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SUBJECT: Update of legal aspects of artificial intelligence and patents

SUBMITTED BY: President of the European Patent Office

ADDRESSEES: Committee on Patent Law (for information)

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#### SUMMARY

This report covers the main topics discussed in the context of patenting artificial intelligence (AI): patentability, inventorship, assessment of inventive step, disclosure and using AI by administrative authorities. It reflects the initiatives taken by the EPO and other organisations worldwide and explains the latest developments concerning applications indicating an AI system as inventor. The purpose of the report is to provide an update on the legal aspects of patenting inventions relating to AI and a basis for an exchange of views in the Committee on Patent Law.

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## I. **STRATEGIC/OPERATIONAL**

1. Operational.

## II. **RECOMMENDATION**

2. The present document is submitted to the Committee on Patent Law for information.

## III. **MAJORITY NEEDED**

3. N/A.

## IV. **CONTEXT**

4. Artificial intelligence (AI) technology remains one of the main drivers of the present Fourth Industrial Revolution (4IR). While promising to resolve many of the issues humanity faces, AI at the same time challenges society, ethics and the law.

5. The EPO was one of the first organisations to drive the discussion on issues relating to patenting AI. With a view to providing a broad discussion platform, the EPO hosted an IP5 expert roundtable on AI<sup>1</sup> (October 2018) focussing on the legal aspects of AI patenting (such as inventorship, subject-matter eligibility, sufficiency of disclosure and inventive step). It also organised two major public conferences, both in 2018, dedicated respectively to patenting of AI<sup>2</sup> and to blockchain.<sup>3</sup> Additionally, the EPO discussed patentability of inventions involving AI with its contracting states,<sup>4</sup> gaining a shared understanding of critical issues important for the development in this technical area. Furthermore, the EPO has conducted studies in the area of patents and the 4IR technologies<sup>5</sup> as well as patents and self-driving vehicles.<sup>6</sup>

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<sup>1</sup> The report from the expert roundtable is available here:

[https://www.fiveipooffices.org/material/ai\\_roundtable\\_2018\\_report/ai\\_roundtable\\_2018\\_report](https://www.fiveipooffices.org/material/ai_roundtable_2018_report/ai_roundtable_2018_report)

<sup>2</sup> More information is available here: <https://www.epo.org/news-events/events/conferences/2018/ai2018.html>.

<sup>3</sup> More information is available here: <https://www.epo.org/news-events/news/2018/20181205.html>.

<sup>4</sup> In 2018 the EPO conducted a questionnaire with the EPC contracting states. The contracting states reported on their law and practice concerning inventorship issues, patentability of AI, assessment of inventive step (the standard of person skilled in the art) and sufficiency of disclosure (CA/PL 10/18) and their replies were discussed during the 50<sup>th</sup> Committee on Patent Law (CA/PL 7/19, with Add 1-3).

<sup>5</sup> The study is available here: <https://www.epo.org/news-events/news/2017/20171211.html>.

<sup>6</sup> The study is available here: <https://www.epo.org/service-support/publications.html?pubid=177#tab3>.

6. The patent system has to a large extent been harmonised internationally and the users of the patent system are filing applications world-wide. Continuous monitoring of the technical developments and exchange of policies and practices between the patent offices and beyond contributes to aligning practices and increases legal certainty for the users of the patent system.
7. In order to address the rapid development of new emerging technologies (NET) and AI, the resulting challenges for patent law and practices and the potential opportunities for efficiency gains in office operations, the five largest patent offices worldwide, the IP5 Offices,<sup>7</sup> established an EPO-led task force in 2019.<sup>8</sup> The task force will enable the IP5 Offices to develop joint initiatives in coordination with the user associations of the IP5 regions and to respond to global technological developments and evolving user needs. The task force focusses primarily on legal and IT aspects as well as on a long-term approach regarding strategic opportunities and challenges related to NET/AI.
8. In addition to these initiatives, the EPO actively engages in the discussion of AI patenting led by other organisations world-wide. For instance, the EPO provided comments on the patent-related aspects of the consultations by the World Intellectual Property Organisation (WIPO),<sup>9</sup> the European Commission<sup>10</sup> and the USPTO.<sup>11</sup>
9. Moreover, the EPO was one of the authorities where applications indicating an AI system (“DABUS”) as inventor were filed. The “DABUS applications” were filed in 2019 and were refused because the EPC requires that the inventor is a natural person.<sup>12</sup> The applicant filed appeals against these decisions. Corresponding applications were filed with the Intellectual Property Office of the United Kingdom (UKIPO) and with the USPTO, who both rejected them for similar reasons.

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<sup>7</sup> European Patent Office (EPO), China National Intellectual Property Administration (CNIPA), Japan Patent Office (JPO), Korean Intellectual Property Office (KIPO), United States Patent and Trademark Office (USPTO).

<sup>8</sup> IP5 NET/AI Task Force, report from the first meeting available here: <https://www.fiveipoffices.org/news/20200117>.

<sup>9</sup> For more information on WIPO Conversation on IP and AI see here: [https://www.wipo.int/meetings/en/details.jsp?meeting\\_id=55309](https://www.wipo.int/meetings/en/details.jsp?meeting_id=55309).

<sup>10</sup> For more information on the Roadmap on the IP action plan of the European Commission see here: <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12510-Intellectual-property-action-plan>.

<sup>11</sup> For more information on the USPTO Request for Comments on AI and the replies received see here: <https://www.uspto.gov/about-us/news-updates/uspto-posts-responses-from-requests-comments-artificial-intelligence>.

<sup>12</sup> A report on these decisions was given in the 51<sup>st</sup> PLC meeting under AOB.

10. The initiatives mentioned above have proven to be an excellent framework and basis for the discussions among various stakeholders and thus contribute to increased legal certainty for the users of the patent system world-wide. Aimed at facilitating a discussion of the issues and latest developments in the area of AI among the EPC contracting states, the EPO has prepared the present document containing an update on the legal aspects of patenting inventions relating to AI and serving as a basis for an exchange of views in the Committee on Patent Law.

## **V. PATENTABILITY OF AI**

11. The European patent system has witnessed many technical developments, notably in the areas of biotechnology, pharma and computer-implemented inventions (CII). The legal framework provided by the EPC has proved to be flexible and adaptable, thus enabling accommodation of technical developments into the framework of patent protection, including AI and machine learning (ML).
12. AI is a branch of computer science which is attempting to build machines exhibiting “intelligent behaviour”. The main enabler of AI is ML. It concerns algorithms allowing computers to self-improve at solving computational tasks, thereby involving mathematical methods. The EPO understands that AI and ML are based on computational models and algorithms for classification, clustering, regression and dimensionality reduction, such as neural networks, genetic algorithms and support vector machines. Such computational models and algorithms are per se of an abstract mathematical nature. However, depending on how they are implemented, they may have a technical character and thus be patentable inventions.
13. Under the European Patent Convention (EPC), patents are granted for any inventions in all fields of technology, provided that they meet the patentability requirements (novelty, inventive step, industrial application; Article 52(1) EPC).<sup>13</sup> Exclusions from patentability laid down in Article 52(2)-(3) EPC and exceptions to patentability stipulated in Article 53 EPC relate to certain types of subject-matter (such as discoveries, mathematical methods, rules for performing mental acts, programs for computers claimed as such, plant or animal varieties, methods of treatment of the human and animal body), or its exploitation (contrary to ordre public or morality). The EPC does not contain any provisions which would prevent patenting certain subject-matter based on how or by whom it was generated.

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<sup>13</sup> See also Article 27(1) TRIPS Agreement.

14. The technical character of inventions involving AI is acknowledged if the claimed subject-matter requires the presence of any technical means, e.g. a computer or any other technical device. It follows that inventions involving AI are normally considered computer-implemented inventions (CII) and can therefore benefit from patent protection, as long as they meet the above-mentioned patentability requirements, which are explained in detail in the Guidelines for Examination in the EPO, G-II, 3.3.1.

## **VI. INVENTORSHIP**

15. From the perspective of inventorship, three possible types of inventions using AI technologies can be considered:
- 1) human-made inventions using AI for the verification of the outcome,
  - 2) inventions in which a human identifies a problem and uses AI to find a solution,
  - 3) AI-made inventions, in which AI identifies a problem and proposes a solution without human intervention.
16. The EPC requires that the applicant designates a natural person as inventor (Article 81, Rules 19, 21 EPC).<sup>14</sup> Beyond this formal requirement, the EPO does not check the correctness or completeness of the designation of inventor. The determination of the person of the inventor lies in the competence of the national courts (Article 61 EPC).

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<sup>14</sup> The laws of the EPC contracting states appear to contain the same requirement, see feedback from the EPC contracting states collected by the EPO in 2018, available in documents CA/PL 10/18 and CA/PL 7/19, with Add 1-3, and summarised here:

[http://documents.epo.org/projects/babylon/eponet.nsf/0/3918F57B010A3540C125841900280653/\\$File/AI\\_inventorship\\_summary\\_of\\_answers\\_en.pdf](http://documents.epo.org/projects/babylon/eponet.nsf/0/3918F57B010A3540C125841900280653/$File/AI_inventorship_summary_of_answers_en.pdf).

17. The state of technology suggests that the AI systems might not reach the level of human ability before ca. 2075.<sup>15</sup> Thus, it seems premature to conclude that inventions can be autonomously generated by AI.<sup>16</sup> It appears that AI is currently and will remain for the foreseeable future a tool for a human inventor, who may use various tools in the inventive process, ranging from simple mechanical tools such as a hammer, to refined software and AI machines.
18. The person of the inventor is strictly connected with the determination of the claimed invention. Depending on where the invention lies, the inventor may e.g. be the software developer who set up an AI system, the person who trained the machine with data, the person who interpreted the output of an ML algorithm, the person who improved an AI algorithm to obtain a certain technical effect or who identified the technical application of the output of an AI system (or a combination thereof). The question whether an AI application should be permitted to be a sole inventor or a joint inventor with a human is deemed premature. For a broader analysis of these issues, we refer to the academic study on AI inventorship which was commissioned by the EPO.<sup>17</sup>

## **VII. OWNERSHIP**

19. The right to a European patent belongs to the inventor or their successor in title (Article 60(1) EPC) and rights to inventions and patents are transferable (cf. Rules 22, 85 EPC). Under the EPC, applicants are deemed to be entitled to exercise inventors' property rights (Article 60(3) EPC). In case of a dispute, the national courts determine the person of the inventor (Articles 60(1), second sentence, and 61 EPC). The judgments of the national courts are binding on the EPO (Article 61(1) EPC and Rule 20(2) EPC).

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<sup>15</sup> V. Müller and N. Bostrom, "Future progress in artificial intelligence: A Survey of Expert Opinion, in V. Müller" (ed.), *Fundamental Issues of Artificial Intelligence* (Synthese Library; Berlin: Springer 2016), page 14, available at <https://nickbostrom.com/papers/survey.pdf>. See also K. Grace, J. Salvatier, A. Dafoe, B. Zhang, and O. Evans, "When Will AI Exceed Human Performance? Evidence from AI Experts" (*Journal of Artificial Intelligence Research* 62 (2018) 729-754), available at <https://arxiv.org/pdf/1705.08807.pdf>; T. Walsh, "Expert and non-expert opinion about technological unemployment" (*International Journal of Automation and Computing* 06/2018, 15(5): 637-642) available at: <https://link.springer.com/content/pdf/10.1007/s11633-018-1127-x.pdf>.

<sup>16</sup> See e.g. D. Kim, 'AI-Generated Inventions: Time to Get the Record Straight, GRURInt 2020, 443.

<sup>17</sup> Dr Noam Shemtov, A Study on Inventorship in Inventions Involving AI Activity, available here: [http://documents.epo.org/projects/babylon/eponet.nsf/0/3918F57B010A3540C125841900280653/\\$File/Concept\\_of\\_Inventorship\\_in\\_Inventions\\_involving\\_AI\\_Activity\\_en.pdf](http://documents.epo.org/projects/babylon/eponet.nsf/0/3918F57B010A3540C125841900280653/$File/Concept_of_Inventorship_in_Inventions_involving_AI_Activity_en.pdf).

20. Accordingly, if the natural person who trains the AI system is the inventor, that person may have the right to file a patent application. If the person filing an application is not the inventor, they may obtain the right to the invention from the inventor by assignment or by another type of succession. If a person who trains the AI system creates a new invention using an earlier invention, they may be able to obtain patent protection for a dependent invention.

### **VIII. THE “DABUS APPLICATIONS”**

21. The principles of inventorship and ownership were challenged in 2019 when two applications<sup>18</sup> indicating an AI system (“DABUS”) as inventor were filed with the EPO.
22. The applications were refused by the EPO Receiving Section because they did not meet the formal requirements of Article 81 and Rule 19 EPC, which require that the designation of inventor indicates a natural person. In the reasons for the decision the Receiving Section explains that Rule 19(1) EPC requires that the designation of inventor indicates the inventor’s name. Names given to things may not be equated with names of natural persons which enable them to exercise their rights and form part of their personality. The wording of the EPC and the legislative history show that the term “inventor” refers to a natural person only. Also the EPO boards of appeal have consistently referred to the inventor as a natural person, even though they have not yet had to decide on whether an entity other than a natural person can be designated as inventor. The Receiving Section points out that AI systems have no legal personality. They cannot be party to an employment relationship or own their output and they cannot transfer any rights thereto. Thus, the owner of an AI system cannot be considered to be a successor in title within the meaning of Article 60(1) EPC. The Receiving Section also stressed that the EPO does not verify the origin of the subject-matter claimed in a patent application. Designation of inventor is a formal requirement of an application. Assessment of the formal requirements, which relate to the application, is independent from and has no bearing on the substantive patentability requirements, which relate to the invention.

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<sup>18</sup> Applications number EP 18 275 163 and EP 18 275 174. Documents relating to application EP 18 275 163 are available here: <https://register.epo.org/application?number=EP18275163&lng=en&tab=doclist>; documents relating to application EP 18 275 174 are available here: <https://register.epo.org/application?number=EP18275174&lng=en&tab=doclist>.

23. The applicant filed appeals against these decisions requesting that they be set aside, the applications be reinstated and that DABUS be named as the inventor. The appeals are pending with the Legal Board of Appeal as cases J 8/20 and J 9/20.
24. Corresponding applications were filed with the UKIPO, the USPTO and WIPO. Similarly to the EPO, the UKIPO<sup>19</sup> and the USPTO<sup>20</sup> argued that DABUS cannot be accepted as inventor because the inventor must be a human being. The applicant filed an appeal against the decision of the UKIPO; the outcome is not yet known. The USPTO decision is final, but the applicant filed a civil action challenging it.<sup>21</sup> WIPO<sup>22</sup> does not assess designations of inventor in international applications.

## **IX. POTENTIAL REVIEW OF THE PRINCIPLES OF INVENTORSHIP AND OWNERSHIP**

25. Without prejudice to the decisions of the EPO Legal Board of Appeal and the national courts in the pending cases, currently it appears that any review of the principle that the inventor can only be a natural person or persons (in case of co-inventorship) or any revision of the rules regulating ownership, would be linked to a policy debate about the role of the patent system, including the basic principle that patents are granted to natural persons in order to reward them for inventive contributions which benefit society. Such a policy discussion would need to take due account of the fact that patent law with its requirement of human inventorship is part of a system of protection of intellectual property which is based on principles shared globally and has been harmonised to a significant extent at international level. It would also need to recognise that the question of inventorship must be seen in a broader context of rights allocated to persons. The question is not limited to rights of intellectual property. It also concerns more general concepts of law such as ownership, employment, legal personality, liability and accountability. Since these concepts constitute the basis of the legal system(s) as a whole, any revision must be considered with due account of its impact going far beyond patent law.

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<sup>19</sup> Decision of the UKIPO on the DABUS applications is available here: [https://www.ipo.gov.uk/p-challenge-decision-results/p-challenge-decision-results-bl?BL\\_Number=O/741/19](https://www.ipo.gov.uk/p-challenge-decision-results/p-challenge-decision-results-bl?BL_Number=O/741/19)

<sup>20</sup> Decision of the USPTO on the DABUS applications available here: [https://www.uspto.gov/sites/default/files/documents/16524350\\_22apr2020.pdf?utm\\_campaign=subscriptio ncenter&utm\\_content=&utm\\_medium=email&utm\\_name=&utm\\_source=govdelivery&utm\\_term=](https://www.uspto.gov/sites/default/files/documents/16524350_22apr2020.pdf?utm_campaign=subscriptio ncenter&utm_content=&utm_medium=email&utm_name=&utm_source=govdelivery&utm_term=)

<sup>21</sup> The related documents are available here: [https://www.pacermonitor.com/public/case/35707229/Thaler\\_v\\_lancu,\\_et\\_al](https://www.pacermonitor.com/public/case/35707229/Thaler_v_lancu,_et_al)

<sup>22</sup> Application number WO 2020/079499 A1.

26. From the technical perspective, due attention is to be paid to the aspect that a patentable invention is often devised combining different elements (such as data, computer programs and technical considerations) as well as hardware. Should one consider dispensing with the requirement of a human (natural person) as the inventor, the decisive criteria would need to be established for accordance of the inventorship between these various elements which might all be comprised by the AI in question.

**X. INVENTIVE STEP**

27. The "person skilled in the art" is presumed to be a skilled practitioner in the relevant field of technology, who possesses average knowledge and ability and is aware of what was common general knowledge in the art at the relevant date. The notion of the skilled person is a theoretical concept which is sufficiently flexible to allow assessing patentability of inventions in the AI area and does not need to be changed in view of the current technical developments.
28. The relevant field of technology is determined by the invention claimed in the patent application. It can e.g. refer to the AI algorithm, to the emerging product or process, or to both. Accordingly, the knowledge of the skilled person depends on the invention claimed. AI inventions usually encompass various technical fields, and correspondingly the skilled person may be a group of persons, e.g. an interdisciplinary research or production team.
29. In particular, it is noted that the skilled person has at their disposal the means and capacity for routine work and experimentation which are normal for the field of technology in question. Accordingly, if AI is used in the relevant field of technology, it will be used by the skilled person and their skills will raise accordingly.
30. The considerations made when determining prior art for the assessment of novelty and inventive step are the same for AI inventions as for other types of inventions. The concept of state of the art is defined broadly and encompasses everything made available to the public by means of a written or oral description, by use, or in any other way, before the date of filing of the European patent application (Article 54(2) EPC). There are no restrictions whatsoever as to the origin, the geographical location, the language or the manner in which the relevant information was made available to the public. Therefore, content generated by AI qualifies as prior art as long as it was made available to the public. To match the volume of the anticipatory prior art produced by AI, the EPO will assist its examiners with state-of-the-art AI in searching and examining more prior art.

## **XI. DISCLOSURE OF THE INVENTION**

31. A patent application must disclose the invention in a manner sufficiently clear and complete for it to be carried out by a skilled person (Article 83 EPC). This requirement ensures that a patent is only granted in return for the applicant making the invention available to society. It is noted that the disclosure requirement has been harmonised internationally (Article 29.1 TRIPS Agreement). The EPC requirement of sufficiency of disclosure applies equally to all inventions, including AI inventions.
32. It is sometimes suggested that it is difficult to disclose AI inventions. However, the assessment of sufficiency of disclosure is fact-dependent and may involve different considerations for inventions involving improvements of e.g. algorithms, training steps or classifiers. It is generally possible to enable the skilled person to reproduce the results of an AI algorithm by e.g. disclosing the underlying algorithm and/or the training steps involved (e.g. in the training of the classifier). Algorithms can be disclosed in the written description of a patent.
33. As with any invention involving a mathematical method, the application for an AI invention should elaborate on how a certain AI system and/or AI algorithm is being adapted to a specific technical implementation or how it is applied to a recognised field of technology. The field of technology must be given in the application and the objective technical problem must be directly derivable from the application documents. This information allows the determination of the level of knowledge of the skilled person.
34. The perceived difficulties in disclosing AI inventions are sometimes proposed to be resolved by the creation of a system of deposit for AI applications or training data, similar to the deposit of microorganisms. However, such a system does not appear suitable in the case of algorithms. Firstly, depending on the subject-matter and the scope of protection, it is not always necessary to disclose the whole algorithm. Secondly, unlike microorganisms, algorithms can be described in writing. Thus, the rationale for the deposit of microorganisms under the Budapest Treaty<sup>23</sup> (to safeguard disclosure of microorganisms which require special handling) does not apply to algorithms. It would not provide any added value. Thirdly, the introduction of such a deposit system would need international acceptance and the administration of the system may prove complicated.

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<sup>23</sup> Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure (as amended on September 26, 1980).

35. Related to sufficiency of disclosure is the clarity requirement. While patent applications in the AI field often contain buzzwords and marketing terms, best practices in claims drafting require the use of precise and unambiguous terminology in order to meet the clarity requirement.

## **XII. USE OF AI IN PUBLIC ADMINISTRATION AND ACCOUNTABILITY FOR DECISIONS**

36. It is sometimes proposed to consider whether AI should be allowed to make decisions in the prosecution of IP applications and, if yes, who is accountable for such decisions.
37. The EPO is exploring the ways in which AI can be used as a tool to enhance the efficiency of the patent grant process, in particular in classification and search. However, all final decisions are left to human beings, in line with the fundamental principles of good administration and legal procedures and the human-centric approach endorsed by the European Commission.<sup>24</sup> As a public authority responsible for granting patents, the EPO remains fully accountable for its decisions, irrespective of the tools used in the decision-making process.

## **XIII. IMPACT OF AI ON OTHER AREAS**

38. While the EPC is prepared to accommodate AI inventions, the development of AI technology poses questions for other areas of law and beyond: for society and ethics.
39. The impact of the development of AI technology on society, including changes in the right-holder's position, employment market and ethical challenges that AI poses are also areas which may need to be addressed as the technological development progresses.

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<sup>24</sup> See e.g. European Commission White Paper On Artificial Intelligence – A European approach to excellence and trust (19.02.2020, COM(2020) 65 final), available at [https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020\\_en.pdf](https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf). See also Study of the European Parliament on European Civil Law Rules on Robotics, available at [https://www.europarl.europa.eu/RegData/etudes/STUD/2016/571379/IPOL\\_STU\(2016\)571379\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2016/571379/IPOL_STU(2016)571379_EN.pdf)

#### **XIV. SELECTED ACTIVITIES AT EU, WIPO AND NATIONAL LEVEL**

40. As explained above (points 7-8), in addition to leading the initiatives mentioned above, the EPO actively engages in the discussion of AI patenting led by other organisations world-wide, including:

- WIPO Conversation on IP and AI, where the EPO intervened in the second session of the WIPO Conversation on 7-8 July 2020. For more details see [https://www.wipo.int/meetings/en/details.jsp?meeting\\_id=55309](https://www.wipo.int/meetings/en/details.jsp?meeting_id=55309)
- European Commission White Paper On Artificial Intelligence – A European approach to excellence and trust (19.02.2020, COM(2020) 65 final), available at [https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020\\_en.pdf](https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf)
- Roadmap on the IP action plan of the European Commission, on which the EPO provided written comments. For more details see <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12510-Intellectual-property-action-plan>
- USPTO Request for Comments, on which the EPO provided written submissions. For more details see <https://www.uspto.gov/about-us/news-updates/uspto-posts-responses-from-requests-comments-artificial-intelligence>

#### **XV. ALTERNATIVES**

41. N/A.

#### **XVI. FINANCIAL IMPLICATIONS**

42. N/A.

#### **XVII. LEGAL BASIS**

43. N/A.

#### **XVIII. DOCUMENTS CITED**

44. CA/PL 10/18, CA/PL 7/19, with Add 1-3.

#### **XIX. RECOMMENDATION FOR PUBLICATION**

45. Yes.