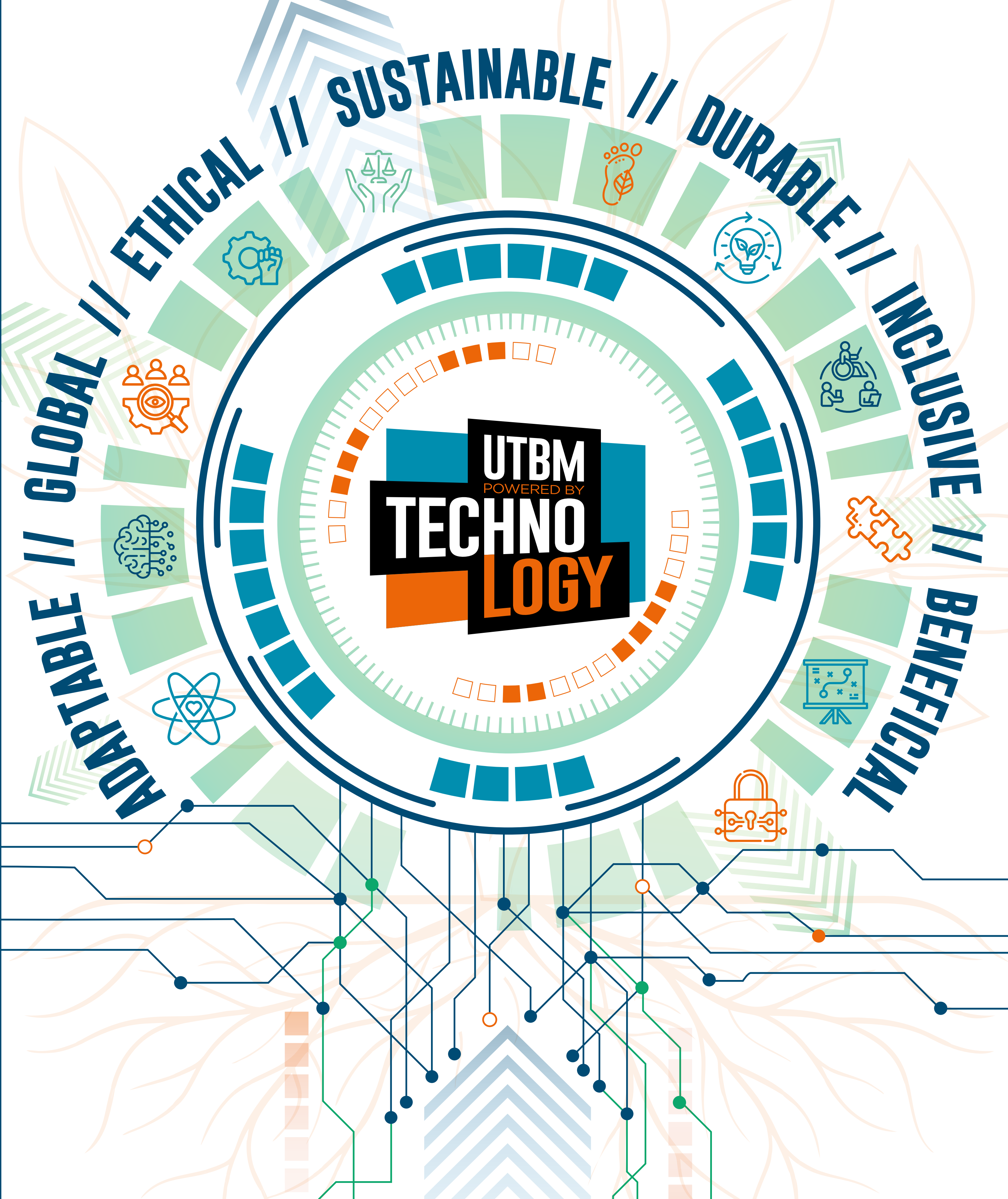
BUILDING
RESPONSIBLE TECHNOLOGY

MANIFESTO OF THE UNIVERSITY OF TECHNOLOGY OF BELFORT-MONTBÉLIARD



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The University of technology of Belfort-Montbéliard (UTBM) asserts through this manifesto its vision of technology which, far from being limited to isolated technical solutions, embraces a holistic, global and sustainable vision.
This manifesto affirms the ethical and responsible framework for the development and use of technologies that UTBM uses and promotes.
This manifesto emphasizes the necessity of an inclusive, sustainable, and transparent approach for technology to contribute in a way that benefits everyone.

WHAT IS TECHNOLOGY?

Technology is the set of knowledge, skills, methods, and tools that humans use to design, develop, and operate systems, devices, and processes aimed at meeting specific needs or solving concrete problems. It encompasses not only physical objects, such as machines, devices, and infrastructures, but also immaterial processes, such as software, algorithms, and protocols.

Structured around innovation and creativity, technology is constantly evolving, influenced by scientific advances, social needs, economic constraints, and cultural dynamics. It plays a central role in the development of human societies, transforming how individuals interact with their environment, produce goods and services, and communicate with one another.

Technology also raises ethical, philosophical, and environmental questions. The development and use of technologies must be carefully considered and regulated to ensure that they serve the collective well-being while minimizing potential risks and negative impacts on society and the planet. Thus, technology is both a driver of progress and a constant challenge, requiring continuous vigilance and adaptation.

1. PREAMBLE

In this first quarter of the 21st century, humanity stands at a critical crossroads, facing a series of unprecedented challenges that threaten not only our natural environment but also the stability of our civilization and the future of generations to come. Among these challenges, the climate and ecological crises stand out due to their scale and urgency, but they are not alone. Energy crises, biodiversity loss, increasing pollution, depletion of natural resources, as well as economic and social inequalities, add to an already long list of complex and interconnected problems that require a collective, coherent, and above all, measured response.

In this increasingly complex context, technology is a key player, not only because of its ability to provide innovative and potentially transformative solutions but also because of its omnipresence in our modern daily lives. Recent technological advances in fields such as renewable energy, artificial intelligence, biotechnology, and global communication networks offer a wide range of possibilities to mitigate the effects of current crises. For example, smart energy management systems or advanced recycling techniques are tools that could significantly contribute to reducing our ecological footprint and to help us to transition towards a more sustainable model.

However, it is crucial to recognize that technology, despite its immense potential cannot, alone, be a panacea capable of solving all our problems. Technological solutions, no matter how sophisticated, must be integrated into a broader framework that includes coherent public policies, appropriate education, and a profound radical shift in individual and collective behavior. Indeed, technological innovation must be accompanied by strong political will and a commitment to promoting development that is both sustainable and equitable. This involves not only setting clear and ambitious goals for reducing greenhouse gas emissions or preserving ecosystems but also establishing regulatory and financial mechanisms that encourage innovation while limiting potential risks and abuse.

Moreover, it is essential to carefully assess the impacts of new technologies on the environment and on society as a whole. While some technologies may offer proven solutions to immediate challenges, they can also generate negative externalities, notably by increasing our dependence on scarce resources or exacerbating social and economic inequalities. Therefore, technological solutions must be sustainable in the long term, not only environmentally, but also economically and socially. They must contribute to the creation of a development model that is resilient, inclusive, and capable of adapting to the inevitable changes that will accompany the coming decades.

Technology undoubtedly represents a powerful tool in humanity's arsenal for addressing contemporary challenges. However, its effectiveness depends on our collective ability to intelligently integrate it into a comprehensive, holistic approach. This involves combining technological innovation with appropriate regulation, strong social engagement, and a long-term vision that places the interests of all stakeholders above specific parties. While technology can be a crucial lever in building a more sustainable future, it should not be seen as an end but rather as a means, among others, to achieve harmonious and balanced development, respectful of our planet's limits and addressing the well-being of all its inhabitants.

2. OF THE VERY NOTION OF TECHNOLOGY

2.1. Technology in ambivalence

In France, the perception of technology is often ambivalent. It is frequently seen as synonymous with technoscience and associated solely with advanced or cutting-edge techniques. This narrow perception can limit our understanding of the scope and impact of technology in our daily lives and in society.

Technology is often viewed as a purely scientific field, tied to the latest and most sophisticated innovations. This perspective can lead to an overestimation of the capabilities of modern technologies to solve all problems in isolation. It is important to remember that technology, while a driver of innovation, must be integrated into a social, economic, and environmental context to be fully effective.

Advanced or cutting-edge techniques, such as artificial intelligence, nanotechnology, or biotechnology, often capture media and public attention. However, it is crucial to recognize that technology also includes more modest but equally important innovations, which gradually improve daily life and meet essential needs in a sustainable manner.

2.2. A definition of technology

According to Guy Denielou[1], technology is the name of science when it addresses the products and processes of human industry. It is therefore situated at the intersection of engineering science and the human and social sciences. This definition highlights the intrinsic interdisciplinarity of technology and its central role in industrial and social development.

Engineering science includes disciplines such as mechanics, electronics, computer science, and materials science, among others. They provide the theoretical and practical foundations necessary for designing and developing technologies. Collaboration between these disciplines is essential to create innovative and effective solutions.

The human and social sciences, such as sociology, anthropology, economics, and ethics, among others, play a crucial role in understanding the impacts of technology on society. They help assess the social, economic, and ethical consequences of technological innovations and guide their development to meet human needs in an equitable and inclusive way.

1 Guy Deniélou (1930-2014) was a French engineer and academic, recognized for his major contributions to higher education and research in France. After earning his engineering degree, he embarked on an academic career marked by a deep commitment to innovation in teaching. In 1972, he became the first director of the University of Technology of Compiègne (UTC), a pioneering institution he helped to establish. Under his leadership, UTC quickly became a model of academic excellence and interdisciplinary research, closely linking scientific and technological education with industrial needs. Guy Deniélou played a crucial role in developing an innovative teaching approach, focused on student autonomy and integrating innovation at the core of the university curriculum. He led UTC until 1987.

2.3. On complexity and technology

Complexity refers to the quality of a system or phenomenon whose characteristics emerge from the interactions between many components or variables, making it difficult to understand, predict, and manage its overall behavior. It involves the presence of nonlinear relationships, dynamic interactions, and adaptability, leading to a richness of unpredictable behaviors and effects.

The main elements of complexity are:

→ **The interdependence of the components of a complex system.**
These components are highly interconnected, and changes in one part of the system can influence other parts in unpredictable ways;

→ **Non-linear interactions**
between the components, which are not simply proportional. Thus, small changes can lead to disproportionate effects, and interactions can be reciprocal and amplifying;

→ **The emergence**
of new global properties of the system resulting from local interactions between components, often in unpredictable ways. These properties cannot be directly inferred from the properties of the individual elements;

→ **Adaptability and evolution,**
which are capacities of complex systems, in response to internal or external changes. This adds to their unpredictability;

→ **Dynamics and uncertainty**
also characterize complex systems.

The objectives of studying complexity, an integral part of any technological development, are therefore:

→ **Understanding,**
by developing a deep insight into the interactions and relationships within a complex system;

→ **Prediction,**
by attempting to anticipate behaviors and emerging dynamics, despite the unpredictable nature of the system;

→ **Management,**
by designing management strategies adapted to complex systems, considering their dynamism and interdependence;

→ **Agility,**
by facilitating the adaptability of systems and strategies in the face of continuous evolution and uncertainty.

3. THE VISION OF TECHNOLOGY AT UTBM

Technology, envisioned in its global dimension, is defined as an integrated system of knowledge, practices, and tools that interact and mutually reinforce each other to transform human and environmental realities. This holistic vision considers technology not as a simple collection, a mere juxtaposition, of techniques and tools, but as a complex ecosystem where each component plays an interdependent role and where interactions create new dynamics and possibilities.

3.1. Concept of holistic technology

The concept of holistic technology is based on the idea that technological solutions must be developed and implemented while taking into account all environmental, social, economic, and ethical aspects. Rather than focusing solely on technical innovation, a holistic approach integrates technology into a broader framework, where it is seen as a component of an interconnected system. This approach aims to achieve efficiency while minimizing risks and negative impacts, thus contributing to sustainable and balanced development for all society. The following three pillars are considered:

➔ Interconnectivity
Each technological element is linked to others, forming a dynamic network where interactions are essential for overall functioning. For example, the Internet of Things (IoT) illustrates this interconnectivity, by connecting various devices to create «smart» systems

➔ Technological ecosystem
Technology is viewed as an ecosystem where hardware, software, data, and users constantly interact. These interactions produce emergent effects that could not be achieved by isolated components;

➔ Indispensable co-evolution
Technologies evolve together and mutually influence their trajectories. For example, developments in artificial intelligence depend on progress in data processing and computing infrastructure, and vice versa.

3.2. Holistic dimensions of technology

Holistic technology embraces an integrated vision where technological solutions are assessed and implemented by considering several essential dimensions: environmental impact, social well-being, economic viability, and ethical implications. This multidimensional approach ensures that technological innovations not only solve isolated technical problems but also contribute in a balanced and sustainable way to the overall progress of society, considering the complex interactions between these various aspects:

➔ Systemic dimension
Technology encompasses complex systems where each part contributes to the whole. An example is the «smart grid» that integrates energy production, distribution, and consumption in a coordinated manner to optimize efficiency and sustainability;

➔ Sociotechnical dimension
Technology is inherently linked to social structures and human behavior. It influences and is influenced by cultural, economic, and political contexts. Social networks, for example, are not just technological platforms but spaces where social dynamics manifest and transform;

➔ Ecological dimension
Technology interacts with the natural environment, altering ecosystems and being altered in return. Environmentally friendly technologies illustrate this dimension by integrating ecological considerations into their design and operation.

3.3. An integrated approach to technology

The integrated approach to technology involves creating interconnected systems and applying interdisciplinarity. By combining different disciplines and connecting technologies, this approach enables the design of more coherent and effective solutions to the complex challenges of our time. It fosters a synergy between scientific, technical, economic, and social fields, ensuring that innovations are not isolated but well-integrated into a broader framework capable of addressing global needs in a harmonious and sustainable way:

➔ Integrated systems
Technology can function as integrated systems, where subsystems align to achieve global objectives. For example, an integrated healthcare system uses information technology to coordinate patient care, diagnosis, treatments, and follow-ups coherently and effectively;

➔ Interdisciplinarity
Modern technological development requires an interdisciplinary approach, combining knowledge and techniques from various scientific and technical fields to solve complex problems. Biomedical technologies, for instance, require collaborations between biology, chemistry, engineering, and computing.

3.4. Implications and challenges of a holistic vision of technology

Adopting a holistic vision of technology means considering not only technical advances but also their repercussions on the environment, society, and the economy. This global perspective raises crucial issues such as managing long-term impacts, ensuring equitable access to innovations, and addressing the ethical responsibility of those involved. By integrating these dimensions, a holistic approach ensures that technologies contribute in a balanced and sustainable way to collective well-being, while anticipating and minimizing potential risks:

➔ Innovation and adaptability
A holistic vision of technology fosters innovation by encouraging synergy between different technological domains. It also allows greater adaptability to rapid and unforeseen changes;

➔ Ethical responsibility
Considering technology holistically entails increased ethical responsibility, as the impacts of technologies are multiple and interconnected. This requires reflection on long-term consequences and consideration of the impacts on all stakeholders;

➔ Sustainability
A holistic approach to technology emphasizes sustainability, aiming to minimize negative environmental impacts and promote sustainable practices. Technologies must be designed not only to meet current needs but also to preserve resources for future generations.

3.5. Technology at its necessary minimum

UTBM advocates for technology that meets the necessary minimum, developed in response to real needs while ensuring a judicious use of resources. This means avoiding technological excesses and redundancies, and focusing on solutions that bring real added value while using the fewest resources possible. Technology must thus be developed to address the real needs of individuals and communities. This includes solutions to improve quality of life, health, education, and environmental sustainability. Technological projects should be evaluated not only in terms of technical feasibility but also in terms of their social and environmental impact. A reasoned use of resources implies efficient and frugal management of materials, energy, and space. It is essential to minimize waste, maximize energy efficiency, and promote the recycling and reuse of materials. Technologies should be designed to be sustainable, repairable, and scalable to extend their lifecycle and reduce their environmental impact. In summary, the notion of «technology at its necessary minimum» is based on the idea that technological solutions should be precisely adapted to the specific contexts in which they are deployed. This means developing technologies that:

➔ Effectively meet the real needs of users;
➔ Minimize the ecological footprint and use resources sustainably;
➔ Are accessible and appropriate to the users' socio-economic context;
➔ Integrate sustainable life cycles, including maintenance, recycling, and waste management.

3.6. Technology at the service of humanity

Technology must serve humanity and contribute to its progress. This means it should be developed to improve well-being, health, education, and social inclusion. Technology must also respect ethical values and fundamental rights, ensuring dignity, freedom, and justice for all.

Technology should thus contribute to improving individuals' physical, mental, and social well-being. This includes innovations in health, nutrition, housing, and leisure. Health technologies, for example, can provide more accurate diagnoses, personalized treatments, and remote care, improving access to healthcare and patients' quality of life.

Technology should also play a key role in education, offering tools and resources for personalized learning accessible to all. Additionally, technology should be developed to be accessible to people with disabilities, the elderly, and marginalized populations, ensuring a more equitable and inclusive society.

3.7. Technology as respectful as possible to the planet

Technology must respect the planet by minimizing environmental impacts and promoting ecological sustainability. This includes, for example, reducing greenhouse gas emissions to combat climate change, protecting biodiversity, and sustainably managing natural resources.

Technologies must be developed to reduce fossil energy consumption and increase the use of decarbonized energy. This includes innovations in transportation, industry, agriculture, construction, etc.

Moreover, technology should contribute to biodiversity protection by minimizing impacts on natural ecosystems and promoting sustainable practices. This includes solutions for habitat conservation, pollution reduction, and sustainable land and water resource management. Environmental monitoring technologies, for example, can help detect and prevent threats to biodiversity.

Finally, the sustainable management of natural resources is essential to ensure their long-term availability and to preserve ecosystems. Technologies must be developed to optimize resource use, reduce waste, and promote recycling and reuse. Innovations in agriculture, forestry, and fisheries can contribute to more sustainable management of land and aquatic resources.

4. THE NECESSITY OF AN ETHICS OF TECHNOLOGY AND THE RESULTING REQUIREMENTS

4.1. A Definition of technology ethics

The ethics of technology can be understood as a branch of moral philosophy that examines the implications and consequences of technologies on the environment, society, and individuals. At a first level, it aims to ensure that the development and use of technologies respect moral values and fundamental rights, and contribute to general well-being without causing harm or injustice. At a second level, it seeks to anticipate how the introduction of new technologies transforms the norms and practices of stakeholders, the «thetic landscape» [2], within the targeted sphere of activity.

Technology ethics draws upon principles of moral philosophy such as respect for human dignity, justice, responsibility, and sustainability. It analyzes how technologies can be developed and used to promote the common good, protect individual rights, and prevent environmental and social harm.

Technology ethics examines the implications and consequences of technologies at various levels: individual, societal, and environmental. This includes evaluating the risks and benefits of technological innovations, assessing social and economic impacts, and considering environmental effects. It also encourages stakeholder participation in the technological development process to ensure that diverse perspectives and concerns are considered.

4.2. Integrating ethics into technological development

Integrating ethics into technological development is crucial to ensuring that technologies are developed and used responsibly and equitably. This involves adopting deontological practices throughout the lifecycle of technologies, from design to use, including research and development.

Ethical practices in research and development include respecting the norms of informed consent, protecting personal data, and evaluating the social and environmental impacts of technologies. Researchers and developers must be trained in the ethics of technology and encouraged to adopt a reflective and critical approach in their work.

The participation of stakeholders is essential to ensure that technologies address the needs and concerns of society. This includes, as much as possible, consulting local communities, civil society organizations, policymakers, and experts in relevant fields, through workshops as well as field surveys conducted in immersion within usage contexts. Stakeholder participation allows for the gathering of diverse perspectives and ensures that technological decisions are made in a transparent and inclusive manner.

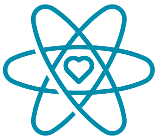
Responsibility and transparency are key principles of the ethics of technology. Technology developers and users must be accountable for their actions and their impacts. This includes transparent communication of the risks and benefits of technologies, as well as a commitment to minimize negative impacts and maximize benefits.

2 The notion of a «thetic landscape» refers to something that is clearly and explicitly stated or posed, often in the context of an idea, a thesis, or a proposition. It involves presenting something as a declaration or a stance on a particular subject. In philosophy, the term «thetic proposition» is sometimes used to describe a statement that stands out for its clarity and assertive nature. As an example, the statement «Climate change is primarily caused by human activities» is a thetic proposition. This statement explicitly presents a precise thesis, which can then be discussed, proven, or contested. In summary, a «thetic landscape» refers to something that affirms a clear idea, much like a declaration or a proposition that emphasizes an opinion or a fact.

4.3. UTBM imposes 11 requirements on itself

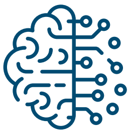
The eleven requirements that we set for ourselves in regard to technological development reflect our fundamental values. These can be categorized as goal-based requirements and method-based requirements.

Goal-based requirements are:



1. Education and awareness of technology requirement

It is essential to promote education and training on technologies and their ethical implications at all levels of society to encourage informed and responsible use.



2. Social justice and global equity requirement

Technologies must promote social, economic, and global justice, while respecting international human rights. They should reduce inequalities and improve access to resources for all.

3. Transparency and democratic governance requirement

Technological systems must be transparent in their operation and automated decisions. The governance of these technologies must be democratic, involving all stakeholders, to ensure they serve the public interest.

4. Ethics and social responsibility requirement

Technologies must respect fundamental ethical principles such as justice, human dignity, and non-discrimination. Creators and users must assume responsibility for their actions, whether at the social, environmental, or moral level.

5. Inclusivity requirement

Technologies must be accessible to everyone, regardless of physical, cognitive, or economic abilities. They must be designed to include and respect human diversity and reduce social inequalities.

6. Responsible innovation and anticipation requirement

Technological innovation must improve quality of life and respect human rights while anticipating the long-term social, environmental, and economic impacts. A precautionary approach must be adopted for technologies with uncertain effects. However, the precautionary approach should be balanced by the principle of plausibility[3].

3 The principle of plausibility is a concept used to assess the likelihood of a hypothesis or explanation in the absence of absolute certainty. It is based on the idea that, among several possible scenarios, the one that appears most coherent with known facts and established knowledge is deemed plausible. Unlike truth, which requires definitive proof, plausibility relies on logic, experience, and common sense to estimate the probability that a hypothesis is correct. This principle is particularly useful in science, philosophy, or risk analysis, where certainties are often inaccessible, but where it is crucial to distinguish credible hypotheses from unfounded speculation.

Method-based requirements are:

7. Reliability and resilience requirement

Technologies must be reliable, predictable, and resilient to disruptions. Errors and biases must be corrected transparently, and continuity plans must be in place to ensure the availability of services.

8. Environmental sustainability requirement

Technologies must minimize their ecological footprint throughout their lifecycle and contribute to combating climate change. This includes product sobriety, frugality, and reparability.

9. Holistic approach requirement

Technologies must be developed and evaluated holistically, considering their foreseeable social, economic, environmental, and political impacts in the long term. Technological decisions must be integrated into a global and systemic perspective.

10. Interoperability and collaboration requirement

Technologies must be interoperable and compatible with other systems, facilitating collaboration and open innovation among different technological actors.

11. Security and data protection requirement

The security of technological systems and the protection of personal data must be ensured by robust measures and minimal data collection, thereby guaranteeing the informed consent of users.

UTBM POWERED BY TECHNOLOGY

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