ITALIAN DEFENCE GENERAL STAFF

Future Scenarios Concept: Trends and Implications for Security and Defence

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PREFACE BY THE CHIEF OF THE DEFENCE STAFF

Thinking about the future is an exercise of absolute value. It is a necessary moral duty to be fulfilled in order to survive the inexorable passage of time by understanding tomorrow, as well as by using the strategic weapon of "foresight" as a decisive advantage in preparing the "battlefield".

This is all the truer and more topical today where, in the face of the swirling change in the geo-strategic, technological, environmental, and cultural context that surrounds us, relying on studies that help 'Think of the Future' is vital for complex organisations such as Defence. The latter is called upon to guarantee adequate strategic relevance in the future, also through effective predictive capabilities about the trends of tomorrow.

The Future is both the starting point and the hoped-for destination. It is only by studying the trends of tomorrow today that we can face them with greater awareness and with better cognitive and material tools. We are called upon, in fact, to anticipate trends and transformations whose depth and scope are likely to reach a global scale through integrated, adaptive, and innovative thinking.

Looking ahead in a long-term perspective (2040+) requires an intellectual effort and the assumption of a calculated but necessary risk. By stepping outside our comfort zone, it would allow us not only to anticipate trends, but also to outline their effects and future consequences capable of redefining the priorities of societies and the relative balance of power, influencing our behaviour, driving innovation, and bringing about structural changes. Anticipating these trends in our minds is a fundamental exercise in order to lay the foundations of the provisions that will allow us to govern their effects and consequences effectively.

What impact will the use of artificial intelligence have? What consequences can we expect from climate change and demographic decline in the West? Will the space and cyber domains bring more opportunities or more risks? Will we really live in smart cities

capable of being energy sustainable? How and with what tools will the Defence industry be able to adapt to all this?

In the long term, the different responses to the framework outlined above are likely to influence interactions among states, international organisations, and non-state actors, even in the face of diverging strategic agendas, sometimes conflicting levels of ambition and different priorities and scales of values. From this awareness, which represents both a challenge for us and for the new generations, comes the responsibility for the Defence industry to understand the major trends currently underway, to outline those expected and to be expected in the future and, not least of all, to examine their related implications. At the same time, it is necessary to analyse the future, identifying the trends and studying the vectors of change in order to guide, with immediate concreteness, the strategic decisions that, through programmatic actions based on an authentic whole-of-government approach, outline a clear path to prepare and shape the "Country of the Future".

According to the "public-private synergy" paradigm, we have brought together several authoritative players from the world of research, academia, industry, and civil society, to study and investigate these aspects in depth. They are engaged in a virtuous dialogue with the defence sector to develop credible trends with respect to the many directions of change in the most integrated manner possible. Aware of the margins of error associated with such a long-term analysis and applying a national perspective, "Future Scenarios" were deciphered and developed based on the main geopolitical, socio-economic, technological, and environmental trends. Subsequently, by systematically breaking down the lines of change that emerged, generic security implications and specific defence implications were identified, which will inform, as guiding principles, the transformation process, the paths to be followed for research and development, and the evolution of the military instrument, inspired by a joint and multi-domain approach.

The outlined scenarios envisage an overall picture where hybrid threats, technological confrontation, competition for access to natural resources and the need for environmental sustainability are in close interaction. In order to continue to be relevant and to safeguard indispensable national interests, the military instrument will have to respond with a conscious and rapid adaptation to innovation. It will have to implement courageous and far-sighted planning decisions that anticipate trends of change and

initiate the necessary preparations in time to ensure adequate operational capability, indispensable systemic resilience and, at the same time, a virtuous process of continually updating our contribution to national strategic thinking.

Having an inclusive leadership able to invest in expertise, training and values represents a necessary response to cope with the uncertainty of the future with long-sighted courage, by suggesting solutions that can enhance human resources and make the difference against the technology of machines and artificial intelligence.

The Defence industry's human capital is therefore called upon, as of now, to update itself and to take up the challenge of "governing change" through the best strategic weapons we have as a country system, namely creativity, lateral thinking, and the ability to work as a team, valuable resources that are unparalleled in the world.

In conclusion, in the light of the ongoing debate on national security and defence, I believe that this document, and the process used to draw it up, represent an ideal model of inspiration for the oft-hoped-for "collective intelligence" that will see an increasingly structured collaboration between defence and the country's strategic assets, in line with what is outlined in my "Strategic Concept" and as a premise for greater "systemic efficiency and overall relevance" of the military.

I hope you will enjoy reading it.

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INTRODUCTION

THE COMPLEXITY OF FUTURE SCENARIOS

The ability to foresee **Future Scenarios**, attempting to bridge the gap between the speed with which new and traditional threats change and the consequent ability to adapt, requires thinking about the future in a way that is unconstrained by classic schemes, scrutinising the best and most innovative ideas, and seizing the resulting challenges and opportunities.

Given the current pace of change, the ability to identify "possible futures" and the relative lines of anticipatory action (so-called **strategic foresight analysis**) has become an indispensable feature of every organisation. This analysis is based on a set of methodologies that civil and military organisations use to foresee and identify factors and events that could affect the operational context of the organisations themselves. The aim is to mitigate risk factors and, where possible, exploit opportunities through a systemic process to interpret the present and future context in a holistic manner, identifying alternative scenarios determined by the associated probabilities. However, this approach upholds the importance of present trends that remain relevant for understanding the future. Building on those trends that could be observed for years in multiple global domains (social, economic, political, and technological), specific directions of change, defined as megatrends, can be identified that will remain relevant in the future. These include an ageing population, digitalisation, globalisation, and urbanisation. Identifying tomorrow's megatrends is also a difficult but necessary challenge, even if there is a risk of making mistakes.

The world is going through a period of significant changes in the political, social, economic, and environmental areas substantially influenced by exponential developments in technology, trends that are redefining the global security environment with consequent complexity and indeterminacy, thus highlighting the **'new normal'** on the horizon. The growing number of stakeholders combined with the interconnected nature of the international system, the exponential rate of change and the confluence of trends, have continued to increase the potential for disorder and uncertainty, making today's environment increasingly complex and with too many interactions to encompass all possible outcomes. Thus, the risk of surprise or even failure increases.

Complexity is already part of many people's daily lives and will be increasingly pervasive in the future. Dealing with it will require a more integrated approach. Although socio-economic dynamics and political systems are now slow to adapt to major global changes in society, technology and innovation, world economy and the environment, recognising current complexity will help to anticipate the potential trajectory of future trends, enabling the development of measures and responses that are deemed necessary and feasible.

Complexity is likely to reverberate on the definition of national interests and fuel differences in the perception of risks and threats. With the involvement of non-state

actors that may aim to influence the expected outcomes of a situation, decision-makers will face greater challenges when trying to create a unity of purpose among Allies and Partners whose components may be more inclined to pursue their own agendas. Complexity will also increase the number and likely trajectories of potential outcomes, which in turn will require leaders to use a more comprehensive and rapid decision-making system.

In this framework, therefore, adaptability and resilience are features that will allow Defence, within the National Security perimeter, to be ready to counter future threats through a strategy and cultural shift from tailored solutions to agile solutions. In other words, fast change is needed to maintain relevance in the future ("**adapt at the speed of relevance**").

The elaboration of **the Future Scenarios Concept** was therefore approached according to the **Open Innovation** paradigm, i.e., by resorting to ideas from inside and outside Defence and scanning the different sensitivities of national society, through critical academic thinking, the pragmatism of industrial reality and the insight of the research context. The Future Scenarios have been broken down and developed into the main geopolitical, socio-economic, technological, and environmental **trends**, **contextualised in a national perspective**. The definition of the multiple directions of change has then allowed the identification of generic **Security** implications and specific **Defence** implications.[1]

[1] Working methodologies and bibliography are detailed in Annex B.

CHAPTER 1

THE GEOPOLITICAL SCENARIO

The future international geopolitical scenario (2040+) will be characterised by profound changes and recurring instability **("pervasive instability**"), characterised by dynamic, volatile and unpredictable phenomena, in which the manifest and latent forms of competition for access to and management of the limited precious resources of the planet will increase, in which old and new state and non-state actors will move unscrupulously across the areas of confrontation, crisis and conflict, whose boundaries will appear increasingly blurred.

The fundamental feature of the geopolitical framework will see, in the future, the resurgence of the "**Great Power Competition**" and the consequent questioning of the Liberal International Order by, mainly, authoritarian systems (Russia and China) and some regional state actors (Iran and North Korea), as well as by international terrorist groups, non-state "malicious" actors (Al-Qaeda, the Islamic State - IS), and their local "franchisees".

In particular **China** and **Russia**, as "Revisionist Powers", are committed to altering the current strategic balances in order to revive "spheres of influence" (Russia) or to stand alongside and replace the USA as the hegemonic world power (China).

Europe will have to face challenges made even more complex by its internal heterogeneity by increasing areas of cooperation, through greater Euro-Asian integration at an economic level (exchange of goods, resources, and financial markets), infrastructural level (ports, railways, roads) and digital level, partly modifying the balances between International Organisations.

With the turbulence of **the MENA region** (Middle East and North Africa) that is geographically closer to us, the **Enlarged Mediterranean** will see a dynamic demand for reforms aiming at democracy, always hindered by social, cultural, and economic factors, and exacerbated by the strong regional impact of religious aspects.

Populism, polarisation, reduction of civil liberties, eroded political power and sovereignty, post-truth information, post-ideological and post-secular politics, crisis of global and planetary identity will characterise **national dynamics**.

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1.1 GEOSTRATEGIC AREAS AND SPHERES OF INFLUENCE

Power rivalries between states will concern the possession, control, or influence of specific areas of interest, a confrontation linked to the appropriation, maintenance and control of resources and supplies. The inevitable redistribution of economic and military power towards the Asia-

Pacific regions will have global effects and consequently lead to competition between the major powers, the effects of which will also be evident in the main areas pertaining to Europe, the Middle East, and North Africa (MENA) and the Enlarged Mediterranean.

The Indo-Pacific Area

China's policy will be characterised by the pursuit of political, social, and military modernity, including wide-ranging efforts to expand national power, refining systems of governance, and reviewing the international order (global reach). Aiming to achieve technological advantage, China will set up a process of innovation based on a series of structural reforms to strengthen the role of the State and, at the same time, a restructuring of the economy to generate greater domestic consumption and reduce dependence on foreign countries.

One can presume a growing tendency towards control, also militarily, within the First Island Chain - which stretches from Japan to the Philippines, passing through Taiwan and the complex local geography - through its own missile defence and demographic-military mass.

With regard to Europe, China will continue - in the short to medium term - to show greater activism as to the economic-financial aspects than military ones. Thus, one should observe in a wide-ranging perspective the evolution of investments, especially in the logistics sector [2](from Duisburg to Taranto-Piraeus - the new Silk Road) which will make it possible to bypass Suez, or to make its strategic role functional to the expansionist needs of China towards the West. This arc could encircle Europe and

[2] Through projects aimed at building or upgrading commercial infrastructure such as roads, ports, bridges, railways, airports, as well as energy production/distribution and communication systems. The aim is to facilitate and boost trade and commercial relations between Chinese companies and the rest of the world, as well as to attract and co-opt alliances (Soft Power).

provide China with a strong influence on the world's largest intra-regional trade flow, namely the one between Europe and Asia.

Russia & Central Europe

Due to its structural characteristics (geographical, demographic and level of ambition) and despite its serious economic difficulties, Russia will remain, in the future, a global power, focusing on the opportunities and threats that will develop along its borders. This aims to control and contain the expansion of Western institutions and military alliances (NATO and the EU), promote the Eurasian project and work with China to strengthen its influence in Asia and improve the development of the Far East regions.

Russia will have to face many domestic challenges, the implications of which may modify its aspirations and capacity for international projection, confirming the imbalance between internal development and its international ambitions. Such a situation could in fact favour the stability of the country, preserving its status quo to the detriment of its social and economic development.

As far as the system of alliances is concerned, the Russia-China relationship is based on an opportunistic advantage and not on a natural partnership, therefore divergent and/or converging trajectories will be materializing. These could either reinforce the cooperation based on reciprocal rivalry towards the United States or become separated due to the lack of a common long-term vision, which could create a real and proper military alliance.

As a military power, Russia could pose a threat to Western interests in Europe and MENA, even though its economic system is very weak, based on the sale of energy resources, especially to the EU, and totally lacks any significant productive activities. Russia's energy resources, however, may become less and less relevant in the future, thanks to the construction of a series of pipelines through Transcaucasian states and areas of the Maghreb. The latter have been traditionally characterised by general instability and have been the object of hegemonic interest on the part of Russia itself. On the other hand, the new resources made available by the melting of the Arctic could strengthen its role.

Europe

Soon, Europe will have to face a series of challenges which, on a purely geopolitical level, will be linked on the one hand to the end of the US unipolar moment and, on the other, to its loss of centrality in economic/technological/value terms in the face of the ambitions of rising states. In particular, all European States will, albeit to varying degrees, be faced with:

- the management of domestic crises, the resilience of liberal democracy in Europe and the crisis of institutions;
- the maintenance of the area of free movement of persons in the Schengen area, concern over the respect for human rights in domestic and foreign policy;
- the energy issue and supplies of raw materials, given the decline in domestic production;
- a strategy that is not shared unequivocally as regards climate change (zero-carbon target by 2050);
- migratory pressure, both from Africa and from the east-west, and the definition of a single strategy regarding the stabilisation of and relations with the countries of origin of the flows (e.g., the sub-Saharan area and North Africa), as well as with countries that could benefit from these flows in view of European hesitations and disagreement in managing the phenomena.

Depending on the ways in which these issues are addressed, it will be possible to hypothesise different trajectories in the future. The response to the pandemic can already be seen as an accelerator of change and a test of the European Union's organisation and cohesion, response capacity and decision-making processes, based on consultation among states, with two possible outcomes. We could either see greater integration of European States (including in the military field) with the resurgence of a new European centrality in world dynamics, or political responses given in random order by the countries of the European zone with a consequent lack of cohesion and progressive marginalisation. This will have an impact in particular on Italy, which considers its participation in the European Union a fundamental pillar, also in terms of national cohesion, which may be confirmed when faced with new challenges.

Ultimately, and with a view to the future, the European Union may experience a process of redefinition that could go from its geopolitical reassertion with new balances or, in the extreme, its partial fragmentation.

The Enlarged Mediterranean

Competition and the fluidity of the international scenarios will be increasingly fierce in the wide area of the Enlarged Mediterranean. Owing to its being a connection between non-homogeneous realities, this will reverberate well beyond the various contiguous and culturally different areas that are enclosed within it. In fact, the Mediterranean in the strict sense, the southern portion of the African continent, the Middle Eastern and Arab context, the Caucasian-Caspian region remain the most relevant scenarios for our country. Italy's security is incontrovertibly linked to the security of the region, not only because it is geographically closer, but also because of its economic, political, and diplomatic interdependencies.

In the future, the area will be characterised by endemic turbulence, caused by a multiplicity of actors and factors, including mainly competition for energy sources, which may also affect the security of communication routes.

Climate change may exacerbate the process of desertification in some southern areas of the Mediterranean, fuelling migratory phenomena with potentially disruptive effects on the area, which is already stressed by the rising levels of the seas and the increase in extreme natural phenomena with continuous erosion of the territory. This is a fundamental scenario for the relocation of settlements, infrastructure, and resources. Cooperative security in the Enlarged Mediterranean will continue to be a priority also for the Atlantic Alliance, the so-called 'Southern Flank' to be protected - also through the projection of the Military Instrument - from the threats posed by the permanent instability of North Africa and the Middle East, the proliferation of extremist organisations and the illegal trafficking by international criminal networks. In addition, as regards Sahel and West Africa a trend is confirmed showing the strong deterioration in security conditions due to a context characterised by multiple vulnerabilities such as structural problems, serious governance deficits, proliferation of terrorist groups, increased illegal trafficking, including transnational trafficking.

1.2 COMPETING VALUE SYSTEMS AND THE CHALLENGE TO THE LIBERAL INTERNATIONAL ORDER

Competing value systems can fuel global geopolitical fragmentation, weakening the role of International Organisations and, more generally, the Liberal International Order.[3]

Russia will continue to wear down the existing International Order through an assertive foreign policy based on asymmetric and non-linear forms of intervention (disinformation, "war of narratives", interference in national political processes and promotion of social polarisations for destabilising purposes) in open opposition to the concept of "strategic stability" that underlies the North Atlantic Alliance. In particular, Russia will continue to present itself as an alternative to the Western system through a campaign supported by a coherent "narrative warfare" as well as activities carried out in the cyber domain aimed on the one hand at building the loyalty of former Soviet countries and illiberal regimes (rogue states) according to a so-called package deal formula (political, economic, military support) and on the other hand at creating political paralysis in its adversaries, undermining their internal cohesion and exacerbating social divisions. Should Russian military activity extend beyond the threshold of deterrence, the conditions could be created for a potential conventional conflict between peer competitors, which would determine a massive deployment of all components and the redeployment of forces on the eastern European border.

However, it is **China** that possesses the economic and prospective potential to position itself as a major power in a possible bipolar and no longer 'asymmetrical' alternative to the Western alliance system. In addition to being engaged in a veritable arms race, China is pursuing a line of hegemonic assertion - even in open defiance of international law (South and East China Seas) - and, in parallel, a sort of multi-continental economic neo-colonialism (Belt Road Initiative), as well as the occupation of the world's network of critical infrastructure (i.e.: the initiatives in the telecommunications and technology sectors - 5G, technological standards,

[3] Architecture of strategic security and sustainability based on International Organisations that regulate vital areas of global cooperation on freedom of trade and commerce, on the efficiency and reliability of financial and credit markets, on the pursuit of the peaceful settlement of disputes between states, on the non-proliferation of armaments and weapons of mass destruction.

semiconductors, rare resources and rare-earth elements [4], and quantum computing - with the aim of achieving technological superiority and control of communications). Looking ahead, it is not expected that China will be able to forge an effective system of alliances and, consequently, will be able to invest in its exclusive strategic military reinforcement.

In the Chinese economic strategy, no longer characterized by the mass production of low-cost goods, but by the race for technological superiority, the use of all forms of asymmetrical conflict is central, mainly in the economic sector. This includes the theft, on a very large scale, of Western intellectual property with the so-called "technology transfer", the massive government subsidy to national industrial competitors, the use of coercive forms of diplomacy and systematic campaigns of disinformation and manipulation of international law (the so-called "lawfare").

In this context, it is clear that the challenge that China will pose to the Western world in the coming years, economically, militarily, and culturally, will be crucial and could erode the liberal international system.

Democracies based on the rule of international law and Liberal International Order will continue to defend themselves without going against human rights and will reassert themselves in the face of the lack of viable and sustainable alternatives, based on international organisations, economic freedom and freedom of trade, human rights, and the paradigms of *pacta sunt servanda*. However, democracies will have to be able to take more assertive positions than at present as it is necessary to guarantee respect for fundamental rights in the face of the present threats.

In any case, the emergence of alternative or competing value systems against the liberal model can also be seen as an opportunity to rebalance rival value systems. Consequently, the hegemonic role of the Atlantic Alliance and the West will be continually challenged by emerging and re-emerging powers challenging the Liberal International Order, mainly by Russia and China and secondarily by regional state actors (e.g., Iran). As a result of what some analysts call 'strategic insolvency' [5] the US may confirm an approach of offshore balancing of its military forces by relying on local allies to prevent the rise of regional hegemons, or by relying on increasingly sophisticated weapons systems. However, this trend may also result in a marked strategic assertion of US power in the Pacific region as current long-term plans

[4] Rare resources are the so-called 'conflict minerals' which include the 3TG metals: tin, tantalum, tungsten, gold - essential for batteries and electronic devices - and rare earth elements, essential for many modern technologies, from fibre optics to superconductors (95% produced by China).

[5] Caused by the expense of operational missions in Afghanistan and Iraq, the financial crisis, and defence cuts imposed by the Obama administration.

highlight. Therefore, future trajectories emerge in which true multilateralism may remain that of a world painstakingly built on such a cooperative basis, or it may become that of the 'spheres of influence' that have always led to conflict in history.

1.3 PERSPECTIVES OF GEO-STRATEGIC COMPETITION

Notwithstanding the evolution of the instruments used and the areas of confrontation, the traditional forms of conflict will continue to constitute the essence of military competition, with the addition, in the short and medium term, of the potential enabled by technological development in the emerging domains (cyber and space).

The Instruments of 'Conventional' Competition

Growing international competition will lead to forms of direct confrontation for which the use of "conventional" instruments will continue to be necessary.

The continuous building up of military capabilities within the framework of renewed Russian military activism will lead to an ever-increasing presence in areas of direct confrontation along territorial borders, and in the Arctic and Baltic areas in particular. Against this background, the present convergence of interests with the Chinese power will feed, in the short-medium term, an opportunistic Sino-Russian alignment whose long-term evolution cannot be determined.

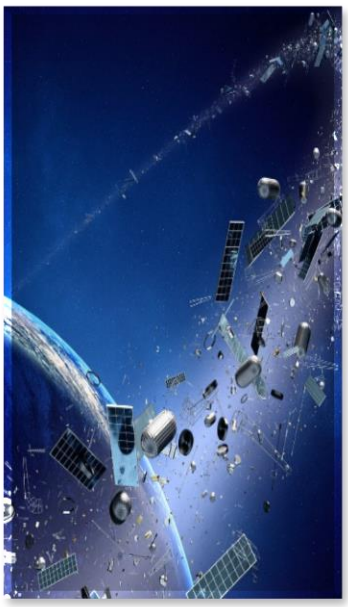
From the military point of view, China will continue to strengthen its military capabilities through the modernization and renewal of the People's Liberation Army (PLA Objective 2035-'world class forces'). In the future, this modernisation will also include the development of a doctrine for employment in the new domains (Space and Cyber) by redefining future competitions and increasingly extending battlespace to political aspects, the strategic enablers - in terms of defence and force projection - and digital infrastructures supporting information. This is a technology-driven totalitarianism that could become, in the long run, a real Chinese system of exportation and stimulates other nations to follow suit, thus becoming a threat that is not only a military one, but also an economic, technological, and health-related threat.

In order to maintain their own capacity for deterrence and to counter possible hostile actions of competing actors, within the alliances, the single Countries will have to confirm and update their own conventional component, adapting it to the potential offered by technological development.

Competition in the Cyber Domain

The challenges connected to the cyber dimension will also assume geopolitical and geostrategic relevance due to the specific cross-cutting nature of the domain itself.
In fact, the cyber dimension of conflicts has been integrated with the traditional ones, extending its pervasiveness also to the cognitive domain.
In particular, the rapidity of development and diffusion of innovative technologies, which are more and more pervasive (e.g., the field of information and social networks), in addition to the possibility of provoking the collapse of essential systems and services, has highlighted the destabilising and conditioning potential regarding public opinion through the "control" of networks and data.
The ability to manage a huge amount of data will be one of the fundamental parameters for determining the weight of each actor in the economic and political spheres. The importance of data flows is such that one speaks of digital sovereignty, or rather of the possibility that subjects, even private ones, able to intercept them and make them usable, can rewrite the geo-strategic balance and impose new rules.
Unlike all the other traditional domains, the Cyber domain represents something intangible by nature, therefore endowed with strong intrinsic volatility, but which cannot be considered as completely detached from the territorial factor because the actions carried out in a cyber environment, whilst developing on a virtual level, cause 'concrete' effects in the real world.
A further important aspect will consist of the widespread access to technology by state and non-state actors who will aspire becoming major counterpars of geo-strategic relevance, thus creating new challenges and threats we will have to face and whose outcomes are certainly not to be taken for granted.
Cyberspace will become the new arena of competitiveness in which the new dynamics and rules of international relations will be rewritten, and in which the balance will be redefined according to new parameters.
Consequently, cyber security will be a strategic and crucial sector for the protection of the critical institutional infrastructure of a country in which the growing level of cyber threats requires the continuation and implementation of a programme to strengthen security. It will therefore be necessary to invest in preparing leaders to manage the digital domain at a strategic level.

Competition in the Space Domain



In the future, Power Competition will be projected into the 'space domain', with an increasingly active involvement of the military. Technological development has contributed to expanding the possibilities of access to space, creating new opportunities, challenges and extending services to more and more users. The traditional financial and technological barriers in the satellite field are constantly decreasing and, thanks to the reduction in access costs, more and more users (civil, military, and commercial) can benefit from space services. On the other hand, one cannot hide the existence of a dark side to the space domain related to the increasing exposure to new risks and systemic vulnerabilities such as espionage, sabotage, and debris proliferation. Therefore, the ability to operate even in conditions where space-based services are limited or denied must be maintained.

In the continuum of competition, space will increasingly be the area of confrontation, and space technologies will be the strategic sector with a decisive role in all of a country's public and private activities (e.g., helping to connect people globally, providing essential data in case of natural disasters, supporting the conduct of military operations). Today we are witnessing the unstoppable growth of satellites belonging to more than 50 countries and multinational organisations, and only 11 players (China, India, Iran, Israel, Japan, Russia, North Korea, South Korea, France, the United States and the European Space Agency) possess the capabilities for launching destructive (kinetic and non-kinetic) Earth-to-space attacks against orbiting satellites or to position satellites that can be used to intercept communications or interfere with enemy satellites. However, the defence of national interests and opportunities that may arise in space, such as the exploitation of natural resources from asteroids and planets (space mining), must also be considered.

The absence of an international regulatory framework regarding military space operations requires overcoming the limitations of existing agreements based on general international law, international space law, and international law on the use of force and international humanitarian law, which is ambiguous and presents problems of interpretation. This is especially true with regard to the distinction between military and non-military uses of outer space, which is notoriously blurred since the nature of the actors or objects involved in a specific activity does not conclusively determine the character of that activity. Therefore, there might possibly be a convergence towards international institutions of international law that have been developing over centuries - such as the Law of the Sea - which already has many similarities with Space law.

1.4 NEW FORMS OF CONFLICT

The change of paradigm in certain forms of "advanced" conflict will mainly concern the presence and pervasiveness of the cyber threat and the necessity of ensuring a freedom of manoeuvre in this ambit before being able to operate in the other domains. Therefore, the modern threat appears multidimensional and transversal, i.e., pertaining to one or more dimensions and able, at the same time, to weaken the entire Country system also by striking a single vital interest because of its ability to produce effects/consequences in all the other dimensions.

One of the possible scenarios could consist of an attack on sensitive objectives in the Country, conducted by a variety of assets (not necessarily weapon systems) and actors (combatants and non-combatants) maintaining, in any case, the clash below the threshold of "open aggression". The ambiguity, the pervasiveness of this threat and the difficulty in identifying the aggressor hinder the clear and timely recognition of the attack, especially if it is directed towards apparently unrelated targets, exposing the risk of a late and less effective response. This form of conflict is referred to as the **hybrid threat**, i.e., a type of complex threat that involves the centralised, controlled, and combined use of covert and non-covert tactics, as well as various strategic tools by military and non-military actors, in a conventional and/or irregular manner. These include cyber-attacks, information operations, economic pressure, destruction of energy supplies and the appropriation of critical infrastructure. Hybrid attacks are designed to exploit national vulnerabilities across the spectrum of political, military, economic, social, information and infrastructure functions through the coordinated, systematic, and synchronised use of DIME (Diplomatic, Informational, Military and Economic) Instruments of Power, to create friction along the natural boundaries between peoples, nations, and organisations and to undermine people's trust in their governments, institutions, allies, and partners.

However, deterrence will continue to underpin the balance of traditional and non-traditional submarine capabilities, the use of nuclear power and, eventually, hypersonic technologies.

1.5 THE INTERVENTIONIST STATE

The delayed multilateral response to international crises has severely tested democratic countries, which have seen in the figure of the state as rescuer an inescapable solution (the so-called return of the "interventionist state"). In these circumstances, it is conceivable that there could be an increase in trust in the State, on which the population could rely to obtain the necessary support (subsidies, loans, and emergency income). However, the opposite phenomenon could also occur, with less likelihood in general but latent necessity in some geographical realities, where non-state actors could take over the provision of services delivered by the State.

In perspective, the role of the interventionist state supports a narrative about the strict application of criteria that is oriented towards a transition from economic rigour to flexibility, where the possibility of some state interventionism is admitted.

A profound divide emerges between the liberal-democratic model and the authoritarian-totalitarian models that have materialized both economically and geopolitically. Although these countries represent different challenges for the West and for liberal democracy (military Russia, global China), they have shown that authoritarian models are able to provide immediate responses in the short term by virtue of the nature of their regimes. The story of the spread of the current pandemic (COVID-19) has shown how the reaction of these governments was prompter, both internally and externally, than the steps taken, for example, by the EU and, to some extent, NATO. All this, of course, can only encourage the questioning of the liberal-democratic model and the future role of the State. As already mentioned, while the pandemic has favoured greater economic interconnection, it has demonstrated, at the same time, the need to strengthen the role of the State as opposed to supranational entities. In fact, individual Countries had to face, sometimes in complete solitude, the first phases of the emergency. Evidently, the consequences of these events are still evolving, but one does not seem wrong in assuming the strengthening of the State's role in terms of internal control of society, as well as in the economic field, with significant consequences.

On the one hand, the contest between authoritarian and liberal models of State is evident. On the other, a certain authoritarian involution of liberal models is emerging, or rather, a stronger role of the State in the political and economic spheres that will pose obvious challenges to the concept of democracy that we have known so far.

1.6 THE DEFENCE OF NATIONAL INTERESTS

National sovereignty may be challenged by multiple threats ranging from purely conventional to missile/nuclear/submarine, from systems to gain an information advantage to attacks in space, cyberspace and the electromagnetic spectrum that will put military and civilian targets at high risk. State and non-state adversaries will employ direct and indirect approaches without distinction, which will inevitably spill over into the national territory, targeting civilians, institutions, and critical infrastructures. As a matter of fact, there will be greater interconnection between domains, greater overlap between security concerns and criminal activities, where illegal migration, terrorist actions, piracy, biological attacks, and weaponized information will be used to erode internal decision-making processes.

The asymmetric demographic growth between the Northern section of the world, characterised by stagnating birth rates, and the Southern section will fuel further deep social, economic, and prospective disparities, with propulsive effects on mass migration. The arrival of large masses of populations with cultural and religious references different from those of Europe could have significant repercussions, undermining the solidity and stability of the national state. The long-term effects of human security trends caused by the growing migratory phenomena, by which Italy in particular is affected, must however include the safeguarding of national interests in a broad vision that takes into account the Enlarged Mediterranean as an area of crucial interest. Its prospects for prosperity and, consequently, stability depend both on the pursuit of sustainable and inclusive growth policies, and on responsible support to the international community in containing potential sources of tension and conflict, through the promotion and safeguarding of stability and peaceful coexistence among peoples.

The terrorist threat and Islamic radicalism will continue to be critical, with different forms but common elements despite the profound ideological differences and will continue to be a constant threat through attacks and attempts to infiltrate societies, promoting uprisings and internal turmoil, and not least through the 'territorial-governmental drift' to which terrorist groups aspire for control of resource-rich areas. The complex phenomenon of terrorism represents one of the threats in continuous evolution to be faced with important repercussions not only on security, but also on the quality of life of the citizens, undermined by fear, anxiety, and uncertainty.
This instability is a direct consequence of the innate adaptability of the terrorist organizations, which are continually stimulated to seek solutions allowing them to preserve that element of tactical surprise necessary in order to face more powerful and better organized adversaries. Precisely because of this instability, it could be opportune to adopt a methodological approach which succeeds in increasingly integrating the capacity of human investigation and intelligence with the

technological approach (machine learning). However, technological instruments can continue to provide support and assistance to investigation only if they are able to adapt to the investigative needs identified by human intuition.[6] This approach should be seen as complementary to classic stabilisation operations.
A further trajectory highlights the fact that terrorism could in the long term be primarily motivated by technophobia [7], which would stimulate a new wave of modern terrorism.[8]

Among the relevant elements in the terrestrial context one can observe the exponential growth of urbanisation, which will lead to the increasing concentration of the world's population in large urban agglomerations and the inevitable emergence of tensions over access to resources and essential services. In such contexts, characterised by extreme complexity, it will be indispensable to exercise control over the urban territory in all its dimensions, from the physical (with a strong vertical connotation from the subsoil to the top of the buildings) to the virtual and cognitive. This will make it possible to combat the emergence of threats such as terrorism, organised crime, illegal trafficking, piracy, etc., and to prevent them from spreading. In fact, the fight against piracy should also be carried out by stabilising areas through the presence of forces on the ground to help strengthen local forces and the development of forms of support for the population.

The importance of the maritime context is linked to what analysts define as the Blue Century and should be enhanced in the national and European context with a strategy devoted to the so-called Blue Economy. One should do so with a view to the sustainable exploitation of the precious resources that the seas hold, according to the concept of Blue Growth, by embracing different sectors: fishing, exploitation of seabed resources, tourism, and recreation. Moreover, in relation to the intrinsic vulnerability of the national economic system - mainly based on processing activities - it will be vital to ensure the protection of the Sea Lines of Communication (SLOC), which not only channel trade flows of imports and exports to and from the country, but also ensure a large part of the national energy supply. Lastly, the deep sea will be a sector where technological growth will offer extraordinary opportunities for

[6]North-western University's Kellogg School has developed a model with predictive capabilities on the behaviour of terrorist organisations, estimating the heinousness and impact of future attacks.

7 Constant and persistent fear and aversion to technology and its achievements. www.researchgate.net/publication/332493249_Five_Terrorist_Dystopias.

8 Terrorist phenomena develop according to 'waves', composed of scattered organizations, more or less connected, sharing the same ideology and methodologies, adapted to the local context. Historically, the following waves of international terrorism can be recognized: anarchic, anti-colonialist and the so-called "New Left". At present, we are dealing with the "wave of modern terrorism", mainly Islamist, which combines religion and internationalism. See Prof. D.C. Rapoport 2001.

exploitation and exploration but will also pose new challenges. With more than 95 per cent of sensitive data and communications now travelling on underwater Atlantic backbones as important energy supply lines do, it will be inevitable to maintain a competitive edge in the research and development of underwater technologies, as well as in the military ability to monitor and protect such infrastructure.
Piracy is likely to remain a major risk factor, which tends to flare up again when the containment measures put in place, mainly consisting of multinational devices, slacken. The direct threat to the maritime lines of communication towards the Mediterranean could lead to an increase in commercial traffic towards new routes, in particular the Arctic ones, which will be more accessible in the future. This will entail very serious socio-economic consequences for Italy, caused by the increase in the direct costs of supplying raw materials and the loss of commercial traffic.

Relevant elements in the space and aerospace context are instead linked to the strong and rapid technological and capacitive expansion in these dimensions. The growing cross-domain dependence on space will require safeguarding the security of national interests against new risks and vulnerabilities. It will therefore be necessary to develop a capacity to monitor, mitigate and interdict potential threats. At the same time, it will be necessary to identify the most suitable capabilities to seize the new opportunities that will emerge, also strengthening collaboration with other countries and private entities, while preserving areas of national technological expertise.

1.7 GEOPOLITICAL IMPLICATIONS FOR SECURITY

SECURITY	➢ **Exercising credible deterrence at the international level.** ➢ **Acquiring a pro-active approach to ensure independence in the supply of primary and energy resources.** ➢ **Promoting the adaptation of the ethical-legal framework to the new paradigms of armed conflict.** ➢ **Promoting and enhancing the culture of National Security and Soft Power in the public debate.** ➢ **Using AI to understand and predict behaviour.**

The future security picture remains uncertain, characterised by widespread instability and a high degree of unpredictability and interconnectedness. A cone of trajectories emerges, ranging from the resurgence of the Great Power Competition, characterised by the challenge to the Liberal International Order and the relative geo-strategic balances of the Revisionist Powers (Russia and China), which have become strategic competitors of the West, to the change in socio-economic relations that interconnection entails. New forms of conflict, strategic competition and regionalisation will characterise and influence international scenarios and balances, requiring an increase in adaptation gaps to prepare for new challenges and threats.

Exercising credible deterrence at the international level

The resurgence of the Great Power Competition characterised by the significant military progress achieved by peer competitors in certain sectors (electromagnetic, hypersonic weapons, conventional and potentially nuclear arsenals, underwater deterrence technologies, unmanned vehicles, robotic autonomous system, Artificial Intelligence, etc.) highlights the need to define the perimeter of national interests in the following directions:

- strengthening and ensuring a credible international deterrence system within the consolidated alliances (UN, NATO and EU first and foremost);
- maintaining a leading role in crisis response, through a balanced deployment of one's own instruments (Diplomatic, Informative, Military and Economic - DIME) according to a concept of the Whole-of-Government Approach;
- increasing bi-multilateral initiatives resulting in a growing international role to protect national interests;
- being prepared to contribute, within the framework of alliances, to increasing one's own presence in possible areas of direct confrontation.

Acquiring a proactive approach to ensure independence in the supply of primary and energy resources.

Security and prosperity will be closely linked to stability in the Euro-Atlantic area and, in particular, in the Enlarged Mediterranean, integrating both physical and non-material domains. Italy will continue to show interest in the territories bordering its coasts (Morocco, Tunisia, Libya) and in the Enlarged Mediterranean from where energy supplies arrive and destabilising phenomena in the domestic and international political framework materialize, such as terrorism and piracy and the exploitation of illegal migratory flows. In this context, one must protect the precious resources that the seas hold to counter the pheonomena of territorialisation, to protect the Sea Lines of Communication and the energy infrastructure that supplies the country. Therefore, it will be necessary to:

- adopt an assertive posture in international and economic policy;
- safeguard national interests and protect supply routes also through International Law Enforcement and Maritime Security initiatives;
- act, in concert with third countries within established organisations (UN, NATO and EU first and foremost) and through bi-multilateral collaborations.

Promoting the adaptation of the ethical-legal framework to the new paradigms of armed conflicts

In an era of greater complexity and interdependence, law too must face up to the challenges of change, new power mindsets and economic and financial dynamics, which are also used as a lever for initiatives of a hybrid nature. The need to regulate relations and interests on a global level has exacerbated, but also refined, the competition between political and strategic actors who, in the different interpretations of law, find new useful tools to pursue their own goals.

Against this background, it is appropriate to:

- promote the protection of national interests in the adaptation of international law;
- prepare measures to mitigate the use of "International Law" in an asymmetrical manner in the geo-strategic field, as an expression of operational capacity (Lawfare);
- counter the phenomena of territorialisation of the Global Common, where renewed forms of aggression materialize in the high seas, in space and in the cyber domain.

Promoting and enhancing the culture of National Security and Soft Power

The dissemination of a shared "Culture of Security" is increasingly important, as it is of primary importance to nurture the relationship between institutions and citizens through the

creation of a common language on national security.

At the international level, the conceptualisation of domestic cultural policy is also necessary, through Public Diplomacy (closely linked to the tenets of national identity) and Soft Power. In this perspective, it is appropriate to:

- foster strategic leadership by facilitating decision-making processes;
- promote inter-agency osmosis, especially with regard to the academia and innovation, in order to understand complex future scenarios in depth and seize opportunities;
- support the development of Soft Power by addressing Influence Operations as a phenomenon of socio-political distortion and threat to national security.

Using Artificial Intelligence to understand and predict behaviour

The Chinese authoritarian "technology driven" system could become a real system of exportation and propaganda, encouraging nations to follow its example, thus becoming a weapon/threat not only militarily, but also economically, technologically and in terms of health.

While one can appreciate the dynamic and adaptive aspects offered by the most recent technological innovations, the sense of power that comes from handling such devices must not translate into an underestimation of the centrality of the human factor and the need for constant reinforcement of the latter to meet the new requirements. In addition, the growing centralisation of organisational processes favoured by the rapidity of information technology tools finds its limit in the processing capacity of the human operator who - having a pivoting role - is called upon to decide on the basis of the information received. The solutions to be identified must constitute a multiplier of power, shaping an operational doctrine characterised by quick decisions that are consistent with situations, with an evident improvement of performance resulting from the harmonious exchange and relationship among the various members of complex organisations.

Therefore, one needs to:

- re-align intelligence resources in a preventive and predictive perspective, identifying network models in which each division is granted autonomous competences and decision-making levels;
- encourage benchmarking against more and more direct and open centres of excellence by developing Innovation Labs for the implementation of digital technologies and meet the demand for services-systems for Homeland Security and the business world (SMEs and start-ups).

1.8 GEOPOLITICAL IMPLICATIONS FOR DEFENCE

DEFENCE	➢ **Developing a resilient, versatile, and interoperable Military Instrument.** ➢ **Promoting Security Force Assistance and Stability Policing capabilities.** ➢ **Promoting the development of multi-domain national defence instruments, including their use in hybrid situations.** ➢ **Developing the capacity to operate in Information Age Warfare to produce effects in the physical, virtual, and cognitive dimensions simultaneously.** ➢ **Promoting development in the cyber, space, missile, electromagnetic and underwater domains.**

The complexity of the challenges we will be facing in future scenarios is particularly demanding. In the future, the international scenario will not show any tendency to improve. On the contrary, emergency-related crises will exacerbate already complex contexts under the economic, social, and ethnic profile. This might entail an increase in threats and growing instability, which, associated with the demographic dynamics, sets all the premises to generate and make conflicts, even armed ones, chronic with inevitable repercussions on our security.

In a multidimensional concept of national security, phenomena such as illegal immigration, international terrorism, organised crime, piracy, "failed states", regional crises and environmental disasters will continue to have a significant impact on the Defence sector.

In this context, the military will have to innovate to meet future needs and evolve towards an increasingly joint dimension, as a prerequisite to having a unified perspective on issues and identifying the most effective solutions in view of long-term strategic competition.

Developing a resilient, versatile, and interoperable Military Instrument

In order to ensure an adequate response to multiple and changing current and future threats, it is necessary to:

- have a modern, versatile, interoperable, and increasingly joint Military Instrument, able to operate in a credible and synergistic manner with European and NATO allies in all contexts of crisis, from high-intensity scenarios to ones of stabilisation;
- seek specific resilience and redundancy in the Military Instrument, within the broader framework of national resilience, to respond to crisis situations;

- ensure that the Military Instrument has an adequate capacity for self-reliance in terms of presence, deterrence, and projection, and is able to guarantee interoperability with multinational coalition/alliance arrangements;
- Confirm the necessity of a "conventional" component, adapting it technologically in order to ensure the ability to access areas subject to A2AD (Anti Access Area Denial).

Promoting the capabilities of Security Force Assistance and Stability Policing, as an effective means of penetration and influence in areas of particular interest, in order to stabilise them, thus limiting undesirable effects on our country and national interests. This approach will make it possible to:

- implement the use of the military component on the ground to effectively contribute to preventing and/or stabilising crisis situations;
- cooperate to implement the level of security and mediate with a multitude of actors.

Promoting the development of national defence instruments in a multi-domain perspective, envisaging their use in hybrid situations, through the following actions:

- increasing command and control capabilities and decision-making agility in order to maintain the necessary information superiority;
- enhancing the intelligence function through AI systems that automate processes such as data collection, data management, exploitation, and information synthesis.

Developing the capacity to operate in Information Age Warfare to produce effects in the physical, virtual, and cognitive dimensions.

The complexity of Information Age Warfare is related to the quantitative (in terms of volume, speed, and variety) and qualitative growth of data (veracity) that can produce effects simultaneously in the physical, virtual, and cognitive dimensions. Therefore, a comprehensive approach appears necessary for Defence to influence perceptions and counter similar actions by the adversary, by developing:

- multi-domain force packages capable of integrating enablers from the Electronic Warfare (EW) component, cyber, intelligence, psychological operations, public information, etc;
- joint influence through Soft Power - social media, information operations and ICT that can be integrated in real time with forces on the ground to influence orientations and decision-making

processes that impact on the consensus of alliances.

Promoting development in the Cyber, Space, Missile, Electromagnetic and Underwater fields

In order to maintain the indispensable operational and technological advantage over potential current and new "strategic competitors" that have already achieved, albeit on a different scale, significant military progress in the domain of new threats, it is necessary to invest in "high technology" by boosting R&D spending to:

- develop an autonomous military cyber defence capability, as a tool to be added to the full range of military operations and that is complementary to the national cyber security system also to ensure, in the future, the continuity of the Command-and-Control function.
- identify space as a strategic sector with a decisive role in all public and private activities;
- promote the review of an international ballistic missile defence system (NATO-EU);
- invest in the fields of electromagnetics (Electronic Warfare), CEMA (Cyber Electro-Magnetic Activities), hypersonic weapons, underwater technologies, and innovative technologies (Cloud Computing, Artificial Intelligence and Machine Learning).

CHAPTER 2

"The new trend of economic-entrepreneurial growth can only look ahead to the aspects of environmental sustainability. The economy will evolve with national autonomies and new alliances, with an ever-greater technological contribution and an increase in the demand for resources. "

THE SOCIO-ECONOMIC SCENARIO

Consistent and asymmetrical demographic growth, also conditioned by climate change, will further push the concentration in coastal areas, strengthen the trend towards urbanisation, and increased migratory flows will pose new social, economic, environmental and security challenges. The new trend of economic-entrepreneurial growth can only look prospectively also at the aspects of environmental sustainability. The economy will evolve with national autonomies and new alliances, with ever-greater technological contributions and increased demand for resources (food, water, energy, raw materials) which, being limited, may exacerbate competition for access and management. Polarisation phenomena will worsen, making socio-economic balances a challenge. They will be conditioned by the long-term effects of the pandemic emergency and the difficulties of national and international legal-legislative systems.

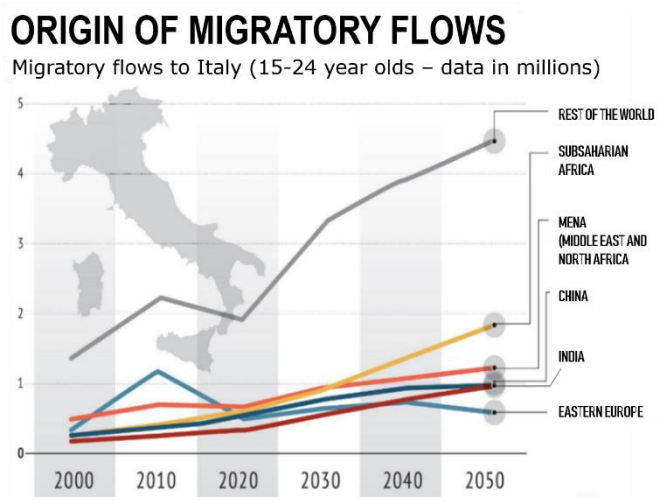
2.1 POPULATION GROWTH

World population growth will continue unstoppable, reaching 10 billion in 2050, with a prospect of over 11 billion[9] by the end of the century. However, the particular unevenness of the increases, concentrated in some countries (50% of the population in 10 countries)[10] concentrated substantially in coastal areas, should be highlighted. Furthermore, the growth in life expectancy and the reduction in infant mortality rates in developing countries will determine an uneven distribution of the average age. In Europe and North America, 25% of the population will be over 60 years of age (in Italy 35%), while in Africa and India 41% will be under 14.Two different societies will emerge in terms of economic and social structure: countries characterised by growing ageing and welfare needs, as opposed to countries in a demographic explosion with growing needs for education, training, access to work and aspirations for well-being. From the national

[9] On the figure over 10 billion, some studies hypothesize that the planetary population, after reaching a peak of 9 billion between 2040 and 2060, may subsequently begin to shrink to return to current data at the end of the 21st century.

[10] China, India, Nigeria, Pakistan, Congo, Ethiopia, Tanzania, Indonesia, Egypt and the United States (by 2050, India will be the most populous country, and Nigeria will have a population equivalent to the EU-UN World Population Prospect).

point of view, Italy, with a population of 60 million inhabitants, will confirm the current trends with a decline of about 100 thousand[11] inhabitants per year, the lowest European replacement rate of the population (fertility of 1.32 children per woman[12]), the decrease in the number of people under 14 (500,000 a year) and the increase in the number of people over 60 (a quarter of the population in 2019) reinforced by the increase in life expectancy. The regional distribution will confirm the pressure towards the centre-north (71% against the current 66%). It is an overall picture of a decreasing population, an increasing average age, a decreasing youth workforce and increasing welfare costs. A country that tends to be less attractive for immigrants limits itself to being a country of transit or a destination of interest due to phenomena of illegality. Sub-Saharan Africa and parts of the Middle East could see a baby-boom setback due to education access, contraception, and the partial emancipation of women. On the whole, the population distribution could change in favour of high-density countries.



The demographic decline is a determining phenomenon. Today's children will be adults in a world with very different circumstances and expectations from today, a more urbanised, more ecological, safer planet and an older population and with changed job prospects significantly constrained by rising social costs.

The most developed countries are already paying for these changes: fewer children and fewer schools with stagnant economies, fewer young people who work and consume, and difficulties in guaranteeing social services, demanding more lawfulness and policies to increase fertility. Unless courageous solutions such as countering demographic decline by promoting immigration, as Canada has done by promoting integration and multiculturalism within a rich, peaceful, prosperous and polyglot mosaic.

Immigration and multiculturalism could prove to be the solution for combatting depopulation. However, these measures are costly and require long-term programs including ethical, social, moral, and legal implications.

2.2 MIGRATORY FLOWS

Different factors, such as population growth, with masses mostly of young people

[11] The gap between births and deaths stood at around 190,000 units a year, partially offset by the influx of immigrants.

[12] The value of 2.1 children per woman is considered the population replacement limit (fertility index: high > 5 female children, average <5 and> 2.1 and low <2.1).

looking for opportunities, combined with the effects of climate change and scarcity of and competition for resources, the demand for well-being and democratisation, could increase in migratory flows.
Flows will initially converge towards Western countries and emerging economies, creating multicultural and multi-ethnic communities, with social and value consequences (hybridisation beyond the sustainability of integration) and impacts on the economic sector. Consequently, the concentration of the world population in the coastal-urban belt and the vulnerability in terms of sustainability and interconnection will tend to increase. It is possible to identify migratory flows of an "economic" type (induced by the search for better life prospects coming from countries with a low degree of education and with reduced job prospects), "security" (due to flight from violence, insecurity and conflicts) and "climatic "(following the effects of global warming).
As for Italy, regular immigration projections estimate an average of 155,000 immigrants per year up to 2040, reaching a total of over 3 million and then decreasing to another 3 million in the next thirty years (2040-2070). At that date, more than 10 million foreigners are estimated to be in Italy, which will make Italy the fourth country in the world for the number of immigrants.

2.3 NEW WORKING SKILLS

The evolution of work will pass through an increase in quantity, quality and speed of updating skills, an increase in the technological contribution in each sector that will require adapting and studying new training paths. For human capital to be up to the challenges to be faced and concretely develop man-machine teaming, it will be necessary to adapt the ethical and legal frames and develop suitable Leadership qualities.
This change in the concept of work and the dematerialisation of wealth will have a disruptive impact, more significant in scope than the current economic revolution brought by the most innovative companies (*e.g.,* GAFA - Google, Amazon, Facebook and Apple), which have exceeded the commercial value of *traditional* competitors.
Through the development of Artificial Intelligence, the digital revolution will produce an excess of human resources no longer necessary, which will have to be re-employed following training courses related to the so-called gig economy[13].
An economic model that will require a substantial change of mindset is linked to acquiring new skills, creating an adequate information structure and adapting the ethical-regulatory framework. The model will determine substantial benefits in terms of welfare allowing households needs to be met and many activities to be relocated in contrast to the rush to urban centres. However, the effects from the point of view of employment could be disruptive (it is estimated that a physical working position is lost for every worker in remote work).

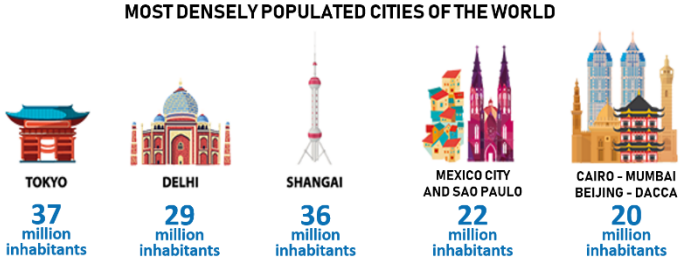
[13] An economic model based on on-demand, occasional and temporary work, and not on continuous services with contractual guarantees, which in the future could be managed with structured formulas.

The future work will be characterised by transversal skills and an increase in the separation between skill levels (either very high or very low), which will lead to a decrease in the so-called average workers, even if many professions will evolve in a technological sense. There will be excellent work mobility, with continuous learning based mainly on the green economy, welfare and clusters of Information Technologies. Jobs traditionally based on human relationships will inevitably acquire IT skills (e.g. the concierge for the overall management of entirely digitised users or the broad-band architect for the management of the home IoT). Some professions will be disrupted (memory augmentation surgeon - *e.g.* doctors) to maintain cognitive abilities). Furthermore, thanks to the growing relevance of the ecological theme, new professions such as geo-engineers could develop.
In Italy, confirming the perspective relevance of the leading sectors of the economy (tourism, art and food-agri-food), technological innovation will require greater transversal skills and a high degree of mobility.

2.4 URBANISATION

Sixty-eight percent of the world's population by 2050 will be concentrated in urban areas, in cities with more than 1 million inhabitants mainly on the coastal strips, with a growing number of megacities (over 10 million inhabitants) with 40% of the urban population relegated in the suburbs. China, India and Sub-Saharan Africa will drive the urban growth trend. Above all, growing societies will have to reinvent the urban fabric to meet new needs and consider resilience and autonomy. Such events as pandemics and/or climate change will make it more current. Cities have been identified as key players in achieving the UN's sustainable development goals[14].

Smart cities should be developed as autonomous units capable of producing the resources and energy necessary (partially) for their own needs, through new concepts such as exploitation and expansion of the vertical dimension including the subsoil, "vertical agriculture", "usable mobility" and circular economy (cities today occupy 3% of the planet's surface, but consume 70% of the resources with related CO2 emissions).
Italy will not create megacities, rather it will maintain the current characterisation in municipal agglomerations converging in daily urban areas. The flow of people and goods will be proportional to everyday single metropolitan reality, and the services to be provided. Consequently, the problems to be analysed will be similar to those of metropolises.



[14] UN Agenda 2030 - Goal 11: Development of inclusive, safe, resilient and sustainable cities and communities.

2.5 INDIVIDUAL AND COLLECTIVE SECURITY

Security has assumed a prominent role by profoundly changing its social meaning from a broad concept, based on the defence of collective goods, to a more restricted idea, typical of the society of individuals. The control of uncertainty has shifted to an intimate and personal dimension of social life. Also, it aims to protect physical and moral integrity, privacy, data security, transactions, decorum, and environment, historical and cultural heritage. The application of this new meaning requires a change of mindset to contemplate forms of identity aggregation (linked to the new value system).

In the future, forms of collaboration between institutions, including the defence, will continue to develop with communities and entities that are active protagonists of security, which will result in evident and beneficial effects in terms of increasing citizens' trust in institutions.

The use of the military in maintaining public order and security in peacetime, which was to be a temporary and exceptional measure, has become a structured line of intervention (not only in Italy). This situation will likely become the "new normal" in the face of the prevalence of hybrid threats and, above all, the community's response to the perception of security and trust in institutions.

In this balance, the Private Military & Security Companies (PMSC) role, which is increasingly widespread worldwide, must be considered. Their integration into the internal and external security system involves a moral, economic, legal, social and institutional reflection, which the dynamics of the security balance will make necessary. The contribution of technological innovation may be decisive in the development of new forms of control. However, it will be necessary to review the regulatory framework and, in some cases, personal and collective sensitivity towards the issues of privacy and personal freedoms.

2.6 “GLOCAL” ECONOMY

The transition to high-tech production and the incorporation of robotics, Artificial Intelligence and 3D printing, among the various enabling technologies, into the production processes, will lead to a new global distribution of power and wealth.

Increasing integration will exacerbate inequality as automation changes the labour market (talent could represent the critical factor of production more than capital or labour with greater competition but also individualism), contributing to the creation of new poverty and of the aforementioned mass migrations and the risk of phenomena of social tension that could lead to possible riots.

In light of the consequences of the pandemic phenomena, economies based on global trade will have to revise their prospects locally; those based mainly on small and medium-sized enterprises will suffer an economic regression and a contraction in consumption production. Fiscal manoeuvres, greater awareness of governments towards a sector indispensable for economic growth, the resurgence of nationalistic sentiment will favour reshoring (return home of companies that had previously delocalised production to other countries), which will contribute to the resilience of the national industrial sector. Despite this, the limited availability of valuable resources, essential to supporting technological innovation, will still make interactions with the outside inevitable, especially for economies such as the Italian one heavily dependent on imports and exports, and are difficult to restructure in a short time.

Globally, there could be a renewed tendency to use trade leverage as a foreign policy tool.

In particular, in the Eurozone, new opportunities could be opened in areas with a growing economy, which would affect the political balance as well as the balance of alliances.

The realisation of such a scenario requires the stabilisation of areas of particular interest to be achieved through the presence of forces on the territory to contribute to the strengthening of local institutions and the development of forms of support for the population. On a national basis, updating the legislation on golden power[15] is crucial, with the definition of “assets and relationships of strategic importance for the national interest”.

2.7 RESOURCES IN THE FUTURE

[15] Intending to safeguard the ownership structures of companies operating in sectors deemed strategic and of national interest, the legislator has provided for special powers exercisable by the Government in the field of defence and national security, as well as certain activities deemed to be of strategic importance in the sectors of energy, transport and communications. In this case, the faculty is envisaged to dictate specific conditions for the acquisition of shareholdings, veto the adoption of certain corporate resolutions, and oppose the purchase of shareholdings.

The scarcity of energy and subsistence resources (food and water) will be a reason for competition. Technological evolution could make available new sources and opportunities (Arctic subsoil, change in fertile soils, opening new routes in the North Sea), equally harbingers of new factors of competition and instability. Today 90% of world agriculture is subsistence agriculture, with very low productivity, while up to 50% of the food produced is wasted in distribution chains before reaching the consumer. Some hypotheses foresee in 2040 the use of tankers or desalination plants, on a small scale and low cost, to meet the needs of drinking water using renewable energy.

Despite the estimated 40% increase (compared to the current 8.4%) in the use of renewable resources (sun, wind, biomass, geothermal sources) in 2040, oil and coal will remain the main energy sources for the next twenty years, making energetic security a determining factor in geopolitical balances, considering that it is estimated that the world will increase energy consumption by 30% in the next 20 years.

Technology can help make the use of these sources more efficient and convenient. In the last 10 years, the cost of photovoltaic panels has decreased by 80%, and their efficiency has doubled, while the amount of energy produced by a wind turbine has increased by 40%, with a decrease of 23% in cost. Technological development should also contribute to solving the problem of storing the energy produced from renewable sources (investments in this sector of $620 billion are expected by 2040).

The competition for the so-called rare-earth elements deserves particular attention. Currently, the largest producer, China, has a near monopoly on the supply of these minerals, which are essential for many productive sectors, especially those linked to the technological sector. From this perspective, these materials will play a role in the geopolitical balance, think of the threatened suspension of supplies following the US ban on Huawei. The large deposit recently discovered in the depths of Japanese waters, if technological evolution allows for economically sustainable exploitation, could upset the balance.

2.8 GENDER PERSPECTIVE

When we talk about “gender”, we refer to the social and cultural dimension of being male or female, models of reference, social roles, and how society thinks and, consequently, evaluates and treats its population[16]. Therefore, gender takes on a

[16] V. Cardinali, *Repetita iuvant: il “Rilancio dell’Italia 2020-2022” e le questioni di genere*, 20 luglio 2020, giustiziainsieme.it/it/cultura-e-societa/1243-repetita-iuvant-il-rilancio-dell-italia-2020-2022-e-le-questioni-di-genere-2.

cultural dimension and value going beyond mere biological difference and, therefore, changeable in time and space.

There are systematic inequalities between men and women transversal to other differences such as age, social status, religion, sexual orientation, ethnicity, etc., contrasts with the ethical principle of equality. Furthermore, in the future, there will be a tendency to eliminate such discrimination to achieve effective equality, as desired at the international level (UN Agenda 2030 for Sustainable Development - Sustainable Development Goals)[17]. Therefore, public policies will pay increasing attention to the gender perspective, considering the diversity of impact that such policies can have regarding the male and female population.

[17] Objective 5: achieve gender equality and self-determination for all women and girls.

2.9 SOCIO-ECONOMIC IMPLICATIONS FOR SECURITY

SECURITY	➢ Promote change towards new equilibriums of a **complex society** ➢ Adapt to the characteristics of the **urban environment** ➢ Develop new **security** paradigms adapted to the changed context ➢ Intercept the new dynamics of the **economy and labour**

Trends in the socio-economic field - demographic variations, social hybridisations, aspirations for well-being, sustainability of existing welfare, access to the world of work, migratory flows - will merge into social tensions, and potential needs change the ethical-value system of reference. The complexity of the future society will be characterised by multiple interactions with overlaps and complex complexity, often more significant than the sum of the weights of the individual factors. The convergence towards large urban environments, with related social problems, and the different perception of the concept of safety will characterise the context in which to build social order, without forgetting the rapid change in the dynamics of work, closely linked to technological evolution and its social and economic implications.

Promote change towards new equilibriums of a complex society

The future will see an increasingly multi-ethnic society where cultures, ethnic groups, and religions will first be side-by-side in a complex acceptance process. Then they will mix in an integration process driven by increasing and ever-expanding migratory phenomena.

Gender integration and equality and the evolution of the same concept will play an ever-increasing role as a desirable goal for ideal, moral, existential reasons and, fundamentally, as a condition of survival for the social and economic system. From a demographical point of view, society will experience a generational imbalance, with a growing percentage of an elderly population and an increase in welfare costs that will affect the production sector.

In this context, it, therefore, appears appropriate to:

- create a new and dynamic value system capable of balancing a situation of instability in this society in which to balance differences and integration, while to some extent preserving the national ethical-value value;
- manage adequate information to protect vulnerabilities, potential targets of campaigns aimed at increasing discontent and a sense of distrust in institutions, with the opening of areas of influence for the new actors of the power system;
- prepare a renewed kind of training of the ruling class that combines a solid

value base, a renewed mindset open to understanding complexity, with a strategic vision and adequate professional and technological-digital training capable of meeting the challenges of the future.

Adapt to the characteristics of the urban environment

Consistent and asymmetrical population growth, also conditioned by climate change, will further push concentration into coastal areas, with a marked tendency towards urbanisation. There will be a tendency to aggregate into large urban units, with enormous suburbs in which the lower social, economic and cultural perspectives will exacerbate polarisation and the phenomena of social tension.

Efforts will have to converge towards:

- developing a renewed protection system, in which old schemes and new technologies can interact innovatively;
- pursuing urban development, according to the smart city paradigm, in order to make cities and human settlements more inclusive, safe and resilient, with particular attention to the safety of new areas that will develop, including coastal ones and those in the deep hinterland of the territory.

Develop new security paradigms adapted to the changed context

The need for protection will constantly evolve in an increasingly dynamic and mixed society where the cultural, religious and social dimensions will constitute the new bastions of identity to be defended, alongside physical security.

The sense of trust in institutions, a fundamental point in the constitution of a growing society, will also pass through a dynamic and extensive enhancement of the concept of perception of the population's safety. This renewed perception will make it appropriate to:

- develop a legal framework capable of adapting to the needs of the new data security environment, also including the needs of the new and increasingly numerous and diverse players of reference;
- foresee dynamics of spending in safety that innovatively balances the needs of the military sector with the sensitivity towards social security, to achieve significant effects in readiness, integration and modernisation of materials;
- develop a sense of identity and social capital that engages the stakeholders to obtain consensus towards strategic sectors of the security of the country system;
- create a system of values and well-defined rules that allows forms of collaboration among different actors (police, military, Private Military Security Companies - PMSC) capable of building a new model of management of security at overlapping levels.

Intercept the new dynamics of the economy and work

The post-pandemic depression will trace a long and arduous route towards normality (new normal) in which some common mechanisms will characterise the complex economic dynamics, the dematerialisation of wealth, think of the main world companies based on services (often IT) and often released from the intangible capital assets.

The relocation of activities, with the possibility, thanks to this immateriality, of working thousands of kilometres from the physical centre of gravity of one's business, with social implications in terms of insecurity and disaggregation.

Work will see an increasing integration between man and machine with a constant updating of skills and professionalism, thus forcing workers to be and feel constantly under the spotlight and depriving them of that social and economic security that usually increase with age.

There will be a convergence of efforts towards:

- seeking a more efficient balance between economic processes of globalisation and those of localisation ("glocal economy");
- identifying new training courses for job skills dictated by digital transformation (digital soft skills);
- identifying sovereign technologies and protecting them with strategic use of the "golden power";
- developing alternatives to limit dependence on certain raw materials, such as semiconductors from a perspective of Industry-Based Defence, i.e., government-owned industrial activities that have direct or indirect significance for the production of equipment for a country's Armed Forces).

2.10 SOCIO-ECONOMIC IMPLICATIONS FOR DEFENCE

DEFENCE	➢ Adapt the skills, ethical and regulatory framework within which the Military Instrument will have to move. ➢ Reshape training courses at all levels with suitable regulatory tools to operate in urban contexts ➢ Adapt the Military Instrument to the new security paradigms ➢ Prepare to incorporate the new social and professional characteristics of the future context.

The next twenty years' social and economic developments could create a different society from the current one, characterised by cultural mixing, and transversality among areas, a highly technological imprint in all fields, the polarisation of values, and a sense of insecurity.

In this context, to be ahead of the curve and maintain an advantageous position. Defence will have to reshape its mindset and be more open to innovation, starting from the processes of recruitment, basic training, and leadership training.

It will be necessary to review the reference regulatory framework at the national level and the relationships of the alliances.

Before that, however, it will be essential to develop a socio-institutional debate and a shared and effective narrative on the need for the Armed Forces to maintain their historical role of protection, enrichment, and promotion of the national ethical heritage and values.

Adapt the competencies, skills, ethical and regulatory framework within which the Military Instrument will have to operate

The future scenarios in which the Military Instrument will operate will be characterised by complexity and overlaps, with a multi-faceted reference context, with undefined boundaries. State and non-state actors, political, military, and opinions will overlap the public, strategic, and tactical levels.

This constantly evolving context will make it necessary to:

— adapt the Military Instrument with diversified and continuously updated skills also functional to developing the culture of strategic anticipation on which to orient one's capacitive development models;

— adapt a dynamic and flexible regulatory framework, both national and international, within which the Military Instrument will have to move with "fluidity", and a-territoriality of future hybrid threats in undefined battlefields reduce the time elapsing between information acquisition - decision - implementation.

Reshape training courses at all levels with suitable regulatory tools to operate in urban contexts

The growing concentration of the population in large urban areas, mainly

coastal areas, will require the need to adapt the Military Instrument to operate in an "urban" environment through:

- remodelling of training courses, doctrine, training and use, platforms, personnel equipment, and the characteristics of future weapon systems (autonomous robotic system, AI, non-lethal weapons, direct energy) which must be suitable for use in such congested environments in which the safe management of the data flow in real-time will be essential, with which to allow an increasingly reduced and rapid decision-making process;
- preparing leadership through training courses adapted to the new dynamics in constant and rapid evolution, with a mindset open to innovation and strategic vision with a strong drive for decision-making.

Adapt the Military Instrument to the new security paradigms

The need for protection will constantly be evolving. The remodelling of security paradigms could develop new areas of protection to be defended by adapting to a broader perception of the concept of security itself. The mix between the areas could also flow towards military, police, and private forces in managing different security contexts and through forms of collaboration to be developed and regulated with innovative tools and methodologies. Therefore, it will be necessary to:

- prepare for the ever-more extensive and synergistic use of all security forces for the protection of new areas of society;
- prepare for the mix of public and private (Private Military Security Companies - PMSC).

Prepare to incorporate the new social and professional characteristics of the future context.

The evolution of society leads to outlining some changes with indirect implications on the Military Instrument that suggest the need to create new recruitment dynamics which, in addition to adapting to the new value system, adapting to a multi-ethnic society, at the same time can capitalise the introduction of already consolidated technical figures at an academic level, without neglecting the importance of an effective narrative that enhances the historical role of the military dimension in the protection, enrichment and promotion of the national ethical-value heritage.

In particular, the following are important:

- adapt the dynamics of recruitment to the new value system, contemplating cultural, religious and gender diversity. From a social point of view, the gender perspective for which it is foreseeable not only increasingly numerous participations of the female component (also in the

degrees and positions of responsibility) but also the acceptance of all types of gender, with the social consequences, especially concerning the management of family aspects; but also, a greater cultural, ethnic and religious pluralism will have to foresee inclusive forms respecting the different peculiarities;

- facilitate the implementation of disruptive technologies through the introduction of already consolidated technical figures at an academic level (cyber operators, computer scientists, economists, jurists, etc.) favouring the most invasive ones, for which it will be necessary first to develop and resolve an ethical debate and, subsequently, create a legal framework that contemplates new relationships in the balance of decision-making and responsibilities;
- incentivise a mindset open to innovation that allows in perspective to accept the needs of adaptation of the Military Instrument by understanding the challenges to seize risks and opportunities.

CHAPTER 3

THE TECHNOLOGICAL SCENARIO

The development of new technologies and the growth of Emerging & Disruptive Technologies (EDT) generate a transversal push in every domain, trigger unexpected accelerations and decelerations that are unpredictable as well as complex to manage and control.

Technological innovation is influencing and changing our lives, society, the economy, politics, and the military world. Its tempo is steadily increasing and getting out of control as it changes shape. Innovations pervade existence, alter reality and the environment, do not allow for an understanding of the change nor of the magnitude of its effects, thus reducing the possibility to react promptly.

The development of new technologies and the proliferation of Emerging & Disruptive Technologies (EDT) generate a cross-domain push on every domain and trigger unexpected accelerations and decelerations that are unpredictable and complex to manage and control.

Such a complex and sudden transformation requires going through a process of adaptation that is just as fast, but has hidden implications, variables, as well as unpredictable and unquantifiable fallout. Behind these rapid and complex transformations lie inevitable and profound cultural and social changes that will reflect on the geopolitical, stability and security balance.

On a Planet where there will be more and more inhabitants, fewer resources, water and food shortages, land devastated by climate change, more elderly people, and more waste, technological progress will be the driver of a crucial game for the future of mankind. The race to develop and acquire new technologies is turning into a geopolitical challenge with foreseeable consequences for global security.

3.1 THE FOURTH INDUSTRIAL REVOLUTION

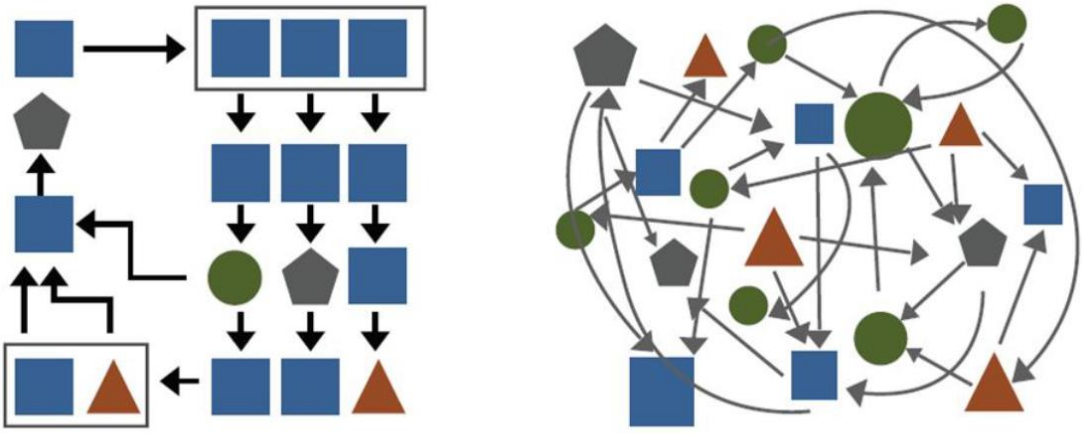
Technological development is enjoying unstoppable and exponential progression. It is pushing mankind towards a much more complex future, through continuous, accelerating change, frequent disorder, and inherent uncertainty. The astonishing speed at which EDTs are maturing calls for quick, predictive and anticipatory actions as we face uncertainty, insecurity, and growing risks.

In the framework of such a complex scenario, systems are less and less linearly interconnected; instead, they have become highly dependent on one another. Complexity not only affects systems, but also the behavioural and cognitive sphere of individuals and masses, whom can be influenced by deviant information flows that can be manipulated and/or are the result of intentional misinformation. All of this generates profound disproportions in the cause-effect relationships.

Small changes can sometimes result in major effects and, conversely, major changes generate effects of lesser intensity. Sometimes these changes are steady in terms of time and terms, and sometimes they are disruptive.

Much of the increase in complexity is directly connected to the continued, exponential development of technology, its impact, and spreading among societies. Information technologies in general, and the World Wide Web in particular, have played and continue to play a crucial role in today's society.<0} The Word Wide Web is becoming one of the structural elements of post-modern people and is helping to activate and shape new forms of socialization and community based on multiplicity, plurality and the management of diversity. <0} The "flow society" is a mobile and borderless dimension where communication is very fast, space and time seem to contract and expand, and relationships become infinite.<0}

Reference if often made to the 4th Industrial Revolution, in particular to the growing interaction among the physical, digital, and biological as the sum of technological advances, with special regard to artificial intelligence (AI), robotics and autonomous systems, the Internet of Things (IoT), biotechnology and quantum computers.<0} Due to their potential synergistic interactions, transverse patterns, and interdependence, these strategic sectors will tend to create even more disruptive and unpredictable effects.



The increasing reliance on technological systems will increase the sense of vulnerability and the need to intensify resilience, including cultural and value-based resilience, against events that are more complex and unperceived – also known as black swans or gray rhinos – that are overshadowed by fake news and misinformation, or downplayed / dismissed for convenience, lack of analysis critical reasoning, or research.

Future changes will increasingly require mankind to identify a new role for itself, in which synergy between its own cognitive capacities and technologies will have to achieve compromise, balance, and advantage, also known as Human-Autonomy Teaming.

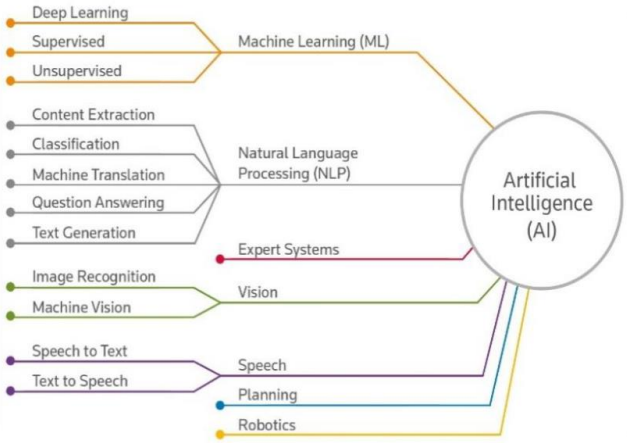
Constant and significant technological evolution will also change the ‘nature of war’ and transform the way in which future military operations will be carried out, with the understanding that the human component will remain central at all times. The

new technologies will affect scenarios by increasing speed of action, minimising reaction times, and maximising the unpredictability of tactics.
Hence the need for technological edge to be preserved not only in the most technologically innovative sectors, but also in those where competitors are gaining ground. It is essential to understand the mechanisms and development paths that will shape and/or contribute to disseminating one technology over another, i.e. the parameters that come into play, whether natural, legal, ethical, or external.

3.2 CORE TECHNOLOGIES

Underlying the new technologies will be the development of information technology, increasing digitisation and the development of communication technologies – i.e. 5th and 6th generation connectivity. A 'universe' that has invaded transversally and profoundly every field of human activity, influencing and changing broad scenarios.
With the ever-increasing interconnection of systems to information networks (such as 5G networks and Clouds) and with the rampant drive towards the Internet of Things that pervades environments and activities across the board, it will be necessary to reconsider the use and maintenance/strengthening of systems and structures that are on the verge of obsolescence, paradoxically, but realistically, in some cases, less attackable and vulnerable.
In addition to the complexity of the systems and scenarios, there is also the complexity of the data that, in order to be used, must not only be identified but also interpreted according to the 4Vs of Big Data, i.e., *volume*, as the entity of the data generated by heterogeneous sources; *velocity,* as the rapidity with which they are generated, changed and processed; *veracity*, as the qualitative connotation of the data, the starting point of the analysis and interpretation activities; and *variety,* as the number and diversity of the sources of origin and their type.
The proliferation of Supervisory Control And Data Acquisition (SCADA) systems, in the field of air, rail, car and sea traffic control, of management structures of transportation and distribution systems of fluids and energy (aqueducts, gas pipelines, oil pipelines, power plants and transmission networks), of production plants and complexes (hospitals, computer centres, construction sites, airports and ports, logistic nodes) but also of military structures and systems (C2 rooms, TLC plants, weapons systems) will have to be particularly protected and possess suitable back-up capacities.
Speed in communications, decisions and actions will be a decisive element in military operations. In order to manage an ever-increasing amount of data, increasingly high-performance computer systems will be required, supported by extremely capillary, fast (in terms of transmission/reception), capable (in terms of bandwidth) and highly interoperable and secure networks and info-structures. It is also necessary to guarantee redundant storage and back-up systems (also in terms of energy supply) that are mobile and projectable if necessary. Below are the technologies that are considered to be of greatest interest and their development trajectories.

Artificial Intelligence



In a world where Artificial Intelligence (AI) is advancing, the best choice for humans is to become symbiotic with machines. Not humans versus AI, but humans working with AI. Connecting our minds to machines will not be a foregone conclusion, it will rather represent a radical change in our ability to communicate, think, and work. If we connected the human mind to the cloud, all knowledge would be instantly accessible.

The operational relationship between human beings and artificial intelligence – also known as Human-Machine Teaming, i.e. human beings' enhanced skills and knowledge through augmented reality and brain machine interfaces, and brain-to-brain neural links, respectively – will have to be defined from the learning process phase onwards. Bio and human enhancement technologies will also have an impact on improving human capabilities in the physiological, cognitive, and social fields. At present, human-AI relationship sees people at the core of the decision-making process – i.e., Human in the Loop. However, in the planning horizon considered, it could evolve into a "proxy" so that machines can perform certain tasks/actions autonomously under supervision by human beings – again, Human on the Loop. In certain areas and/or sectors, one cannot rule out that using AI may remove people from the management process, that is, a Human out of the Loop scenario.

Against this background, foreseeing the implementation of human cross analysis by defining new and additional training paradigms is considered key. It would allow analysts to improve their own capacity, as required by the massive amount of data the many sensors on the battlefield provide. Given the evolution of political, economic, and social scenarios, urban warfare scenarios in theatres with high-density population will likely characterise the very battlefield. This means not only conflicts in highly populated environments, but any type of conflict, tension, risk, or threat with direct or indirect repercussions on the systems and dynamics that characterise the urban macro-agglomerates of the future. Of course, it would involve all the connected devices whose data will become part of the bulk of data that AI and then analysts will have to deal with.

Finally, for disruptive technologies such as AI to be used correctly, principles such as ethics by design and ethics by default should be implemented, together with the definition of new legal rules applicable to the emerging scenario.

The positions of AI within the military sector is already consolidated, but the limits of this technology are not yet apparent as it penetrates the domain of defence even more. Complex maintenance and logistics (supply chains) will be managed through AI, which will make the military more agile and responsive. Together with the increase in computing capacity due to developments in quantum technology, the

moves of opponents could be analysed through AI to anticipate them and define more effective tactical choices. One of the possible practical applications will consist of perfecting the management of remotely piloted vehicles, when not properly unmanned, in the true meaning of the term. These vehicles could operate simultaneously and autonomously in all dimensions - including as swarms – to conduct missions, including in-depth. Moreover, each of them will become a sensor of a network integrated with both the Internet of Things (IoT) and the Internet of Battlefield Things (IoBT).

Biotechnology

Biotechnology can be described as a science that creates products designed to improve the quality of human life through biological processes, organisms, or systems. Since ancient times, biotechnology has been evolving in different markets and through applications: in the field of agriculture, cross-pollination and various genetic crossings were certainly among the first applications; in the industrial field, genetic engineering and recombinant DNA technology were core applications.

One of the largest and most current applications of biotechnology is certainly energy production. With oil resources dwindling and the increasing awareness of their environmental impacts, much has been invested in finding alternative sources of environmentally friendly fuel. Thanks to research and development in recent years, biotechnology is using maize as a fuel for cars and has opened a path to research into many other possible biofuels. In the medical and military fields, biotechnology will drive the improvement of human capabilities in the physiological, cognitive, and social sectors, as they counter diseases more effectively and shift the balance towards customised medicine. All these applications have obviously brought important ethical issues to emerge that are sometimes difficult to evaluate. Careful and correct scientific popularisation is essential to ensuring that decisions everyone takes are not biased due by misconceptions.

Nanotechnologies

Nanotechnology, together with nanoscience, has been around for a few decades and involves particles that can be measured in nanometres – i.e., a millionth of a millimetre – which is tens of thousands times smaller than the thickness of a human hair.

The increasing ability to 'see' and manipulate infinitely small objects on a molecular and atomic basis through scanning electron microscopes has opened up exceptional horizons.

'Miniaturisation' is changing the way many objects are used, their capabilities, and the development of many technologies. Objects that until a few decades ago were very large in size have now been reduced hundreds or even thousands of times. Consider electronics for one: circuits, circuit boards, and mass memories moved from thermionic valves and transistors to 'silicon wafers' that can house billions of components. Access to the nanometric world is opening up large-scale horizons in many sectors: from the construction of nano-technologies through '1D/2D printing' to the creation of composite materials. They represent endless possibilities in the most varied fields of technology, from electronics to aeronautics, from medicine to space exploration. The possibility of interacting with the molecular structures of materials with characteristics that were inaccessible in the past, such as graphene, silicone, and others, makes it easy to create new materials.

The miniaturisation of technology favours portability and reduction in size. This applied to Radio Frequency Identification[18] devices, which can be as small as a grain of sand and through which anything can be 'tagged'.

In the military field, applications range from the creation of super-strong materials to 'invisible' materials, i.e. materials that change colour, as well as in increasingly miniaturised instruments. The combination of nanotechnology with AI and quantum computing will open up unfathomable horizons of innovation, exceptional social and technological changes, but probably equally disconcerting and potential risks.

[18] RFID *Radio Frequency Identification*: a technology that enables the remote recognition of an object by means of radio communications.

Hypersonic Technologies

The revolution of current weapons systems could represent a turning point for the traditional concepts of deterrence and strategic stability. The advent of hypersonic threats, namely hypersonic gliding vehicles and hypersonic cruise missiles, with their hypersonic speeds and extreme manoeuvrability, tha ability to follow much more irregular flight paths, will make the logic behind modern anti-missile defence systems obsolete. At the same time, hypersonic weapons have an important impact on global strategic stability and represent one of the main unanswered questions for the military and geopolitical worlds. As a matter of fact, even if strategic equilibrium existed, where the principle of Mutual Assured Destruction (MAD) applies and therefore the incentive to wage a conflict is reduced, the degree of ambiguity and the risk of a possible escalation would increase, together with the possibility of misattribution of the attack from the earliest stages of launch. The fact that hypersonic missiles are becoming part of military inventory of several states will influence the strategic equation and shatter the traditional concept of deterrence, which is based on the existing Intercontinental Ballistic Missiles (ICBM) and related defence systems. In designing the new global balance, taking into account the proliferation of hypersonic technologies will be key, as it could quickly render current air defence systems and RADAR discovery networks ineffective and outdated. This will inevitably lead to a paradigm shift in the concepts of deterrence and security, thus requiring investments in sensors, especially space sensors (sensor-based defence).

Innovative Materials and Additive Manufacturing

These materials offer new functionalities and increasingly high performance and are used in high-tech applications. Whether polymeric, ceramic, or metallic in nature, products based on these materials have a reduced environmental impact and consume fewer resources. This category also includes the so-called smart materials, i.e. those capable of reacting to appropriate environmental stimuli and modifying their own characteristics such as colour, refractive index, internal tensions, volume, etc. They can be used in the cyber and ICT domains and to implement the quantum capabilities of future computers. In addition, certain materials will be used to develop equipment for the soldier of the future, such as exoskeletons, or to improve the ability to camouflage, self-heal, and react to electromagnetic attacks. All of the above will be supported by 2D/3D printing, in fact, a further area of interaction between new materials and additive manufacturing.

Quantum Technologies

Also due to the miniaturisation of components and the use of new materials, computing capability is expanding daily. If cracking a password took weeks before, now one can crack it in a few hours.[19]

This technology, although seemingly of little relevance because it is not integrated into our daily lives, yet, would provide a considerable boost to increasingly pervasive innovations of extreme strategic value if combined with the development of artificial intelligence and other new technologies, e.g. nanotechnologies.

In a world where the amount of data and information is increasing dramatically, having systems capable of processing billions of operations per second becomes essential. It is not a question of power, but another way of processing data and information. Through the cloud, quantum computers could be used for communications, computational science, precision navigation, as well as for improving the capabilities of AI through parallel calculations (instead of linear ones), thus exponentially multiplying the power and the speed of calculation.

In less than a decade, we will be witnessing the second quantum revolution. Quantum information technologies, quantum

[19] We have gone from computers with 1,000 transistors (ca. 1970), to chips containing 10/20,000,000 transistors (ca. 2017); from processing 100 operations per second to today's 10^{14} operations (around 1,000,000,000,000) to probably reach 10^{25} in 2045; a processing capacity that will no longer be equal to that of a single human brain, but equal to that of the entire population of the Earth (ca. 9 billion people) by moving from binary alternating calculations to so-called quantum computers. The smaller memory unit in quantum computing is called a quantum bit (or qubit, from Quantum BIT). While the classical bit can only take one of the two binary states, a qubit also exists in a simultaneous 'superposition' of 1 and 0. This 'expansion' of alternating states exponentially increases the computational capacity by allowing an enormous increase in simultaneous operations.

electromechanical systems, quantum coherent electronics, quantum optics and coherent matter technology will emerge. At present, however, quantum computers will not replace traditional computers, but will work with them, exploiting their respective capabilities.

Robotics and Autonomous Systems

The first two decades of the 21st century have brought us striking examples of what is commonly referred to as 'autonomous technology' and 'artificial intelligence': cars and drones, robots in the open seas and in space and seabed exploration, weapon systems, software, to name but a few. Artificial Intelligence, especially in the form of machine learning, and the increasing availability of large amounts of data from various sensors are rapidly making interconnected systems more powerful. They are being used more and more in the public and private sectors, they have improved the working conditions for humans and reduced interference during the performance of tasks. Deep Learning allows machines to learn new strategies from themselves and look for new solutions to be analysed. In some cases, their actions are not immediately comprehensible and no longer open human oversight, as performance is based on data that has been generated during learning.

These so-called 'autonomous systems' are currently the providers of the most important services modern societies receive, from industrial production to health care, from logistics to security. From a military point of view, there is a huge opportunity concerning their use. Once fully mature, autonomous systems could radically reshape the characteristics of the battlefield and consequently redesign the role of humans in future operational scenarios. However, even today, robotics and autonomous systems raise important questions[20]. First of all, the question of safety, security, damage prevention, and risk mitigation. How can we create a world with interconnected artificial intelligence and safe 'autonomous' devices? And how can we assess the risks? Second, there are issues concerning liability in case the autonomous system fails. Finally, unanswered questions exist about the transparency of the algorithms underlying AI and 'autonomous' systems, governance, regulations, monitoring, and certification. All this is likely to lead to a re-evaluation of our institutions and our body of law to ensure that they can interact and coexist with such kinds of technology.

[20] Recent projects such as GloRIA (Global RPAs Insertion Architecture) concern the integration of remotely piloted aircraft in increasingly complex and congested 'domains'. They show how the integration of increasingly 'intelligent' machines (together with the exploitation of data) represents an indispensable goal for increasing situational awareness, situational understanding and battlefield superiority.

3.3 CYBERSPACE APPLICATIONS

In order to guarantee the security of the networks within which data and information will travel, it will be necessary to provide protection tools capable of recognising and rejecting increasingly sophisticated attacks from various actors. Given the diversity of possible interactions between the military and other sectors of everyday life, the range of possible attackers has progressively widened. *C*yber criminals, hackers, activists, and groups working for techno companies to carry out espionage and sabotage operations will be the new opponents that national security and defence will have to face. The resilience of networks and the ability to maintain their operability will be crucial in a context of total dependence on interconnected networks. The acquisition of mastery in the management of the Cyber tool integrated with activities carried out within the electromagnetic spectrum (CEMA - Cyber Electromagnetic Activities) will represent a certain multiplier of strength especially in view of the progressive transition from a kinetic to a non-kinetic operational context in which social media and the ability to direct people's sentiment will also play an important role. Furthermore, given the possible future electrification of the battlefield, the full management capacity of the CEMAs will ensure the acquisition of a tactical-operative advantage over the adversary. Finally, the Cyber domain will be fundamental for the management of the operations that will take place in Space, which will probably represent the next and further battlefield.

3.4 SPACE APPLICATION

"The 21st century will be remembered for the Space Race." Space systems are the key enablers of the national and international infrastructures of today and tomorrow. The current speed of technological developments indicates that there will be an increasing dependence on space architecture and services. As a result, outer space will become increasingly congested, contested and competitive.

Space technology will, in the near future, be particularly relevant to the Security and Defence sector. This technology can be used to manage platforms such as satellites, space stations, offensive tools and active and passive countermeasures.

Space technology will be strongly integrated with cyber technology. Both are likely to be the main users of quantum technologies, especially for that which concerns communications. Whether it is deciding what to wear in the morning or monitoring the ceasefire in Libya, setting a route on Google Maps or guiding some of the most modern weapon systems to the target, everything is mainly linked to the use of space-based infrastructures and, even more, to the 'free' access and use of the electromagnetic spectrum. The growing dependence of modern societies on this type of infrastructure, fuelled also by the decisions of companies to provide more and more services via satellite, brings with it new challenges for National Security.

Possible hostile actions against the space infrastructures of a state, through the use of physical/kinetic instruments or through cybernetics - in anticipation of multi-domain operational scenarios and hybrid threats - would have a significant impact, both on the military capabilities of the same, and on the non-military activities carried out by the community. The dual nature of space infrastructures and the close cooperation between state and private actors in the space sector also raise new questions about the boundaries of the next battlefields.

Against this background, our nation should be fairly autonomous in the areas of space services, infrastructure and access to space as a prerequisite for international collaboration.

3.5 TECHNOLOGICAL SOVEREIGNTY - INVESTING IN HIGH TECHNOLOGY

Despite the uncertain and complex forecasts about certain scenarios, choices will have to be made to develop new technological/capability trends, especially in niche sectors that have a potential and high impact on future strategic balances. However, essential and already consolidated state-of-the-art capabilities will have to be preserved. The definition of specific, consistent, and sustainable investments will therefore determine both the maintenance of a coherent response capacity and the trend and evolution of transformations. It is therefore necessary to establish how innovative technologies useful for acquiring national technological sovereignty in strategic sectors such as computing power, data control and secure connectivity will be developed.

In the past, the military sector was the driving factor in the field of research and development of new technologies, but today the paradigm has shifted in favour of the non-military world. The speed at which technology is evolving means that military procurement has to be updated quickly to become faster and more effective. The military will therefore keep up with the times and not become subject to external threats based on the obsolescence of its instruments/assets/equipment. Failure to do so may hold back technological development and the implementation of innovations.

Strategies will be needed to mitigate the quick obsolescence of platforms due to the rapid spread of new technologies. For example, open architecture systems will guarantee quick upgrades to counter the dynamic evolution of threats from multiple domains, while interoperability of the systems will be preserved.

Continuous upgrades of IT tools and infostructures underpinning digitisation, communications, and almost all new technologies and future capabilities will be required. Likewise, new skills and new organisational and decision-making processes will have to be defined.

3.6 TECHNOLOGICAL IMPLICATIONS FOR SECURITY

SECURITY	➢ **Promoting the maturation of an ethical-legal framework suited to technological development** ➢ **Considering cyberspace as an arena for discussion among competitors** ➢ **Increasing awareness of the role of space** ➢ **Getting ready for the dissemination of quantum technologies**

In an international order born in the "pre-digital era", some geo-strategic players, especially self-governed countries like China, have understood how technology represents the core of modern geo-strategic competition, the Digital Silk Road being a clear example. First and foremost, the maturation of the general mindset and leadership that leads to a full understanding of the digital dimension is the starting point. Enabling technologies should then be intercepted and exploited effectively. Similarly, the finance and investments connected to technology are fundamental. The strategic advantage can only be achieved and maintained with a prudent and constant investment over time, so as to always maintain high national technological standards. Synergy between technological 'demand' – i.e., Ministries and Industry – and 'supply' of emerging and disruptive technologies that are already available to or are being developed for the military and civil state-owned and private research centres, universities, districts, technological hubs and parks could achieve this.

Promoting the maturation of an ethical-legal framework suited to technological development

The need to adapt the ethical-legal framework to rapid technological development is strongly felt in relation to the increasing pervasiveness of the human-machine relationship and the ever closer integration between the parts.

The ability to adopt highly technological solutions to solve problems in every field will, on the one hand, lead to a new potential global distribution of power and wealth, but, on the other, it will also raise ethical questions about the role of technology and its intensive use in both the civil and military spheres, to which adequate answers will have to be found. In the time horizon under consideration, although an unsupervised delegation of human responsibilities to such systems is not yet conceivable, it will be crucial to:

- promote an ethical and legal debate on the development and use of emerging technologies;
- change the role in the employment dynamics of human and technological resources;
- optimise the increase in life expectancy through 'tailored' medical solutions, and the greater integration of smart materials with biological tissues (tracking -microchips);
- assess the redefinition of the concept of 'what is right and what is wrong' by changing the perception of technology.

Considering cyberspace as an arena for discussion among competitors

For some time now, cyberspace has flanked the traditional domains, assuming a growing importance as a ground of confrontation among the various actors of the geo-strategic scenario in the resolution of crises. Although it is characterised by material

volatility and inconsistency, it is a transversal element to all the domains with concrete effects on the real world. The cyber domain will represent a force multiplier for those new state and non-state actors that will have the ability to become credible counterparts on the geo-strategic stage and represent new forms of threat. At the same time, it will inject the system with unavoidable vulnerabilities of crucial importance, which should also be taken into account. The definition of an organisational and cognitive approach towards early identification is therefore advised, which is both all-encompassing and highly predictive to identify even the slightest early signs of change. The perspective view of the cyber dimension will entail:

- reducing vulnerability by strengthening the resilience of both systems and networks and cultural- and value-based resilience;
- integrating the human element with intelligence , surveillance and reconnaissance networks made up of overlapping systems of sensors and autonomous systems to ensure proper situational awareness capable of effectively assisting decision-makers;
- Implementing the technologies that improve the ability to predict, grasp, and analyse transformation factors and mitigating the growing influence on public opinion of what are known as techno companies.

Increasing awareness of the role of space

Today, space has become an important part of a country's economy. Through it, one can develop cutting-edge technologies with important spin-offs on the economic and social fabric, from communications to the management of environmental emergencies, and the fulfilment of security needs. To that effect, science and technology have become the very foundation of a state's power, independence and sovereignty. Consequently, hand in hand with globalisation and the increasing commercialisation of space activities, the space race will be the driving force behind future technological development, and the problem of exporting sensitive technologies and its compatibility with national security interests will arise.

Technology transfer brings into play the issues of sovereignty as an essential component of a nation's independence, and a fundamental tool to support its political ambitions. This implies the need to:

- develop an adequate capacity to assess threats to and from space through Space Situational Awareness (SSA) and Space Surveillance and Tracking (SST); conduct space operations and support programmes in the SATCOM and observation domains; maintain effective Intelligence, Surveillance & Reconnaissance capabilities; draft Maritime Situation Awareness, Meteorology and Hydrooceanography, ISR, RADAR, Hyperspectral, SIGnal INTelligence reports and achieve autonomous orbital insertion capability. For the latter, an enhanced national industry will develop to launch projects from naval or air platforms;
- Defend the national interests and opportunities such as the exploitation of natural resources from asteroids and planets (space mining);

- assess the risk of the weaponization of space due to the growing exposure to new risks and systemic vulnerabilities such as espionage, sabotage, and proliferation of satellites and hypersonic weapons.

Getting ready for the dissemination of quantum technologies

There is broad agreement throughout the international community about the potential of quantum technology, but not so much about its use.

This means that quantum technology is still secluded into a niche and cannot be compared to how supercomputers are used. It will achieve an exponential increase in calculation capacity, which will determine the geopolitical mass of a subject based on "the more calculation power, the more specific weight" equation.

Trends analyses show such far-reaching implications that it seems reasonable to imagine that we are close to what people call ‘the quantum revolution’, i.e., the massive spreading of this technology. All of the above will lead to:

- seeking innovative solutions for storing and analysing the vast amount of data that will be produced and fed into quantum systems;
- resolving the dichotomy between trust – i.e., trusting systems without fully understanding how they work – and reliance, that is, trusting systems after ensuring their compliance;
- investing in R&D of a new generation of microelectronics that can represent an increase in computing power;
- identifying a strategy for the use of Emerging (and) Emerged Disruptive Technologies (E2DT) through which – coupled with multilateralism – we can regain the initiative against those competitors that are currently at the forefront.

3.7 TECHNOLOGICAL IMPLICATIONS IN THE DEFENCE SECTOR

DEFENCE	➢ **Implementing artificial intelligence in all aspects of Defence** ➢ **Acquiring a relevant role in the space and cyberspace domains** ➢ **Strengthening research & development (R&D)** ➢ **Improving Command & Control capability**

Technology is where much of the game is played to achieve and maintain the strategic advantage traditionally held by Defence and now characterised by factors related to all domains. The ability to develop and deploy emerging and enabling technologies brings into play issues of (technological) sovereignty as an essential component of a nation's independence and a fundamental tool to support its political ambitions. The ever-increasing use of artificial intelligence, the race to dominate cyberspace and space - with their influence and synergies as opposed to the traditional domains that more direct relevance have for human beings – and the need to enhance command and control capabilities, especially with a view to advanced projection – are the areas that will shape the military of the future through investments in research and development to identify priority and relevant capabilities.

Implementing artificial intelligence in all aspects of Defence

The development of artificial intelligence will have an increasingly leading role and, together with other technological trends, will have a cross-cutting impact in the multi-domain scenarios characterized by high-speed action. At the same time, it will inevitably bring new ethical and legal challenges that will require due attention and care. Artificial intelligence will be one of the defining aspects that will radically alter the very nature of the battlefield of the future. One of the most relevant aspects lies in the huge amount of data in its broadest sense - 'the new gold' - that will represent the fuel as well as the outcome of this technology. With their ever-increasing volume, they will certainly become an indispensable military enabler. Therefore, considering a proactive approach as leaders towards the implementation of AI will be a priority, also to maintain a constant technological level and a strategic advantage over the opponents. In particular, we should:

- promote the spread of AI by foreseeing its implementation at all levels and in all sectors, from strategic to tactical, from logistical to organisational;
- acquire professional and technological skills to be able to collect, classify, store, analyse, correlate, and exploit this huge amount of data safely;
- review the role of human beings on the battlefield through human-machine teaming and the connected principle of man in the loop in the short term. The latter may evolve into the man-on-the-loop principle in the long term as a central and unavoidable feature of any service member.
- preventively and carefully assess the ethical and legal implications

inevitably linked to a simplistic and aprioristic introduction of AI.

Acquiring a relevant role in the space and cyberspace domains

These two domains undoubtedly represent the next stage of international dispute, for they alter the economic and financial balance of the most technologically advanced countries. Technological development in these areas has soared in conjunction with renewed interest in their exploitation, with a disruptive impact on the military from a strategic – but also and above all – from an organisational and operational point of view. Both cyber and space have unlimited intrinsic potential due to the increasingly fewer financial resources required. More and more civil, military and commercial users operate in cyberspace and space without limitations and are aware of the influence and synergies these domains have on the traditional domains of human existence. With the increasing importance of infostructures (such as networks, servers, mainframes, etc.), and the growing dependence on computer networks, Defence should be ready and properly equipped to face future threats. In fact, it will have to:

- strengthen its resilience to mitigate the vulnerability of the military itself;
- define an organisational and cognitive approach to Early Identification in space that is all-encompassing and highly predictive;
- take on a primary role in the cyber domain where, given that the attacks on commercial networks and mission-critical information facilities also during peacetime, will become a key element of future hybrid conflicts.

Strengthening Research and Development

A military force that is technologically ready, effective, and able to deliver should achieve and maintain consistently high standards through identification and implementation of the best enabling technologies. The R&D functions are the spotlight to see the future innovative opportunities that will allow Defence to anticipate, predict, and face future challenges without suffering the consequences of the rapid technological developments that will characterise future complex scenarios. In the near future, we will need to:

- implement an R&D investment strategy to constantly choose and identify priority and most relevant capabilities for Defence in order to anticipate events;
- explore, with a view to safeguarding national interests, opportunities for collaboration with other countries so that the specialisations of individual states become an overall advantage for the Allies;
- increase cooperation between the public and private sectors in order to achieve technological advantages, both with a view to rationalising resources and developing human capital, the latter being fundamental for the management and deployment of new assets;
- maintain/not lose the technological edge on technologies that may entail further developments or

open new areas of employment. Besides the confrontation in space and cyberspace, the deep sea will represent another sector where technological growth will offer extraordinary opportunities for exploitation and exploration but also new challenges for the protection of critical underwater infrastructures;
- develop capabilities that can effectively deal with the A2AD threat to ensure freedom of manoeuvre in congested areas.

Improving Command and Control Capabilities

In the future operational scenarios characterised by high technological content and inter-hyperconnectivity, command and control will still be key to ensuring optimal battlefield management through harmonisation of all the systems involved, in order to make decisions consistent with the existing threats. Command and control relationships will be characterised by automatic and accelerated exchange of data facilitated by the use of Artificial Intelligence, which will have to be processed to provide field commanders with solutions to complex problems. More and more real-time correction of deviations from original planning processes will be possible thanks to new technologies, such as machine learning and information retrieval including, for example, minimising collateral damage in the targeting cycle to optimise efforts and reduce/contain risks. Areas such as cyberspace, space-based technologies, tactical cloud, Joint ISR, robotics, big data exploitation, edge-quantum computing, and digital collaboration will have to become priority areas for the modernisation of C2 systems and procedures.

In order to maintain the initiative in this area, Defence will have to:
- identify the main technological areas that will alter the concept of battle and support improved situational awareness and situational understanding in a multi-domain environment;
- implement emerging technologies to foster the expeditionary characteristics of forces, achieve greater force dynamism and agility by reducing the logistical footprint, and operate in near-zero energy structures;
- Build capabilities for responding to directed energy and/or hypersonic weapons, autonomous systems and sensors, quantum computers and systems, technologically advanced soldiers.

CHAPTER 4

THE ENVIRONMENTAL SCENARIO

The natural environment represents a physical dimension of our planet that is experiencing profound changes today mainly due to human actions and the current trends of global warming, rising sea levels, increased frequency and intensity of natural phenomena, as well as loss of biodiversity. There is now a clear and urgent need to analyse the dynamics and evolution of these phenomena in order to understand the characteristics of the natural environment in which humans will be living in the future and the related risks and opportunities.

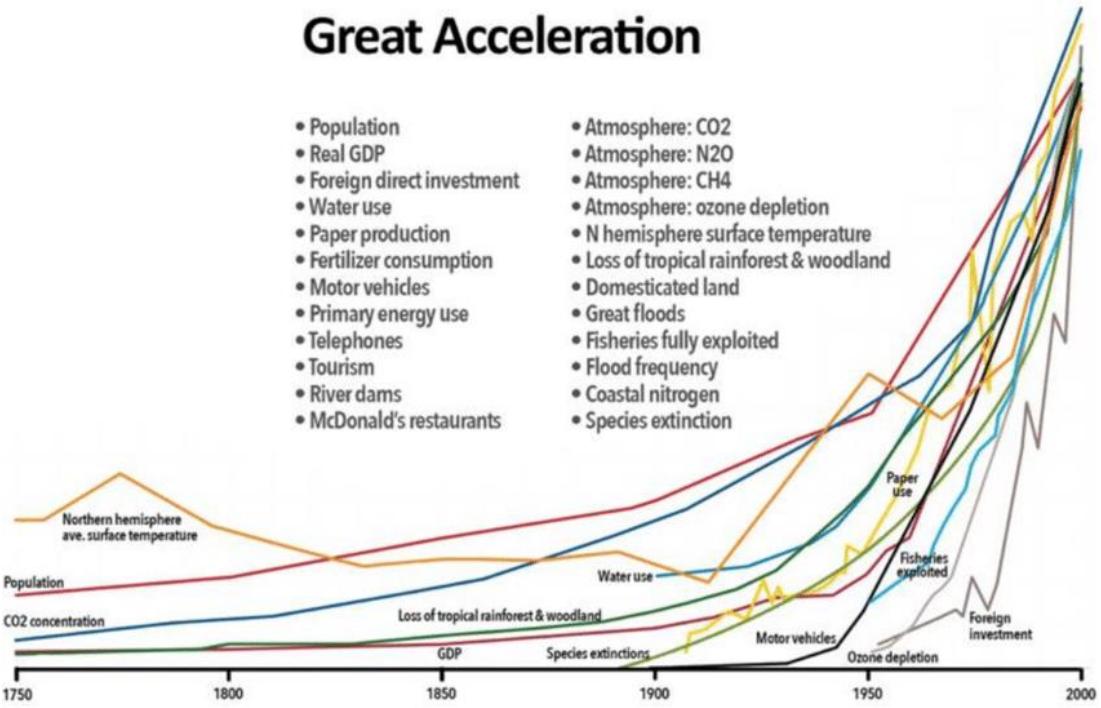
"The natural environment represents the physical dimension of our planet that is experiencing profound changes today due mainly to human actions and the current trends of global warming, rising sea levels, increased frequency and intensity of natural phenomena, as well as loss of biodiversity".

4.1 THE GREAT ACCELERATION AND PLANETARY LIMITS

For the first time in the history of our planet, certain climatic and biological changes are largely attributable to direct and indirect human interventions: the current era is also referred to as the Anthropocene. Two main ideas describe the impact of these interventions on global dynamics. The first one concerns the acceleration of certain global processes or indicators – also known as 'the great acceleration'. According to the trends of 24 global indicators from the beginning of the industrial revolution to date, the main driver of change in the Earth system is the sum of the physical, chemical, biological, and anthropogenic processes[21].

The second idea concerns the finite planetary resources – also known as planetary limits – that is, the natural limits through which resilience of the Earth system and its ability to continue to provide a range of services and support ("ecosystem services") to society is ensured. The concept of planetary limits identifies nine global priorities in relation to human-induced environmental changes. For each system, a limit is defined that separates the 'safe zone' from the 'risk zone'. It represents a critical threshold beyond which the stability of the Earth system would be compromised. Between the two zones lies an 'uncertainty interval' within which the system is already at risk, but the effects can still be mitigated. Four of the nine planetary limits have already been surpassed, including climate change and the integrity of the biosphere. These are believed to be limits that could lead the Earth System to a new

21 *International Geosphere and Biosphere Programme* 2015- *The trajectory of the Anthropocene: The Great Acceleration*, in «*Anthropocene Review*», *2015:* https://journals.sagepub.com/doi/10.1177/2053019614564785.



balance in which the very existence of living beings as we know it today could be at risk.

More specifically, the loss of biodiversity is one of the most serious threats because it irreversibly leads to the rapid extinction of living species. Due to human action, the planet is experiencing the Sixth Mass Extinction, or Anthropocene Extinction, with more than 100,000 species threatened (IUCN Red List[22]), 32,000 of which are at risk of extinction.

The progressive degradation of the natural environment as a result of human intervention will also significantly affect the area of the 'gobal commons', the set of the planet' common goods – i.e., water, land and air and everything they contain, including energy and mineral resources – that belong to the set of ecosystem services Earth provides. The exponential growth in demand for such goods and their exploitation will lead to an increasing scarcity of resources. This phenomenon is known as the 'tragedy of commons'.

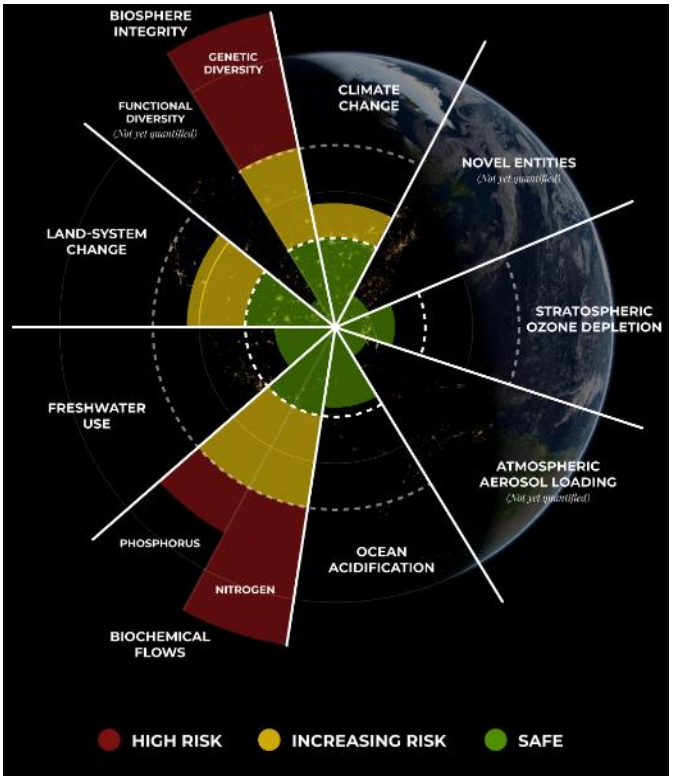
It is therefore necessary to reshape the entire human-nature system, make the management of energy sources such as hydrogen, tides, geothermal, solar, wind, and bioenergy more sustainable, also with reference to the exploitation of mineral resources (rare earth elements) or new trade routes (North Seas). In addition, the issue of biosecurity is of particular importance[23], with the risk of new potential epidemics/pandemics being higher due to environmental exploitation and ecological imbalance. New health risks associated with increased migration for climatic reasons and the emergence of new pandemic phenomena are also part of the picture.

The attention received internationally is evidence of the importance this issue has, for there are implications well beyond the geographical limits of the areas affected by the direct effects of these changes that may compromise the social, political and

22 https://www.iucnredlist.org/

23 Geri, M., http://www.natofoundation.org/food/emerging-challenges-environmental-change-and-biosecurity-in-a-complex-world-maurizio-geri/

economic balance of the entire planet. Indeed, climate change brings with it potential new forms of conflict, as in the case of the new polar routes and territories that are still inaccessible today. A global competition for the exploitation of newly available resources has therefore emerged. In this regard, the EU estimates[24] that 40 per cent of internal conflicts over the past 60 years have been related to competition for natural resources, and this will result in up to one billion 'environmental migrants' by 2050[25].



In this context, the concepts of human security and environmental security will be increasingly interlinked: on the one hand, the steady degradation of the environment threatens global GDP; on the other, addressing the future environmental crisis through energy transition and the use of sustainable resources may create new opportunities for – inter alia – labour and economic growth, as well as safeguarding biodiversity and protecting from new pathogens.

4.2 THREATS TO BIOSECURITY

The main drivers of biodiversity are declining – i.e., agricultural expansion, urbanisation, climate change, overexploitation of ecosystems – will increasingly facilitate spillovers and the emergence of new zoonotic diseases[26]. Indeed, the emerging and re-emerging zoonoses will pose an increasing threat to public health and the resilience of democratic institutions. Therefore, they must be tackled just like any other national security threat, such as terrorism or the proliferation of unconventional weapons (CBRN). These new threats have the potential to generate disruptive effects with systemic shocks to societies and economies worldwide, as in the case of the current COVID-19 pandemic. The latter has made clear how threats to biosecurity can easily undermine the stability of societies and erode trust in democratic institutions, thus weakening their credibility and resilience.

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[24] *https://ec.europa.eu/knowledge4policy/foresight/topic/changing-security-paradigm/environmental-security_en.*

25 *https://www.climateforesight.eu/migrations-inequalities/environmental-migrants-up-to-1-billion-by-2050/.*

26 About 75% of emerging diseases are of animal origin and 80% of pathogens classifiable for potential bio-terrorist use are zoonoses. Rossi E. 2020, "*Biosicurezza, perché serve una strategia nazionale. I consigli di Amorosi*", Formiche: *https://formiche.net/2020/05/biosicurezza-minacce-strategia-nazionale-amorosi/*.

Modern science is increasingly able to reproduce natural phenomena in BSL-3 (High risk) and BSL-4 (very high risk) by manipulating micro-organisms and using guinea pigs or cell cultures. Under certain circumstances, these scientific activities could compromise collective security, especially where there are no adequate bio-containment or bio-security protocols. Furthermore, 'gain-of-function' (GOF) research[27], despite its likely positive aspects, may represent a risk to public health and safety as genome editing could increase virulence against humans or the ability to avoid the host's immune system. This is how low-risk pathogens could be modified to become high-risk agents[28]. New risks may come from the overlapping among biotechnologies, robotics, artificial intelligence, and additional manufacturing (3D printing). This series of technologies may represent a risk factor for possible criminal actions with unpredictable/disruptive effects.

Confronted with nuclear and chemical risks, those posed by biotechnologies are more digital in nature and will have an unusual momentum. They will shake the foundations of the armaments control paradigms that underpin the system of international relations, especially the Chemical Weapons Convention and the Biological Weapons Convention. As a matter of fact, compared with fissile material – which is always physical in nature and therefore can be tracked at all times – the point of origin of a biological weapon, in fact a pathogen, it is just a digital piece of information that is harder to track. Genomic data are a case in point, with chemical weapons being between the physical and digital dimensions.

The intersection of biology and chemistry is of special significance, for it is supported by progress in the fields of neuroscience and toxycology. New agents could be developed by sharing the characteristics of traditional chemical and biological agents. Developments in the fields of artificial intelligence or machine learning may accelerate the identification of harmful genes or DNA sequences that, in turn, could also facilitate the creation of more targeted biological weapons. The latter may be designed to target specific individuals or groups of individuals based on their genes, previous use of vaccines, or known vulnerabilities in their immune system. This is why bioterrorism is something one can hardly translate into risk probability. Its consequences in case of attack, however, can be devastating, as pathogens can contaminate the population, the soil, blight crops, infect cattle, affect the agri-food chain, and therefore the economy of a country. Even the more organised countries can be taken aback by such a threat. It is therefore necessary that approach and common programmes are shared and adopted internationally to prevent and mitigate this threat[29].

4.3 CLIMATE CHANGE

27 Research aimed at generating 'activating mutations' on proteins or pathogens to give them new or enhanced capabilities. In virology, such research is used to increase the capacity of a pathogen in order to identify the nature of human-pathogen interactions, assess its pandemic potential, and develop the necessary medical countermeasures.

28 Amorosi M. 2020, "Perché una nuova missione internazionale per accertare l'origine del Sars CoV-2", Istituto Gino Germani di Scienze Sociali e Studi Strategici: http://fondazionegermani.org/wp-content/uploads/2019/01/MASSIMO-AMOROSI-NOTA.pdf.

29 Amorosi M. 2020, "*Il patogeno come arma*", LiMeS: https://www.limesonline.com/cartaceo/il-patogeno-come-arma?prv=true.

The energy balance and the optimal functioning of the biosphere[30] are already partially compromised by the effects of anthropogenic intervention. In particular, gas emissions – i.e., greenhouse gases like CO_2 and other climate-altering gases – affect the energy balance of our atmosphere, and influence the global warming effect.

The latest report of the Intergovernmental Panel for Climate Change[31] (IPCC AR5, 2014) reveals that the average temperature of the planet (regardless of whether it is measured on land or sea) in the decade 2006-2015 is 0.87°C higher than the pre-industrial average (period 1850-1900). In line with this trend, the six years between 2014 and 2019 were the hottest ever and the first six months of 2020 were the second hottest semester in our history after 2016. With this trend, global warming could cause an increase in the global temperature between 1.5 and 2°C in the next 20 to 40 years, with disruptive effects on the balance of the ecosystems.

At a local level, between 20 and 40% of the world's population already live in areas where the temperature has risen by 1.5°C compared to pre-industrial levels[32]. However, on an overall level, these variations are mitigated by the effect of the seas, whose surface waters have become warmer, on average, by at least 0.1°C per decade, albeit with significant regional variations: the Mediterranean shows almost three times that figure, with an increase of more than one-third of a degree per decade.

The planet's seas and oceans will play a major role in global warming. Seawater, which covers 70% of the planet's surface, performs a number of essential functions[33], the oceans are powerful thermal regulators whose major currents that are regulated by salinity and temperature transport immense amounts of heat[34]. What is more, our seas are home to over 250,000 animal and plant species that feed almost 2 billion people, generate 50% of the oxygen we breathe, and absorb 40% of the total CO_2 emissions through phytoplankton. Last but not least, 90% of the world's goods are transported by sea. It is precisely because of the capacity of water to perform these vital functions that, although we often speak of 'atmospheric

30 Made up of the lithosphere (soil and subsoil), the hydrosphere (sea, river and lake water) and the lower part of the atmosphere (up to 10 km), which is the environment in which the development of life on earth was possible.

31 Verification and validation body for numerous studies, established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP).

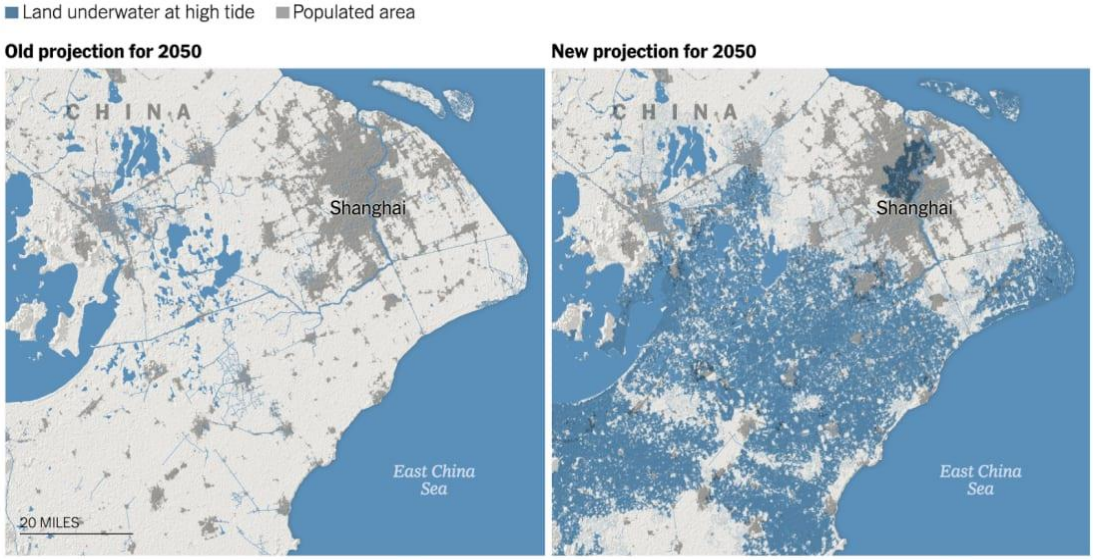
32 A parameter recognised as the benchmark between the possibility of managing serious and unavoidable consequences and the realisation of scenarios that are no longer manageable.

33 Carniel S., 2017. *Oceani, il futuro scritto nell'acqua* (Hoepli ed.). ISBN 978-8820379858.

34 The North Atlantic thermohaline cell alone, which actually continues the Gulf Stream back to the east, has a flow rate of about 15 million cubic metres per second, capable of heating the air in the North Atlantic regions by 7-10 degrees Celsius.

warming', the warming of the seas is an equally worrying phenomenon with possible consequences on a global scale[35].
One of the effects directly connected to global warming is the thermal expansion of water masses and the melting of glacial masses. These result in the expansion of and rise in average sea levels (3.5 mm/year and rising)[36]. The rate of ice melting is also heavily influenced by sea warming, as shown by the dramatic reduction in ice sheet thickness in recent decades.

The size of the Arctic ice shelf has decreased by 4% every decade from 1979 through 2012. Greenland alone loses 290 Gt (giga tonnes) of ice per year (about 3,000 times the weight of the Coliseum), which melts and flows into the Atlantic Ocean. Such flow changes the ocean's salinity, along with the more than 200 Gt lost each year from Antarctica.
This impressive change not only accounts for two-thirds of the total increase in sea levels, but also influences the global circulation of waters across the seas. The increased amount of unsalted water not only affects the salinity of waters directly, with obvious consequences for living species, but also changes their density, which in turn alters the process of sinking and mixing of heavier waters, thus interfering with the general circulation of deep currents, that is, the planet's main thermostat.
In addition, this warming process influences other dynamics, such as the intensity of climatic and atmospheric events that are becoming increasingly extreme at land-sea interface points[37], the distribution of fish stocks, the melting of glaciers, the availability of fresh water, and the erosion of coastal strips. Warmer seas generate



Marine Heat Waves (MHW). These are phases during which ocean temperatures become extremely high, and persist for days or months over thousands of kilometres

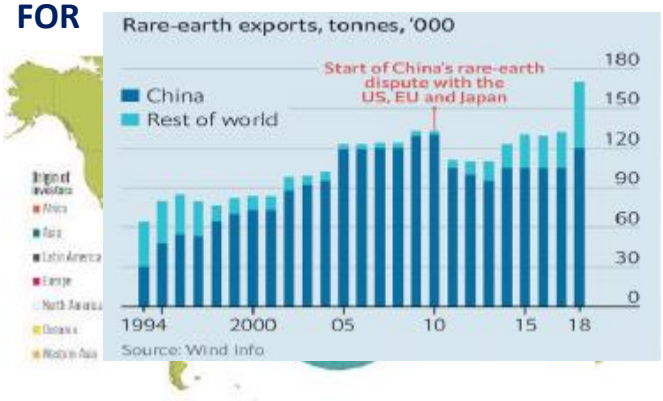
35 Carniel S., 2020. Il riscaldamento degli oceani. *Sapere*, 4, pp. 16-22. DOI **10.12919/sapere.2020.04.2**

36 The IPCC AR5 report certifies a global increase of 20-24 centimetres since 1880, and a current rate of about 3.5 millimetres per year (2006-2015), which is accelerating compared to the trend of the previous century.

37 Tropical cyclones preferably occur at surface temperatures above 26°C, and their intensity is expected to increase, as is the intensity of extra-tropical cyclones that also form in the Mediterranean Sea.

and hundreds of metres deep. They can alter the climate of entire regions through 'teleconnections', thus causing droughts, extreme rainfall, or heat waves. It also increases the possibility that more intense rainfall and winds are observed, and that potentially more destructive waves occur, putting infrastructure in coastal urban areas at risk. This risk therefore affects hundreds of millions of people, given the number of megacities located close to the coast (Coastal Megacities such as Miami, Mumbai, Ho Chi Minh City, Shanghai, Bangkok, Alexandria, New York).

4.4 COMPETITION FOR RESOURCES



The phenomenon of the 'tragedy of commons' will trigger new forms of competition: on the one hand, there will be long-term unavailability or scarcity of basic resources such as food and water, common energy resources (coal, oil, gas, uranium, etc.), and rare resources[38] due to demographic explosion, global competition, and greater resource consumption by an incresingly larger part of the world's population. On the other hand, the socio-economic-political conflicts will increase, including those happening through clashes among different populations (farmers-breeders, urban-agricultural-rural population, etc.), and between populations and private stakeholders, also as a result of phenomena related to eco-colonialism, such as land/water grabbing[39].

In this regard, when referring to Africa, people usually mention a 'new scramble for Africa', i.e. the partitioning of the continent among multinational companies to control the food markets (e.g. in Congo, Ghana, Guinea, Liberia, Congo, Nigeria, Senegal and Sierra Leone). Similarly, in Asia, land-grabbing to make room for intensive agriculture has already given rise to forms of ethnic and religious persecution of minorities.

As a result of climate change and the growing demand, stronger scarcity of arable land and water resources is being observed mainly due to increased industrial demand in meeting the needs of the increased population, urbanisation and economic expansion. In line with current population growth forecasts, it is estimated that demand for food and water could increase by up to 50% and 30% respectively by 2050. This will require the development of new techniques and technologies to increase agricultural production and reduce the need for livestock. However, population growth and the effects of climate change will have very different consequences across the world. It may be impossibile, in some areas, to follow sustainable transition. New forms of competition for primary resources will emerge as a consequence, where the absence of international agreements regulating the use of those resources could trigger new tensions for their exploitation.

In particular, Africa will again be the continent most affected by climate change, desertification, resource scarcity, famine, drought and natural disasters, to which issues from increased population pressure should be added. These phenomena will have disruptive social, economic and political consequences, they will amplify the scale of migration flows with a potentially significant impact on southern Europe (the

38 Rare resources are the so-called 'conflict minerals' that include the 3TG metals (tin, tantalum, tungsten, gold) - the basic elements for batteries and electronic devices – and rare earths, which are essential for many modern technologies, from fibre optics to superconductors (95% of which are produced by China).

39 Purchase/privatisation of common goods by multinationals, a phenomenon that is strongly on the rise after the rise in the cost of food due to the 2008 crisis.

IEP estimates that climate change will bring 86 million additional migrants from sub-Saharan Africa)[40].

The increase in the world's population in relation to available resources has also raised concerns about urbanisation: by 2050, more than 68% of the world's population will live in cities[41]. This phenomenon is particularly important in developing countries where, in the absence of a well-developed industrial sector, economic growth could stagnate, while resource consumption and population would increase significantly.

Access to energy and mineral resources will also have important implications for the international balance. In fact, the effects of introducing innovative technologies to reduce dependence on traditional energy resources and move towards a sustainable transition will be offset by the increase in energy demand in rapidly developing countries. This will maintain the current system in which traditional sources will continue to be the main source of energy. Even more so, technological development will lead to increased competition for access to rare resources, which are crucial to the technology sector. Today, China is the largest producer (more than 70% of the market) of 18 minerals (including 5 rare earths), and holds a de facto monopoly that prevents other players from undertaking effective procurement and investment campaigns, while it continues to control prices and retain strategic advantage.

In such a complex scenario, the scarcity of resources will heighten the competition to access raw materials and energy sources, which will also be sought by exploring new frontiers (land, water with possible territorialisation phenomena regarding the sea - and, in a long-term time horizon, space) or by redefining spheres of influence, thus triggering new international tensions.

4.5 MAJOR INTERNATIONAL INITIATIVES

The need to identify and urgently implement actions to mitigate the effects of human actions on the environment has led to the development of many international sustainability initiatives for the planet, although the post-pandemic global economic crisis will affect the ability of states to support this transition to varying degrees.

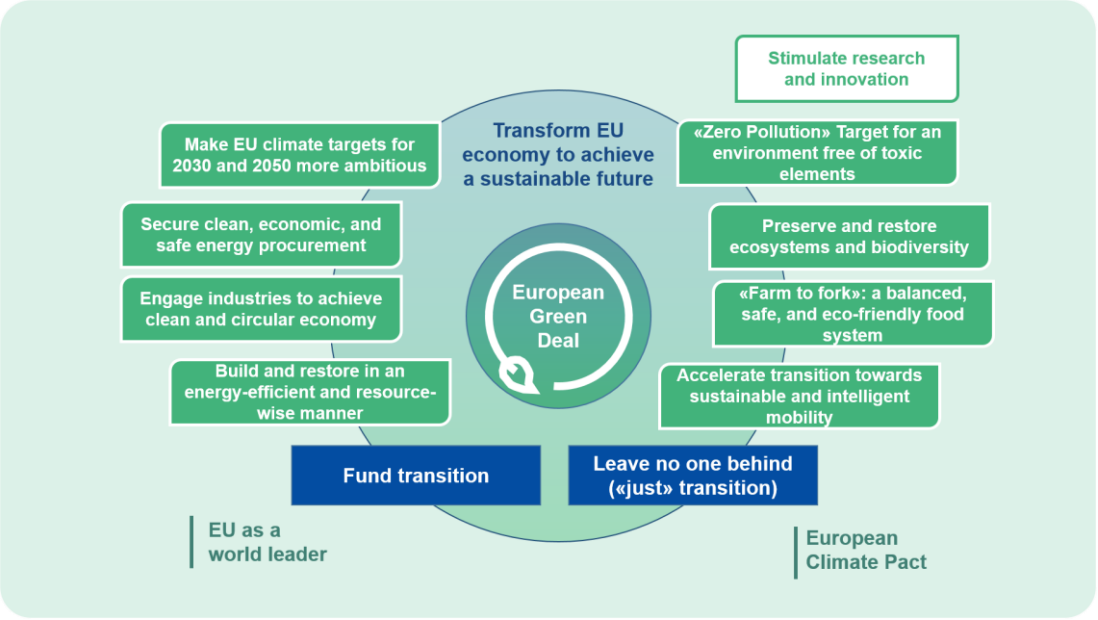
At the global level, the main environmental initiative – and presumably the future test case for world governments – is the **UN 2030 Agenda for Sustainable Development**. Its 17 Sustainable Development Goals (SDGs) will have to be achieved gradually. The States are invited to report progress through Voluntary National Reports.

40 *http://visionofhumanity.org/app/uploads/2020/09/ETR_2020_web-1.pdf*.

41 *United Nations, World Urbanizations Prospects*, 2014 *https://population.un.org/wup/publications/files/wup2014-highlights.Pdf* .

Based on population growth estimates, the equivalent of three planets would be needed in 2050 to provide the natural resources needed to sustain current lifestyles. Achieving these goals is therefore necessary for the future of humanity, which will not only increase in numbers, but also in the demand for higher standards of living (consumption). The goals go beyond the environmental dimension to include the economic and social in a **holistic sustainability perspective**. Attaining the targets is individual to each country and therefore the adoption of sustainable policies and the achievement of targets is difficult due to the absence of binding mechanisms.

The **European Union** has also developed a regional programme that will promote a sustainable economy through the ***Green Deal*** objectives, with a view to a climate-neutral continent, with a target 40% to 50% fewer gas emissions in 2030 compared to 1990[42].



42 The 'net zero' target for 2050, i.e. an even balance between emissions produced and emissions removed from the atmosphere (including removal through storage in biospheric sinks underground), was set by the IPCC (UN Intergovernmental Panel on Climate Change) to keep global warming within 1.5 degrees.

In addition to this first objective regarding energy transition, the two additional macro-objectives of the Green Deal include 'economic growth without wasting resources' and 'leaving no-one behind'. Furthermore, in order to avoid possible delays in reaching the final targets and to ensure the necessary level of commitment of individual countries, the European Commission has recently proposed a regulation on climate to turn political commitment into a legal obligation. Achieving the goals of the Green Deal will require investments in environmentally friendly technologies; technological innovation; cleaner, cheaper and healthier public transportation; decarbonisation of the energy sector; and ensuring that buildings are more energy-efficient. Compared to the UN 2030 Agenda, in which the attainment of the SDGs remains the responsibility of the signatory countries, the EU Green Deal could, thanks to possible sanctions by the European Commission for States that fail to meet the targets, be more effective and ensure that Europe is able to preserve a sustainable system while securing a lead in environmentally friendly policies and technologies, at least on a regional level.

In short, the UN programmes or the Paris Agreements[43] do not provide for a regime of monitoring and sanctions and, therefore, actions to achieve the targets will remain limited to the sensitivity and capacity of individual countries. On the other hand, the EU programme, if adequately supported over time, could instead 'guide' the countries of the Union through this transformation. Europe, but also Italy, would therefore enjoy a position of strategic advantage, both in the field of energy and technology, in the medium to long term.

[43] International Treaty on Climate Change - adopted by 196 parties at COP 21 in Paris on 12 December 2015 and entered into force on 4 November 2016 - with the aim of limiting global warming to well below 2, preferably 1.5 degrees Celsius, compared to pre-industrial levels.

4.6 ENVIRONMENTAL IMPLICATIONS FOR SECURITY

SECURITY	➢ **Supporting transition toward holistic sustainability** ➢ **Developing a national strategic biodefence organisation** ➢ **Preventing the spread of instability/complexity across the Wider Mediterranean** ➢ **Mitigating escalation in international competition for resources** ➢ **Planning the response to extreme natural events and increasing systemic resilience**

The scale and complexity of the challenges entailed by the effects of the progressive degradation of the natural environment (sustainability, biosecurity, instability, competition for resources, extreme climatic events) will require policies to prevent/manage the main related threats.

Supporting transition toward holistic sustainability

Adhering to international sustainability agendas – notably the UN 2030 Agenda and the EU Green Deal – will require significant investments to effectively achieve the assigned targets. Against this background, the following will be key:

- acquiring strategic capacities in the fields of technology, energy, and infrastructure, in fact, important opportunities to guarantee Italy a future strategic advantage in these sectors;
- reducing the country's heavy dependence on imports to avoid being exposed to possible claims, especially in the energy sector, developing a circular economy, and ensuring greater security of national supply chains and routes;
- carrying out an energy-oriented transformation, including a cultural one, through green technologies with a strong eco-sustainable character (e.g. new forms of bio-fuel). They would also allow the military to have greater operational autonomy in contexts characterised by serious scarcity of resources;
- investing in research and development so that the current prospects for technological development (e.g. heavy reliance on rare earths) can find viable, environmentally sustainable alternatives, that is, an improved condition that would also entail an enormous strategic advantage.

Developing a national strategic biodefence organisation

Minimising the risks associated with the natural or artificial emergence of new pathogens will require the adoption of specific measures, such as:

- increasing international cooperation to adopt joint programmes to effectively monitor advanced biological research and development in the biotechnological field, also with a view to ensuring the security of agri-food supply chains and genomic databases;
- developing a national strategic biodefence organisation, possibly based on a framework provided by the Armed Forces. Such an organisation would envisage advanced forms of cooperation among Ministries and Agencies, the creation of an early warning system

with cutting-edge technological tools in a permanent surveillance structure supported by a solid intelligence network and equipped with consolidated and shared operational procedures where Civil Protection, Public Health and Defence structures can be quickly called to intervene.

Preventing the spread of instability / complexity across the Wider Mediterranean

The main effects of climate change will mainly affect the African continent, the MENA region and, more generally, the Wider Mediterranean area, where the scarcity of primary resources and exponential demographic growth will contribute to generating large scale phenomena of local destabilisation that may generate massive migration flows. Therefore, in view of the complexity of the factors at play and the potential scale of the phenomenon – to which piracy, terrorism and the resurgence of competition among states should be added – combating the emergence of such destabilising processes will require:

- seeking an integrated, multidisciplinary approach at supranational, multilateral, and bilateral level;
- implementing a shared sustainable development strategy for weak and at-risk states;
- strengthening the cooperative dialogue on security by increasing cooperation, especially in the field of security and defence, including the deployment of military contingents in territories where crises occur as a last resort;
- anticipating threats, adaptig and intervening rapidly in different operational scenarios.

Mitigating escalation in international competition for resources

The tensions arising from the competition for resources in the new frontiers (polar areas, remote areas and, in the future, space) will possibly redefine international relations and spheres of influence. Therefore, it is necessary to:

- identify clear strategies to protect national interests;
- promote reforms that protect the global commons and common resources, from the oceans to the atmosphere and space, on the international legal stage;
- ensure, within the framework of international organisations and/or coalitions, the strategic ability to mitigate/counteract possible monopolies in the exploitation of available resources;
- ensure sovereignty and protection of national interests by protecting communication routes and the ability to project, within a single strategy, all the elements of national power. The mere prevention or the search for cooperative solutions may not be enough in all cases.

Planning the response to extreme natural events and increasing systemic resilience

The effects of climate change will contribute to extreme natural phenomena, especially at the land-sea interface. Therefore, given the natural exposure of our peninsula and the increase in such extreme phenomena, it will be necessary to:

- plan the national response through the development and continuous update of specific contingency plans to increase resilience to environmental challenges;
- review the current Civil Defence system and take into account the real level of commitment required from the individual operational components that contribute to that system while updating the contribution required from Defence;
- verify the compatibility of contributions that individual operational components are required to provide versus the execution of their institutional tasks; if necessary, based on the experience acquired in a specific sector, with special regard to interventions in the event of natural disasters, threats to public health, or crisis management.

4.7 ENVIRONMENTAL IMPLICATIONS FOR DEFENCE

DEFENCE	➢ **Increasing the operational agility of the military** ➢ **Increasing the ability to counter biological threats** ➢ **Counteracting the emergence and spread of instability in the Mediterranean region** ➢ **Helping mitigate the effects of international competition for resources** ➢ **Adapting the response capacity to cope with extreme natural events**

The scale, unpredictability and cross-cutting nature of environmental challenges will require greater integration among various departments and agencies and strong cooperation with the intelligence community in order to intervene promptly in potential areas of crisis. In particular, the defence organisation will need to have a ready, motivated, and highly prepared military instrument, to face any combination of threats across the whole spectrum of conflicts and, at the same time, deal with the possible risk of incidents within the same area of operation (large-scale diseases or epidemics, natural disasters, industrial pollution and humanitarian disasters).

Increasing the operational agility of the military by:

- promoting culture, processes, and operational structures to perceive and assess emerging threats, anticipating their effects through focused training and agile technological acquisition, for the rapid deployment of new capabilities;
- increasing operational autonomy by implementing new technological solutions to adapt to new, external and internal operational challenges;
- reducing the logistic footprint to promptly project the military in areas of competition/crisis characterised by great scarcity of resources, while identifying suitable solutions in order to guarantee a strong logistic autonomy of contingents by exploiting synergies with the research and national industry communities;
- focusing the process of modernisation and capability transformation of defence on the principle of energy efficiency. This would involve infrastructures (smart bases), to reduce their environmental footprint and support the national energy transition, which includes researching new forms of bio-fuel or adopting measures to convert the power systems of thermal machines.

Increasing the ability to counter biological threats

The renewed sensitivity towards the fight against the biological threat will have to drive the implementation of a technically-advanced and inter-agency system that can deal with diversified situations, focus on resources for planning and consequence management, the strengthening of command, control and communication structures, and the definition of a clear command chain for a coherent and harmonious

use of national specialised units. In particular, it will be necessary to:

- stimulate the search for new organisational/capability solutions and the development of related expertise;
- integrate military CBRN Warning & Reporting organisation with the civilian component;
- strengthen health support capabilities, including through the enhancement of dual-use capabilities such as territorial military hospitals and hospital ships;
- enhance air transport capacity in strategic airlift of biocontained patients, also in support of fellow nationals abroad.

Counteracting the emergence and spread of instability in the Mediterranean region

The overall effects of environmental degradation will facilitate the emergence of instability at the local level that can spill over to the neighbouring territories. It will therefore be necessary to:

- ensure high projectability and timely intervention;
- contribute to increasing resilience of weak and endangered states;
- have robust capabilities available in the areas of Security Force Assistance and Stability Policing.

Helping mitigate the effects of international competition for resources

International competition for resources will trigger new forms of competition in an attempt to change areas of influence and/or establish forms of monopoly for access to resources. In this context, the military should:

- maintain a credible and technologically advanced deterrence capability;
- ensure security along communication routes, also to counter the possible territorialisation of the sea;
- contribute, within the framework of the main international organisations of reference, to the protection of the global commons.

Adapting the response capacity to cope with extreme natural events

The increased extreme natural phenomena will make it necessary to:

- consider an increased involvement of the military in humanitarian assistance and disaster relief with logistical projection capabilities;
- ensure greater support of /contribution to the defence/civil protection units on the home front;
- assess and adjust the current size of the support component (used in emergency management);
- evaluate the implementation of a response organisation based on the pre-positioning of emergency materials with a planned network of mobilisation in the areas of intervention ("hubs and spokes").

CONCLUSIONS

A TRANSFORMATION PATH FOR DEFENCE

The ability to predict the future has always fascinated humankind. Today, companies and State institutions often ask for predictive studies to obtain helpful information for long-term strategic decisions. This applied to defence, too, for the growing instability that will characterise the near future puts into question the many certainties on which our societies rest, and represent a significant challenge to face.

By applying the Open Innovation paradigm through the involvement of scholars and researchers from academia, industry, and research, reasoning and considerations have been developed to get a better understanding of the future, outline the disruptive changes to adapt quickly, and steer the process of transformation and evolution of security and defence. The analysis is focused on theme areas, namely political, socio-economic, technological and climatic-environmental. It has highlighted the complexity, the interconnections, and the transversal nature of the future challenges and opportunities, and put the scenarios that Italy will face into a national and international perspective – with an accent on EU and NATO ones.

The international geopolitical scenario of 2040 and beyond will be characterised by profound changes and recurrent instability. Dynamic, volatile, and unpredictable phenomena and confrontation between crisis and conflict will be the defining traits, with increasingly blurred boundaries. Demographic changes, urbanisation, social hybridisation, sustainability of the current welfare system, new labour dynamics, and migratory flows will be the factors at the basis of a renewed economic balance. There will be social tensions, identity aggregations of ethnic, religious, national nature that are different from the current ones. Changes to the ethical-value system of reference will be required to define new global arrangements that are intertwined with the clash of values, but national ethics and values will have to be preserved. The anthropogenic factors will be accompanied by climatic and environmental phenomena that will lead to an increase in the demand for resources and manifest or latent forms of competition. Both forms refer to access and management of the planet's limited resources, such as food, water, energy, raw materials, and for the exploitation of new domains, such as space and cyber. The latter two have become more and more accessible by new state and non-state actors. The sense of trust in institutions, a fundamental point a growing society relies upon, will also go through a dynamic and extensive enlargement of the concept of safety, that is, collective to individual.

Given these directions of change, or megatrends, Italy will first have to define the **Level of National Ambition** within the international organisations it belongs to – UN, NATO and the EU – and in the areas where its geostrategic interests are at stake, namely the enlarged Mediterranean and Middle East and North Africa (MENA). Its wellbeing prospects will depend on its ability to exercise an assertive posture internationally as crises and instability are managed through the balanced use of its

Diplomatic, Information, Military and Economic (DIME) tools. They will also depend on the possibility to ensure the supply of primary and energy resources. This new framework will also require to adapt the national and international regulatory framework given the fluid and non-territorial nature of future threats. At the same time, an adequate response will be necessary to face environmental and or pandemic challenges through greater collaboration between Civil Defence and the military component. As a result, specific acquired expertise would be enhanced as specific institutional tasks are executed. However, on the side lines of capacity development, encouraging public debate on the "**Culture of National Security**" appears essential, as it would enhance this specific sector and promote the development of a soft power approach in terms of sense of belonging and national identity.

In this respect, today as in the future, the development of new technologies and the multiplication of disruptive technologies – notably Emerging & Disruptive Technologies - Artificial Intelligence, quantum computers, robotics and autonomous systems, bio and nanotechnology, smart materials, hypersonic technology – will be a significant driving force, for they are modifying and influencing society, the economy, politics, and the military world. The timescale is so accelerated that one has no chanche of grasping change, nor the extent of the consequences. The ability to develop and implement emerging technologies brings into play issues of sovereignty – also known as technological sovereignty – as an essential component of the independence of a state and a fundamental tool to support its political ambitions. Behind these rapid and complex transformations, there are inevitable and profound cultural and social changes that will be reflected on the geopolitical, stability, and security equilibrium. The increasing adoption of artificial intelligence will play a leading role. Together with other technological trends, it will affect multidomain scenarios where people will have to identify a new role for themselves; scenarios in which synergy between technologies and human cognitive abilities will have to find a much required compromise, balance, and advantage through what is known as Human-Autonomous Teaming. There will be ethical questions raised both in the civil and military spheres about the role of technology and its intensive use, to which adequate answers will have to be found by looking to an adaptation of the ethical-legal framework given the growing pervasiveness of the human-machine pair and the ever-closer integration between the parties, from the current master-slave to peer-to-peer relationship.

Cyber and Space domains cross cut the traditional ones and are bcoming more and more important as a place of confrontation among the players across the geostrategic scenario, with significant disruptive impacts on national security and defence. In the cyber field, great emphasis must be placed on the creation of a robust, redundant, and secure info-structure. The 5G/6G, networks, servers, mainframes, cloud, etc. will have to be able to support the pervasiveness of IT services and the internet of things, ensure the necessary resilience to mitigate the vulnerability to which the civil society and defence will be exposed.

The spatial dimension will increasingly become a strategic segment for all public and private activities, with substantial repercussions on the real economy. It will be capable to support the development of cutting-edge technologies, from communications to the management of environmental emergencies, to security needs. It will be necessary to defend national interests and opportunities, carefully assess the risk of space weaponisation or mitigate vulnerabilities such as espionage, sabotage, and the proliferation of satellites and hypersonic weapons.

The convergence of political, social, technological, economic and environmental trends will therefore shape the context of future global security. We will witness the transition to an increasingly complex environment in which the entire "*contested environment*" must be reconsidered with a view to a fluid, continuous and intensive overlap of the "irregular" dimension ("*hybrid*") within a process of progressive evolution of "*Information Age Warfare*" in multiple domains and among domains, through multi-domain and cross-domain operations. Therefore, a comprehensive response will have to be coordinated by a variety of actors, civil and military, state and non-state through whole-of-government approach and whole-of-nation/society approach.

Against this background, **Defence** must be characterised by the ability to fill adaptation gaps and face future challenges, give coherence to the transformation of the military instrument as per technological development trends, deal with environmental sustainability, and strengthen collaboration between public and private sectors. There are some **paths of transformation**, through which the **military instrument** can anticipate times, maintain its technological capabilities and a deterrence posture consistent to pursue its national interests. These paths should focus on the following macro-areas:

THE ARCHITECTURE OF THE MILITARY INSTRUMENT

The Military Instrument will have to adapt to the new role within the organisations and alliances of reference through more diversified and top-notch skills. Spacial attention will have to be paid to technological aspects and the new ethical-legal framework, so as to seeking stronger resilience, as well as sustainability and multidimensionality.

In particular, we will have to:

- create a "instrument of power" for the State that is able to carefully calibrate military response, soft power, and concrete deterrence capabilities, and express them independently. Such instruments would have to be integrated/federated into multinational coalition/alliance military forces to tackle threats that could put national security at risk, both internally and externally;
- achieve greater agility, projection, flexibility, and autonomy to proptly deploy to scenarios of increasing instability, ensure the protection of supply areas/routes, project capabilities and generate effects to protect citizens and national interests abroad wherever they are threatened, also with reference to the capacity and decision-making time of the political leadership;

- prepare for competition in the cyber and space domains by foreseeing new methods and tools that these very domains make available.
- be configured as to meet the needs of environmental sustainability, also through a reduction of one's metabolism/energy needs;
- develop packages of forces with multidomain capabilities that can integrate electronic warfare, cyber, intelligence, psychological operations, and public information enablers;
- implement advanced decision-making, management tools, and AI, without taking any step from the national legal, cultural, and value system.

INVESTMENT IN HUMAN CAPITAL | Recruitment – Training – Leadership

An overall review of human capital management will have to be achieved by investing in training at all levels, from boot camp to advanced leadership training. The resulting military instrument will fit new scenarios, be open to innovation, be inclusive in terms of multiculturalism and participative, while enjoying effective public-private partnerships.

In particular, we will have to:

- reshape recruitment dynamics and adapt the related narratives to embrace the evolution of society in a multi-ethnic and multi-valued perspective, while preserving the foundations of our national identity and values;
- review training at all levels through innovative tools to prepare military and civilian personnel to deal with a world in continuous evolution, as well as create a mindset open to innovation;
- train to deploy in urban environments – i.e., an environment with high housing density or with direct or indirect repercussions on the systems and dynamics of the urban macro-agglomerations of the future where any conflict, tension, risk, or threat may arise – also by using new technologies, such as Robotic & Autonomous systems, Non-Lethal Weapons, etc.;
- implement a adequate and structured training campaign for future leadership to learn how to use technology as a strategically indispensable enabler.

TECHNOLOGICAL DEVELOPMENT

Anticipate the future through the digitisation process rather than adapt to it. Make the process predictive to guide the technological development within the military instrument and therefore its transformation. In addition, establish a long-term plan today to create an adequate military instrument tomorrow thanks to more effective and streamlined synergy with the research sector and a more agile procurement structure. In particular, we will need to:

- intercept emerging and disruptive technologies that will change the character of conflicts, either hybrid, cyberwarfare, weaponisation of space, etc., to ensure situational awareness and situational understanding in a multidomain key are maintained;
- invest in research and development to maintain an adequate technological advantage as well as in new applications for the Internet of Things/Internet

Battlefield Things and 5G/6G technology, or even in the more traditional fields, where new competitors could fill the cognitive/capability gap in the future;

- promote the electromagnetic (Electronic Warfare), CEMA (Cyber and Electromagnetic Activities), hypersonic weapons, underwater technologies, and innovative technologies (Cloud Computing, Artificial intelligence and Machine Learning) fields;
- face the new challenges of a constantly changing context with innovative responses, speeding up the elaboration, decision-making and approval processes;
- define an investment strategy and the remodelling of military procurement to acquire technologies in a dynamic and streamlined manner, on an equal foot with the leading international competitors;
- develop increasingly eco-sustainable capabilities/structures, such as smart bases, biofuels, and hybrid propulsion.

REDEFINITION OF THE ETHICAL-LEGAL FRAMEWORK

We will need to develop a mindset open to innovation by revising the ethical, moral, and legal frameworks to implement tools and methodologies that meet the needs of the new challenges. In particular, it is necessary to:

- launch a broad debate with all the parties involved on the ethical implications the use of new technology tools, especially AI and all its applications such as autonomous systems, could have;
- review the ethical-moral parameters of reference, adapt them to the evolution of a multi-ethnic and multi-valued social system in continuous evolution, while maintaining the national cultural identity;
- adapt the legal framework to the new scenarios so that the military instrument is flexible, effective and adaptive in both the acquisition and deployment phases. This includes a decision-making process that is adequate in speed, complete, and effective considered the opponents;
- promote an ethical-legal international law framework to protect the Global Commons, counteract territorialisation phenomena, protect the Sea Lines of Communication (SLOC) and energy infrastructures on which the country depends;
- support regulatory development to support a larger role for the State in the international economic and political fields and to deploy its military force for international law enforcement and maritime security in all crises, from highest intensity to stabilisation.

ANNEX A

"TRENDS & IMPLICATIONS" MATRIX

	TREND	IMPLICATION	
GEOPOLITICAL	The resurgence of Great Power Competition requires the definition of the national interests' perimeter	**SECURITY**	
		Exercise credible deterrence internationally	Strengthen and secure a credible deterrence system within well-established alliances (UN, NATO, and especially EU)
			Maintain a leading role in responding to crises through the balanced use of tools, such as the Diplomatic, Information, Military, and Economic (DIME), as per the Whole-of-Government Approach
			Increase bilateral and multilateral initiatives that would lead to a larger international role in protecting the national interests
		Build a proactive approach with a view to autonomous procurement of primary and energy resources	Assume an assertive role in the international economic and political fields
			Safeguard the national interests and protect supply routes also through International Law Enforcement and Maritime Security initiatives
			Act together with third countries within well-established organizations (UN, NATO, and especially EU) and through bilateral and multilateral collaboration
		DEFENCE	
		Develop a resilient, versatile, and interoperable military instrument	Have a versatile, interoperable, and increasingly joint military instrument that can operate credibly and synergistically with allies in every context, from high-intensity to stabilization scenarios
			Aim for resilience and specific active redundancy in the military within the broader framework of national resilience to react to crises
			Ensure the military is adequately autonomous in terms of presence, deterrence, and protection to achieve interoperability with multinational coalition/allied forces
			Confirm a "conventional" component is essential and adapt its technology to ensure it can access areas subject to Anti Access Area Denial (A2AD)
	Competing value systems can fuel global geopolitical fragmentation by weakening the role of International Organizations	**SECURITY**	
		Promote the adaptation of the ethical-legal framework to the new paradigms of armed conflicts	Promote the protection of national interests in adapting international law
			Arrange mitigating measures for the enforcement of International Law in an asymmetric mode (Lawfare)
			Oppose the territorialisation of the Global Commons, of the High Seas, Space, and Cyber
		DEFENCE	
		Promote the development of national defence instruments in a multi-domain perspective for their use in hybrid situations	Increase command and control capability, and decision-making agility to maintain the required information superiority
			Enhance the intelligence function by means of AI systems to automate processes, particularly data collection, data management exploitation, and summarization of information
		Promote Security Force Assistance and Stability Policing	Use the military component across the territory to prevent and/or stabilise crises effectively
			Cooperate to implement the level of security and mediate with a multitude of actors
	Disseminating activities of a shared "culture of safety" to feed the way of conceiving the relationship between institution and Citizen	**SECURITY**	
		Promote and enhance the culture of national security and Soft Power in the public debate	Implement Strategic Leadership by facilitating decision-making processes
			Promote interagency integration with academia and innovation to identify the possible futures and seize the opportunities
			Support the development of Soft Power by tackling 'Influence Operations' as a phenomenon of socio-political distortion and a threat to national security
		DEFENCE	
		Develop the ability to operate in Information Age Warfare and generate effects in the physical, virtual, and cognitive dimensions at the same time	Develop multi-domain force packages capable of integrating EW, cyber, intelligence, psychological operations, public information, etc. component enablers
			Develop joint influence through soft power, social media, information operation, and ICT technology that are integrated with the forces on the ground in real-time to influence trends and decision-making processes that impact consent for alliances
	The technology-driven system, related to the redistribution of geostrategic power, could become a real system of export and propaganda, configuring itself as a weapon/threat, which is not only military, but also economic, technological and sanitary	**SECURITY**	
		Use Artificial Intelligence to understand and predict behaviour	Realign intelligence resources in a preventive and predictive perspective, identify network/node models where autonomous capacity and decision-making are present in all levels
			Encourage dialogue with foreign realities to develop innovation Labs where digital technologies can be implemented, and meet the demand for services and systems for national security and the business world (SMEs and start-ups)
		DEFENCE	
		Promote development in the cyber, space, missile, electromagnetic, and underwater domains	Develop an autonomous ability for military cyber defence as a tool that adds to the full range of military operations and complements the national cybersecurity system
			Identify space as a strategic sector with a decisive role in all activities of a Nation, both public and private
			Promote the review of an international ballistic missile defence system (NATO-EU)
			Invest in electromagnetics (Electronic Warfare), CEMA (cyber electromagnetic activities), hypersonic weapons, underwater, and innovative technologies, such as cloud computing, artificial intelligence, and machine learning.

	TREND	IMPLICATION	
SOCIOECONOMIC	In the increasingly complex societies pf the future, culture, ethnic groups, and religions will mix in a complex process of acceptance and integration	**SECURITY**	
		Promote change towards new balances of a complex society	Adapt to the new value system by balancing differences and integration
			Manage information by overcoming the loss of trust in institutions
			Prepare a renewed mindset of the ruling class that is open to complexity, challenges, and future opportunities
		DEFENCE	
		Adapt the skills, abilities, ethical and regulatory framework within which the Armed Forces will operate	Adapt the military instrument through diversified and continuously updated skills
			Adopt a dynamic and flexible regulatory framework due to the liquid and non-territorial nature of future hybrid threats
	Increased tendency to aggregate into large urban units with enormous suburbs in which the lower social, economic and cultural perspectives will exacerbate polarization and social tension phenomena	**SECURITY**	
		Adapt to the characteristics of an urban environment	Develop a renewed protection system
			Pursue the development of smart cities
		DEFENCE	
		Reshape training courses at all levels with suitable regulatory tools	Remodel training courses, doctrine, training, employment, equipment to operate in urban contexts
			Prepare the leadership for new scenarios with new regulatory tools open to renewed synergies
	The need for protection will constantly evolve into an increasingly dynamic society, while overlapping the public world's cultural, religious and social dimensions with those of the private one, the state systems with non-state actors.	**SECURITY**	
		Develop new security paradigms for the new context	Develop a legal framework covering cybersecurity (data)
			Forecast new dynamics of spending for security
			Develop a sense of identity allowing the engagement of all stakeholders in the security sector
			Create forms of collaboration to manage security at overlapping levels
		DEFENCE	
		Adapt the military instrument to new security paradigms	Prepare for the increasingly extensive and synergistic use of all security forces to protect new areas
			Prepare for the public-private mix (PMSC: Private Military Security Companies)
	The integration of the new socio-economic dynamics will require an adaptation that contemplates integrating values with a mindset open to innovation with its disruptive applications	**SECURITY**	
		Intercept the new economic and labour dynamics	Search for the balance between globalization and localization
			Identify new needed skills
			Identify and protect "golden power" technologies
			Develop alternatives in an industrial-based Defence perspective
		DEFENCE	
		Prepare to incorporate the new social and professional characteristics of environment of reference	Adapt the dynamics of recruitment to the new value system by contemplating cultural, religious, and gender diversity.
			Facilitate the implementation of disruptive technologies, which will oblige to develop and resolve an ethical debate first and them to create a legal framework
			Encourage a mindset open to innovation

	TREND	IMPLICATION	
TECHNOLOGICAL	The need to adapt the ethical-legal framework to the rapid technological development is something people feel strongly, due to the growing pervasiveness of artificial intelligence or the subsequent man-machine relationship, and the closer and closer integration among the parties	**SECURITY**	
		Encourage the development of an ethical-legal framework suitable for technological development	Change the role in the dynamics to use human resources
			Optimize the increase in life expectancy through tailored medical solutions and greater integration of smart materials into biological tissues (tracing - microchips)
			Evaluate the redefinition of the "what is right and what is wrong" concept by changing the perception of technology
		DEFENCE	
		Implementation of artificial intelligence across Defence	Promote the use of AI by providing for its implementation at all levels and sectors from strategic to tactical, from logistic to organizational
			Acquire professional and technological skills to collect, classify, archive, analyse, correlate and (safely) use large amount of data
			Outline a revision of the people's role on the battlefield through Human-Machine Teaming bound to the principle of "man in the loop" (short term). This could evolve into the man on the loop principle (long term) as a central and unavoidable factor of any soldier
	Cyber and space add to the traditional domains, assume increasing importance as a place of competition among the actors across the geostrategic scenario where crises are solved. The ensuing significant impact on the military instrument will force the latter to adapt to the rapid technological development in these sectors	**SECURITY**	
		Consider cyberspace as a place for competition	Reduce vulnerability by strengthening the resilience of both systemic networks and cultural values
			Integrate the human element with an intelligence, surveillance and reconnaissance network consisting of overlapping systems of sensors and autonomous systems to achieve correct situational awareness andeffectively assisting decision-makers
			Heavily implement those technologies that can amplify the ability to predict, grasp, and analyse transformation indicators and mitigate the growing influence on public opinion of what are known as techno-companies
		Increase awareness of the role of the Space	Develop an adequate capacity to appreciate the threat to and from space (Space Situational Awareness - SSA and Space Surveillance and Tracking - SST) and conduct space operations
			Defend national interests and opportunities such as the exploitation of natural resources deriving from asteroids and planets (space mining)
			Assess the risk of space-related weaponisation versus increasing exposure and new systemic risks and vulnerabilities, such as espionage, sabotage, and proliferation of satellites and hypersonic weapons
		DEFENCE	
		Assume a relevant role in the Space and Cyberspace domain	Strengthen resilience to mitigate the vulnerability to which the military is exposed
			Define an organizational and cognitive approach for the early identification in the spatial domain that is comprehensive and highly predictive
			Assume a primary role in the cyber domain, which will become a fundamental element of the future hybrid conflict due to uninterrupted attacks on commercial networks and mission-critical info-structures, including during peacetime
		Strengthen Research and Development	Implement a R&D investment strategy to identify priorities and the most relevant skills for Defence continuously and in a targeted manner
			Explore collaboration with other countries so that the specialization of individual states becomes an advantage for all allies
			Increase cooperation between the public and private sectors to achieve the technological advantage with a view to both the rationalization of resources and the development of human capital
	Quantum technology is supported by a growth trend that highlights implications of such magnitude as to reasonably suggest that we are close to the so-called quantum revolution	**SECURITY**	
		Prepare for the dissemination of quantum technology	Search innovative solutions to store and analyse the large amount of data that will be generated and will feed quantum systems
			Resolve the dichotomy between 'trust' (trusting systems without fully understanding how they work) and 'reliance' (relying on systems after ensuring their compliance)
			Investing in research and development of a new generation of microelectronic devices that can lead to an increase in computer power
			Identify a strategy to use Emerging (and) Emerged Disruptive Technology (E2DT) and regain the initiative, through multilateralism, towards competitors who have a leading edge
		DEFENCE	
		Improve Command and Control skills	Identify the main technological areas that will modify the concept of battle to improve situational awareness and situational understanding in a multi-domain environment
			Use emerging technologies to make the tasks of expeditionary forces easier through greater dynamism and agility, reduced logistic footprint, and ability to operate in nearly-zero-energy structures
			Prepare response to direct energy weapons and/or hypersonic weapons, autonomous systems and sensors, computers and quantum systems, or technologically advanced soldiers

	TREND	IMPLICATION	
ENVIRONMENTAL	Reduce greenhouse gas emissions to slow down the degradation of natural environment. Subscription to international sustainability programs (UN Agenda 2030 and EU Green Deal) will require significant efforts to reach the assigned objectives	**SECURITY**	
		Support the transition to holistic sustainability	Acquire strategic skills in the fields of technology, energy and infrastructures
			Reduce the strong national dependence on imports and develop circular economy
			Carry out a transformation, including in its cultural aspects, that is energy-oriented and implements green technologies
		DEFENCE	
		Increase the operational agility of the military	Encourage culture, processes, and operational structures aimed at perceiving and evaluating emerging threats
			Increase operational autonomy by implementing new technological solutions and reducing the logistic footprint
			Focus the modernization and transformation process on the principle of energy efficiency, also involving infrastructures sector (smart bases), biofuels, hybrid engines
	The progressive loss of biodiversity and the advance of biological research will increase the risk of possible natural and/or artificial pandemics/epidemics	**SECURITY**	
		Develop a strategic organization for biodefence	Increase international cooperation for the development of common control programs on advanced biological research
			Develop a national strategic organization of biodefence
		DEFENCE	
		Increase the ability to counteract biological threats	Encourage the search for new organizational/capacity solutions and in the development of related expertise
			Integrate the military organization of observation and reporting of CBRN events (CBRN Warning & Reporting) with the civilian component
			Strengthen health support skills
			Strengthen strategic biocontainment transport to include fellow nationals abroad
	The factors related to climate change, demographic growth and scarcity of primary resources will spread instability in the MENA region and the wider Mediterranean	**SECURITY**	
		Prevent the spread of instability as a result of the complexity of factors in the wider Mediterranean	Seek an integrated and multidisciplinary approach to be implemented at a supranational, multilateral, and bilateral levels
			Implement a shared development strategy in favour of weak and at-risk states
			Strengthen cooperative dialogue on security by increasing cooperation activities, especially in the field of security and defence
			Create the ability to adapt and intervene promptly in different operational scenarios
		DEFENCE	
		Counteract the onset and dissemination of instability in the region	Guarantee high deployability and promptness of intervention
			Contribute to increasing the resilience of weak and at-risk states
			Ensure a robust capacity in the areas of Security Force Assistance and Stability Policing
	Tensions from the competition for resources, including across new territories – such as polar and remote areas and, in the future, space – will translate into the possible redefinition of the spheres of influence	**SECURITY**	
		Mitigate the escalation in the international competition for resources	Identify clear strategies for the protection of national interests
			Promote reforms that protect the global commons and common resources (from the oceans to the atmosphere and space)
			Ensure within international organizations and/or coalitions the strategic ability to mitigate/counter possible monopolistic positions in the exploitation of resources
			Guarantee the defence of sovereignty and the protection of national interests (also through the protection of communication routes and the ability to project all the elements of national power, including military power, within a single strategy)
		DEFENCE	
		Contribute to the mitigation of the effects in international competition for resources	Maintain a credible and technologically advanced deterrence capacity
			Guarantee the safety of communication routes to prevent possible phenomena of territorialization of seas
			Contribute to the protection of the global commons within the international organizations of reference
	The overall effects of climate change will contribute to generate extreme natural phenomena, especially at the land-sea interface	**SECURITY**	
		Plan the response to extreme natural events and increase systemic resilience	Plan the national response capacity through the drafting and continuous update of specific contingency plans
			Reassess the current Civil Defence system by taking into account the real level of commitment required to individual operational components
			Verify the compatibility of the requested contribution to operational components and adopt specific adaptation measures
		DEFENCE	
		Adapt the ability to respond to extreme natural events	Prepare for a greater level of engagement in Humanitarian Assistance and Disaster Relief operations
			Request greater support for the Defence and Civil Protection divisions
			Evaluate and possibly adjust the sizing of the support component used in emergency management
			Evaluate response organization based on a hub and spokes system

ANNEX "B"

WORKING METHODOLOGY & REFERENCE

This Concept has been drafted by the Committee for Defence Innovation, also known as "Project Group for the Innovators Team", or by its Italian acronym, COMIND. The COMIND was established to project the military instrument into the future to develop and integrate the Strategic concept of the Chief of Defence Staff.

Embracing the Open Innovation paradigm through the involvement of a network of experts from academia, industry, and research within the Centre for Defence Innovation (INNOV@DIFESA), the future has been analysed from a 2040 and beyond perspective. Multiple ideas and diverse perspectives from different environments have been scrutinised in weekly meetings and discussion sessions, interspersed with regular summarisation and sharing across the Armed Forces.

From the methodological point of view, th implementation of the Concept Development & Experimentation (CD&E) method, specific contributions from experts were collected and disseminated, international sources on Futures Studies[44] were accessed, and the results of the participation in international NATO and EU activities on the above-mentioned topics were shared.[45]

Specific assumptions with a purely national connotation ("medium regional power", "unchanged international position", "legitimacy of institutions", etc.) have led the early analysis of future perspectives. A subset of trends was identified together with risk factors and opportunities connected to the national interest. Several theme-specific workshops have followed that were supported by scenario-based discussions and questionnaires on alternative scenarios with probability allocation. Thanks to alternative analysis techniques, we were able to identify future paths, interpret possible disruptive changes and identify possible adaptation options.

The future scenarios were then broken down and developed into main geopolitical, socio-economic, technological, and environmental trends in a national perspective and – through a specific phase of convergence – checks were carried out on the consistency of the trends and implications identified with the current directions of the Armed Forces.

In a nutshell, the document represents the sharing of perspectives on the future that involved the different souls across Defence and the civil society, with a view to guiding the choices for transformation and change in the field of national security and defence.

[44] Futures studies are understood as the set of methodologies to predict and identify factors and events that may affect the future environment of organisations.
[45] NATO ACT *Strategic Foresight Analysis* (SFA) ed EU *Global Compass*.

Below is the list of experts who have provided continuous and extensive support to the development of the Concept, to whom the Defence Staff expresses its recognition, and some bibliographic reference.

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- Francesca STERZI, freelance advisor and expert in security, defence, and international staff training within civilian and military institutions.
- Andrea STRIPPOLI LANTERNINI, independent researcher.

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