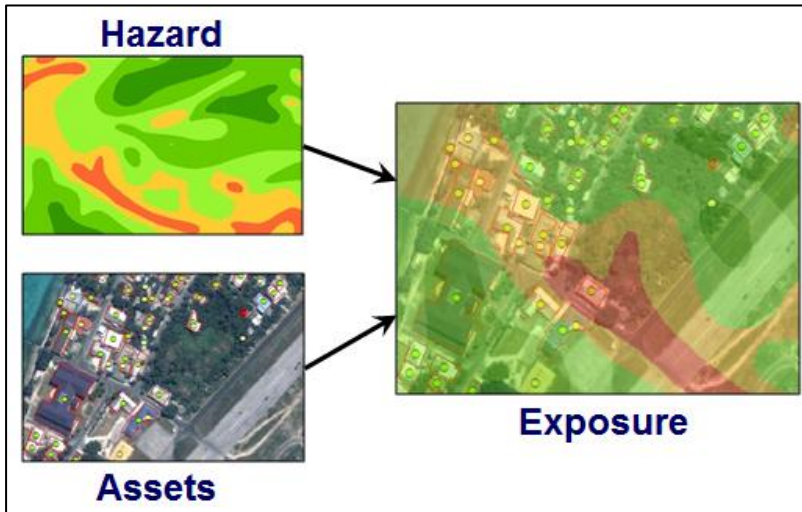


Figure 2: Example of Multi-Hazard Exposure

Characterizing Hazard Zones

Hazard zones represent areas in which certain hazards are likely to occur. Hazards zones may be derived from historical events and impacts, probabilistic models, environmental susceptibility, or a combination of sources. Variations within the hazard zones may then be characterized by event frequency, probability of occurrence, relative susceptibility (ex. high, medium, low), event severity, magnitude, or intensity.

Typical hazards of interest include events that threaten people, livelihoods, and assets within the study area. Some sample hazards include, but are not limited to:

- Earthquake
- Tsunami
- Flood (inland and coastal)

- Tropical Cyclone Wind
- Landslides
- Drought
- Extreme Temperature

PDC's Global RVA considers four hazard types: tropical cyclone winds (Categories 1-4), tsunamis, earthquakes (MMI 7 and above), and floods. PDCs Risk Assessment of Africa looked at HIV/AIDS and conflicts threatening national security. The NDPBA for El Salvador looked at seismic, flood, landslide volcanic ash and tsunami hazards. These hazards selected for each analysis were chosen because of their extent, potential impacts (or damage) and data quality/availability.

Characterizing Assets or Elements of Interest

Assets or elements of interest, consider the population, socio-cultural, economic, or environmental resources and systems that could be exposed to hazard events. Examples of potentially exposed assets or elements include:

- Population (fine scale)
- Infrastructure (energy, health, communications, transportation, education, etc.)
- Critical facilities and key resources
- Water supply
- Food supply

- Economic assets
- Environment

The Global RVA considers population and economic exposure. Both raw and relative exposure are combined. The raw exposure gives an estimate of how many persons are exposed and how much economic exposure occurs. This is useful in planning operations however, it penalizes smaller populations and economies that may be more highly exposed. The relative hazard exposure calculates exposure as it relates to population or GDP of a country or region. This aspect of exposure highlights the importance of exposure to a population or economy and highlights smaller countries or regions. Raw and relative exposure are averaged to allow for a balance assessment of overall exposure.

Vulnerability

In the context of the assessments, Vulnerability is the result of pre-event conditions that increase the likelihood that an area will suffer damage as a result of a hazard event. Nine general sub-component themes are typically considered, including several representing various dimensions of poverty.

Each of the nine themes used to describe Vulnerability are listed below, along with the rationale for inclusion, and examples of the types of datasets typically applied to the assessment.

Vulnerable Health Status

This theme reflects the population's general health as an outcome of multiple factors (e.g., health care processes and practices, physical and socio-economic environment). Poor health contributes to increased susceptibility to injury, disease and stress associated with disasters and may complicate activities like evacuation.

Sample Datasets

- Life expectancy
- Infant mortality
- Maternal mortality
- Undernourished population
- Disabled population
- Non-communicable disease prevalence or incidence
- Infectious disease prevalence or incidence

Access to Clean Water

This theme represents the general state of water-related infrastructure. Poor distribution and containment systems contribute to poor water quality (and associated potential for spread of disease) and increased labor required to fill basic household needs (limiting resources available for other activities that would reduce susceptibility to impact).

Sample Datasets

- Access to improved sanitation
- Access to improved water source

Access to Information

This theme represents the ability to access and comprehend hazard and disaster related information before, during and after an event. If channels and formats for information exchange are limited, exposure to information on mitigation options, preparedness measures, available resources and impending hazard events will be reduced. Limited familiarity with somewhat technical information will also constrain decision making. Access to information may also help increase and diversify skill sets and opportunities for individuals and countries before and after a hazard event.

Sample Datasets

- Adult literacy
- Enrollment in education (public and private schools)
- Average years of schooling
- Households with internet
- Households with television
- Households with radio

Economic Constraints

This theme represents limitations on resources available to invest in mitigation and preparedness measures at the individual, household, and country levels.

Sample Datasets

- Population at working age
- Economically dependent population
- Population with unmet needs
- Households receiving program benefits
- Unemployment rates
- Poverty rates
- Household income and expenditures

Marginalization and Inequality

Represents group-based differences regarding access to resources, services, opportunities and formal economic and political structures. Marginalized populations are less likely to have their needs met under “normal” conditions, and therefore become more susceptible to harm during times of disaster. They may be excluded from and/or overlooked in mitigation and preparedness planning and subsequent response and recovery activities. Exclusion also limits the pool of ideas from which effective innovations emerge. Substantial inequality may indicate the need for more tailored interventions prior to an

event and specific arrangements during mass care operations (e.g., sheltering, health care delivery).

Sample Datasets

- Proportion of government leadership positions held by females
- Number of females and males enrolled in secondary school
- Economically active population (female and male)
- Ethnic minority, religious, or indigenous groups facing economic or political discrimination

Population Pressures

Rapid changes in the size and distribution of a population are more difficult to plan for and can destabilize social, economic, and environmental systems. In addition to altering patterns of exposure, the resulting mismatches in needs, existing institutional structures and available resources can diminish resource quantity and quality and strain infrastructure and service delivery before, during and after an event.

Sample Datasets

- Population change over time (e.g., past 5 years)
- Population in urban areas over time (e.g., past 5 years)

Environmental Stress

Environmental stressors such as substantial water withdrawals and deforestation can degrade habitat and reduce quantity and

quality of resources required to maintain human health and livelihoods. Additionally, these stressors increase the likelihood and magnitude of hazards such as flooding, landslides, and subsidence and can exacerbate impacts.

Sample Datasets

In general, indicators of land degradation, fresh water quality and quantity, desertification, salinization, and deforestation, including:

- Use of freshwater resources (e.g., household use, agricultural use)
- Water stress
- Forest loss over time
- Number of grazing animals
- Use of fertilizers or pesticides on arable and crop land
- Areas of degraded or salinized land (e.g. severe erosion, saltwater intrusion)

Recent Disaster Impacts

Countries that have recently been affected by disaster may still be recovering and more susceptible to additional stressors.

Sample Datasets

- Number of deaths caused by natural disasters in recent years (e.g., last 5 years)

- Total losses (damages) that have resulted from natural disasters in recent years (e.g., last 5 years)
- Number of people affected by natural disasters (e.g., last 5 years)

Conflict Impacts

Countries affected by conflict may be more susceptible to additional stressors. Populations displaced as a result of conflict may lack ties, connections, or support systems and may have special needs associated with the impacts of recent conflict. These populations can present a challenge to host countries in terms of service provision and integration. These populations may not be included in disaster management related plans.

Sample Datasets

- Number of deaths resulting from conflict in recent years
- Number of refugees and asylum seekers
- Internally displaced persons (IDPs) displaced by conflict

Coping Capacity

Coping Capacity intends to capture those social, economic and environmental factors that contribute to disaster outcomes. In the case of coping capacity, the indicators and themes chosen represent factors that influence the ability of those affected to effectively absorb or “handle” and respond to negative impacts associated with a hazard event. Infrastructure represents critical

resources and mechanisms for coordinating and delivering required services during response and short term recovery.

PDC examines four themes to describe Coping Capacity; the themes, rationale for inclusion, and examples of the kinds of datasets that help describe each of the themes are provided below.

Strength of Governance

Represents the political will to learn about impacts and needs, to provide relief or enact programs equitably, and engage outside organizations if necessary. The theme also reflects the stability and effectiveness of the institutional structures required to do so. Governance is often cited in the literature as influencing other measures of coping capacity and/or vulnerability.

Sample Datasets

- Delivery of government services (e.g., garbage collection)
- Crime rates
- Crime clearance rate
- Number of violent protests
- Gang activities
- Control of corruption
- Voter participation

Economic Strength

Represents the ability to absorb immediate economic losses and quickly mobilize financial assets to provide needed assistance.

Sample Datasets

- Local GDP
- Local disaster reserves per capita
- Income per capita
- Local contingency funds
- Households receiving remittances
- Local taxes collected

Infrastructure

This sub-index represents the resources that enable the exchange of information (Communications), and physical distribution of goods and services to the population (Transportation and Health Care).

Communications

Represents the density and variety of communications infrastructure available to support coordinated action among local, national, and international actors.

Sample Datasets

- Households with fixed telephone lines
- Mobile phone coverage

Transportation

Denser transportation networks provide more options for bringing outside resources into a country (ports and airports) and increase the likelihood of alternate routes for reaching impacted populations.

Sample Datasets

- Seaports
- Airport runways
- Railroads
- Major roads

Health Care

If the availability of skilled caregivers and dedicated facilities is limited, timely and effective treatment of sickness and injury is less likely, potentially leading to increased casualties and financial burden.

Sample Datasets

- Hospitals and health center locations
- Number of hospital beds per population
- Number of nurses and/or midwives per population
- Number of physicians per population
- Vaccination Rates

Environmental Strength

Represents the ability of the environment to recover from a shock and maintain species health, biodiversity and critical ecosystem services after impact.

Sample Datasets

- Natural protected areas
- Reforested areas or reforestation programs

RVA Emerging Applications: Network Approach

An emerging use of the RVA is in the assessment of security threats. The basic RVA framework is expanded to capture the influence of specific networks of interest within partner nations. The foundation of this approach was developed in conjunction with US Southern Command (SOUTHCOM) J7. The networks framework includes the white network, which represents civil society; the green network, which represents the partner nation's government; the red network, which represents a national or transnational security threat; and the blue network represents the military counter to the red network. Because the V component of the RVA is a measure of relative socio-economic stability across geography, the addition of further components representing expanded dimension of civil society would adequately capture and describe the white network. Similarly, CC measures aspects of governance and the ability of a government to effectively operate and provide for its citizens, and a small number of components could be added to

adequately capture the green network. The red network can be modeled as the exposure of interest and would replace the MHE in the RVA. The blue network represents an additional component that could be leveraged to counterbalance exposure to the red or insufficiencies in either the white or green.

The composite index approach utilized in the RVA is currently being leveraged to assess the green and white networks of nations of interest. Existing components, indices, and indicators are being utilized as a baseline representations with the addition of relevant indicator and thematic areas. For example, in the PDC Global RVA, population pressures indicator is represented by the change in 5-year in average urban population growth. Population pressures for the white network has been designed also to include the so-called youth bulge and unemployment rates. This adds an additional dimension to population pressures to capture potential population dynamics that have been associated with radicalization and gang membership⁴.

The flexible nature of the RVA approach has allowed for its reconceptualization by SOUTHCOM. The joint work between SOUTHCOM and PDC has taken a tool for disaster risk reduction and reimagined it for assessment for the potential for influence by transnational threat actors. This illustrates the

⁴ Council on Foreign Relations (2007). The Effects of “Youth Bulge” On Civil Conflicts

power of a simple, easily understood methodology for the creation of a model for decision support.

Hotspot Identification

A benefit of the PDC RVA approach is the ability to identify hotspots and explore the drivers or underlying causes, helping to better understand the dynamic nature of risk. Hotspots are defined here as areas of high human vulnerability and/or low capacity coinciding with the occurrence of geophysical and/or human-induced hazards. The term hotspot usually implies an event/location requiring immediate attention due to the severity of degrading conditions and/or the potential effects of the situation if left unattended. Hotspots represent the impacts of regional *stressors* to the social and physical fabric of community leading to extreme or catastrophic effects to 1) physical health and safety and 2) the effective operation of social/governmental institutions. Conventionally, natural hazards, such as flooding, typhoons, fire, and drought are considered the stressors, but human induced hazards also can and should be considered. Identifying regional hotspots and their drivers might improve the effectiveness of comprehensive HA/DR activities for NATO.

Conclusion

The PDC RVA is a dynamic and flexible model leveraging existing open source, regularly updated data to represent aspects of the partner nation government and civil society networks to enable consideration of a wide assortment of

attributes that are relevant to assessment of resilience and vulnerability. The outlined approach (and many adaptations) can support NATO members engaged in planning for natural hazards or human-induced security events.

Powerful decision support tools are easily understood and able to be used by a wide variety of practitioners. The PDC RVA approach provides such a tool. It can be leveraged for prioritization, analysis of potential drivers of risk and vulnerability, and generate hypotheses for further examination. No model perfectly captures reality, but the RVA approach allows for adaptation as new information becomes available and continued refinement ensuring continued relevance to practitioners and ensuring that it can easily be applied and consistently support evidence-based decision making.

For access to the any of PDC RVA products or data contact response@pdc.org. To view the data in PDCs DisasterAware System, you can request access at www.emops.pdc.org.

TECHNOLOGIES AND ACTIONABLE KNOWLEDGE FOR DISASTER AND CLIMATE CHANGE RESILIENCE OF URBAN ENVIRONMENT

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Abstract: The optimal decision-making in urban crisis and disasters requires updated situational awareness, information exchange and interagency coordination. The authors propose an innovative approach for assessing city disasters, by exploiting interoperable GIS, historical datasets, hazard and climate models, simulations, risk assessment and interconnection analysis processes. The proposed web-based urban Decision Support tool can provide situational awareness leading to better emergency planning, critical infrastructure resilience building and operational and logistics planning. A mix of GIS, M&S tools and an end-to-end collaborative modelling environment are applied on a) short term to estimate the preparedness level, evaluate the mission concept, simulate impact on population and responders’ actions, and b) long term to assess potential climate hazards impacts, provide resilience monitoring and

support cost-efficient adaptation. In conclusion, testing of the proposed solution demonstrated a high level of interoperability. For short term analysis, a high resolution urban GIS, interoperable innovative simulation and C2 systems were tested. The web app COP can be supplemented in near real- time by sensors' data, web-scraped data and citizens' tweets. For long term analysis, coastal city virtual data have been generated and exposed to climate hazards (e.g. forest fire and smoke, flooding) related to extensive disruption to interconnected critical infrastructure operation.

Keywords: Crisis, Disaster, Climate Change, Decision-making, Modelling & Simulation, City, Resilience, Critical Infrastructures

Introduction

Global Trends and threats are changing the urban paradigm. Since 2008 more than one half of the world population lives in cities (UN, 2014) often located in coastal areas vulnerable to the growing impact of extreme weather conditions. In fact, scientific results pinpoint that climate change will increase the upward trend in the numbers of floods and storms worldwide, while the population that needs protection is expected to increase. There is a complex multi-dimensional link among food insecurity, migration and civil conflict (Figure 1), e.g. lack of food security greatly increases the risk of conflict (FAO, 2016).

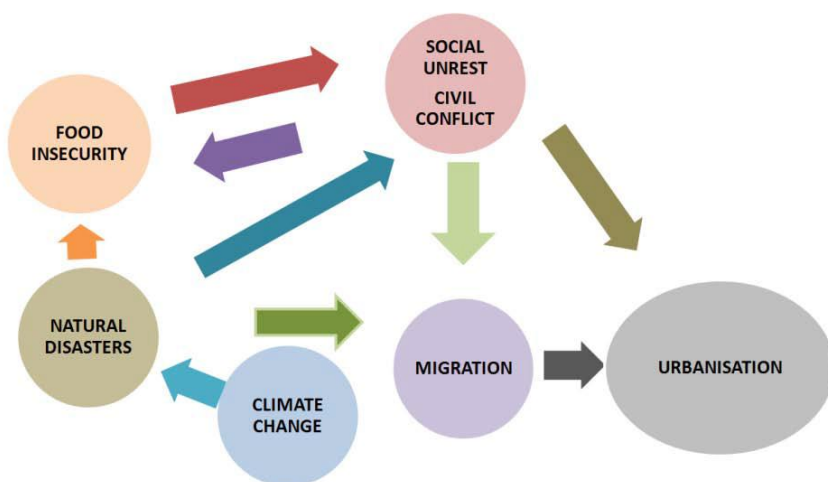


Figure 4. Global Trends and Threats (David et al., 2017a)

As a leading player in responding to food insecurity, the World Food Programme (WFP) produced the study “*At the Root of Exodus: Food Security, Conflict and International Migration, WFP May 2017*” to determine the role of food security, in the context of migration caused by conflicts in countries of departure and in ‘transit’ countries.

In general terms, areas more affected by natural hazards are also those most conflict prone; when natural hazards strike an area the reduction of food could lead to subsequent conflicts (Lana, 2015). Food security can play a role in triggering migration, but also the migration itself may cause food insecurity and influence a migrant’s decision to continue the travel and move to a city, thus contributing to the global urbanization process.

Cities are increasingly under pressure and are also becoming the preferred scenario for hybrid threats including terrorism, organized crime and cyber-attacks (David, 2017a) thus increasing the chances for the military to be tasked by the civilian authority to operate in cities in support to security and emergency agencies in response to situations such as:

:

- Large scale natural disaster, e.g. flood, tsunami, earthquake;
- Man-made disaster, e.g. wildfire, explosions, toxic agent contamination;
- Mass migration;
- Inner city turmoil (e.g. social unrest, riots) and armed conflicts;
- Epidemics and pandemics.

The optimal decision-making in urban crisis and disasters requires information exchange and interagency coordination and updated situational awareness. This is a critical element to increase system's resilience under pressures, such as population growth and climate change.

To model highly complex and interconnected systems, like cities, technologies like advanced Geospatial Information Systems and Simulation Tools can be exploited. Models and

simulations are also an effective way to learn and acquire Actionable Knowledge regarding disasters and challenges in crisis management.

Further to the above, vital services produced by critical infrastructures (CI), such as energy, transport, health, etc. are also affected by natural hazards and climate change. According to the recently published IPCC AR5 report, climate change-related risks to infrastructures are increasing with widespread negative impacts on local and national economies and ecosystems (IPCC 2018). As CI are critical components to the normal functioning of modern EU societies, their resilience encompasses the operational component in addition to its structural integrity and its capacity to maximize business output under climate stressors (CEN 2002; Dimova et al., 2015). On the other hand, the increasingly dependent, interdependent and interconnected nature of EU critical infrastructures exposes previously unseen risks, new vulnerabilities and opportunities for disruption across the CI networks (Hokstad, Utne & Vatn, 2012).

Research Aim, Objectives, and Rationale

Decision-making process allows the choice among different courses of actions in a set of alternatives (Wang and Ruhe, 2007) and is required at every step of the problem solving process (FEMA, 2005). In a crisis it is essential to assess the

situation, estimate available resources and make decisions. (Menoni and Pugliano, 2013). A decision-making model like the *Observe, Orient, Decide, Act* - OODA cycle allows the iterative deliberate change, adapting to the evolving situation. The NATO Lessons Learned (LL) process (David et al, 2017b) can be thought of as the continuous application of this cycle, based upon the premises of continuous learning. A fast learning mechanism could supplement technology tools. In fact, decision-making requires a *combination of software tools and human judgment*. In an optimal situation **many decisions can be "pre-loaded" and anticipated**, e.g. in inventory management; inventory includes basically all the assets (people, resources, supplies, goods).

The responsibility may involve various ministries and agencies including the national military. The "*Guidelines on the Use of Military and Civil Defence Assets in Disaster Relief - Oslo Guidelines*" (UNOCHA, 2007) identify the use of facilities and capacities of foreign militaries, as "*last resort*" when only the use of military or civil defence assets can meet a critical humanitarian need. In effect, emergency logistics, led by World Food Programme in the UN cluster system, can account for 80 percent of the total costs in disaster relief efforts (Trunick, 2005) requiring a mutual understanding between military and civilian sides and ways of working together supported by common training (David, 2016).

This paper focuses on the development of platforms capable of exploiting modern technologies and actionable knowledge for Disaster and Climate Change Resilience of Cities, supporting decision-making in crisis management and disaster response analysis, preparatory training and exercises. In particular, the paper emphasizes the need of combining highly detailed GIS data, social and sensor data, disaster models, repository of procedures and triggers, *constructive* simulations and C2 systems and the role of mixing civilian and military tools to face hybrid threats and disasters impact on city population and critical infrastructures. On the basis of this platform, decision-making processes can be supported and the procedures improved. By integrating these aspects, the military would be better prepared for disaster challenges and these systems would also support community resilience through emergency and humanitarian organizations exploiting the military capabilities to simulate in realistic fashion the deployments and logistics.

Methodological Approach

Concept development and experimentation (CD&E) have been used for the Interactive Model for Operations in Metropolitan Areas (IMOMA) study of M&S Centre of Excellence (M&S COE) that has reused the “Archaria” megacity GIS model of the NATO Urbanization Study. IMOMA has been tested within the NATO research group MSG-147 whose specific goal is to develop the *“M&S support for Crisis and Disaster Management and Climate*

Change Implications”, chaired by CMDR Centre of Excellence, Sofia,.

Authors’ Research Questions included:

- *What are the cutting-edge training technology and architectures considering modern crisis, disaster and emergency management cooperative scenarios?*
- *Is it possible to demonstrate the capabilities of existing disaster, simulation and C2 tools and to federate as many as possible of these modules?*
- *How it is possible to acquire actionable knowledge to support resilience?*

A review of models and simulations in NATO, UN, military and emergency and interviews and meetings with experts have been conducted. Meetings and Workshops with the Industry, Academia have been accomplished. The research has used international standards like the *High Level Architecture (HLA)* for simulations federation and the C-BML/MSDL.

Testing and Experimentation have been use to validate the concept in Bulgaria, Poland, Mar 2017, Oct 2017, Oct 2018

Technologies and Actionable Knowledge for Resilience of Cities

Risk is the probability that negative consequences may arise when hazards interact with vulnerable areas, people, property, and the environment. If risks are identifiable the first step in risk

analysis is *hazard identification*. And in fact, the governance paradigm of the past has been risk analysis, with a risk approach requiring building systems that are resistant to identified threats (Park et al., 2013).

However a city comprises at least three main systems, the *Social*, the *Natural* and the *Economic* interacting with Technologies and Knowledge (Menoni, 2017). According to (Holling, 1973), social-ecological systems have the capacity to absorb or resist perturbations and keep their regime, structure and functions. This is called *resilience*, which allows complex systems as such, to self-organize, learn and adapt (Holling, 1973, Gunderson & Holling, 2002).

Recently, the rhetoric has shifted toward the necessity of understanding and designing for resilience (Linkov, 2013). Resilience approaches embrace uncertainty and failure via anticipation and adaptation. Resilience requires *flexibility, adaptation, improvisation and innovation*, (Park et al., 2013).

According to the US National Academy of Sciences (NAS) report on “Disaster Resilience”, resilience can be defined as the ability of a system to perform four functions with respect to adverse events: ***planning and preparation, absorption, recovery, and adaptation*** (Linkov et al., 2013).

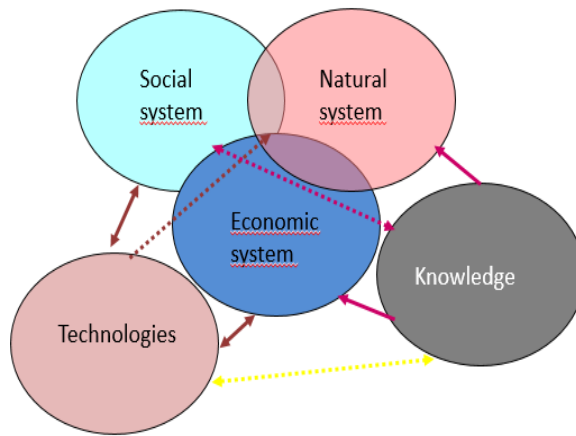


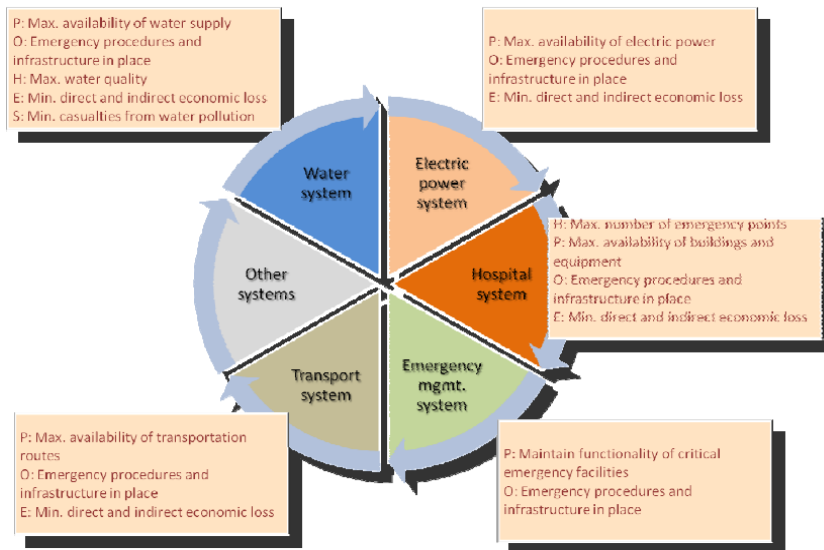
Figure 5. Cities' environment framework (Menoni, 2017)

In conclusion, while risk assessment methods aim to reinforce a vulnerable component of the system, resilience analysis instead aims to ensure that an important shock (climate change, cyber-attack, disease, etc.) does not reduce significantly the functionality and efficiency of the system (IRGC, 2016).

Measure of Resilience

Modelling a city requires large amounts of data about its systems and their interrelationships, e.g. we can define, for every urban system (Figure 3) its *Units of Community Resilience: Physical, Health, Economic, Organizational, Social (PHEOS)* (Simonovic, 2012). This suggests the opportunity to develop a new city *Decision Support System (DSS)* based on highly detailed GIS and interoperable M&S to address the

requirements arising from the threats by means of combining multiple models (Bossomaier and Green, 2000).



*Fig 6. Units of Community Resilience Analysis and City Systems
(Simonovic, 2012)*

New approaches, like the military doctrine of *Network Centric Warfare (NCW)*, support the translation of resilience concept into practical terms by allowing the measurement of resilience. In fact, also warfare is characterized by surprise, complexity, urgency and the necessity of adaptation. NCW doctrine focuses on providing shared situational awareness and decentralized decision-making by distributing information across networks in the physical, information, cognitive, and social domains:

- **Physical:** sensors, facilities, equipment, system states and capabilities;
- **Information:** creation, manipulation, and storage of data;
- **Cognitive:** understanding, mental models, preconceptions, biases, and values;
- **Social:** interaction, collaboration and self-synchronization between individuals and entities (Linkov et al., 2013).

Linkov's framework matrix (Figure 4) provides an actionable metrics by combining the disaster management processes aspects identified in the National Academy of Sciences (NAS) report (i.e., *planning/preparation and adaptation*) with the aspects of performance under shocks/stress (i.e., *absorption and recovery*). The cells describe the requirements for the development of quantitative and qualitative measures of each of the four resilience's functions and provide guidelines for resilience metrics that need to be developed and combined to measure the overall system resilience..

Considering the four domains, **the data accessed from the information domain are used in the cognitive and social domains where the lessons learned enable a continuous improvement** and future planning/preparation.

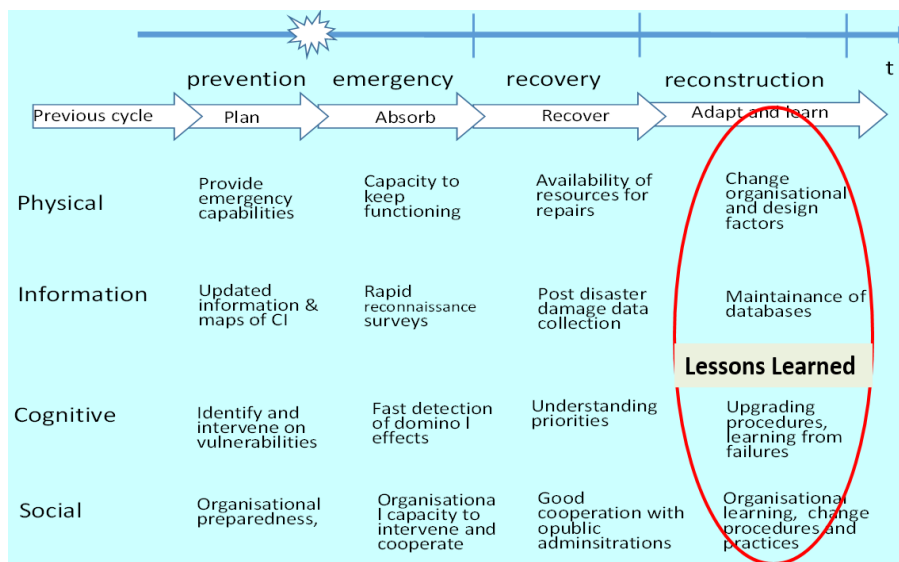


Figure 7. The Resilience Matrix (Linkov et al., 2013)

The crucial role played by **knowledge** in building resilience or better in translating resilience into operational terms is well explained with Zeleny's statement "**Knowledge is embodied in an organism (or social organism) and embedded in action. Knowledge is not information. Information is a description of action. As an input, information contributes to the product of knowledge (action)**" (Zeleny, 2006). By focusing on actionable knowledge, we can ask ourselves the question *if and how modern ICT and in particular M&S can support the provision of the required knowledge to support analysis, training and operation.*

Resilience of interconnected Critical Infrastructures towards Climate Change

Within the EU-CIRCLE H2020 funded project (GA 653824), resilience of interconnected critical infrastructures to climate change has been defined as multi-dimensional components, incorporating risks and capacities in the following way:

- **Resilience for what** – the disturbance which is Climatic Hazard (CH), including current and future climate change (Layer 1)
- **Resilience of what** – the context which is Critical Infrastructure (CI), their networks and interdependencies (Layer 2)
- Disaster **risks and impacts** (Layer 3)
- **Capacities** of critical infrastructure (Layer 4)

The capacities of critical infrastructure is one of the main ingredients for infrastructure resilience, as expanding capacities will result in risk reduction. The level of each type of capacity can vary even within a single critical infrastructure against a particular type of hazard. For example, a railway network along the coast can have a good level of anticipative capacity through an early warning system for a storm (leading to a storm surge and coastal flooding) but a poor level of absorptive and coping capacity: it can minimise the damages only by avoiding the disasters rather than facing it.

- ***Anticipatory capacity***: is the ability of a system to anticipate the hazard and engage in preparatory activities, planning and training to reduce the impacts of climate variability. This is a proactive action to avoid disturbance, (re-) design the asset technical specification and engineering components, either by avoiding or reducing exposure or by minimising vulnerability.
- ***Absorptive capacity***: is the ability of a system to buffer, bear and endure the impacts of climate extremes in the short term and avoid collapse.
- ***Coping capacity***: is the ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters. It is also linked to inter- and intra-agency cooperation and how emergency responders may be integrated to the response procedures.
- ***Restorative capacity***: is the ability of a system to be repaired and restore its functionality in the shortest possible time.
- ***Adaptive capacity***: is the combination of assets, skills, technologies and confidence to make changes and adapt effectively to the challenges posed by long term trends and emerging threats, as is future climate change.

Systems and Tools to support Emergency Analysis, Planning and Training

Geographic Information Systems (GIS)

Cities' GIS requires a large quantity of terrain features data and social data. Spatial and network analysis can be integrated with historical data sets (David et al., 2017a), disaster models and simulations. GIS integrates, stores, edits, analyses, shares, and displays spatial and networks information for informing decision-making.

The idea behind the *Interactive Model for Operations in Metropolitan Areas (IMOMA)* IMOMA is the GIS providing a central infrastructure for crisis management in terms of database, analytical models and visualization tools, addressing the three dimensions: *immediacy*, *relevancy*, and *sharing* (Cai et al., 2006) coupled with the dynamic simulation provided by M&S systems. **IMOMA reuses** the “Archaria” virtual megacity GIS created (with data extended in order to bring the population of Naples up to 6 million) by M&S COE and Fabaris srl for the NATO Urbanisation Experiment. Geo data include resident population, Informative Territorial System data, digital elevation model DTED level 2, Open Street Map data, GPS points of interest, etc. The model comprises 250 data layers describing the city and its *Political, Military, Economic, Social, Information and Infrastructure (PMESII)* information.

Disaster damage is usually measured in physical units (e.g., square meters of housing, kilometres of roads, etc.) and

describes the destruction of physical assets, the disruption of services and damages to livelihood's sources (UNSDR, 2017). The specific built in **Damage/Networks Analysis tool** allows to analyse interconnected networks (electricity, water, gas, etc.) and the disaster damage on a network *by specifying the point of service disruption*. Raster and vector layers can be added to the GIS providing the results about damaged buildings/infrastructures. These data are integrated into a 2D and 3D web app map *Common Operational Picture* accessible from pc and mobile devices.

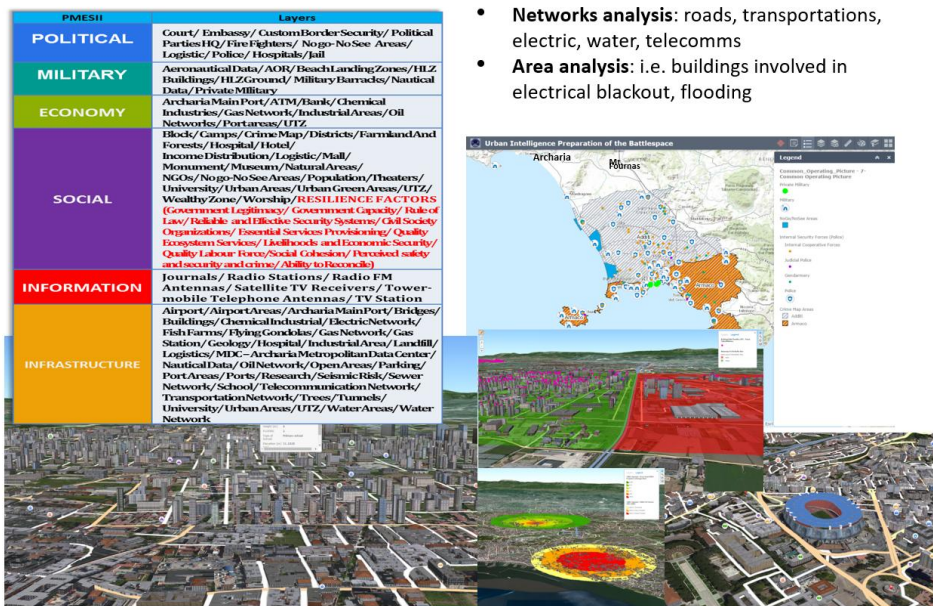


Figure 2. “Archaria” GIS Model for City Environment Analysis

Simulation Systems

Because GIS are static models, in order to run the model over time, an innovative, *constructive* simulation has been chosen for experimentation, with the ability to show in real-time what the impact is when a disaster strikes. MASA Sword is an Artificial Intelligent (AI) simulation platform, that can work with external disaster propagation models and that can be populated with emergency response actors.

The propagation of the disaster is one of the most important aspects. Since the propagation of the disaster very much depends on the geography, to make its output as accurate as possible, Sword needs as much as precise data as possible. Geospatial data have been used for generating the MASA Sword simulator's terrain using the "de facto standard" ESRI shapefiles. The Sword terrain generation process regroups vector data layers and delimitation of terrain area and builds the land use (forest, urban, farms...) and allows to import in the Sword simulator basic types of terrain but many other geospatial data can be imported in the Scenario preparation as xml objects used by the simulation engine.

The integration of the IMOMA City GIS with Sword has been achieved by addressing the use of the Military Scenario Definition Language (MSDL) standard for the civil/military units location and due to the large amount of information layers the conversion of the ESRI shape files to xml format simulation

objects has been standardised by developing an *ad hoc* middleware software.

Crisis managers do want to work with their own Command and Control system (C2) for getting a Common Operational Picture. In this case Sword is used to stimulate the C2 system and make it come to life as if a real disaster was happening. Sword supports a wide range of interoperability standards like HLA, DIS, API, C-BML, MSDL and a range of GIS-standards. The output of the simulations is replicate, in the 2D/3D GIS environment used as a decision support system, and in CBML/MSDL-compliant C2 systems if available.

Web crawling and web scraping techniques can be exploited for updating the available information using Python for extracting data from online databases. Near *real-time* social media data can support better decision making. In fact, Twitter can provide fast, real-time information about a large-scale disaster as it unfolds. For example, in flooding, a significant number of tweets include information about water depth and location - very useful information to find the affected people or plan evacuation routes.

However, due to the high number of stochastic factors and variables and the mutual interactions among many different elements, a single simulation system cannot cover all aspects and it is necessary to create a crisis and disaster management simulation environment integrating tools, models, simulation

solutions with the use of standards, such as the High Level Architecture-HLA (Bruzzzone et al. 2014).

NATO MSG-147 Reference Architecture

NATO MSG-147 research group's aim is to develop a reference architecture and a technical platform, with several federated tools and simulations, to support and conduct crisis management and disaster response analysis and planning, training and exercises enabling operations in the course of disasters. This will enable prompt, reasonable and effective tests of response plans in a distributed simulation environment, thus reducing the number of problems that decision-makers have to address when dealing with crisis response operations. This project covers three areas: 1) the Analysis of Disaster Risk Management processes preceding the development of the Operations Plan; 2) Disaster Response during Operations; 3) Development of a Module for realistic modelling of Disasters to support training, experimentations, tests and validations (Nikolov & Lazarov, 2016).

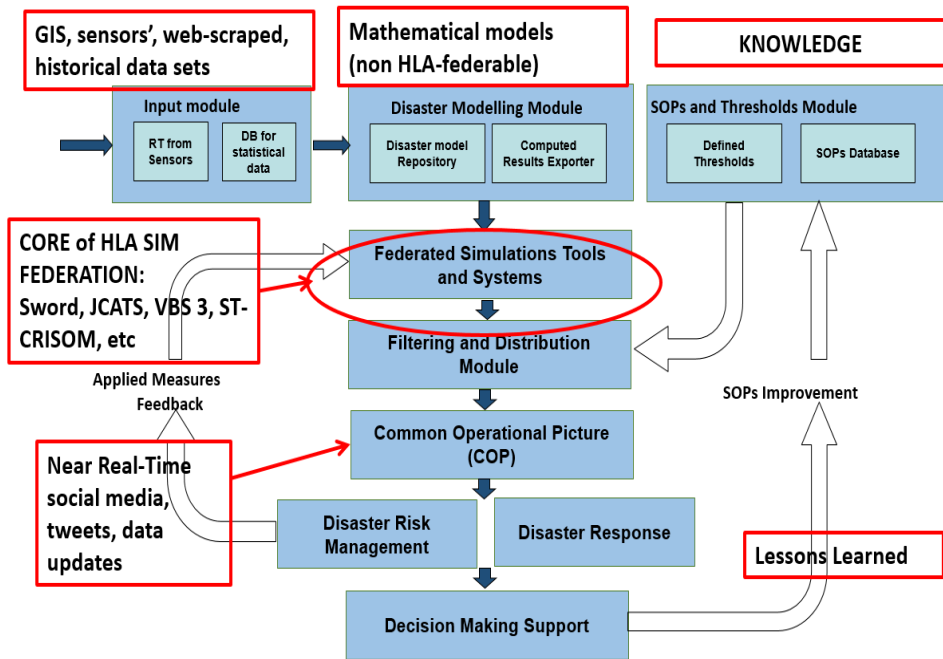


Figure 3. NATO MSG-147 Technical Architecture

This platform should collect data from mathematical models for different disasters. The results will be compared with statistical and historical data from past events. The human impacts will be assessed by decisions from the decision-makers. In that way the architecture will define the accuracy of different models for disasters and every decision-maker will choose the kind of model he/she prefers for different situations.

The disasters models repository will be connected through HLA standard (IEEE 1516-2010) with a simulation federation (according the NATO Allied Publication AMSP-04), *a union of essentially independent applications - federates interoperating using common infrastructure services* accessed through well-

defined standard interfaces). To identify what data have to be shared using the *Federation Object Model - FOM* (objects, attributes and interactions) has to be defined.

Testing and Experimentation

The research group has defined a specific scenario; addressing different kinds of crisis such as: *Flooding, Forest Fires. CBRN (Chemical, Biological, Radiological and Nuclear) Threats*. These subjects require to combine different elements such as GIS, CBRN simulators, Flooding and Fire simulators and Population Simulation. The Federation should demonstrate its capability to estimate the effects of alternative decisions on the whole system including the population behaviour: *for instance the effectiveness in placing sandbags during a flooding* or the responsiveness of the resources in applying evacuation plan during the simulation (Bruzzzone et al., 2017)

In this research, test trials are conducted to actually federate existing disaster models with simulations in accordance with the above mentioned architecture. These trials became experiments with an independent analysis according to NATO *Concept Development and Experimentation (CD&E)* procedures. The Limited “Test-Experiment” October 2017 at NATO Joint Force Training Centre (JFTC), Bydgoszcz, Poland, were planned in close cooperation between MSG-147 members, Academia and Industry. The experiment planning

conferences for the experiment were conducted in conjunction with MSG-147 Concept Development workshops. The parallel conduct of CD&E planning allowed for immediate input from conceptual development into experiment design.

The capability of the simulation systems to collaborate/federate was well explored. There was also a successful assessment and evaluation of their capabilities to interact with other systems, predictive tools and C2 systems. To make an impartial analysis of the experiment objectives, the group defined the following metrics: *fully, partly or not achieved*.

Experiment serial 7 included the IMOMA tests to connect several systems and tools:

- HPAC – “Archaria” GIS – Sword – “Archaria” web app map
- Sword (“Archaria” scenario) – Sword (“Balkan Bridge” scenario) – (Aircraft flight from “Archaria” extended to Balkan locations) – “Archaria” web app map
- Sword (“Archaria” Extended) – p RTI - Other Simulation Systems (JCATS, ST-CRISOM, ETC...).

Simulation Systems



Standardization allows the Integration of megacity GIS with (standard) compliant C2 systems and 3D viewer



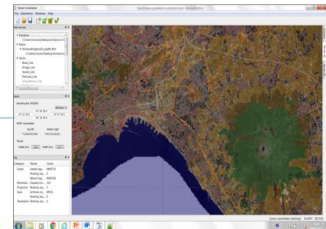
Google Earth adaptor



Middleware toolkit



Sword Simulation



MSDL/CBML Connector

C2 System

Decision Support System

3D Viewer



Figure 5. IMOMA Megacity Model Federation

Critical Infrastructures Resilience and Risk Validation

Climate is considered as a threat multiplier on critical infrastructures. (Table 1).

	Research	Space	Chemical	Transport	Financial Health	Food	Water	ICT	Nuclear	Energy
High winds										
Extreme convection										
Extreme precipitation										
Ice storms										
Hurricanes										
Flood-inducing storms										
Fire weather										
Cold snaps										
Heat waves										
Drought										
Climate change										

Table1: Critical Infrastructures and threats (Yellow: Low impact; Red: High Impact)

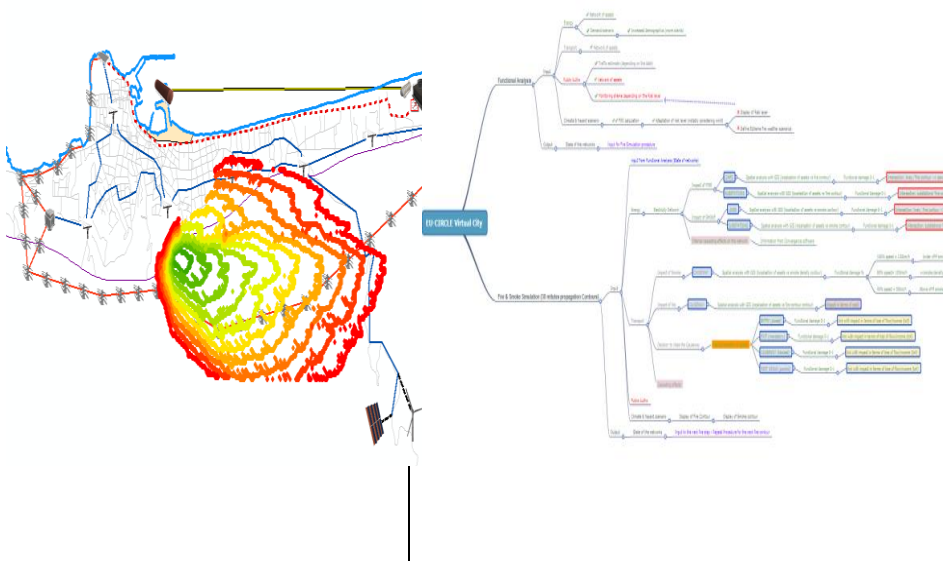
According to recent studies and based upon future climate projections the following impacts are expected:

- Changing nature of hazards (faster, more frequent, extended, higher magnitude)
- This could result in Change of design thresholds or require adaptation to changing hazards
- Faster degradation of performance (e.g. higher temperatures on pavements) different requirements for predictive maintenance
- Change in supply and demand profiles (higher energy demand in more warmer days)
- Increased vulnerability of infrastructures to a) physical damages due to extreme events, b) impact on humans (e.g. heatwaves), c) changes in operational profiles of the infrastructures
- Within EU-CIRCLE, resilience of interconnected critical infrastructures to climate change has been defined as a multi-dimensional components, incorporating risks and capacities.

EU-CIRCLE has created a dataset of virtual data allowing for stakeholders and the CI community to validate resilience and

risk concepts¹. The virtual city's Forest Fire & Smoke scenario is based on extreme climatology conditions in 2050 using RCP8.5 scenario. In summary, the conditions were strong westerly winds, prolonged high temperatures and low relative humidity values. These conditions resulted to low fuel moisture content and intense fire regime. The fire burned a forested area covered by typical Mediterranean vegetation (i.e. open aleppo pine forest, dense shrubs, grasslands).

The simulation was performed for six hours with a 30 minutes step and the smoke simulation was calculated for the event. The CI assets affected by the fire event and the released smoke are defined using Spatial Overlay analyses functions.



¹ EU-CIRCLE D7.4Demonstrable EU-CIRCLE Scenarios in SimICI,

Figure 8. Fire propagation for 6 hours in 30 minutes time-steps (left) and Mindmap of scenario definition (right)

The Impacts to the Electricity Network come from:

- a) direct fire crossing with the high voltage transmission lines,
- b) dense smoke over a certain concentration ($> 500 \mu\text{g}/\text{m}^3$) causing flashovers in air gaps. Furthermore, substations should be checked for electricity shortcuts caused by deposited smoke (usually represented as fine particulate matter PM2.5)

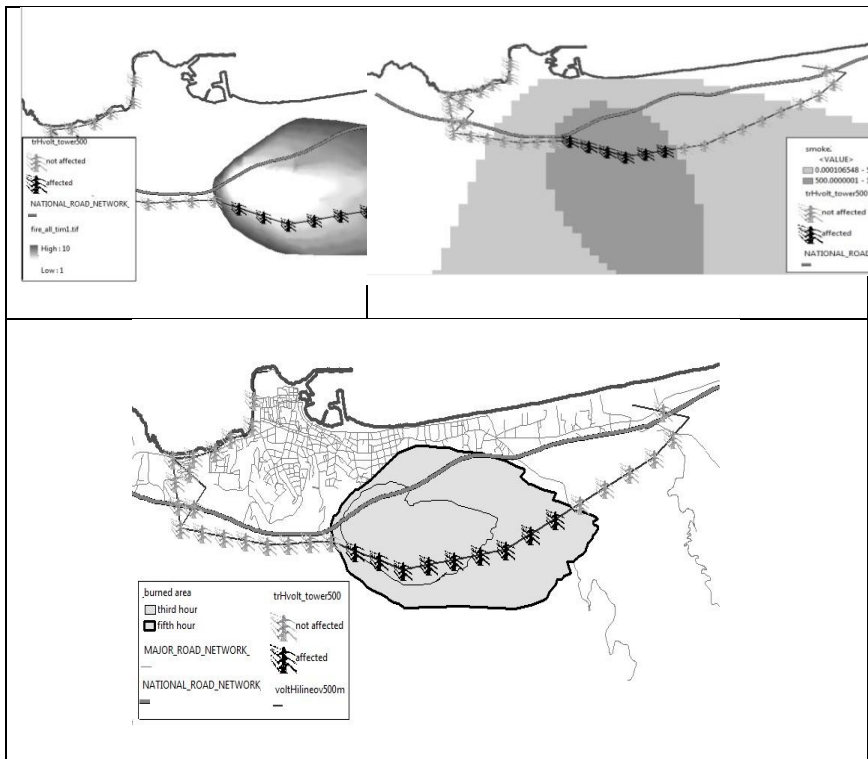


Figure 9: Electricity network assets affected by the fire event and the released smoke

EU CIRCLE project aspires to make an impact on:

- Support the establishment of climate resilient infrastructure by ensuring that an asset is located, designed, built and operated with both the current and future climate conditions and incorporates resilience to the impacts of climate change over the lifetime of that asset.
- Provide a coherent baseline for moving from sector-based climate resilience infrastructure frameworks, into holistic resilience plans for entire regions, introducing the interdependencies of heterogeneous infrastructures in the implementation process.

Conclusions and Lessons Learned

In this paper an example of application disaster simulation within a complete GIS environment has been presented. The research has enhanced existing knowledge in an effort to fill the gap between military simulations and specialised disaster models and predictive tools by combining different simulators and data sources with a special focus on large cities and infrastructures.

Military constructive simulation systems like Joint Theater Level Simulation (JTLS) and Joint Conflict and Tactical Simulation (JCATS) have been used in the past to support exercises for training also emergency personnel (David, 2007). However population simulation is an issue, available military constructive

simulations lack the ability to model with high accuracy disaster damage on infrastructures and the impact and behavior of civilian population (Levesque et al., 2009). They can just simulate civilian groups (firefighters, police, paramilitary, health service, terrorists, crowds, rioters, etc.) organised in hierarchical structures ("order of battle", ORBAT). Therefore, it is necessary to import the outcomes from external disaster models into those simulators where the commanders' decisions will be translated into orders.

The IMOMA has integrated a City GIS with the MASA Sword simulation and disaster models, and within MSG-147 research, also with other federated simulations.

The analysis on the distribution of population on the GIS, during the night time (exploiting the available census data) and during work time (considering the commuters' flows to work places) has been performed thus supporting quantitative analysis of a disaster's effects on people.

Moreover, within this paper another type of simulation and risk/impact analysis is presented, showing the capabilities of such simulators to assess and analyze CI networks towards climate change. CIRP solution within EU-CIRCLE has been developed and supported the establishment of climate resilient infrastructure by ensuring that an asset is located, designed, built and operated with both the current and future climate conditions and incorporates resilience to the impacts of climate change over the lifetime of that asset. In this direction EU-

CIRCLE, provided a coherent baseline for moving from sector-based climate resilience infrastructure frameworks, into holistic resilience plans for entire regions, introducing the interdependencies of heterogeneous infrastructures in the implementation process.

Furthermore, the document presents the virtual data generated within the framework of the EU-CIRCLE project with forest fire scenario and smoke scenario related to extensive disruption to interconnected CI operation. The document describes the GIS Services component and the 'virtual city' dataset that has been ingested and exposed through that component. The components were produced as follows:

- **Fire propagation:** GFMIS software by ALGOSYSTEMS and NCSR associates
- **Smoke:** HYSPLIT from NOAA
- **Electricity impacts:** coded in CIRP from damage functions found in the literature and discussed with French Operators.

The creation of the city terrain within a simulation system enables the direct interaction of decision-makers with planned tactical actions performed by deployed civil and military units. Such interoperability has been achieved through standardization of data exchange. Simulation results in MSDL standard enable the creation of scenarios that can be shared

and reused between a variety of simulations, between simulations and Command and Control (C2) systems, and between C2 systems. Those outcomes are represented on the *web app* map and used as an innovative urban *Decision Support System* or they can feed C2 systems.

This architecture model supports applications for emergency management simulation in a comprehensive innovative framework implementing *Virtual Command and Control* capabilities to support an agile emergency management approach. The training audience (disaster managers, military commanders and other decision-makers) could be trained remotely in a *Virtual Emergency Operations Centre*. (David, 2016). Remote users will be able to participate within a common synthetic environment and situational awareness could be updated in near-real time by input data supplemented by sensors' data and damage information and emergency requests data provided by virtual communities, using crowd mapping platforms and other social media (Mejri et al., 2017) thus supplementing official available data.

In conclusion, **for short term analysis**, high resolution urban GIS, interoperable and federated simulators, and C2 systems, were tested. The web app COP can be supplemented in *near real-time* by sensors' data, web-scraped data, citizens' tweets (using *big data* techniques). This solution could support training and analysis of damages, impacts on population and decisions, estimate the preparedness level, evaluate the mission concept,

simulate deployment and logistics, *by interaction of players with their tactical actions.*

For long term analysis, virtual data of a coastal city has been generated and exposed to climate hazards (e.g. *forest fire and smoke, flooding due to rising sea levels and increasing rainfall intensity*) related to extensive disruption to interconnected Critical Infrastructure operation.

The Way Forward

The next experiment will take place in Sofia in October 2018. Modelling wildfire could be achieved by using the Tiger model developed by the University of Naples, providing fast updates of wildfire propagation and evaluation of disaster dynamics depending on a chosen decision (for example decision to deploy a Canadair aircraft).

The M&S Federation should estimate the effects of alternative decisions including population behaviour (e.g., effectiveness in performing a Canadair intervention during wildfire spreading near a refugee camp or electricity network infrastructures).

It is therefore recommended to integrate IMOMA with:

- JCATS *constructive* simulation system used at Joint Force Training Centre for training military forces to disaster response tasks;
- a repository of procedures in order to compare simulation outcomes from disaster impact and taken decisions with

expected outcomes from procedure's compliance thus building knowledge and lessons learned;

- near real-time information provided by social media feeds, in particular Twitter with updated situation evolution information;

We introduced a set of complementary software tools for computationally intense modelling of cities, infrastructures and their interconnections. Future plans include linking the two approaches conceptually moving to:

- a *real time* disaster prediction and management system focusing on the interconnectivity between societal functions;
- highly resolved and detailed scenario building accounting for extreme events under climate change, e.g. optimal dispatching of personnel and maintaining a supply chain of needed response equipment and first aid material;
- examine new governance models focusing on the role of military capabilities in disasters (e.g. the “multi-purpose by design” concept of main military equipment to be designed from the beginning to be used also for civilian protection);
- introduce new hazard simulations models for flooding, forest fires, extreme climate events.

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