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GENERAL SECTION

ARTIFICIAL INTELLIGENCE, NEW RESEARCH DYNAMICS AND PATENTS

Abstract

The rise of AI and its increasing use in achieving inventions has raised concerns about the effectiveness of the requirements for patent protection, which were designed prior to this technological revolution. Proposals in this regard, from the abolition of patents to the adoption of an inventive machine standard, however, circumvent the key issue in assessing patentability, which is whether or not the skilled person would have achieved the invention in an obvious way by using the available toolkit, which may include AI algorithms if they are publicly available. The fear of excessive patent monopoly resulting from the use of AI is also a false problem, since greater ease in attaining inventions will lead to more problems being solved in alternative ways, new ones being posed, and strong competition among innovators. What critics of patents forget is the effect of disclosure achieved through patenting: patent databases (normally freely accessible online) are nowadays the world's largest and most up-to-date source of technical information. The importance of this disclosure is increased precisely by the advent of AI, which needs wide availability of data to operate effectively. Thus, more than ever, patents contribute decisively to scientific and technological progress and also to its democratisation. The analysis will show that the growing use of AI in research does not require changes to existing patent law or challenge the fundamental rationale for patent protection. On the contrary, AI enhances innovation potential, reinforcing the importance of the patent system—especially its role in promoting competition and knowledge disclosure.

JEL CLASSIFICATION: K110, 031, 034

SUMMARY

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DOI 10.13135/2785-7867/12274

1 Introduction

The patent for invention is deemed[1] to be the most important one among intellectual property rights, as it is fundamental in ensuring protection for investors in research leading to technical progress.

The fundamental requirement for the patentability of an invention is the so-called "inventive step", which pursuant to the US legal system can be found "*if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention* pertains"[2], while in the European Union one, it is necessary that it represents an "*original*" solution to a technical problem, ie, - according to the approach (determined by comparing the invention for which protection is claimed with the so-called *closest prior art*), which is not obvious to the person having ordinary skill in the art to which the claimed invention pertains, to the state of the art: and, more precisely, according to the criterion of the *problem and solution approach* and the so-called *could-would* rule, which is not obvious, in the absence of knowledge and suggestions that would have led (and not that *could have led*, being recognisable only *ex post* facto as suggestions) the inventor to consider "*obvious to try, with a reasonable expectation of success*" the invention then patented[3].

The results arrived at by applying these two standards are substantially homogeneous and most of the most important patents (for which protection is sought worldwide) are granted by both the USPTO, the EPO and the JPO with the same or very similar claims[4].

However, it is true (or will be true at some point in the ongoing technological evolution) that the use of *prior art* investigation tools such as those of Artificial Intelligence will more easily lead to the identification of information inherent in the solution of the technical problem and probably, by virtue of the capacity of these systems to establish correlations between data, even to point out in the known art suggestions that the human being without the aid of the machine would not have grasped (and therefore that, for the human being, *could* have *led to* the *invention* - *could* -, but would not have '*led to the*

[1] William M Landes and Richard A Posner, 'An Economic Analysis of Copyright Law' (1989) 18(2) Journal of Legal Studies 325, 'For a new work to be created the expected return – typically, and we shall assume exclusively, from the sale of copies – must exceed the expected costs'; European Commission, 'Making the Most of the EU's Innovative Potential: An Intellectual Property Action Plan to Support the EU's Recovery and Resilience' COM(2020) 760 final, 25 November 2020.

[2] 35 United States Code 103; the corresponding norm in the European Patent Convention system can be found under art 56 of the European Patent Convention.

[3] Hansjörg Knesch, 'Assessing Inventive Step in Examination and Opposition Proceedings in the EPO' (1994) 3 EPI Information 95; Pèter Szabo, 'The Problem and Solution Approach in the European Patent Office' (1995) 457 International Review of Intellectual Property and Competition Law 293; Mario Franzosi, 'Non ovvio' in *Studi di diritto industriale in onore di Adriano Vanzetti* (Milano, 2004) 474; Cesare Galli, 'Per un approccio realistico al diritto dei brevetti' (2010) 136 Il Diritto Industriale 133; Cesare Galli and Mariangela Bogni, 'Il requisito di brevettabilità dell'attività inventiva' in Galli and Gambino (eds), '*Codice commentato della Proprietà Industriale e Intellettuale*' (UTET Giuridica 2011) 578.

[4] Antoine Dechezleprêtre, Yann Ménière and Myra Mohnen, 'International Patent Families: From Application Strategies to Statistical Indicators' (2017) 111 Scientometrics 793.

invention' - *would* -, it being only in this second case that the inventive activity is lacking) and that, conversely, with the use of AI will become available (or rather recognisable as such) already *ex ante*. On the other hand, it is likely that, speculatively, the offices in charge of examining patent applications will equip themselves with AI tools to carry out their evaluations, thus in turn being able to take these suggestions into account.

For the purpose of this analysis, the definition of "AI system" given by the "AI Act", will be taken into account: therefore, an AI system will be deemed to a "*machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments*"[5].

It appears that there are already examples of patented inventions made autonomously by artificial intelligence (it being understood that it will always be a human being who poses the technical problem to be solved).

The question of whether artificial intelligence systems can be recognised as inventors under patent law has been tested globally through a series of applications involving the AI system DABUS (Device for the Autonomous Bootstrapping of Unified Sentience), developed by Dr Stephen Thaler. Patent applications were filed in multiple jurisdictions listing DABUS as the sole inventor, challenging existing legal definitions of inventorship.

In the United States, the United Kingdom, and the European Union, courts and patent offices uniformly rejected the applications on the grounds that inventorship under current laws requires a natural person. Notably, the U.S. Court of Appeals for the Federal Circuit, the UK Supreme Court[6], and the European Patent Office (EPO)[7] all concluded that AI systems do not meet the statutory criteria for inventors.

In Australia, an initial 2021 Federal Court ruling accepted the premise that an AI could be an inventor; however, this was subsequently overturned by the Federal Court in 2022[8], reaffirming the necessity of human inventorship.

By contrast, South Africa granted a patent in 2021 naming DABUS as the inventor—the first known instance of such recognition. However, the decision was made without substantive examination and does not represent a binding interpretation of patent law[9].

More realistically, however, one must imagine that AI assists humans in realising an extensive part of the process leading to the invention. An emblematic example is that of the team *of* a pharmaceutical company, which, wanting to make a molecule that would

[5] See Article 3 Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (AI Act).
[6] *Thaler v Comptroller-General of Patents, Designs and Trade Marks* [2023] UKSC 49 (20 December 2023).
[7] EPO Board of Appeal, 21 December 2021, J 0008/20, ECLI:EP:BA:2021:J000820.20211221.
[8] *Commissioner of Patents v Thaler [2022] HCATrans* 199 (High Court of Australia, 11 November 2022).
[9] More extensively on this topic, Desmond Oriakhogba'Dabus Gains Territory in South Africa and Australia: Revisiting the AI-Inventorship Question' (2021) 9 South African Journal of Intellectual Property Law 87, 108.

target exactly one protein linked to fibrosis, used artificial intelligence (the proprietary GENTRL system), which 'designed' 30,000 molecules and automatically discarded those '*bearing structural alert and reactive groups*', reducing the viable hypotheses to a much smaller number, subsequently profiled (again by the system). Of the remaining molecules, 40 were chosen '*randomly*', with a subsequent synthesis of 6, all of which were tested, with the result that 4 of them proved active '*in* biochemical assays', 2 were validated in 'cell-based assays' and one was tested on mice, demonstrating '*favourable pharmacokinetics*'. The process took a total of 46 days, demonstrating how the use of AI proves to be a tool that can make researchers' work much faster[10]. In another well-known case, artificial intelligence is said to have 'proposed' the solution of crossed bristles for optimal toothbrush functionality, following Oral B's request to produce a new generation of toothbrushes: a device based on an artificial neural network, also the subject of a patent[11] and called the 'Creativity Machine', realised, after being fed with information about the characteristics and performance of existing toothbrushes, 2,000 possible *designs*, many of them with crossed bristles[12]. In both cases, however, it was humans who posed the problem, provided the machine with the data and made the decisive selection on the assumptions provided.

More generally, it can be hypothesised that today there are devices capable of assisting humans in achieving solutions to technical problems, analysing (in an insightful manner) the prior art administered - and possibly, filtered and calibrated - or autonomously researched by the machine, for example, through *databases* such as the EPO database, highlighting the solutions relevant to the problem, and, upstream, identifying, testing and discarding solutions.

The new potential of AI has already prompted action by lawmakers[13], who however seem to sense its risks more than its opportunities. Faced with this new reality, intellectual property scholars[14] too have begun to wonder whether the use of artificial

[10] See Bogdan A Zagribelnyy and others, 'Deep Learning Machine Enables Rapid Identification of Potent DDR1 Kinase Inhibitors' (2019) 37(9) Nature Biotechnology 1038.

[11] Patents No. US 5,659,666 and No. US 7,454,388, both filed in the name of Dr Stephen Thaler, founder of Imagination Engines, Inc, dated 13 October 1994 and 8 May 2006, respectively, available at <http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=1&f=G&l=50&co1=AND&d=PTXT&s1=5659666.PN.&OS=PN/5659666&RS=PN/5659666> and <http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=4&f=G&l=50&co1=AND&d=PTXT&s1=stephen.INNM.&s2=thaler.INNM.&OS=IN/stephen+AND+IN/thaler&RS=IN/stephen+AND+IN/thaler> accessed 20 June 2025.

[12] See Robert Plotkin, *The Genie in the Machine: How Computer-automated Inventing is Revolutionising Law and Business* (Stanford University Press 2009) 51, who explains that this device was able to 'not only recognise existing patterns but create new ones', making use of two special neural networks that the creator of the system, Dr Thaler, called 'the Imagination Engine' and 'the Perceptron'.

[13] Among the lawmakers that dealt with AI-related issue, *ex multis* the EU, Italy and the US can be mentioned.

[14] Noam Shemtov and Garry Gabinson, 'The Inventive Step Requirement and the Rise of the AI Machines' in FM Abbott (ed), *Research Handbook on Intellectual Property and Artificial Intelligence* (Edward Elgar 2022); Marga Schellekens, 'Artificial Intelligence and the Re-Imagination of Inventive Step' (2022) 13 Journal of Intellectual Property, Information Technology and Electronic Commerce Law 89; Olga Gurgula, 'AI-Assisted Inventions in the Field of Drug Discovery: Readjusting the Inventive Step Analysis' (2020) 2(8) International Journal of Social Science and Public Policy 7.

intelligence will not make obvious (and easily attainable) what would not be obvious to the human being who does not use such a tool, and whether this does not impose a revision of the patentability requirements for inventions, and in particular for inventive activity, in a quantitative or qualitative sense, in order to avoid an exponential increase in exclusivity and, therefore, an excessive obstacle to competition.

These critical issues run the risk of being instrumentalised by those who have already for years taken an attitude of ideological criticism of intellectual property and patents, arguing that copyright and patents are a useless evil because they do not generate more innovation, but only hinder the diffusion of new ideas[15]. Even if, as we shall see, the analysis of these radical critics appears flawed by premises that are not in line with the legal rules governing intellectual property, starting with the identification of the content of exclusive rights and the mechanisms for legal review of their validity and infringement, one cannot underestimate the risk of patents being among the victims of the debate on Artificial Intelligence and its consequences in terms of legal policy.

It is therefore necessary to answer the questions on the compatibility of the advent of artificial intelligence with the traditional protection of inventions by means of patents granting exclusive rights to their author and then assess whether there are corrections to be made to the current system or whether new forms of protection should be considered or even the abolition of this right.

In this perspective, three main issues deserve to be addressed: firstly, it is necessary to ask whether the standards of access to patent protection, based on the criteria we mentioned at the beginning, are still able to function in a context in which the dynamics of research increasingly involve the use of artificial intelligence; then it must be ascertained whether artificial intelligence applied to inventive research does not adversely affect the balance between competition and exclusivity that underlies all intellectual property law; finally, it is necessary to ask what role can be played by the alternatives to patents that are already used today to protect technological innovations, and in particular *trade secrets*, and whether and to what extent they should be encouraged in the face of the ever-increasing use of artificial intelligence in the research from which innovations arise.

Once these issues have been addressed and resolved, it will be possible to reach conclusions and indicate possible corrections to the current system that are desirable from the perspective of the free market economy.

2 The first regulatory interventions: from the European Union's AI Act to the Italian government's draft bill

In order to properly contextualise the subject of this research, it is first necessary to

[15] Michele Boldrin and David K Levine, *Against Intellectual Monopoly* (Cambridge University Press 2008).

give an account of the regulatory framework that is taking shape in Europe regarding AI as a whole and its guiding forces.

Artificial Intelligence (AI) is a broad field of computer science that encompasses technologies designed to perform tasks typically requiring human intelligence, such as reasoning, learning, problem-solving, and decision-making. AI systems are often categorised into narrow AI and general AI. Narrow AI refers to systems designed for specific tasks, such as facial recognition or legal document review, whereas general AI aims to replicate the full range of human cognitive abilities, a capability not yet achieved.
Generative AIs[16] (often referred to as GenAIs), on the other hand, is a subset of AI, referring to models specifically designed to create new content, such as text, images, or music, based on the data they have been trained on. GenAIs, like OpenAI's ChatGPT or DALL·E, have gained particular attention due to their ability to produce human-like outputs, blurring the line between machine and human creativity. Unlike narrow AI, which is task-specific, GenAIs exhibit a higher degree of autonomy in generating novel material, often exhibiting behaviors that appear to be creative, adaptive, and innovative.

As a matter of fact, the attitude towards artificial intelligence algorithms nowadays is two-faced. On one hand, generative AI algorithms, such as the above-mentioned very popular ChatGPT, are currently widely used; on the other hand, there are loud calls warning of the alleged risks they pose to humanity's future, as though these algorithms could actually surpass human intelligence. This perspective disregards the fact that these algorithms are all based on the logical-deductive model of the "Turing machine[17]," which underpins electronic computers, while "the human brain performs functions that cannot be defined according to the Turing machine model," and "the number of different semantic structures that a human brain can generate is virtually infinite, 10 to the power of 700"[18]. As a result, the brain will never be replaced by a machine, which can only assist in performing tasks more quickly and efficiently, particularly innovation, by supporting humans in various parts of the process leading to discoveries, even though the human is the one defining the problem, providing the machine with data, and structuring it so that the machine can "learn" from it and make the critical selection among the hypotheses provided.

For the sake of clarity, it must be pointed out that Artificial Intelligence systems often rely on machine learning techniques to improve their performance on tasks over time. Two fundamental paradigms within machine learning are supervised learning and unsupervised learning, which differ primarily in how the algorithm is trained and the type

[16] As stated in Recital 99 of the AI Act: "generative AI models are a typical example for a general-purpose AI model, given that they allow for flexible generation of content, such as in the form of text, audio, images or video, that can readily accommodate a wide range of distinctive tasks".
[17] A Turing machine is an idealised model of a central processing unit (CPU) that controls all data manipulation done by a computer, with the canonical machine using sequential memory to store data. Typically, the sequential memory is represented as a tape of infinite length on which the machine can perform read and write operations.
[18] Bruno Ruffilli, 'Mario Rasetti: "Non costruiremo mai una macchina complessa come il cervello umano' *La Repubblica* (Roma, 5 September 2023).

of data it processes.

Supervised learning involves training an AI model on a labelled dataset, where the input data is paired with the correct output: the model learns to recognise patterns that associate inputs with the correct labels and can later apply this knowledge to classify new, unlabelled data. This method is commonly used for tasks such as classification (eg: e-mail filtering or image classification) and prediction of patterns[19].

Unsupervised learning, by contrast, involves training a model on data without labeled outputs. The algorithm seeks to identify hidden patterns, structures, or groupings in the data: common applications include clustering, dimensionality reduction, and anomaly detection.

The choice between supervised and unsupervised learning has significant implications for how AI systems operate and the transparency of their decision-making processes—factors that are increasingly relevant in legal and regulatory evaluations of AI technologies.

However, paradoxically, the most basic (and often most dangerous) applications of AI are spreading rapidly, while calls for stringent regulations are made often prematurely, in so far as they could hinder its use precisely where it is most needed, namely, to accelerate innovation and increase the competitiveness of businesses, which can become drivers of economic development.

An attempt to strike a balance between these different thrusts was made by the European Union with the so-called AI Act, ie, Regulation (EU) 2024/1689[20], which took a quite prudent approach to the problem, although not without criticism for the extreme detail and complexity of the adopted framework, which only when put to the test of their actual implementation will be able to prove their effectiveness and manageability. This Regulation opted to regulate only high-risk AI systems (specifically identified in an annex to the regulation), systems that interact with individuals, and AI models for general purposes. It provides specific provisions for these systems to safeguard fundamental rights and foresees a gradual implementation of these provisions until 2026 (which also paves the way for possible corrective interventions), leaving the development of AI in other areas free and market-driven.

In contrast, an example of the ambivalence (and substantial misunderstanding) toward AI is the recent draft law on AI (Bill No. 1146/2024) presented by the Italian government, which is currently being discussed in the Senate[21]. Even though this bill does not contain

[19] Julianna Delua, 'Supervised vs Unsupervised Learning: What's the Difference?' (*IBM*, 13 June 2023), <https://www.ibm.com/blog/supervised-vs-unsupervised-learning/> accessed 15 May 2025.

[20] Per una più analitica trattazione dell'argomento, si rinvia alla lettura di Giuseppe Cassano and Enzo M Tripodi, *Il Regolamento Europeo sull'Intelligenza Artificiale - Commento al Reg. UE n. 1689/2024* (Maggioli Editore 2024).

[21] Cesare Galli, 'Il disegno di legge del Governo sull'intelligenza artificiale: un testo inopportuno migliorabile, in problematico rapporto dialettico con il Regolamento comunitario'(*Sistema Proprietà Intellettuale*, 3 December 2024) <https://www.sistemaproprietaintellettuale.it/53-tendenze-e-sviluppi/32328-il-disegno-di-legge-del-governo-sull-intelligenza-artificiale-un-testo-inopportuno-migliorabile-in-problematico-rapporto-dialettico-con-il-regolamento-comunitario.html> accessed 3 July 2025.

rules that could significantly affect Italian patent law directly, it is still important to consider its possible indirect effects, since the provision it may entail if approved could affect the course of innovation and the development of new technologies, which is the factual premise of the entire patent system. The text aims to promote the use of AI, provided that it is done in conditions of safety and transparency. However, this promotion is reduced to vague commitments or the stating of equally vague goals (Article 5)[22], while the constraints—such as those requiring AI systems and models to be developed "*based on data and processes whose correctness, reliability, safety, quality, appropriateness, and transparency must be ensured and monitored*" (Article 3, Paragraph 2) and ensuring "*cybersecurity throughout the entire lifecycle of AI systems and models, based on a proportional, risk-based approach, and the adoption of specific security controls to ensure resilience against attempts to alter their use, behaviour, performance, or security settings*" (Article 3, Paragraph 5) – are largely discretionary in their application and general in nature, imposing broad and indiscriminate requirements (except for the reference to "proportionality," which however is not clearly defined). These provisions may serve as a deterrent to the development of AI research and applications in Italy.

Additionally, the definitions given in the Italian bill for AI systems and models differ from those set out in the Regulation and do not align with Directive (CEE) 1991/250, as they define AI systems as "automated systems" rather than as computer programmes, as they are actually understood in the Regulation. The same issue arises with AI models, which the Regulation considers as components of systems ("Although AI models are essential components of AI systems, they do not constitute AI systems in themselves") and thus regulates them only when they are intended for general purposes. In this case, the need for guarantees for "AI system providers integrating general-purpose AI models" justifies regulatory intervention, which becomes more extensive for models that present systemic risks due to their high impact potential, particularly concerning the cumulative computational power used for training (Articles 51-55 of the AI Act).

This foundational error is further compounded by the Italian government's choice to use

[22] Article 5(d) of the Italian DDL AI introduces a preference for AI systems and services that ensure the localisation and processing of strategic data within Italian territory, with disaster recovery and business continuity solutions also hosted domestically. While the objective is to enhance national digital sovereignty, bolster security measures, and ensure adherence to transparency and ethical AI standards, this provision may potentially conflict with the EU's fundamental principle of the freedom to provide services (Article 56 TFEU).
In accordance with EU law, service providers established within one Member State must be permitted to offer their services across the Union without the imposition of restrictions that are not justified. A national rule that systematically favours domestic infrastructure – such as requiring or preferring data centres within national borders – can amount to an indirect restriction on this freedom, particularly if it disadvantages providers from other Member States who may offer compliant and secure services hosted elsewhere in the EU.
While such restrictions may be deemed justifiable on grounds of public security or the protection of critical infrastructure, it is imperative that they are subject to rigorous proportionality and non-discrimination tests. It is imperative that the measure be commensurate with its stated objective, indispensable, and that it constitutes the least intrusive alternative. The Italian provision, albeit framed as a preference rather than an explicit requirement, may nevertheless be subject to scrutiny under EU law, particularly if it results in systematic exclusion or disincentivisation of non-domestic service providers.

the sectors in which AI systems are applied as the sole criterion for applying the proportionality principle outlined in Article 3 of the bill, which governs the development of AI systems and models. This approach is inadequate and contrasts with the Regulation, as it does not consider the risk levels that these systems pose, nor whether they are intended to interact with individuals, nor whether they have general-purpose objectives (and in some cases, systemic risks). This approach prevents the national legal framework from aligning interpretively with the European framework.

Furthermore, the modification proposed in Article 24 of the bill to the Copyright Law (Law No. 633/1941), which introduces the specification that the law protects "human" works of the mind, seems unnecessary, as this has always been understood. The proposal to extend this to include works "*created with the aid of AI tools, provided they are the result of the intellectual work of the author*" is also problematic; it should also be noted that Article 25 of the Bill, even when considered in light of all relevant criminal and constitutional principles, remains highly complex – particularly in determining what should be understood as a genuine work versus a modified one. The issue is not whether there is intellectual work, but rather determining what type of creativity should be considered relevant. This issue is beyond the scope of national legislators and should be addressed at the EU level, as the concept of "work" protected by copyright is an autonomous EU law concept that must be interpreted and applied uniformly[23].

Similarly, the proposed changes to Article 70-septies of the Italian Copyright Law in the bill, allowing reproduction and extraction of works or other materials through AI models, including generative models, fail to align with EU regulations, particularly the Digital Single Market Directive, which sets limits on AI generative uses that should be respected.

Once the bill is approved, a more thorough evaluation will be possible. However, it is already evident that this regulatory intervention demonstrates a lack of understanding that, in the face of complex phenomena like AI, national legal systems are competing with one another. The laws adopted could isolate a country from critical development opportunities, relegating it to a marginal position. The introduction of limits should be justifiable only for the protection of essential legal rights, based on a balanced consideration of the subject's complexities, economic, technical, and humanistic implications, and the need for caution in recognizing the market's ability to better manage these complexities for the benefit of all.

[23] As re-affirmed with special clarity by Case C-683/17 *Cofemel* ECLI:EU:C:2019:721, on which see Cesare Galli, 'La tutela "Europea" di diritto d'autore per le opere dell'Industrial design e la necessità di un approccio realistico' (2020) 1 Rivista di Diritto Industriale II 42, 51. On the impact of AI on copyright protection see Edoardo C Raffiotta, 'La tutela delle opere generate dall'intelligenza artificiale: il principio antropocentrico tra prospettive passate e future' (2024) 6 Il Diritto Industriale 527.

3 The current debate on the patent system in the face of the challenges of artificial intelligence

The debate on the future of patents in the age of Artificial Intelligence has primarily focused on the figure of the "person skilled in the art", a central concept in assessing the inventive step (or non-obviousness) of an invention. This standard is applied from the perspective of a hypothetical expert in the relevant technical field, and it is through this lens that the obviousness of an invention is evaluated.

A key issue that has emerged is whether this hypothetical expert should be assumed to use AI tools in their problem-solving activities. This includes considering both AI's ability to combine and analyse large amounts of information and the potential need to broaden the knowledge base attributed to the skilled person—particularly in relation to adjacent or neighbouring fields of technology.

This question becomes even more complex when dealing with technical problems that cut across multiple disciplines. For example, consider a mechanical issue affecting machines in two unrelated fields, such as industrial robots and medical imaging devices. Although the machines serve entirely different purposes, they may share a common problem, such as heat dissipation in high-speed rotating parts. In such a case, it may not be sufficient to limit the skilled person's knowledge to just one field. Instead, the relevant inquiry is: what prior art or technical knowledge would the skilled person realistically have considered when faced with this particular problem?

Rather than rigidly expanding the scope of the skilled person's knowledge, the more pertinent question is which technical field is relevant to the specific problem at hand, and whether the skilled person—possibly aided by AI—would have looked beyond their core discipline to find a solution.

The suggestion at issue here is made based on American *case law*, which, for the purposes of judging inventive step, also takes into account among the variables the '*sophistication of technology*' possessed by the expert in the field[24] (of course: not the person who actually made the invention, who may have inferior or superior skills and knowledge[25]). Looking forward, therefore, in sectors where the use of artificial intelligence proves to be widespread, taking this factor into account in the construction of the branch expert's knowledge and skills would be justified, since, in a realistic approach to the assessment of inventive step, one must put oneself in the position in

[24] See Peter S Menell and others, 'Patent Case Management Judicial Guide' (2009) UC Berkeley Public Law Research Paper No. 1328659 11, 47, where it is explained that 'In determining the level of ordinary skill in the art, courts look to the inventor's educational level, the nature of the field's typical problems, the skill required to grapple with the prior solutions to the field's problems, the pace of innovation in the field, the sophistication of technology and the educational level of people working in the field' and *Envtl. Designs, Ltd. v Union Oil Co.*, 713 F.2d 693, 696 (Fed. Circ. 1983. In the same vein, see also GPAC Inc., 57 F.3d 1573, 1579 (Fed. Cir. 1995).

[25] See Catherine Seville, *EU Intellectual Property Law And Policy* (Edward Elgar Pub 2016) 147; Ana Ramalho, 'Patentability Of Ai Generated Invention - Is A Reform Of The Patent System Needed?' [2018] SSNR <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3168703> accessed 3 July 2025.

which this subject examines the *prior art*, also in relation to the tools at his disposal[26].

What is not acceptable, however, is the idea of a 'double standard', depending on whether the patent applicant claims to have used artificial intelligence in the achievement of the invention. Such an approach, in fact, would contradict the need, common to all legislations, to objectivise as much as possible the judgement of inventive activity, reconstructing the conditions in which an expert in the field with all the known art would have found himself when tackling the technical problem subject of the patent. Even in its practical consequences, without wishing to consider the hypothesis that one is not telling the truth in this regard, to benefit from the 'human' standard, such a dichotomy would end up favouring those companies that are less efficient and do not invest in equipping themselves with cutting-edge research tools[27].

4 Standards for access to patent protection and artificial intelligence

It must therefore be determined whether it is possible to take the use of Artificial Intelligence into account when judging inventive step without abandoning traditional standards of evaluation. In favour of this possibility is the circumstance that these standards are based on a realistic approach to the dynamics of research, which aims to concretely identify the knowledge and tools that the expert in the field has at his or her disposal.

In this respect, it must therefore first be considered that the term 'AI' can refer to instruments that are very different from each other in terms of capability and performance (eg: traditional AI and new generation generative AI); however, the key characteristic of all AI systems is their capability to infer. This capability to infer refers to the process of obtaining the outputs, such as predictions, content, recommendations, or decisions, which can influence physical and virtual environments, and to a capability of AI systems to derive models or algorithms, or both, from inputs or data. The techniques that enable inference while building an AI system include machine learning approaches that learn from data how to achieve certain objectives, and logic- and knowledge-based approaches that infer from encoded knowledge or symbolic representation of the task to

[26] See also Ana Ramalho (n 25), ix, according to which "if the use of AI is not a normal means of experimentation in the relevant art, a patent can be granted if the invention is not obvious for a person skilled in the art without the use of AI (even if AI was used by the inventor in question). Conversely, if the use of AI is a normal means of experimentation in the relevant art, the skills of the person skilled in the art improve and AI use is taken into account - which means that a patent can be granted if the invention is not obvious for a person skilled in the art who uses the AI (even if AI was not used by the inventor in question)'. In a similar vein, but with considerations not specifically referring to AI, see also Brenda M Simons, 'The Implications of Technological Advancement for Obviousness' (2013) 19 Michigan Telecommunications and Technology Law Review 101.

[27] On this point, see Ryan Abbott, 'Everything Is Obvious' (2018) 66 UCLA Law Review 2, republished in *IP Watch* (2019) n 19 referring to American authors discussing new criteria for inventive step and non-obviousness, citing Ana Ramalho (n 25), ix-x, who even considers it advisable 'to consider adding a 'made by AI' factor as an indication of obviousness'. This is clearly contradictory to the logic of the patent system, which - as will be discussed later in the text - seeks instead to objectify the judgement on inventive activity, rather than referring to how the inventor subjectively arrived at the patented solution.

be solved. The capacity of an AI system to infer transcends basic data processing by enabling learning, reasoning or modelling[28].

Therefore, starting from this common ground, a sort of standard of the field in which the invention is located would have to be identified: a patentable invention would exist where the result achieved would not have been obvious by using standard instrumentation, even if it would have been obvious by using non-standard instrumentation.

Possession of this non-standard equipment configures a situation not very different from that which arises (and which traditional inventive step standards already allow to be successfully addressed) when the inventor has non-public knowledge that makes it obvious to him to do what is not obvious to the person skilled in the art. In fact, according to these standards, the question is not what the author of the invention whose patentability is at issue could have done - with his knowledge and skills - but what the state of the art would suggest a person with the normal capabilities for a person skilled in the art in his field would do. In other words, neither the inventor's gap in relation to these standards nor his concrete skills are relevant.

Although the inventor subjectively engaged in an inventive effort, the resulting creation does not qualify as an invention in the objective sense, as it would have been obvious to a person skilled in the art who did not face the same knowledge gap. Conversely, if the inventor possessed exceptional skills or knowledge that made the invention appear obvious to them, such attributes cannot disqualify the invention from patentability if it would not have been obvious to the hypothetical person skilled in the art, who is presumed to have only ordinary skill and knowledge.

This "*plus*" may consist of a secret invention, but also of an artificial intelligence algorithm, unless the 'instrumentation' used was not in the public domain, because any exclusive rights over it did not exist or had expired, or because, although covered by a patent still in force, the relevant technology had been made available by its owner to anyone interested in licensing it, or purchasing the device that uses it, or availing themselves of its services, not provided under exclusivity, at least in the sector in which the invention is located.

Even more crucial than the algorithm itself, for the purposes of machine learning and, consequently, the use of Artificial Intelligence in innovation, is the structuring of the data on which AI is trained to study and generate outputs. It is particularly in this context that the identification of a standard becomes both problematic and significant—especially when multiple alternatives were available and the decisions made were not self-evident. For instance, if an AI system is designed to detect fraudulent financial transactions, the choice to include certain behavioural data (such as time of transaction, device used, or spending patterns) over other available data (like biometric verification or user browsing history) reflects non-obvious human judgment. This highlights the crucial role of the

[28] See Recital 12 of the AI Act.

'human factor' in shaping the innovation, as the outcome of the machine learning process is highly dependent on such discretionary decisions.

In this regard, it is important to emphasise that the mere fact that the individual data used to train an AI system are part of the state of the art does not necessarily mean that the outputs generated by the AI—namely, the 'output data' or insights derived from processing such data—are themselves part of the state of the art. This holds true even when the input data are standardised or publicly available, such as when they consist of all published patent applications and granted patents in a particular technological field accessible through official databases, and no subjective or selective choices have been made in assembling them.

This principle applies *a fortiori* when the data supplied to the AI are non-standard. As has been recognised in trade secret law, a party may hold exclusive rights over data that, "as a whole and in the precise configuration and combination of their elements," are not generally known, even if the individual data points—considered in isolation or arranged differently—are publicly accessible. This protection extends even further when the data have been processed or reconfigured by an artificial intelligence system, particularly if the AI itself is proprietary or trained under conditions of confidentiality.

Accordingly, the additional value or insight generated by such data processing is not considered part of the state of the art and cannot be taken into account in assessing the inventive step. This is analogous to the treatment of secret prior art: just as a confidential invention that would render a subsequent invention obvious is excluded from the state of the art, so too are confidential data-derived outputs that were not publicly accessible at the relevant time. What is certain, however, is that, as seen in the cases of the development of molecules for the treatment of fibrosis or the toothbrush, the AI can provide the suggestion that leads to the invention together with numerous others, a circumstance that cannot be disregarded from the point of view of the non-evidence of the invention, at least in the face of a selection made by the inventor (upstream or downstream of the AI's intervention), which does not constitute *routine* activity.

In other words, it seems clear that the correct application of the inventive step tests, especially if they are framed (as they must be) in the context of the balance between competition and exclusivity that underpins the intellectual property law as a whole, makes it possible to address and solve the problems posed by artificial intelligence through a case-by-case verification of what can be considered *standard* and what cannot be, what is actually accessible to the public and what is not. Under this latter profile, the teaching of the EPO *case law* on the distinction between *searchable* and non-searchable disclosures[29] is therefore also applicable to the problem we are considering here, which

[29] In the case law of the EPO *Board of Appeal* this was made clear, for example, in its decision in case T1553/06 [EPO Board of Appeal, 18 November 2008], according to which 'the mere theorical possibility of having access to a means of disclosure did not make it become available to the public', since 'what is required, rather, is a practical possibility of having access': ie, the *Board of Appeal* of the EPO has precisely ruled that the mere presence, in the abstract, of a

precisely poses the problem of *concrete* and not merely *theoretical* accessibility for a *quid* to be considered disclosed.

5 Patents created with the help of artificial intelligence and competition

Among other things, this also answers the objections of those who are concerned about the possible proliferation of patents as a result of easier access to inventions.

To put the question in these terms is to think that the problems to be solved and inventions are a kind of 'closed number', whereas it is likely that the use of artificial intelligence will increase the problems solved (and lead to the formulation of new problems) and increase the solutions, more efficient or even just alternatives, with an overall improvement. Firstly, more inventions mean more progress and thus also more opportunities to create new markets and thus new competition. Secondly, it should not be forgotten that if the possibilities of inventing grow, so does the possibility of finding *alternative* solutions to each technical problem, and thus competition *between* innovators, which in any case benefits the end users[30].

Above all, critics of patent systems seem to underestimate the scope of the *disclosure* that is achieved through patenting, since it is prescribed by the TRIPs Agreement itself (art 29) that "*Members shall require that an applicant for a patent shall disclose the invention in a manner sufficiently clear and complete for the invention to be carried out by a person skilled in the art and may require the applicant to indicate the best mode for carrying out the invention known to the inventor at the filing date or, where priority is claimed, at the priority date of the* application"[31]. The patent rules are in fact inspired by the need to ensure that "*the invention, even if patented, enters as soon as possible into the pool of technical and scientific data accessible to all*"[32] and thus form the basis for further innovation: patent databases (nowadays normally freely

document among those theoretically reachable (eg, because it is present on the Internet) is not relevant for the purpose of identifying the state of the art, if the same cannot, in practice, be found by the expert in the field (again, by way of example because the title or the other elements on which a normal search is based do not contain any reference to the field of the invention or the problem it addressed), because in such a case it cannot *really* be considered to have been brought to the knowledge of an indeterminate number of persons, as is required for purposes of disclosure.

[30] On the growing importance of 'between-patent' competition, especially in cutting-edge sectors, see Tomas Philipson and Carolanne Dai, 'Between- vs. Within-Patent Competition' (2003) 26 (3) Regulation 42, 48, which analyses the pharmaceutical market in particular, concluding that 'between-patent competition, most of which occurs while a drug is under patent, affects the returns to innovators at least as much as within-patent competition, which cannot occur until a drug is off patent'.

[31] *Agreement on Trade-Related Aspects of Intellectual Property Rights*, adopted in Marrakech in 1994 at the same time as the establishment of the *World Trade Organisation*, and which contains an essential regulation of the scope of protection and of the prerequisites for the protection of distinctive signs, patents and copyrights, as well as procedural remedies against their violation. With this agreement, the bloc of economically more advanced countries, led by the United States, had made the liberalisation of trade with the (then) less developed countries conditional upon their compliance with certain standards of protection of intellectual property rights, the most important of which were (and, to a large extent, still are) owned by subjects belonging to the first bloc of countries.

[32] Piergaetano Marchetti 'Commento all'art. 1 r.d. 29 giugno 1939 (revisione della legislazione nazionale in materia di brevetti per invenzioni industriali in applicazione della delega di cui alla legge 26 maggio 1978, n. 260)' (1981) Le Nuove Leggi Civili Commentate 677.

accessible *online*) are today the largest and most up-to-date source of technical information in the world.

Today, the importance of this *disclosure* is further increased by the advent of artificial intelligence, which, being founded on the use of algorithms capable of carrying out highly advanced statistical analyses on very significant quantities of data[33], finds in the great availability of data the possibility of operating effectively, identifying classification schemes and parameters, which, to a large extent, elude human beings (in this regard, we speak of '*deep learning*'). This allows it to determine the correct answer to the problems submitted to it and to identify new ones, thus contributing decisively to scientific and technological progress and also to its democratisation, given the public accessibility of the information contained in published patent applications and granted patents.

6 Patents vs trade secrets

The absence of patent protection would instead encourage companies to resort more extensively to secrecy protection for technological innovations, whereas today they are deterred, when these innovations are patentable, by the risk of others independently obtaining them and patenting them, because this not only makes them no longer protectable as trade secrets, but can even preclude their continued use even by those who had already achieved further use, which is only permitted within the limits of the so-called *prior use defence*, which is not recognised in all legal systems and is in any case limited. It is precisely the increased ability to innovate resulting from the use of Artificial Intelligence in research that will make it riskier to resort to the secretive exploitation of one's innovations, which, instead, in the absence of patents, would be encouraged, hindering the dissemination of knowledge. This will also make it more advisable to resort to the publication[34] - which prevents valid patenting by anyone - whenever the innovation does not guarantee an economic return from its exclusive exploitation such as to justify the costs of patenting (particularly high if one wants to extend one's patents internationally, which is indispensable to truly protect oneself in an increasingly globalised

[33] The application of deep learning techniques is significantly facilitated by the text and data mining (TDM) exception introduced by the Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019 on copyright and related rights in the Digital Single Market [2019] OJ L130/92. Under Articles 3 and 4 of the Directive, certain uses of copyrighted works for the purposes of TDM are exempt from the exclusive rights of rightholders. Article 3 provides a mandatory exception for research organisations and cultural heritage institutions, while Article 4 introduces a broader exception applicable to any user, provided that the rightholder has not expressly reserved rights in an appropriate manner. This legal framework enables developers of artificial intelligence systems to process vast volumes of textual and data-based content—including scientific publications, online databases, and digital archives—without infringing copyright, provided the statutory conditions are met. In the context of deep learning, where the effectiveness of the model often depends on the quantity and diversity of data used in training, the TDM exception plays a crucial role in ensuring lawful access to large datasets. It therefore represents an important regulatory development for the advancement of AI-driven innovation within the European Union.

[34] On *defensive publication* (or *defensive disclosure*) strategies see eg Bill Barrett, 'Defensive Use of Publications in an Intellectual Property Strategy' (2002) 20(2) Nature Biotechnology 191.

world), but one still wants to ensure the possibility of making use, albeit not alone, of that innovation, without risking others patenting it. On the other hand, the spread of Artificial Intelligence tools, especially in the scientific community, will facilitate the use of *open source* in this field too, expanding knowledge in the public domain[35].

In this perspective, one must also consider the possibility of Artificial Intelligence being used not only to build patents, but also to evaluate them - for instance by the EPO and USPTO[36] - and to attack them, proving their obviousness. In fact, it is clear that those attacking for invalidity will prevail if they provide evidence that a *priori*, by feeding a publicly available Artificial Intelligence algorithm and whose use is part of industry practice, the invention is arrived at by taking non-inventive steps, that is, steps suggested by known technique and corresponding to industry practice: it must, of course, be a practice that includes not generically the use of Artificial Intelligence, but an Artificial Intelligence that is available (both on the side of algorism, and on the side of data and the structuring of it), even if it is expensive to obtain, and not of a 'customised' Artificial Intelligence that only the inventor (or the one who challenges its validity) possesses and for which the considerations made above regarding information and tools that do not belong to the domain expert's baggage apply.

Abolishing patents would therefore create much greater distortions to the functioning of the market than those that patent critics see as attributable to the patent system[37], because it would ensure higher returns on investment for innovations that can be exploited under secrecy - as they cannot be *reverse engineered* from marketed products - while diverting them from areas where this possibility does not exist, including, typically,

[35] On open source, see Gustavo Ghidini and Valeria Falce, 'Open Source, General Public Licence e incentive all'innovazione' (2004) 13 AIDA 3; Simona Lavagnini, 'Validità e applicazione delle licenze open source' (nota a Trib Venezia, 13 December 2021) (2022) 31 AIDA 921; Massimo Di Rienzo, 'L'organizzazione dei mondi open source: profili soggettivi' (2004) 13 AIDA 12; Elisabetta Loffredo, 'Open Source e appartenenza del software' (2004) 13 AIDA 67, 86; Giovanni Guglielmetti, 'Open Source e interoperabilità con software proprietario' (2004) 13 AIDA 144, 155; see also, from a theoretical perspective, Brian Behlendorf, 'Open Source as a Business Strategy' in Chris Di Bona, Mark Stone and Sam Ockman (eds), '*Open Sources: Voices from the Open Source Revolution*' (O'Reilly Media 1999).

[36] On what the national patent offices will be able to do in relation to the advent of new technologies, see Simons (n 26) 146, where he observes that 'Determining the prior art that PHOSITAs (Persons Having Ordinary Skills In The Art: editor's note) actually consider at the time of filing and their level of skill will be more costly and time-consuming, and often outside the scope of patent examiners' expertise'. This implies that the Offices will have to equip themselves with adequate tools and probably that at least the major ones among them (EPO, USPTO, JPO and in perspective also CNIPA) will have to collaborate more with each other, at least in exchanging the results of the use of these tools in the patent analysis, it being understood that then, in the absence of a standard in any case in the determination of the *inventive step* each of them will apply its own.

[37] On the potential distorting effects of patent exclusivity see in particular Murrey N Rothbard, *Man, Economy and State with Power and Markets* (Ludwig von Mises Institute 2004) 1134, where he observes that 'Research expenditures [...] are overstimulated in the early stages before anyone has a patent and unduly restricted in the period after the patent is received' and that further distortions derive from the fact that almost all legal systems provide for patent prohibitions or exclusivity regimes that are at least partially different for certain types of innovations, so that 'The patent system thus has the further effect of artificially stimulating research expenditures in the patentable areas, while artificially restricting research in the non-patentable areas'.

pharmaceuticals and, more generally, those pertaining to an essential public good such as health[38].

The fact that the patent system encourages companies to compete in producing innovation in all sectors in which innovation is susceptible to economic exploitation does not, however, exclude - and indeed favours - recourse by innovators also to strategies not based on exclusivity, such as open innovation or Standard Essential Patents. These strategies can achieve a positive return on investment in a way that differs from the implementation of patentable innovation under exclusivity.

Even in these cases, however, it is precisely the existence, upstream of them, of the exclusivity conferred by the patent that makes it possible to resort to these alternative strategies while avoiding opportunistic behaviour of parasitic appropriation of the fruits of others' research. In the first case, it is precisely the fact that the innovator has an exclusive right that allows him to contractually regulate the waiver of it vis-à-vis certain subjects; subordinating it, for example, to the fact that they destine to open innovation the derived innovation created from the protected one. As typically happens, in matters of copyright, the contractualisation of relations relative to the Creative Commons, typically manifests "holders of copyright and related rights aim to 'deactivate' certain restrictions related to the application of copyright in the digital world (primarily on the Internet) by reserving, for the benefit of users, the exercise not of all rights, but only of some (e.g., in addition to the right of authorship, the rights to use the work for commercial purposes or to modify or develop its content)"[39].

In the second case, as the European Commission already clarified in 2023, "*Standardisation is a key contributor to industrial innovation and competitiveness. Successful standards rest on cutting-edge technologies, which require substantial investments in research and development. Under the rules of many standards development organisations (SDOs), such as the ETSI and the IEEE, companies and individuals may patent their technical contributions to a standard. Patents that protect technology essential to a standard are known as standard-essential patents (SEPs). Typically, SDOs require that any person or company wishing to have their patented technology included in a standard commit to licensing the relevant patents to others who may wish to use the standard (firms using/implementing a standard are also known as 'implementers'). These licences must be granted to implementers on fair, reasonable*

[38] On the special importance of patent protection in this field, which the pandemic has highlighted, see eg, Fausto Massimino, 'Vaccini, brevetti e Big Pharma, tra profitto, sostenibilità e diritto alla salute' (2021) 3 Il Diritto Industriale 232; Cesare Galli, 'Il diritto della proprietà intellettuale di fronte alle sfide della pandemia' (2021) 3 Il Diritto Industriale 221.

[39] E Arezzo, G Mazziotti, 'Le misure tecnologiche di protezione e le informazioni sul regime dei diritti' in Galli and Gambino (eds), *Codice commentato della Proprietà Industriale e Intellettuale* (UTET Giuridica 2011) 3358; on this topic see also S James and R Arkley, 'Intellectual Property in Mobile Applications: The Practicalities' [2012] E-Commerce Law & Policy 12; Alessandra Fabiani, 'Creative Commons: Un Nuovo Modello di Licenza per l'Utilizzazione di Opere in Internet' [2006] Il Diritto di autore 157; and Cesare Galli, 'L'Innovazione nel Web: Opportunità e Problemi Giuridici' (2015) 2 Il Diritto Industriale 105.

and non-discriminatory (FRAND) terms and conditions. If the patent holder refuses to make such a commitment, their patented technology cannot be included in the standard"[40].

Thus, in addition to competition between creators of innovation, competition between different legal techniques for the exploitation of this innovation is also encouraged through patent protection.

7 Conclusions & key policy suggestions

The examination we have conducted shows that it is possible to take into account, in the assessment of inventive activity, the spread of AI and its progress, without there being a need to insert new rules and without the advent of this new instrument calling into question the basic reasons underlying the protection of technical innovations by the granting of the exclusive right of exploitation in which the patent consists. On the contrary, it appears from this examination that precisely the increased possibilities for innovation that the use of AI applied to research allows increases the importance of maintaining the patent system, the pro-competitive function of which it accentuates, particularly in relation to the disclosure that is attached to patenting.

The alternative methods to the patent system for managing innovation, and first and foremost the protection of innovations as *trade secrets* and the associated contractual rules, do not seem to be able to achieve the same results, if not in combination with patent protection. Therefore, before an effective replacement of the patent system can be hypothesised, these methods still need to be thoroughly investigated and developed, so that the choice facing states - and supranational aggregations, such as the European Union - remains between the patent system and direct research funding, which, however, leads to results that are usually less efficient than those given by the market and is in fact basically reserved for areas where the economic incentive cannot work properly, as in the case of rare diseases and certain forms of basic research without direct practical implications and applications, as well as research that leads to results that cannot be protected.

Rather, an already current task for scholars - and, based on their reflections, for *policy makers* - is to envisage correctives to the current law, by enhancing the patent system's ability to also incentivise derivative innovation, by broadening the scope of the compulsory licence for dependency. This licence can already be granted when the invention protected by a second patent cannot be used without prejudice to the rights relating to a first patent granted on the basis of an earlier application, but only if "*the invention claimed in the second patent shall involve an important technical advance of considerable economic significance in relation to the invention claimed in the first*

[40] EU Commission, 'Proposal for a Regulation of the European Parliament and of the Council on standard essential patents and amending Regulation (EU) 2017/1001' COM(2023) 232 final.

patent" (Article 31 of the TRIPs Agreement): this requirement in fact implies largely discretionary assessments in the granting of such a licence, which reduces the effectiveness of the rule. In the same perspective, recourse to voluntary *licensing* should be encouraged, especially for small and medium-sized enterprises, to make the patent an instrument of enhancement and not only of protection, with a view to *business-driven* use of the patent system and more generally of intellectual property rights.

Realising that in the battle for progress, the real enemies of all are bureaucracy, inefficiency, and political mediation, and not patents, means starting to lay the foundations for a new happy growth, of which intellectual property has always been the fulcrum, helping to allocate scarce resources efficiently and thus to truly realise a universal destination of goods, which will only be in the interest of peoples around the world if these goods can be produced in ever-increasing quantity and quality.