DEFENCE INNOVATIONS

Finabel

LOOK INTO THE FUTURE

FINABEL
European Army Interoperability Center

INTRODUCTION

The world today is full of new technology that we use regularly every day without even noticing it. Yet behind every new technology lies years of research, testing, and a never ending 'trial and error' process. This technology aids us in making our everyday lives simpler. Technology is no longer solely associated with smartphones and computers either, there are 'intelligent' cars, and even 'revamped' homes. Through the 'Internet of things', the connection via the Internet and 'smart' devices embedded in everyday objects has become a present reality. We can now easily and with a limited budget, control the light bulbs in our homes, or turn on the heating or washing machine from anywhere in the world, needing only a controlling device and internet connection.

As with other sectors, the defence sector has become equally influenced by the phenomenon of innovative technology. Furthermore, it is not very well known how important the military has been, and continues to be, in this innovation process.

For example, "*technologies like radar, the Global Positioning System, the internet, and even driverless cars have benefited from research originally performed for the military.*"[1]

Even though the meaning of war and the spectrum of gadgets employed by the defence sector has changed drastically throughout recent years, the present level of this development is reaching an unprecedented high. Innovation has become a necessity, fueling competition between states, and opening the door to non-state actors as well. This is further fueled by the process of globalization. Due to this, statements have been made that *"successful defence innovation obviously requires both disruptive and capability-based incremental innovation in order to provide Member States with the defence capabilities they need in the future."*[2]

1 Vitter, S. – Corey, J. In a position to lead: How military technology and innovation can ease the world's water challenges. [online]. [Quoted: 2018-11-14]. Online: <https://www.earthmagazine.org/article/position-lead-how-military-technology-and-innovation-can-ease-worlds-water-challenges>

2 EDA. 2017. 10 Upcoming disruptive defence innovation. EDA: European defence matters, 2017. 44p. Issue 14. ISSN (1977-5059)

INNOVATION – A LOOK BEHIND THIS PIVOTAL AREA

What is the meaning of 'innovation'? Where did the story begin? Schilling, from New York University, in her book *Strategic Management of Technological Innovation* defines innovation as *"the act of introducing a new device, method, or material for application to commercial or practical objectives."*[3] Another, more specific, definition comes from Jingjing Huo: *"technological innovation is all about information. On one hand, innovation creates new technological knowledge useful for economic production; on the other hand the very process of innovation is an example of searching under imperfect information, given the uncertain and constantly evolving nature of R&D."*[4] Authors define innovation differently, yet the central meaning appears to remain the same: Visible output of innovation is only a small part of the process as a whole, and we have to understand it in a holistic manner, seeing how it is composed of a lot of small vital steps.

The story begins with an idea (something imagined or pictured in the mind), which is supported by personal creativity (the ability to produce novel and useful works). This creativity is then transformed into a specific creation. Newell, a former army officer and partner at *BMNT Partners,* which focuses on unique and innovative solutions, explained in an interview for military news "Task & Purpose", his opinion on the complexity of this issue: *"Innovation is 5% having an idea, and 95% blood, sweat, and tears, explains Newell. The hard part is developing or finding a pipeline from idea to finished product."*[5]

An innovator can be personified in many different forms and is usually composed not of one individual, but rather a collection, such as a firm, university, non-profit organization, or government funded research group.

Maital and Seshadri try to explain this process through the use of a sport metaphor: *"Cricket is a team sport. But it is also a sport that features individual flashes of brilliance. Innovation is much like cricket. No single individual can ever implement a major world-changing idea – this requires teamwork. But almost always, such world-changing innovations begin in the creative mind of individual. So, innovation is both.*[6]*"*

If the idea was born in laboratory, or on the battlefield, the whole process can be either brought to life or come to an abrupt end. Picture nb.1[7] shows the concept of an "Innovation funnel" which presents the procedure for research, and we can see that in the beginning there are a multitude of processed ideas that eventually lead to the final goal. *"The pharmaceutical industry demonstrates this well – only one out of every 5000 compounds make it to the*

3   Schilling M.A., *Strategic Management of Technological Innovation.* New York University, 2013. p.1. Fourth Edition. ISBN 978-0-07-802923-6.

4   HUO, J. 2015. *How nations innovate: The political economy of technological innovation in affluent capitalist economies.* Oxford: Oxford University Press. 2015. p.2. ISBN 978-0-19-873584-7.
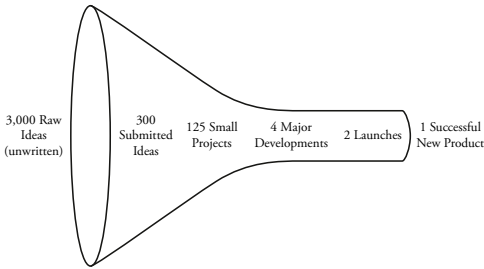
5   Brune, R.A. *Innovation In The Army, Part I: It Starts With The Warfighters.* [online]. 2014 [Quoted: 2018-11-14].
    Online: <https://taskandpurpose.com/innovation-army-part-one-starts-warfighters/>

6   MAITAL, S. – SESHADRI, D.V.R. *Innovation Management: Strategies, Concepts and Tools for growth and profit.* 2. vydanie. New Dehli: SAGE, 2012. p. xlviii. ISBN 978-81-321-0722-4.

7   Schilling M.A., *Strategic Management of Technological Innovation.* New York University, 2013. p.5. Fourth Edition. ISBN 978-0-07-802923-6.

pharmacist's shelf, and only one-third of those will be successful enough to recoup their R&D costs."[8]

| 3,000 Raw Ideas (unwritten) | 300 Submitted Ideas | 125 Small Projects | 4 Major Developments | 2 Launches | 1 Successful New Product |

Innovation funnel

As shown above, the initial part of the innovation process has to go through many phases of research, which naturally takes time. Griffin, in *"Product development cycle time for business-to-business products"* tried to find an answer on how long, on average, it takes for a product to develop from the initial concept to becoming a market ready product. Thanks to the surveys distributed in firms and research institutions she figured out there are three main levels of innovation: "incremental", "more innovative" and "new to the world". On average the longest level is the last "new to the world" stage, taking up to 24 months. The "more innovative" stage can take up to/ over 14 months, and the "incremental" period can take up to 6.5 months.[9] Although this means that as a whole the process can be quite lengthy, all in all for many it will be worth it in the end, as "*Technological innovation is now often the single most important competitive driver in many industries. Many firms receive more than one-third of their sales and profits from products developed within the past five years."[10]*

Yet, there are times when the innovation process can take a considerably different route, namely in the case of accidental innovation. One case of accidental innovation is that of the electro-optical engineer Gavriel Iddan, who was working on the development of the 'eyes' of guided missiles, which were supposed to recognise their targets. While working on this, he travelled to the USA, and befriended Eitan Scapa, a gastroenterologist. After years of their friendship and a lot of research, through their combined knowledge they invented a small camera which was then used in the digestive system, which transmits interior images wirelessly to the computer.[11] Nevertheless, neither one of them planned to invent this technology. In the end, it was coincidence which brought them together and brought about the discovery of one of the most important and helpful inventions in contemporary medicine in this field.

Cases of accidental innovation are rare, and far between. As a whole, it seems clear that the innovation process as a whole should be seen as a complex process, which inevitably carries with it positive and negative externalities. Some of the most important negative externalities are pollution, erosion, medical issues and regulation, and moral and ethical considerations. On the other hand, the positive impact can be argued to be more important, outweighing the negative aspects – the production of food, medical benefits, travel, improved security, as well as simple and easy worldwide communication.

8   Ibid.

9   Griffin, A. *Product development cycle time for business-to-business products.* Industrial Marketing Management 31, 2002. p. 291-304.

10 Schilling M.A., *Strategic Management of Technological Innovation.* New York University, 2013. p.9. Fourth Edition. ISBN 978-0-07-802923-6.

11 Iddan, G. *History and development of capsule endoscopy.* Gastrointestinal Endoscopy Clinics of North America 14, 2004. p. 1-9.

INNOVATION, MODERNISATION OR SCIENCE-FICTION?

Often, we find in scientific literature the words *innovation* and *modernisation* are used interchangeably. On the other hand, there is a lot of literature that denies the existence of one or does not mention the other at all. Yet, it is important to emphasise the difference between the two, even though at first glance they appear similar. Modernisation is a process, where something old is changed (technology, way of work, etc.) or refined (adding a key feature, ability, texture, etc.). With innovation there is something new and unknown that usually comes about through a revolutionary solving of a specific problem, or something that already existed, but through research and development another new exploitation/use is found.

For example, if an army of a specific country decides to buy airplanes from another one, this would be seen as modernization, but if this country decided to invest in research and development, or to buy new exoskeletons that have been recently developed, we can call this innovation.

These two process however, are used by governments to differing degrees. As it is often easier, faster and more cost-effective, governments are usually more open to modernization. Yet, because of the nature of innovation, where at times it can take years to develop, yet other times something is developed quite rapidly, modernization and innovation are inevitably linked in an ongoing cycle. What was finally developed and marketed, can soon become obsolete or less desirable due to a rival product. Therefore, at times *"what's innovative today, is standard tomorrow.[12]"*

Another topic connected to innovation is the connection between science fiction, and real innovation technology products. The difference between these two can at times appear to be quite small and sometimes even negligible, as they influence one another, drawing inspiration and ideas from each other in a constant reciprocal process. MIT Technology Review published a study on this topic, wherein they found that *"Indeed, technology companies increasingly employ futurists who use science fiction as a medium for exploring potential new technologies and their social impact. They call this science fiction prototyping."*[13]

One of the countries, that does not hide the connection between science-fiction and innovation is China. Many people have started to be interested in this connection and the possibilities it presents, because they see it as a chance to fulfill their visions and dreams. One of the well-known authors is Liu Cixin and among his fans are Barack Obama, Mark Zuckerberg and many others. Science fiction is no longer relegated to only books and comics. Now it can be found in the most popular TV series and movies. The Chinese magazine Science Fiction World found that in 2016 there were more than 80 million fans of this genre in China.[14]

We can see how popular this topic is in China by looking at the Chinese administration as well, which demonstrated its interest. *"The*

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[12] PAHLKA, J. 2016. *The CIO Problem, Part 2: Innovation.* [online]. Code for America [Quoted.: 2019-01-25].p.1.Online:<https://medium.com/code-for-america/the-cio-problem-part-2-innovation-af24ebc038e5>.

[13] MIT Technology review. *When science fiction inspires real technology,* 2018. p.1.

[14] BLOOMBERG. 2018. *China uses Sci-fi to try to Spark a tech boom.* [online]. Bloomberg News [cit.: 2019-01-25].p. 1. Online:<https://www.bloomberg.com/news/articles/2018-09-21/alien-invasions-are-part-of-china-s-efforts-to-spark-a-tech-boom/>.

Ministry of Education last year added science as a compulsory subject for primary school students beginning from first grade, with courses focused more on hands-on experiments than textbooks. In the eastern province of Zhejiang, information technology and coding were added as subjects to the college entrance exam on a trial basis in 2017."[15]

Through this, China has begun encouraging the development of science and technology from an early age. European countries could encourage a similar approach and place an increased emphasis on science and technology in the educational system as well, which could lead to younger generations being more deeply interested and involved in the development of new technologies, not only in the defence and security sphere, but in many others as well.
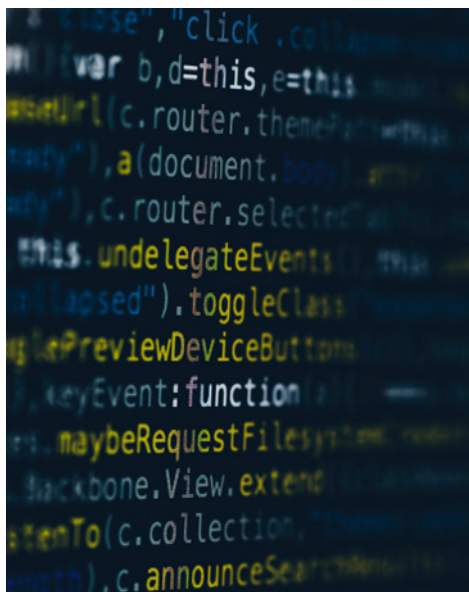
WHAT ARE THE MOST POWERFUL TECHNOLOGIES OF THE FUTURE?

A lot of countries are thinking about new technology through different spectrums and looking at completely different possibilities of use for certain areas and products of technology. The United States and China are constantly working on innovation in the defence and security sector, allocating a considerable portion of their GDPs to this area. Within Europe, countries are also doing the same. For example, there has been an increase of funding towards innovation in this area in countries such as France, Belgium and the Netherlands.

There is a broad spectrum of different new technological innovations. Imperial College London in cooperation with Imperial Tech Foresight composed a "Table of Disruptive Technologies" in 2018. This table consists

of 100 innovations that are sorted into three categories – happening now, near future (10-20 years) and distant future (20+ years). This table can be seen in next page.

The following examples are only a small part of those technologies, that will ultimately lead to life-changing consequences in the next few years. This list has been however, composed and compiled into a few groups according to the author's own choice and opinion.

FOR MOST IMPORTANT TECHNOLOGY: ARTIFICIAL INTELLIGENCE (AI)

The term AI has been mentioned often in recent years, yet with varying meanings and connections. *"AI can be considered in two ways:*

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15 Ibid.

as a science aimed at trying to discover the essence of intelligence and developing generally intelligent machines, or as a science providing methods for solving complex problems that cannot be solved without applying some intelligence like, for instance, playing good chess or making right decisions based on large amounts of data."[16]

POSSIBILITIES OF USE FOR THE ARMY: Analysing and interpreting data quickly and effectively, aiding in a soldier's decision-making process in real time.

FOR OPTIMAL SOLDIER PROTECTION: EXOSKELETONS

Even though there are many countries working on and investing in AI, this can serve to overlook the fact that the whole operation is based on humans and is thus limited by our capabilities. One solution for this problem is the use of exoskeletons. This could be one of the most important innovations of the future yet is at the same time one of the least developed. Most of them are becoming lighter, with

Predictive gene-based healthcare		Automated knowledge discovery		Autonomous robotic surgery		Emotionally aware machines		Humanoid sex robots		Human bio-hacking		Inte...	
61	DE	**62**	EA	**63**	EA	**64**	MI	**65**	MI	**66**	HA	**67**	
Md		Sw		Mm		Pb		Et		La		S	
Mega-scale desalination		Self-writing software		Public mood monitoring		Programmable bacteria		Peer-to-peer energy trading & transmission		Lifelong personal avatar assistants		Sma...	
51	SP	**52**	EA	**53**	DE	**54**	SP	**55**	DE	**56**	MI	**57**	
Mc		Sf		Dt		Se		Bf		Op		B	
Medical tricorders		Smart flooring & carpets		Diagnostic toilets		Smart energy grids		Algal bio-fuels		Human-organ printing		Arti... blo...	
41	DE	**42**	DE	**43**	DE	**44**	SP	**45**	SP	**46**	SP	**47**	
Dl		Pa		Av		Id		Df		Ap		F	
Distributed ledgers		Precision agriculture		Autonomous vehicles		Intention decoding algorithms		Drone freight delivery		Autonomous passenger aircraft		3D-... & ph...	
31	DE	**32**	SP	**33**	EA	**34**	MI	**35**	EA	**36**	EA	**37**	
Rc		Sc		Cm		Ro		As		Rg		W	
Robotic care companions		Smart controls and appliances		Cultured meat		Delivery robots & passenger drones		Autonomous ships & submarines		Resource gamification		Wate... fro...	
21	MI	**22**	DE	**23**	SP	**24**	EA	**25**	EA	**26**	SP	**27**	

Partial picture of the Table of Disruptive Technologies

Please follow the URL address for the full Table:
https://www.imperial.ac.uk/media/imperial-college/
administration-and-support-services/enterprise-office/public/
Table-of-Disruptive-Technologies.pdf

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16 TYUGU, E. 2011. Artificial Inteligence in Cyber Defence. In *International Conference on Cyber Conflict.* CCDCOE Publications, 2011, 3rd. p. 97

improved batteries, providing a longer life, and becoming faster and more ergonomic. A key part of this innovation is not to aim for an "iron man" type suit for soldiers, which is outside of the realm of possibility and cost for now, but instead simply a device to enable soldiers to carry out their duties in a more safe and effective manner.

POSSIBILITIES OF USE FOR THE ARMY: To check the pulse of soldier, detecting the presence of poison in blood or chemicals in the air and automatically notifying their commander. As well as the ability to carry a heavier load.

FOR PROVIDING OPTIMAL CONNECTION: INTERNET TECHNOLOGY ADVANCEMENT

We have become used to being constantly connected, thanks to the internet and new technology; members within the military are no exception. There are three main technologies within this field that are used the most and will likely continue to be used the most, and all are connected by the internet: Blockchain technology, Big Data Technology and the Internet of Things.

POSSIBILITIES OF USE FOR THE ARMY: Connecting all relevant devices to the internet; ensuring the transport of ammunition and other army equipment that can be located in real time via the internet (smoother logistics); using sensors, and other communication possibilities to transmit all relevant and vital data whilst ensuring encryption and security of data for all.

FOR PROVIDING OPTIMAL PROTECTION: NEXT GENERATION SEQUENCING

Biological threats are constant and have become increasingly threatening due to the speed and ease at which a threat could spread through increased travel, an unavoidable part of globalisation. Millions could be affected in a very short amount of time, despite the various safeguards and procedures that have been, and continue to be put into place. For this reason, they have become a popular method for terrorist attacks. Next generation sequencing is one of the solutions to this problem. *"Novel sequencing technologies provide new opportunities in infectious disease detection and diagnostics, such as rapid sequencing in response to the early phase of an epidemic or the determination of genotypes during the investigation of a bio-threat event. Portable near-future sequencing instruments should be low cost to use and widely deployable."*[17] Another huge benefit of this technology, is that it can provide considerable, at times even life-saving, benefits for civilians on a day-to-day basis.

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[17] EDA. 2017. Ten upcoming disruptive defence Innovations. In *European Defence Matters*. ISSN 1977-5059, 2017, Issue 14, p. 25

MAIN ISSUES

One of the real problems is, that because countries are trying to compete with each other in the field of innovation, certain topics and areas of research are being conducted in more than one country in isolation of one another, slowing the process of development in general. Some at times do share certain results, but because of the drive to dominate in this field, fueled by both security and profit concerns, it is usually not truly effective.

The European Union started to support cooperation in this field so countries can try to increase their innovation interoperability, thereby reducing costs and increasing efficiency. Since 2014 the project "Driving innovation in Crisis Management for European Resilience", DRIVER+, which focuses on the crisis management of states decided to be involved in this initiative. The *"main aim is to cope with current and future challenges due to increasingly severe consequences of natural disasters and terrorist threats, by the development and uptake of innovative solutions that are addressing the operational needs of practitioners dealing with Crisis Management.*[18] *"*

Involved in this project are experienced professionals, agencies, policy makers, technology experts and scientists from all over Europe. They are trying to create innovative solutions in software, training planning, and equipment, or even the new collaboration capabilities of all components in the forces. Currently, 14 European countries are involved, and they are cooperating with another 31 external partners.

They are also working with 28 different innovations that can provide solutions to a crisis. For example, one of them is called the "Rumour Debunker", which helps in dealing with disinformation campaigns. *"For example, in a flooding event in Austria, someone posted on social media, that cholera bacteria is in the water, which was not true. In the Munich gunman event, an imprecise situational awareness picture caused a very large amount of bound forces (about 2,300) with two possible crime scenes and an unknown number of potential "terrorists". Social media was a facilitator of a very sensitive public reaction. Even with public communication about social media, it was not possible to calm down the situation."*[19]

A vital part of this project, and innovation in general, is that the products are used in real conditions, allowing for the possibility of improving them further. There have already been two trials in Poland and France, and another two are planned this year in the Netherlands and Austria.

Other innovations, that have already been tested are for example "Drone Rapid Mapping", which grants the ability to compose a real time view of an affected area through the use of drones. "Socrates OC", is another project, and is a platform for rescue units to communicate. The "3Di" project is creating a model, that can predict a flooding location, the water depths or the water arrival times.[20]

In times of crises, one of the key components in response to the crises, is the army, along

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[18] *EÚ – CORDIS. Relaunch of Driver project, welcome Driver+!. EU Publication Office, 2017. p.1.*

[19] DRIVER+. 2018. *Rumour Debunker.* [online]. Program Driver+ [Quoted.: 2019-01-03]. p.1. Online: <http://pos.driver-project.eu/PoS/solution/16/>.

[20] DRIVER+. 2018. *Rumour Debunker.* [online]. Program Driver+ [Quoted.: 2019-01-03]. p.1. Online: <http://pos.driver-project.eu/PoS/solutions>.

with rescue units and specialized organizations. Involvement of new technologies into crisis management creates opportunities for soldiers to try out a lot of new innovations.

Yet, one of the often-used comments about new technologies that was noticed through research for this paper, was the problem of actually using the provided innovative technology. Soldiers mentioned that even though they have access to new technology, they are warned by their supervisors that they should not use the technology, as it is too expensive and valuable.

In times of crises however, the use, and more importantly the knowledge, of these technologies could mean the difference in the number of lives saved. For this reason, it should be emphasised at all levels, that even though the equipment is costly, that it is vital it is used nonetheless, and those which are meant to operate the technology become fully familiarised with its functioning.

This would also allow the possibility of gaining valuable feedback on the product, which can then be used for its improvement. Additionally, innovation, although costly, also drives considerable benefits and profits within national economies, arguably outweighing the costs incurred through their use and replacement.

Even though development for these projects are not yet complete, as they are due to be finished in December 2020, it still brings a lot of questions to the fore, on how states respond and deal with crises.

INTERVIEW WITH MAJ JEROEN FRANSSEN

In this research paper I have decided to include the opinions of Maj Jeroen Franssen, the current Information Manager & Innovation Officer of the Land Component Command at Belgian Defence. Maj Franssen has been working in the Belgian Army for fifteen years, and at the same time as an independent IT consultant. I have decided to include this interview, as Maj Franssen is an expert on innovative technologies in Belgium, who can bring another important dimension to this paper.

This interview was held on the 19th of November 2018 in Brussels, Belgium and before the interview, Maj Franssen was familiar with an earlier publication of this article. The questions chosen were composed by the author. Their main aim was to get an opinion from an expert of the innovation defence industry.

Interview

Author: Have you been interested in innovation your whole life? How did you become dedicated to innovation?

Maj Franssen: Actually, when I started my first year in my unit, as a young platoon commander, I actually started working in the unit where there was a lot of focus on quality control and improving our business. At that time, we had seven logistic battalions and the unit where I was, was considered as the most forward leaning. There was an open culture for change.

The culture was present amongst the members of the unit, the changes were not imposed from our command. After a couple of months of working I saw a lot of possible improvements and I started doing experiments where we tried to automate more and be more efficient. I was given the room by my superiors to experiment and then we discussed the merits of possible changes. I did it for two years and I was also employed in Kosovo where my

boss gave me a lot of autonomy, which I really liked, so there again we started already innovating. We were at that time working with an older logistic information system and we were planning to transition to a new one. We started experimenting with this new system six months before all the rest.

After deployment I became what we call a technical officer of a logistic battalion. You can call it 'logistic consultant of battalion commander' and there I did only projects. Some of those projects were given by the commander and others I could pick myself. I was working logistics-based projects for two years. After that I got to the Headquarters here in Belgium, where I was working for six months in an existing desk and then I asked to create a new office which was to be mainly focused on procedures and performance of army logistics and my boss agreed to that.

Author: This means that we could say, that it was input from your side which led to the start of an Innovation structure in Belgium?

Maj Franssen: Yes. My bosses gave me in the past the opportunity for experimenting and innovating but this wasn't part of the Belgian Defence DNA. I therefore decided to write my research paper in the Advanced Staff Course on this topic. The paper suggests to create innovation officers in the components and this meanwhile has become a reality.

Author: And how does it look like now? Is it still mainly you, or do you have more people working alongside you?

Maj Franssen: It's still mainly me for the Army but I also have a colleague in the Navy & Airforce. The thing that I noticed is that a lot is dependent on the will of individuals in order to push forward a project. Some projects are carried out with no problem, but not everybody is always so lucky. The success of

a project shouldn't depend on the motivation of somebody but should be an innate part of the organisation. I found for my research paper three cases where we were able to innovate but there was a lot of organisational pushback for these innovations. I read a lot of literature on the topic and then I compared the Belgian situation with other nations and there is a big difference, if you compare it, with for example France, who already for 20 years now, have an innovation culture integrated into their structure and organisations.

Especially in the civilian sector, there is a clear desire for bottom-up innovation. This means that people on the work floor are encouraged to innovate. In my current job we believe that we need to focus on the younger generation to be able to allow them to experiment, to test stuff and find projects they want to do. The innovation structure that we are putting in place will help young innovators to dare to innovate and help them with their projects.

Author: Do you come into direct contact with the soldiers, that have a lot of interest and innovative ideas? Is it possible for them to make these ideas a reality?

Maj Franssen: Yes, we have some ongoing projects. If there is a somebody from a unit, who has a good idea, they can send those ideas directly to me. We have decided to skip all the people in-between as is being done by other nations. We also have created a SharePoint website with an "eight liner", which originally came from the USA and their idea of a "ten liner". It doesn't matter who someone is in the organisation, or which position they occupy. If they see an opportunity to change something and they have an idea they should be able to submit that. It is also important to note that it's more than just expressing an idea. They also have to come up with solutions. Of course, this is just the beginning and we need to take a lot of steps to achieve this.

Author: Do you cooperate with other armies in the field of innovation? Do you think innovation can be a way to support interoperability between nations?

Maj Franssen: We need to have, at least, an idea what projects neighbouring country are carrying out. There is no use in doing the same project twice and I think there is a big opportunity for Finabel. We plan on coordinating closely with the French Army and the Dutch Armed Forces, but this is a work in progress.

France has created an innovation institute and they have decided to spend in the next six years €6 billion on innovation alone. I think there is real need to exchange information. Also, for example, the British are now testing 80 unmanned platforms. It would be profitable for all of us to know, if this has failed or if this is a success. There is no need to do one thing twice. There is also the NATO forum, but I think we also need something more European centred.

Author: What do you think are the most powerful defence technologies of the future?

Maj Franssen: I think that one of the issues is the importance of software. Future battles will be driven by software such as AI. At this time, we have limited interoperability between these softwares, especially on a technical level, so this is a very big challenge and space for improvement.

Imagine that there is a world where a computer says to you, and that's actually what they wanted to do with the Scorpion project, 'somebody from your unit is taking a fire and I suggest the following actions to address this'. And you can forward it to other personnel who can help him. That's something that is going to have a big impact in the short term.

Another interesting development is blockchain technology. I'm currently reviewing a possible project that will use blockchain for resilient and secure data storage. The decentralised functioning of the blockchain is also something that we are not used to anymore in Belgian Defence and worth looking into.

Also, drones are very influential and more specifically the unmanned ground vehicles have huge potential. The miniaturisation of guided munitions to even small arms calibers could also be a big change for Land Forces.

Directed energy weapons such as lasers are also an interesting development but have their own problems as you can't shoot over an object as we do now with artillery and mortars.

And something, that we are not looking into, but the US is, is physical enhancement for soldiers. This can be done with exoskeletons, but this is very cumbersome for the moment or also by giving them special "drugs" to enhance focus, reduce the need for sleep, etc. Giving additional attention to food can also increase the performance, as is being done with athletes. We are always looking at technology, but people can also improve a lot and it could be a domain that we may have to look into the future more.

I would like to thank Maj Jeroen Franssen for taking the time to speak with me and share his ideas and opinions.

CONCLUSION

One of the biggest challenges today is the ubiquitous need for innovation in the field of state security. Despite the fact that many European states are working on modernization in the army this should not be confused with innovation. Many of Europe's more advanced countries, especially in the Western region, have sidelined the trend of research and innovation.

We can discuss many different types of specific technologies that are currently in the pipeline and differ from one author to another. However, innovation that is often discussed include, of course, artificial intelligence, and autonomous systems in various forms, that also have great potential for the future, as well as the focus placed on secure data transfer and storage.

In general, we can say that innovation is a very important topic in some countries, and this will only continue to grow. Cooperation in this field however, is a problematic part mainly because of the fact that advancement in innovation is always seen in light of competition and security concerns, and therefore often innovators are not willing, or are forbidden, to share information on progress made in certain areas and projects. The fact that from time to time innovation can draw inspiration from science-fiction should also not be overlooked.

For now, there still remains a huge amount of ideas and projects which are currently unfeasible, and which must remain for now in the realm of fiction and fantasy. With the speed modern society has been innovating technology however, it seems that often the response to many an idea, is not "*if*" it can be created but rather "*when*" it can be created.

BIBLIOGRAPHY

- Bloomberg. 2018. *China uses Sci-fi to try to Spark a tech boom.* [online]. Bloomberg News [cit.: 2019-01-25].p. 1. Online:<https://www.bloomberg.com/news/articles/2018-09-21/alien-invasions-are-part-of-china-s-efforts-to-spark-a-tech-boom/>.
- Brune, R.A. *Innovation In The Army, Part I: It Starts With The Warfighters.* [online]. [Quoted: 2018-11-14]. Online: <https://taskandpurpose.com/innovation-army-part-one-starts-warfighters/>
- DRIVER+. 2018. *Rumour Debunker.* [online]. Program Driver+ [Quoted.: 2019-01-03]. Online: <http://pos.driver-project.eu/PoS/solution/16/>.
- DRIVER+. 2018. *Rumour Debunker.* [online]. Program Driver+ [Quoted.: 2019-01-03]. p.1. Online: <http://pos.driver-project.eu/PoS/solutions>.
- EDA. 2017. Ten upcoming disruptive defence Innovations. In *European Defence Matters.* ISSN 1977-5059, 2017, Issue 14, p. 4-43.
- EÚ- CORDIS. 2017. Relaunch of Driver project, welcome Driver+!. [online]. EU Publication Office [Quoted: 2019-02-03]. Online: <https://cordis.europa.eu/news/rcn/141759/en>.
- Griffin, A. *Product development cycle time for business-to-business products.* Industrial Marketing Management 31, 2002. p. 291-304.
- Huo, J. 2015. *How nations innovate: The political economy of technological innovation in affluent capitalist economies.* Oxford: Oxford University Press. 2015. p.2. ISBN 978-0-19-873584-7.
- Iddan, G. *History and development of capsule endoscopy.* Gastrointestinal Endoscopy Clinics of North America 14, 2004. p. 1-9.
- Maital, S. – SESHADRI, D.V.R. *Innovation Management: Strategies, Concepts and Tools for growth and profit.* 2. vydanie. New Dehli: SAGE, 2012. p. xlviii. ISBN 978-81-321-0722-4.
- MIT Technology Review. 2018. When science fiction inspires real technology. [online]. MIT Technology Review [Quoted.: 2019-01-10].Online: < https://www.technologyreview.com/s/610713/when-science-fiction-inspires-real-technology/>.
- Pahlka, J. 2016. *The CIO Problem, Part 2: Innovation.* [online]. Code for America [Quoted.: 2019-01-25].p.1.Online:<https://medium.com/code-for-america/the-cio-problem-part-2-innovation-af24ebc038e5>.
- Schilling M.A., *Strategic Management of Technological Innovation.* New York University, 2013. p.1. Fourth Edition. ISBN 978-0-07-802923-6.
- Imperial College London. Table of Disruptive technologies [online]. 2018. Online: < https://www.imperial.ac.uk/media/imperial-college/administration-and-support-services/enterprise-office/public/Table-of-Disruptive-Technologies.pdf>
- Tyugu, E. 2011. Artificial Intelligence in Cyber Defence. In *International Conference on Cyber Conflict.* CCDCOE Publications, 2011, 3rd. s. 95-105
- Vitter, S. – Corey, J. In a position to lead: How military technology and innovation can ease the world's water challenges. [online]. [Quoted: 2018-11-14]. Online: <https://www.earthmagazine.org/article/position-lead-how-military-technology-and-innovation-can-ease-worlds-water-challenges>

Created in 1953, the Finabel committee is the oldest military organisation for cooperation between European Armies: it was conceived as a forum for reflections, exchange studies, and proposals on common interest topics for the future of its members. Finabel, the only organisation at this level, strives at:

- Promoting interoperability and cooperation of armies, while seeking to bring together concepts, doctrines and procedures;
- Contributing to a common European understanding of land defence issues. Finabel focuses on doctrines, trainings, and the joint environment.

Finabel aims to be a multinational-, independent-, and apolitical actor for the European Armies of the EU Member States. The Finabel informal forum is based on consensus and equality of member states. Finabel favours fruitful contact among member states' officers and Chiefs of Staff in a spirit of open and mutual understanding via annual meetings.

Finabel contributes to reinforce interoperability among its member states in the framework of the North Atlantic Treaty Organisation (NATO), the EU, and *ad hoc* coalition; Finabel neither competes nor duplicates NATO or EU military structures but contributes to these organisations in its unique way. Initially focused on cooperation in armament's programmes, Finabel quickly shifted to the harmonisation of land doctrines. Consequently, before hoping to reach a shared capability approach and common equipment, a shared vision of force-engagement on the terrain should be obtained.

In the current setting, Finabel allows its member states to form Expert Task Groups for situations that require short-term solutions. In addition, Finabel is also a think tank that elaborates on current events concerning the operations of the land forces and provides comments by creating "Food for Thought papers" to address the topics. Finabel studies and Food for Thoughts are recommendations freely applied by its member, whose aim is to facilitate interoperability and improve the daily tasks of preparation, training, exercises, and engagement.

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