

Title: Consultation stage impact assessment on Artificial Intelligence and Intellectual Property. IA No: RPC Reference No: RPC-BEIS-IPO-5101(1) Lead department or agency: Intellectual Property Office (an executive agency of the Department for Business, Energy and Industrial Strategy). Other departments or agencies:	Impact Assessment (IA)			
	Date: 29 October 2021			
	Stage: Consultation			
	Source of intervention: Domestic			
	Type of measure: Primary legislation			
Contact for enquiries: AICallForViews@ipo.gov.uk				

Summary: Intervention and Options

Cost of Preferred (or more likely) Option (in 2019 prices)			
Total Net Present Social Value	Business Net Present Value	Net cost to business per year	Business Impact Target Status Qualifying provision
£m	£m	£m	

What is the problem under consideration? Why is government action or intervention necessary?
 The government wants the UK to be the best place in the world for research and innovation, and at the forefront of the artificial intelligence and data revolution. The new National AI Strategy will secure the UK's position amongst the global AI superpowers. Venture Capital investment in UK firms increased significantly over the last five years and UK firms are the main beneficiaries in Europe. However, AI uptake remains low relative to other European countries. IP is one of the levers available to government to increase returns on investments for inventors and creators and thereby incentivise investment in AI to invent and create. This consultation considers whether the current IP regime strikes the appropriate balance to encourage the development of AI and its use across the UK economy.

What are the policy objectives of the action or intervention and the intended effects?
 The government's objective is to incentivise investment in AI development and to promote the use of AI for public benefit, whilst enabling competitive markets, consumer choice and fair access to IP-protected goods for the benefit of society.

What policy options have been considered, including any alternatives to regulation?
 At consultation stage there are no preferred options.
 We are consulting on 3 areas of potential change for the Intellectual Property regime.
Section A: Computer Generated Works (CGW) options: Option 0- no change, Option 1 - remove CGW protection, Option 2- replace current provision with an alternative with a reduced scope/duration.
Section B: Text and Data Mining (TDM) options: Option 0- no legal change but possible guidance, Option 1 - adopt a licence-based model, Option 2 - extend existing exception to cover commercial research, Option 3 - adopt an exception for any use with a rights holder opt out, Option 4 - adopt an exception for any use with no possibility for rights holder opt out.
Section C: Patent options: option 0- no legal change, option 1- expand definition of "inventor", option 2- recognise AI as inventor in patent applications, option 3- protect AI devised invention through a new type of protection.

Is this measure likely to impact on international trade and investment?		Yes			
Are any of these organisations in scope?		Micro Yes	Small Yes	Medium Yes	Large Yes
What is the CO ₂ equivalent change in greenhouse gas emissions? (Million tonnes CO ₂ equivalent)		Traded: N/A		Non-traded: N/A	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible
 Sam Brand, Chief Analyst: _____ Date: _____

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Background

AI development and use

Artificial Intelligence is defined in the national AI strategy¹ as “Machines that perform tasks normally requiring human intelligence, especially when the machines learn from data how to do those tasks.”

Machine learning, which relies on the cleaning and use of training datasets, currently dominates the field but it cannot be excluded that this changes in the future possibly enabling AI to play a more important role. However, there is uncertainty about whether this change will happen and when.

Machine learning requires access to labelled data for training, to develop algorithms for the computing systems, and to have access to special purpose hardware to run the algorithms.

In the last few years investments in AI have mostly been made by large technology companies.² Other sectors such as automotive, insurance, health and retail are increasingly investing in this technology, particularly through the acquisition of AI start-ups. Private equity investment in AI firms has accelerated in recent years but remains concentrated in the United States and China. Although UK start-ups are the main beneficiaries of AI investment in Europe and investment is increasing³, the AI adoption by firms remains low relative to other European countries. In 2020, only 4% of UK firms use one or several AI systems, three points below the European Union average.⁴ Nevertheless, uptake is likely to increase as the technology diffuses throughout the economy and the Intellectual Property (IP) framework may affect the pace of this change. Finally, analysis of venture capital funding per capita shows that funding per capita is concentrated in a relatively low number of countries. The UK has the 6th highest level of venture capital funding per capita, behind countries such as Israel, US, Sweden.

In the future industries that are already starting to use AI technology are more likely to be affected by a change in IP legislation. In 2020 in the UK, Information and communication, Administrative and support service activities and Professional, scientific and technical activities have the highest AI adoption - respectively, 9%, 9% and 8% of firms (*Figure 1*).^{5,6} While Information and communication has one of the highest AI adoption rate across sectors in the UK, it is lagging behind other countries (in the European Union, 17% of firms in 2020).

To train the AI algorithm, firms may collect their own data internally (social media, sensors, management information), collect data externally (web scraping, agree licences) or use third party data providers.

¹ <https://www.gov.uk/government/publications/national-ai-strategy>

² OECD (2019). *Artificial Intelligence in Society*. Paris: OECD Publishing. doi:<https://doi.org/10.1787/eedfee77-en>

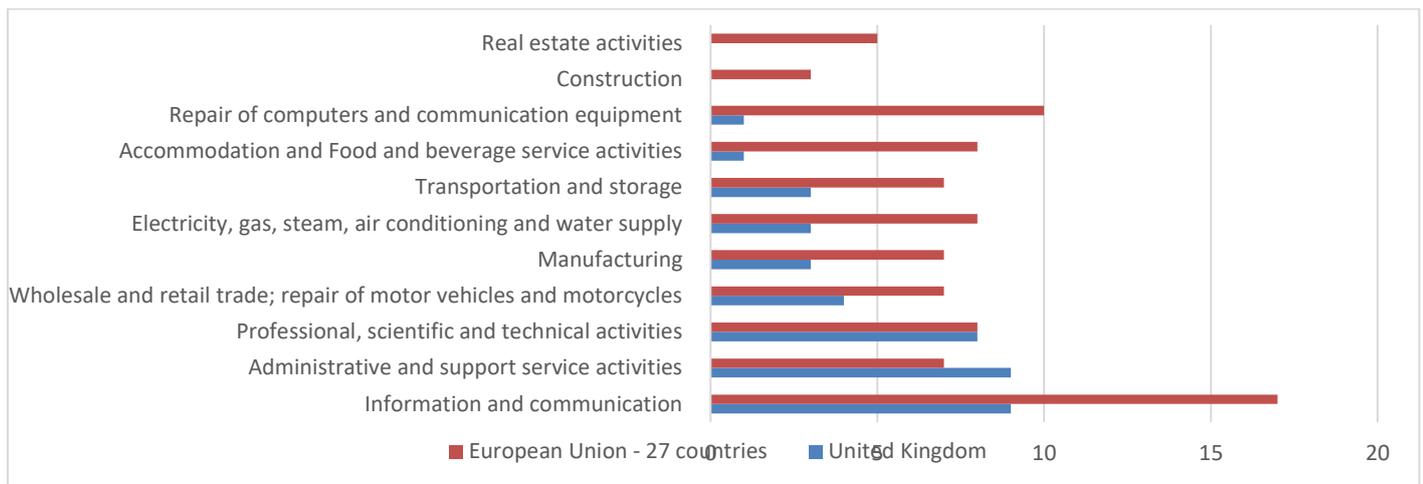
³ Tech Nation (2021). *A Guide to the AI Ecosystem*.

⁴ [Eurostat Digital economy and society database](#)

⁵ Eurostat Digital economy and society database

⁶ It is worth noting that only some firms will be using AI to develop inventions. Current available data on AI use does not allow us to distinguish between those use AI to invent and those that do for other purpose.

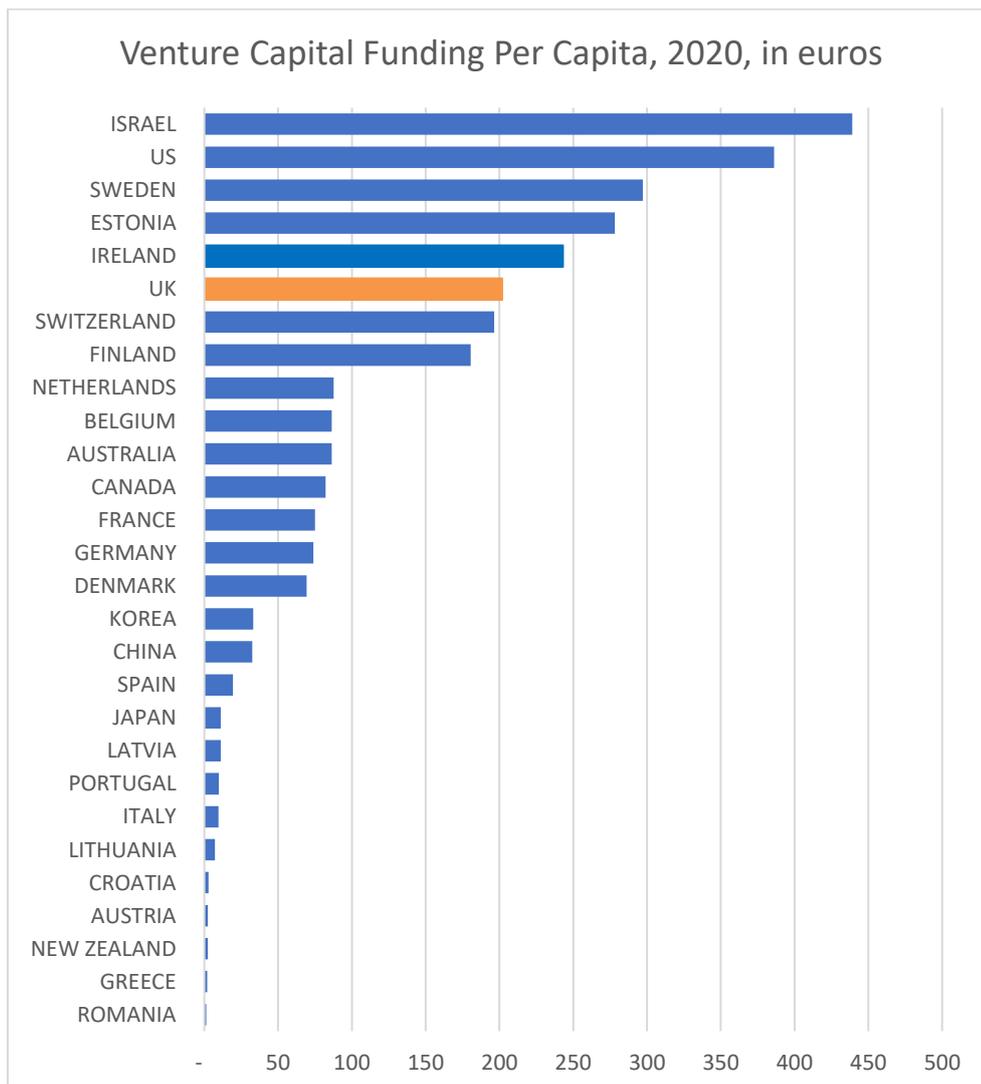
Figure 1: Adoption of AI by firms, by industry



Source: Eurostat Digital economy and society database

Notes: Firms correspond to those with 10 employees or more.

Figure 2 : Venture capital funding per capita, 2020 (in euros)



Source: Funding data from dealroom.co Population data from UN Population Estimates

Graph also replicated on [FT.com analysis](#)

Impact of AI on the economy

Estimates suggest a 1.31-22% increase in UK output by 2030 through increased productivity, product enhancements, and increased consumer demand due to AI.^{7,8,9} This analysis illustrates a broad range of impact with a high degree of uncertainty in the potential impact of AI on the economy.

Use of IP by firms

- Not all creators and inventors use the IP system to protect their creations and inventions. Other forms of protections may be used over patents and copyrights: 0.8% of broader innovators¹⁰ rated patent as highly important to protect their innovations, 1.7% copyrights, 1.8% the complexity of their products, and 2.6% the secrecy (

⁷ Economist Intelligence Unit, 2018. *Risks and rewards - Scenarios around the economic impact of machine learning*.

⁸ PWC, 2017. *The Impact of AI on the UK Economy*.

⁹ McKinsey, 2019. *AI in the UK*.

¹⁰ Broader innovators are firms that (i) introduced a new or significantly improved product (good or service) or process, (ii) engaged in innovation projects not yet complete or abandoned, (iii) introduced new and significantly improved forms of organisation, business structures or practices and marketing concepts or strategies, and/or (iv) engaged in activities in areas such as internal research and development, training, acquisition of external knowledge or machinery and equipment linked to innovation activities.

- *Figure 3*).¹¹ The use of patents and copyrights by firms to protect creations and inventions depends on their size and industry.

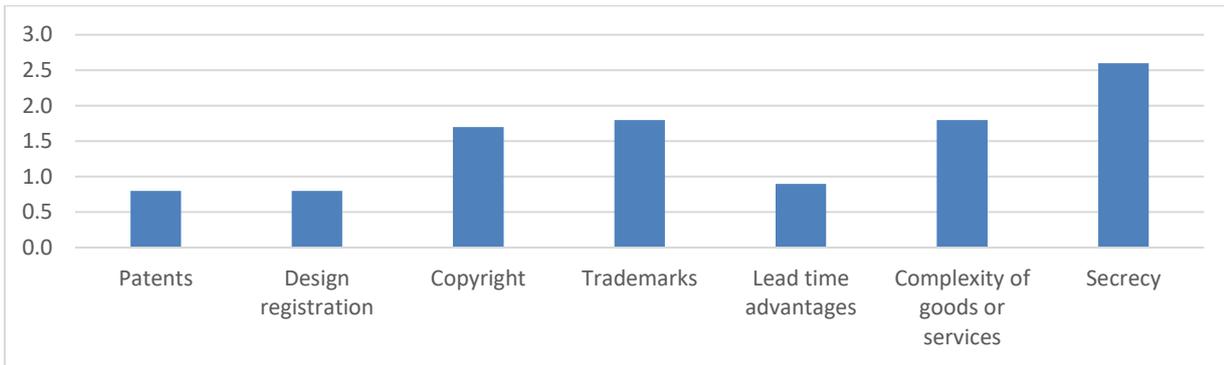
There are challenges on obtaining data specifically pertaining to AI. However, AI often makes use of big data and cloud computing services. Data from the Office for National Statistics (ONS) shows that the proportion of firms in certain creative sectors¹² using big data analysis grew from 2.4% in 2015 to 3.9% in 2019. The proportion of firms in the same sectors using cloud computing services grew from 28.5% to 42.5% from 2015 to 2019. Overall, the ONS data shows us that while big data is only used by an incredibly low proportion of creative firms – a growth from 2.4% in 2015 to 3.9% in use of big data represents over a 50% growth rate in 4 just years.

- The importance of patents for firms to protect their inventions depends on their size and their industry. Larger firms tend to rate patents as "highly important" protection more often than smaller ones
- *Figure 4*). This statistic increases when focusing only on research activities to 14%, 13.9%, 20.3%. Patent intensive industries include manufacture of transport equipment, pharmaceutical and biotechnology and electronics.¹³

¹¹ 2019 ONS innovation surveys.

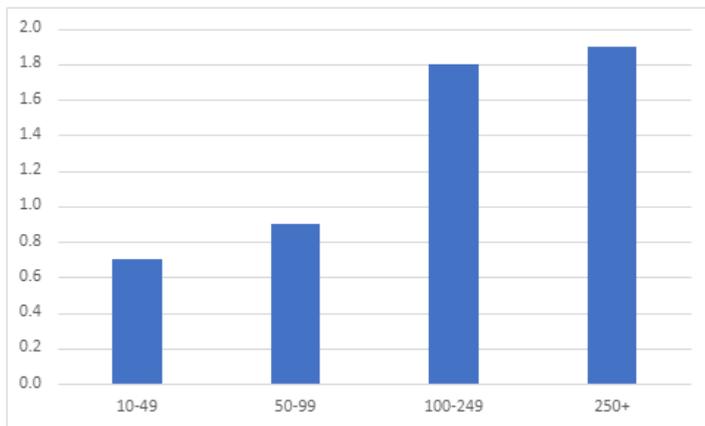
¹² Division **58** Publishing activities; Division **59** Motion picture, video and television programme production, sound recording and music publishing activities; Division **60** Programming and broadcasting activities; Division **61** Telecommunications. A 2020 IPO report has identified that these same sectors are all copyright intensive sectors.

Figure 3: Percentage of firms rating protection of broader innovation as "highly important" (2016-18), by protection type



Source: ONS innovation surveys 2019

Figure 4: Percentage of firms rating patent as "highly important" protection of broader innovation (2016-18), by firm size



Source: ONS innovation surveys 2019

Problem under consideration and rationale for intervention

The government wants the UK to be the best place in the world for research and innovation, and at the forefront of the artificial intelligence and data revolution.¹ The new National AI Strategy will secure the UK's position amongst the global AI superpowers. Venture Capital investment in UK firms increased significantly over the last five years, reaching \$13.2 billion in 2019.¹⁴ UK firms are the main beneficiaries in Europe (55% of total investment received by Europe between 2011 and 2018). However, AI uptake remains low relative to other European countries. In 2020, only 4% of UK use one or several AI systems, 3 points below the European Union average.¹⁵ As the UK seeks to build on its achievements, it is important it improves its policy and legislation in order to promote the development of AI and the sectors which utilise it. IP is one of the levers available to government to increase returns on investments for inventors and creators and thereby incentivise investment in AI to invent and create. This consultation considers whether the current IP regime strikes the appropriate

¹⁴ <https://technation.io/ai-ecosystem-guide/#a-national-overview>

¹⁵ [Eurostat, Digital economy and society database](#)

balance to encourage the development of AI and its use across the UK economy. The objective is to take a proactive approach to ensure that the IP framework provides strong incentives to invest in AI.

AI is increasingly contributing to inventions and creative works. Where there is a clear human inventor or creator, IP protection will apply as normal; even where AI is used as a tool in the inventive or creative process. However, the invention or creative work may not be protected by IP when AI plays a more significant role in devising an invention or generating a creative work as the human contribution is harder to identify. This could deter actors from investing in, or making use of, AI to invent and create. Government is therefore considering whether adjustments to the IP system may assist in creating an improved environment for those wishing to work in this field.

Section A: Computer Generated Works

Unlike most other countries, UK copyright law protects Computer Generated Works (CGWs)¹⁶. These are works that do not have a human creator. The law designates the author of such a work as “the person by whom the arrangements necessary for the creation of the work are undertaken”. The author receives copyright protection which lasts for 50 years from the date the work is made.

The government is reviewing whether the current law is striking the right balance in terms of incentivising and rewarding investment in AI creativity. Copyright has costs for third parties wishing to use protected material (raised prices, reduced competition). However, without protection, intellectual creations can be easily copied, reducing incentives to create them or invest in their creation. Copyright should only be provided where the overall benefits in terms of incentivising the creation and distribution of creative content outweigh the wider costs. Some countries, such as the US, that do not provide protection for CGWs have a law which suggests that copyright protection for CGWs may not be a necessity. For Human Generated Works (HGWs), copyright may have additional incentive effects in that it can bring material reward and public recognition to an author for their work.

An economic rationale for protecting CGWs is that it provides an incentive for private enterprise to invest in their production. The beneficiaries of CGW protection in copyright law are the persons who “make the arrangements necessary for the creation of the work”. This will often not be the developers of AI software itself, but those who input parameters into the software to generate output. Maintaining protection for CGWs means that it is possible for these people to profit from the creation and ownership of CGWs. If an economic incentive (profit) is provided by the protection of CGWs, then an economic incentive may also apply to investment in the production of CGWs.

On the other hand, there is also a rationale for removing CGW protection. It appears from the US and EU, where CGWs are not protected, that there are sufficient incentives to produce CGWs without providing specific copyright protection for such works. This suggests that there is no significant market failure prohibiting the production of CGWs, even when no protection is provided. If copyright protection has a minimal impact on increasing the production of

¹⁶ In this document we will use the terms “computer-generated” and “AI generated” interchangeably. A Computer Generated Work (CGW) is therefore equivalent to an AI generated work. AI generated works are defined in the Glossary (p.39).

works, then there are limited grounds for providing such protection, in light of other costs protections produce.

Section B: Text and Data Mining (TDM)

UK copyright law provides limited exceptions which permit the use of copyright protected works without the owner's permission. One of these exceptions allows for TDM for non-commercial scientific research,¹⁷ allowing the use of automated computational techniques to analyse large amounts of information to identify patterns, trends, and other useful information. For example, data mining analysis of the academic literature to search for the molecular pathways found in both Alzheimer's and Parkinson's disease has helped to identify new targets for drug development. Other copyright exceptions may apply to TDM in limited circumstances (for example, temporary copying¹⁸).

TDM has traditionally been used for the enablement of research (medical and scientific), business intelligence, data analytics and for machine learning and artificial intelligence. The government is considering whether the existing TDM exception in copyright law is geared towards enabling the effective operation of AI. Outputs by AI rely solely on the information provided to them to make decisions, but much of this data is contained within copyright works or databases. Copyright protects original creative expressions and does not protect facts and information as such. However, data may be contained within a copyright work so that the only way to extract the data is by making a copy of the work. Unless covered by the existing exception for data mining for non-commercial research, this requires rights holder agreement. The right holder is under no obligation to agree to this.

Many respondents to the government's AI Call for Views, including copyright owners, said that they supported licensing to manage the use of copyright works by AI. However, many also called for licensing mechanisms to be improved or for TDM exceptions to be expanded. Easier access to data was advocated by respondents, with the rationale provided being that easier access to data could promote innovation.

Without government intervention, the cost of using TDM to support AI might be higher, and therefore the growth of UK industries that use TDM might be lower based on lack of access and costs of licensing. The growth of emerging industries, especially those in the field of AI, could be stunted. Furthermore, the UK could see less investment compared to other countries that have more permissive rules for accessing works for the purposes of TDM.

The economic rationale for the existing copyright exception for the use of TDM is that it reduces the cost of producing non-commercial research that utilises the TDM of copyrighted works. An exception allows researchers to produce research at a lower cost – because it meant they are not required to seek licences for TDM of copyrighted content. As non-commercial research contributes to productivity gains,¹⁹ increased amount of research may result in increased levels of productivity.

However, there could be drawbacks to providing an overly permissive exception. Primarily, the more permissive a TDM exception, the less entitled copyright holders are to demand licences for the use of their content for the purposes of TDM. This reduces the incentive of

¹⁷ Section 29A Copyright, Designs and Patents Act 1988

¹⁸ Section 28A Copyright, Designs and Patents Act 1988

¹⁹ <https://www.oecd.org/economy/growth/35257726.pdf>

creators of such content to produce further content. However, we do not think that producers of such content are currently incentivised to produce content specifically with the objective of licensing content for TDM.

Finally, there is a trade-off; a permissive exception is beneficial for users as it decreases the cost of TDM for whatever purpose. However, the exception should balance this against the need to retain incentives to produce copyrighted content.

Section C: Patents

Currently, the UK patent system requires that an inventor is named in the patent application, and that the inventor must be a natural person. Entitlement to the patent, and therefore the beneficiaries of the exclusive rights, flows from the named human inventor. Even if AI could be identified as inventor, then it will still be necessary for the human patent applicant to show how they would be entitled to the patent. In a recent case involving patent applications naming AI as inventor, the Court of Appeal²⁰ said that the applicant was not able to show any law that would give the applicant ownership of any patent. In other words, patents do not protect inventions if the inventor is an AI system. The UK is not alone in restricting patent inventorship to natural persons. The five territories that receive 80% of the world's patent applications²¹ require the patent inventor to be human.²² As the use of AI increases and AI systems develop, a human may not meet the current legal test for inventorship. There is some dispute whether, or when, this is likely to occur. There is a risk that future patent applications may be legally challenged on the grounds that a human has been incorrectly named as inventor.

So, there are risks that research using AI could produce inventions that cannot be protected by the patent system or some legal uncertainty if inventions are the subject of a patent application. Without government intervention, this may deter investment in AI. The absence of patent protection may limit the opportunity to recoup upfront costs and profit because the invention could then be freely copied by third parties. Alternatively, firms may be able to use trade secrets for protection if the invention cannot be easily copied by third parties. However, inventions will not be disclosed and accessible by other inventors for follow on innovations or to help avoid unnecessary research duplication.

The expected profit, which increases with the duration of the patent, must be superior or equal to the expected R&D costs for firms to invest in an R&D project. And so, other things equal, the number of R&D projects undertaken increases when the duration of the patent increases. At the same time, patents are limited in duration because they lead to a deadweight loss for the consumer due to higher prices imposed by the monopoly of the rights owner. The potential of AI to increase R&D productivity may also lead to significantly decreased R&D costs. Therefore, we are also asking stakeholders if it may be preferable to protect devised inventions by granting exclusive rights that are more limited in duration than full patent protection.

If AI accelerates the pace of inventions, it may also intensify the problem of patent thickets. First AI adopters could intensify their patenting activity, which would make it more difficult for

²⁰ [Thaler v Comptroller General of Patents Trade Marks And Designs \[2021\] EWCA Civ 1374 \(21 September 2021\)](#)

²¹ The IP5 correspond to the United States Patent and Trademark Office, the European Patent Office, the Japan Patent Office, the Korean Intellectual Property Office and the National Intellectual Property Administration of the People's Republic of China.

²² Microsoft Word - IP5 roundtable on AI_report_22052019 (fiveipoffices.org)

new entrants to innovate without infringing other patents or having to pay significant cross-licensing fees. This may limit follow on innovation.

However, AI adoption implies change and thereby uncertainty. It is also costly for firms as they need to invest in new skills and adapt their infrastructure and processes to use this new technology. As a result, limiting exclusive rights may disincentivise firms from investing in and adopting AI if they know their returns on investments will be more limited than by using traditional technology to devise their inventions.

Through the consultation we will explore legal options which adjust the current need to identify a human inventor for grant of a UK patent, and also whether a new IP right may be a preferable solution. By allowing rights to be granted for AI devised inventions,²³ there may be improved incentives to invest in AI. Under each of these approaches, rights will be owned by persons, not AI. Unlike persons, AI is not incentivised to innovate by the potential financial rewards associated with the grant of exclusive rights.

Policy objective

Any interventions should:

- encourage innovation in AI technology or promote the use of AI for the public good; and
- not undermine IP's wider role in promoting human creativity and innovation.

The UK's IP framework should continue to present a good level of balance to all users of the system. Users range from firms and publicly funded research institutions which are actively developing AI, to those wishing to use AI as part of their business, to end users such as private consumers and also public bodies (e.g. the NHS).

IP provides people with a time-limited exclusive right enabling them to control or prevent certain uses of their innovations or creations. It should provide the opportunity for innovators to make money from their protected work, while at the same time permitting others to access and learn from them in various ways. For example, the underpinning principle of the patent system is that time limited exclusive rights are granted in exchange for inventions being made public for other innovators to develop follow-on innovation. The UK copyright framework can be seen as an economic tool that incentivises and rewards creativity.

The question is whether the current IP system strikes the appropriate balance to encourage the development of AI and its use across the UK economy. For example, it is possible that one element of the UK IP system is somewhat prohibitive to the development of AI systems. It is not clear that the IP system currently ensures the right incentives are in place for a future with an ever-increasing use of AI in innovation and creation processes.

²³ AI devised inventions are defined in the Glossary (p.39).

Rationale and evidence to justify the level of analysis used in this assessment

There is a high degree of uncertainty about the impact of potential policy changes as shown by the range of estimates of the potential impact of AI on future growth of the economy in the background section. At this stage, we have been unable to quantify the likely impact of any policy option. This impact assessment contains a qualitative assessment of the costs and benefits and describes who we expect will be affected compiled from desk and academic research, but there remain significant gaps.

There is also a lack of data on AI which hampers efforts to estimate impacts. There is a lack of evidence regarding current and future AI development and use. What data exists on AI adoption is not broken down by purpose (e.g. research, creation, marketing) which hampers use. There is also uncertainty about the extent of the contribution of AI to inventions and creative works. In assessing policy options for CGWs there is very little publicly available information and minimal litigation. We have included what analysis was available, but there is insufficient data to perform robust counterfactual analysis. For example, without better data on usage of CGW provisions, it is not possible to assess the likely impact of removal.

Economic evidence on the likely impact is limited and we will be seeking additional evidence from the consultation and a study the IPO is commissioning on the drivers of investments in AI, including the role of IP.²⁴ We are seeking to resolve the issues of data availability through consultation. However, we may not be able to develop our understanding of headline impact comprehensively.

As part of the consultation, we will seek to build our understanding by gathering information on:

- The effect of AI on the economy, and on productivity;
- The role of IP in driving investments in AI;
- The scale of the use of licences for the purposes of TDM;
- How the patent inventor and patent owner should be identified, and what role this may have in incentivising and rewarding AI devised inventions²⁵; and
- Whether a new IP right may provide an effective incentive, rather than adjusting the existing patent system.

Summary of options considered

This section looks at each section of policy options in turn. So, the 2 options for computer generated works are considered in section A against a counterfactual. The 4 options for text and data mining are considered against a counterfactual in section B. Finally, 3 options for amendments to the patents system are considered in section C. At this stage there is no preferred option for any section as the government seeks to gather additional evidence at consultation.

²⁴ Government response to call for views on artificial intelligence and intellectual property, published on 23 March 2021: <https://www.gov.uk/government/consultations/artificial-intelligence-and-intellectual-property-call-for-views/government-response-to-call-for-views-on-artificial-intelligence-and-intellectual-property>

²⁵ AI devised inventions are defined in the Glossary (p.39).

Section A: Computer-generated works

Option 0: Make no legal change. Literary, dramatic, musical, or artistic works generated by a computer where there is no human author would continue to be protected for 50 years from the end of the calendar year in which the work was made. The “author” would remain the person who made the necessary arrangements for the work to be created, as laid out in s9(3) Copyright, Designs and Patents Act 1988 (CDPA). They would have the right to control certain restricted acts relating to their works, as set out in s16 CDPA. They would be able to license their works for these acts and start enforcement proceedings where these rights have been infringed.

Option 1: Remove protection for new computer-generated works. This would limit copyright protection to human creations. We do not propose removing rights in existing CGWs. However, any new works would not be protected by copyright as CGWs.

Option 2: Replace the current protection with a new alternative with reduced scope/duration. This right would be modelled on existing entrepreneurial rights, like for those in sound recordings, and would limit the protection offered to the specific work generated by the AI. The duration is to be determined but could for example be a 5-year term. The rightsholder would be the person who made the necessary arrangements for the work to be created, for example the AI operator. They would benefit from all the restricted acts laid out in s16 CDPA in relation to that fixation of the work and would be able to license and assign the right. We do not propose changing rights in existing CGWs. Instead, any new right would only apply to new CGWs, generated after the provision came into force.

Section B: Text and data mining (TDM)

Option 0: Make no legal change. The current TDM exception, applicable to non-commercial scientific research for copyright works only, would remain. We would also consider issuing updated guidance on the definition of non-commercial research.

Option 1: Improve the licensing environment for using works for the purposes of TDM. This option would retain the current exception but also facilitate better licensing which would enable users to access works on fair terms to address concerns about costs, access and curatorial bias. The areas for focus would be explored through the consultation. For example, options may include a code of practice, with or without a legislative backstop, or use of the extended collective licensing framework.

Option 2: Extend the existing TDM exception to cover commercial research and databases. Retain the current exception in s29A CDPA but widen it to allow commercial research as well as the ability to mine databases for commercial or non-commercial research. Key areas identified by users have focussed on the restrictions of the definition of non-commercial, the application of the TPMs framework and the non-application to databases. These elements could be addressed by this option.

Option 3: Adopt a TDM exception for any use, with a rights holder opt-out. Permit TDM for any use by anyone, but rights holders would be able to opt-out individual works, sets of works or all of their works that they did not want to be mined. Such works would need to include a machine readable opt-out, so that computers mining significant numbers of works can identify works that can be lawfully mined.

Option 4: Adopt a TDM exception for any purpose, which does not allow rights holders to opt out. This option would apply to both copyright works and databases, commercial and non-commercial uses, allowing copies to be retained as long as necessary, require lawful access, no contract override (including website terms and conditions), and allow rights holders to take reasonable measures to maintain the security and stability of their system.

Section C: Patent

Option 0: Make no legal change. UK patents do not protect inventions unless the inventor is human. Patents are only available for AI assisted inventions²⁶, not AI devised inventions.²⁷ For this impact assessment we are measuring impacts of proposed changes against a status quo corresponding to the current law on inventorship and entitlement as interpreted by the Court of Appeal – that is no UK patent will be granted if AI is identified as inventor.

Option 1: “Inventor” expanded to include humans responsible for an AI system which devises inventions. Under this option patent protection would be available for inventions devised by AI, in addition to AI assisted inventions. For AI devised inventions, the human inventor would be the person(s) responsible for making the arrangements necessary for the AI to devise the invention. This could be the people involved in the following activities:

- Programming the AI, configuring the AI, operating the AI, selecting input data such as training data for the AI or recognising applications of the output of the AI.

As a human inventor is identified, patent rights could follow current ownership rules and always belong to a person. The consultation seeks views on this approach.

Option 2: Allow patent applications to identify AI as inventor. Like option 1, patent protection would be available for inventions devised by AI, in addition to AI assisted inventions. Unlike option 1, there would be transparency that an AI has devised an invention. Responsible persons would be entitled to the patent rights. These could be the same set of people as for option 1, but the consultation seeks views on which persons are most appropriate.

Option 3: Protect AI-devised inventions through a new type of protection. Create a new patent-like right with less rights than currently provided by a patent. This new right would protect inventions which fail to qualify for patent protection on the basis that a human is not eligible to be named as inventor and would operate alongside the current human-centric patent system.

²⁶ AI assisted inventions are defined in the Glossary (p.39).

²⁷ AI devised inventions are defined in the Glossary (p.39).

Non-monetised costs and benefits of each option (including administrative burden)

Please note that we have presented this table across 3 pages. Each policy option (CGW, TDM and Patents) are presented on their own individual pages for ease of use and clarity.

Table 1: Summary Table of Costs and Benefits for CGW, TDM, and Patent Policy Options.

Costs	Benefits
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		CGW Copyright Holders		CGW Copyright Users (and also AI Service Providers)		Human Creators		Legal Advisers (incl. Patent Attorneys)	
Section A: CGW Copyright Option	1: Remove 50-year protection	<p>[Cost] The potential revenue source of future CGWs would be mitigated, relative to Option 0.</p> <p>This should reduce the value of CGWs.</p>		<p>[Cost] Less incentive to ownership of CGWs may result in less interest in using AI to generate works, which would in turn decrease demand for AI Service Providers.</p>	<p>[Benefit] The potential costs of utilising future CGWs by copyright users would be reduced, relative to Option 0.</p> <p>[Benefit] Wider access to CGWs may result in more interest in using CGWs, which would in turn increase demand for AI service providers.</p>		<p>[Benefit] There would be an increase in the value of human works (relative to CGWs), if the potential sources of revenue possible through CGWs is mitigated.</p>		
	2: Replace with <50-year protection	<p>[Cost] The potential revenue source of future CGWs would be mitigated, relative to Option 0.</p> <p>This should reduce the value of CGWs.</p>		<p>[Cost] Less incentive to ownership of CGWs may result in less interest in using AI to generate works, which would in turn decrease demand for AI Service Providers.</p>	<p>[Benefit] The potential costs of utilising future CGWs by copyright users would be reduced, relative to Option 0.</p> <p>[Benefit] Wider access to CGWs may result in more interest in using CGWs, which would in turn increase demand for AI service providers.</p>		<p>[Benefit] There would be an increase in the value of human works (relative to CGWs), if the potential sources of revenue possible through CGWs is mitigated.</p>		

		TDM Copyright Holders		TDM Users (Including AI Service Providers)		Human Creators		Legal Advisers (incl. Patent Attorneys)	
Section B: TDM Copyright Option	<p>1: Improving the licensing environment (e.g., code of practice)</p> <p>IPO still collecting views and evidence on potential licensing improvements.</p>	<p>[Cost] This option could increase compliance costs for this group</p>	<p>[Benefit] More licenses are provided, which in turn would increase income for rights holders.</p>	<p>[Cost] This option could increase compliance costs for this group</p>	<p>[Benefit] This option could result in fewer transactional costs for TDM Copyright Users. It could also result in less time spent on such transactions.</p>			<p>[Benefit] Less litigation between TDM Copyright Holders and TDM Copyright Users due to greater clarity.</p> <p>Litigation is already minimal.</p>	
	<p>2: Widen TDM exception -include commercial scientific research</p>	<p>[Cost] Loss of licensing revenue for copyright holders who are currently able to license out their copyrighted content to the producers of commercial research for TDM.</p>			<p>[Benefit] Commercial researchers would benefit from a decreased cost of using copyrighted material in TDM.</p> <p>AI Service Providers may benefit from an increased demand for their services, as commercial researchers increase TDM use.</p>			<p>[Benefit] Less litigation between TDM Copyright Holders and TDM Copyright Users due to greater clarity.</p> <p>Litigation is already minimal.</p>	
	<p>3: Total TDM exception + opt out</p> <p>IPO still collecting views and evidence on how the opt out could work.</p> <p>This option would still permit licensing.</p>	<p>[Cost] Loss of licensing revenue for copyright holders who are currently able to license out their copyrighted content to the producers of commercial research for TDM.</p> <p>This cost would depend on how the opt-out works.</p>			<p>[Benefit] Commercial researchers and other users of TDM would benefit from a decreased cost of using copyrighted material for TDM.</p> <p>AI Service Providers may benefit from an increased demand for their services, as commercial researchers increase TDM use.</p> <p>This benefit would depend on how the opt-out works out.</p>			<p>[Benefit] Less litigation between TDM Copyright Holders and TDM Copyright Users given the wider permitted use.</p> <p>Litigation is already minimal.</p>	
	<p>4: Total TDM exception no opt out</p>	<p>[Cost] Loss of licensing revenue for copyright holders who are currently able to license out their copyrighted content to the producers of commercial research for TDM.</p> <p>This cost would not depend on how an opt-out works.</p>			<p>[Benefit] All users of TDM would benefit from a decreased cost of using copyrighted material for TDM.</p> <p>AI Service Providers may benefit from an increased demand for their services, as commercial researchers increase TDM use.</p> <p>This benefit would not depend on how the opt-out works out.</p>			<p>[Benefit] Given the much wider permitted uses, cases in the courts will certainly reduce, but we lack data.</p> <p>Litigation is already minimal.</p>	

		Inventors that are AI users (conditional on use of patents)		AI Service Providers		Inventors		Legal advisers, incl. patent attorneys	
Section C: Patent Policy options	1: Named human inventors include those responsible for AI devised inventions ²⁸		<p>[Benefit] Greater patent protection</p> <p>1) Higher expected revenues; Higher investment in AI to invent; Higher revenues (if greater R&D productivity)</p> <p>2) Higher revenues (for AI users)</p>		<p>[Benefit] Larger customer base Greater incentives to seek co-inventorship</p>	<p>[Cost] Increased costs of follow on inventions (patent thickets by first movers)</p> <p>Increased fees?</p>		<p>[Cost] Transaction costs</p>	<p>[Benefit] Higher revenues</p>
	2: AI devised inventions patentable with AI identified as inventor.		<p>[Benefit] Greater patent protection</p> <p>1) Higher expected revenues; Higher investment in AI to invent; Higher revenues (if greater R&D productivity)</p> <p>2) Higher revenues (for AI users)</p> <p>Smaller benefits relative to option 1 associated with some patent applicants who employ international patent filing.</p>		<p>[Benefit] Larger customer base Greater incentives to seek co-inventorship</p> <p>Smaller benefits relative to option 1 associated with some patent applicants who employ international patent filing.</p>	<p>[Cost] Increased costs of follow on inventions (patent thickets by first movers)</p> <p>Increased fees?</p> <p>Smaller costs relative to option 1 associated with some patent applicants who employ international patent filing.</p>		<p>[Cost] Transaction costs</p>	<p>[Benefit] Higher revenues</p> <p>Smaller benefits relative to option 1 associated with some patent applicants who employ international patent filing.</p>
	3: AI devised inventions given limited exclusive rights		<p>[Benefit] Greater patent protection</p> <p>1) Higher expected revenues; Higher investment in AI to invent; Higher revenues (if greater R&D productivity)</p> <p>2) Higher revenues (for AI users)</p> <p>Smaller benefits relative to option 1 & 2 due to less exclusive rights</p>		<p>[Benefit] Larger customer base</p> <p>Smaller benefits relative to option 1 & 2 due to less exclusive rights</p>	<p>[Cost] Increased costs of follow on inventions (more inventions protected by exclusive rights)</p> <p>Smaller costs relative to option 1 & 2 due to less exclusive rights</p>		<p>[Cost] Transaction costs</p>	<p>[Benefit] Higher revenues</p> <p>Smaller benefits relative to option 1 & 2 due to less exclusive rights</p>

²⁸ AI devised inventions are defined in the Glossary (p.39).

Section A: Computer-Generated Works (CGWs)

Different rationales exist for copyright protection. In common law countries, such as the UK, copyright is seen primarily as an economic tool that incentivises and rewards creativity. The rationale is that if a person is offered an economic incentive to create, like the ability to monetise a copyright work for a set period of time, they will do. People creating works is to the overall benefit of society, and results in more works being created for people to enjoy and use. However, there are also costs. Anyone wanting to use those works can only do so with the permission of the copyright owner, and often for a fee.

One question is whether copyright, and the UK's computer-generated works provision, incentivises people to make computer-generated works. Would people generate these works even without copyright protection? Some respondents to the government's call for views pointed out that AI could generate works quickly and at low cost. If this is the case then it is questionable whether economic incentives are needed.

The UK is one of only a handful of countries with a computer-generated works provision. The US, for example, does not provide protections for CGWs but there is no evidence that this has led to a lack of CGWs. Figure 2 (on page 4) shows that both the UK and the US have some of the highest levels of venture capital funding per capita. Furthermore, other countries with CGW-provisions (e.g., Ireland) also exhibit high levels of AI investment, alongside other countries *without* CGW-provisions (e.g., Sweden). In line with the overarching rationale for copyright protection, providing it for computer-generated works should only be considered if the benefits to society outweigh the costs.

Please note that when referring to the status quo option, we are referring to Option 0.

Option 0: Make no legal change

Under this option copyright owners would continue to benefit from protection for CGWs that are original literary, dramatic, musical or artistic works. The term of protection would remain at 50 years from creation. The author/first owner would remain the person who made the necessary arrangements for the work to be created, as laid out in current legislation. They would be able to license or prohibit certain uses of their works and litigate where these rights have been infringed.

Costs and Benefits

In the status quo (Option 0) the costs and benefits are set to zero.

Option 1: Remove protection for computer-generated works

Under this option the computer-generated works provision will be removed. This will effectively limit copyright protection to human authors; CGWs will no longer be eligible for specific copyright protection. Copyright protection for AI-assisted works²⁹ (i.e. where AI has been used as a tool by a human author to create a copyright work) will not be affected by this option. Nor will it affect other types of copyright protection, such as those applying to sound recordings and films.

Under this option, AI generated works³⁰ would only be protected by copyright if:

- They were original literary, artistic, musical or dramatic works and there was a sufficient level of human direction or involvement in the creation of the work so that it reflects their intellectual creation (i.e. they were "AI-assisted").
- They were sound recordings, films, broadcasts or typographical arrangements

This option would only apply to works created after it comes into force.

²⁹ AI assisted works are defined in the Glossary (p.39).

³⁰ AI generated works are defined in the Glossary (p.39).

Costs

CGW Copyright Holders

This option comes at a cost to prospective rightsholders of CGWs. This option would not result in the removal of property rights for *current and existing* rightsholders of CGWs – but it would result in the inability for people to gain copyright protection for *future* works. Hence, removing the right would mean that rightsholders that *would* have been beneficiaries of copyright protections on CGWs, would not be. This would mean a hypothetical loss of the associated revenues that prospective rightsholders would have been able to acquire from their copyright protection.

At consultation we will be asking for evidence on how much rightsholders rely on the CGWs provision, and how much revenue they estimate they receive through licensing.

AI Service Providers

This option could come as a cost to this group. If a decrease in protections for CGWs results in fewer people producing CGWs, then demand for AI software which generates CGWs could also decrease. AI service providers would then make less money from the sale or licensing of this software.

Benefits

CGW Copyright Users

Removing a right means that users of CGWs would no longer need to seek permission or licences to use such works (unless another IP right applied). They would see a decrease in the associated costs of using such works. Overall, this option provides a significant benefit to the users of CGWs in that the costs of using CGWs is significantly diminished.

AI Service Providers

This option could come as a benefit to this group. A decrease in the protections for CGWs could result in a higher utilisation of CGWs. This would be because CGWs would be in the public domain and would be more readily accessible. If these CGWs are utilised in a way that requires the services of AI service providers, then the increased accessibility of CGWs may result in increased demand for AI services.

If CGWs aren't protected by copyright anymore you could use them to train AI, which might mean there's a greater demand for AI

Human creators

This option should provide a benefit to human creators. To some extent, CGWs are a substitute good for human created works. Removing a right to copyright protection in CGWs could promote human created works, as the only types of work eligible for authorial copyright protection. CGWs would not provide a source of revenue for copyright holders, whereas human created works would.

This option should benefit human creators if it leads to less competition between human- and computer-generated works. This could be the case if firms choose to employ human creators rather than use AI to generate creative content, as the products of AI may not otherwise be protected.

Although this concern was raised by a number of creative industry organisations during our call for views, we have no firm evidence that CGWs are causing these competition problems for creators. This is something we are seeking at consultation.

In addition, human creators could benefit from CGWs being freely available in the public domain. For example, if a piece of AI-generated code was not protected by copyright, other coders would be able to use it without needing to seek a licence. This could increase the ability for creators to create and innovate, using works available in the public domain as a springboard.

Option 2: Replace the current protection with a new alternative

Under this option we would remove existing copyright protection for CGWs as original works. Instead we would provide a new, more limited, form of protection for these works. This approach would be justified if there is evidence that protection for CGWs incentivises their production, including investment in their production, but that more limited protection than at present would set a better balance between right holders and third parties. We will consult on what this should look like. For modelling purposes, we assume protection will be similar to that currently applying to sound recordings in that: a) it will not require the work to be “original” (removing some ambiguity from the present law) and b) it will only apply to facsimile copying of the work and not to adaptations of it. It will also have a shorter duration than the present protection, for example five years. As such, it is an intermediate option between the status quo and full removal of protection for CGWs.

As with the other options, parallel rights such as those in sound recordings and films would not be affected.

We do not propose changing rights for existing CGWs. Instead, any new right would only apply to new CGW, generated after the provision came into force. As such, any impacts would be seen for works not yet created.

Costs

CGW Copyright Holders

We are not proposing to change rights in existing CGWs, so these rightsholders will be unaffected. However, rightsholders in future CGWs would receive a narrower right for equivalent works. This may result in lower revenues if they are unable to monetise the right as much because of reduced opportunities to license, for example. People would be free to create derivative versions of the same work without infringing copyright, so may be less likely to seek a licence from the rightsholder. However, creating a separate version of a work may be costly and time-consuming, so licensing may still be attractive if it is affordable and available.

The shorter term of protection will also mean right holders will have less time to monetise their CGWs before they enter the public domain. Rightsholders may feel this is insufficient for them to properly monetise their CGWs and recoup their investment. This means that businesses may choose not to invest in AI technology. That said, if AI produces works at a lower average cost than humans, even a short protection may provide sufficient investment incentives. At consultation we will be asking for evidence on what duration a new form of protection should have.

The costs of Option 2 for this group would be somewhere between the status quo and the cost of Option 1. This is because this option would reduce the term-limit of CGW protection, but not completely remove the protection (as in Option 1).

Benefits

CGW Copyright Users

Removing a right and replacing that right with a related right means that rights users of CGWs would need to wait a limited period of time before CGWs return to the public domain. They would see a decrease in the associated costs of using such works. Unless another type of IP right applied, individuals and businesses would be able to use works without needing to seek a licence or infringing copyright. Overall, this option provides a significant benefit to the rights users of CGWs in that the costs of using such CGWs is significantly diminished. However, the benefit here of rights users is relatively weaker than the benefit afforded to rights users in Option 1. This is because in Option 1 the protection for CGWs is removed completely. In this option, the protection is replaced with a related right.

The benefits of Option 2 for this group would be somewhere between the status quo and the cost of Option 1.

AI Service Providers

AI Service Providers may benefit from this option compared to the status quo. Removing the 50-year protection that can currently be afforded to CGWs would increase the accessibility of newly created CGWs. An increased accessibility of CGWs may mean that more people seek to use CGWs, and as a result, utilise AI services which can analyse CGWs without infringing on copyrights.

The benefits of Option 2 for this group would be somewhere between the status quo and the cost of Option 1.

Human creators

A narrower right for CGWs means that more works will be in the public domain more quickly. This means that creators will be able to use these works without a licence more quickly. For example, when a piece of AI-generated code falls out of protection, other coders would be able to use it without needing to seek a licence. This could increase the ability for creators to create and innovate, using works available in the public domain as a springboard.

The benefits of Option 2 for this group would be somewhere between the status quo and the cost of Option 1.

There may also be wider impacts as a result of the policy changes proposed by all of these options (for example, impacts as a result of computer-generated works being in the public domain). These wider impacts will be examined after consultation.

Section B: Text and Data Mining (TDM)

An Impact Assessment published by the European Commission notes that The International Association of Scientific, Technical and Medical Publishers (STM) publishing group has indicated that researchers in commercial healthcare and pharmaceutical markets highly value their commercial usage rights. These can include the correct tools and content formatting needed for TDM used for scientific research³¹.

STM predicted that the TDM market in Europe for publishers, based on current estimations (€2 million in 2015) will be worth more than €56 million in 2019. This data is not specific to the UK, but the UK is a relatively large market for TDM across Europe. STM members report that even if the pharma sector tends to be more advanced in its use of mining technologies, the use of TDM is on increase also in other sectors, such as chemical manufacturing.

³¹ <https://digital-strategy.ec.europa.eu/en/library/impact-assessment-modernisation-eu-copyright-rules>

It is worth noting that AI rights holders and users of copyright material would be affected by these options, not only those in specialist publishing and research.

Licensing works for TDM

In a simplified model, copyright licensing comprises three elements:

- a payment (P) from the licensee (A) to the licensor (B), representing a cost to the former and equivalent benefit to the latter.
- transaction costs (C) to the licensee and licensor, which will depend on a number of factors such as how easy it is for the licensee to locate and negotiate with the licensor, and how much experience B has of licensing for the specific purpose.
- perceived value (V) to the licensee from entering into the licensing agreement. This could be higher if the licensor has a unique corpus of works which the licensee seeks to use, so they cannot substitute the works for others. The licensor may increase the value of their works by providing adjacent services such as accessible data formats, data-mining tools etc.

The licensee (A) will enter into the agreement when $V > P + C_A$

The licensor (B) will enter into the agreement when $P > C_B$

From the above, licensing is more likely to take place from the perspective of either party if transaction costs are reduced. From the licensor's perspective, licensing is more attractive the higher the amount they can charge; whereas from the licensee's perspective, licensing is more attractive the less they must pay, or the higher the value to them of the works being licensed.

It is also clear from this model that, where either party does not think it is worth the cost, works will not be licensed. A user will then either not use those works (which may mean they do not take forward their project, or they may substitute them with another set of works), or they may use them illegally.

Exceptions for TDM

Copyright exceptions allow a user to perform specific acts with a protected work without seeking permission via a licence.

The user will use the exception when the value to them of doing so is greater than any attendant costs (e.g., legal costs to understand the exception), so when $V > C$.

To the user (the licensee in the above model), this should be cheaper than the licensing option, as the licensing payment (P) is zero.

To the licensor there are no transaction costs (as there is no transaction), but there are no benefits either. If the exception allows a party to use a work when they would previously have taken a licence, then there is a cost to the licensor in foregone profits.

While an exception-based approach will generally be more favourable to data-miners, the value of some works may be lower than under a licence-based model, as right holders will no longer have as strong an incentive to increase the value of their works by making them easier to mine.

Please note that when referring to the status quo option, we are referring to Option 0.

Option 0: Make no legal change

Costs and Benefits

In status quo (Option 0) the costs and benefits are set to zero.

Option 1: Improving the licensing environment

This option would retain the current exception but also facilitate more and better licensing which would enable users to access more copyright-protected works. This may address user concerns about costs, access and curatorial bias. This may also ensure users are better informed which may support their negotiating position in licensing negotiations.

We do not currently have any baseline data regarding licensing, and so this is an area that we will need to be highlighted in the consultation: specifically, how many licences rights holders provide, to whom, for what purpose and at what cost. Although previous attempts for similar data have not been particularly fruitful, such data will enable us to quantify the impact of this, and other options with a higher degree of accuracy.

Examples of how this option could be achieved include: model licences, which reduce transaction costs, making licenses easier to conclude; extended collective licensing (ECL), where a licensor who is sufficiently representative of rights holders in a certain area can provide a licence for all rights holders in that area; a code of conduct – this would be a more informal code, focussing on the specific practices of licensing, and it may be combined with model licences; a code of practice (with legislative backstop) – there is precedent for this intervention, which directs industry to work within certain parameters, with the threat of legislation if they do not.

Costs

TDM Rights Holders

An improved licensing environment in the form of producing a code of conduct (or practice) could introduce compliance costs if rights holders need to comply with a code of conduct (or practice).

TDM Users

An improved licensing environment in the form of producing a code of conduct (or practice) could introduce compliance costs if users need to comply with a code of conduct (or practice).

Benefits

TDM Rights Holders

An improved licensing environment in the form of publishing a code of conduct (or practice) may mean that more licences are provided, which in turn would increase income for rights holders. Better and/or more standardised licensing should also reduce the administrative cost per transaction. Licences provide legal certainty and may reduce the costs of obtaining legal advice.

TDM Users

An improved licensing environment in the form of publishing a code of conduct (or practice) could result in fewer transactional costs and less time spent on such transactions. Licences provide legal certainty and may reduce the costs of obtaining legal advice.

Training on copyright datasets or machine learning for AI would have to wait until the licence were agreed but would have complete certainty of action once the licence was in place.

AI Service providers

An improved licensing environment in the form of publishing a code of conduct (or practice) could provide a benefit to AI service providers if the improved licensing environment promotes the use of TDM to the extent that this increases demand for AI services. More licences could increase the demand for AI service providers, resulting in increased income for this group.

Option 2: Widen existing TDM exception - include commercial research

Retain the current exception but widen it to allow commercial scientific research as well as the ability to mine databases. Key problems identified by users of the current exception have focussed on the restrictions of the definition of non-commercial, the application of the TPMs framework and the non-application to databases. These elements could be addressed by this option.

Costs

TDM Rights Holders

There may be a loss of licensing revenue for commercial scientific research projects in an expanded exception, although the impact will be difficult to quantify without current licensing data from rights holders. The TDM market in Europe for publishers, based on current estimations (€2 million in 2015) will be worth more than €56 million in 2019, with an unspecified portion of this being from within the UK. This loss of licensing revenue would be a cost to rights holders for both copyright and database rights.

Familiarisation cost of applying existing copyright exception to new areas (databases, new application of TPMs). Additional familiarisation cost for database holders covered for first time.

Some rights holders may withdraw works from the market, or find ways to make mining them harder, if their ability to demand licences to mine them is removed.

Under this option there would be a limited loss of licensing revenue for rights holders, who are currently able to license out their copyrighted content to the producers of commercial scientific research for TDM. This option would reduce the number of situations in which rights holders are able to demand permissions and licenses for the use of their works, and subsequently decrease revenue associated with such processes.

TDM Users

Familiarisation cost of applying existing copyright exception to new areas (databases, new application of TPMs).

Benefits

TDM Users

Research partnerships between non-commercial and commercial entities accepted (e.g., HE institution and a commercial funder), public and private funding for scientific research may become more widely available. Reduction in legal costs for users currently not able to justify non-commercial scientific research.

All commercial researchers (educational institutions, commercial research in R&D departments, commercial research organisations, individual researchers) reduce licensing and transactional costs. This exception would significantly expand the pool of users able to use TDM for scientific research without seeking licences from the rights holders.

AI users are a subset of TDM users, and while some of them will use AI for scientific purposes many will not. This option will provide benefits to scientific users of AI, but not to more general-purpose users.

AI Service Providers

A widened exception that includes commercial scientific research will increase the demand for TDM by AI Service Providers. This should increase the demand for their services, and positively impact the revenues and sales of these providers.

Option 3: Total TDM exception + opt out

Permit TDM for any use and by anyone, but rights holders would be able to opt-out individual works, sets of works or all of their works that they do not want to be mined. Such works would need to include a machine readable opt-out, so that computers identifying significant numbers of works of a mixed nature can identify works that can be lawfully mined.

Costs

TDM Rights Holders

There may be a reduction in licensing income depending on whether rights holders opt-out works; the opt-out might be for non-economic reasons as well as economic.

There would be a cost in identifying works for opt-out and developing a machine-readable version of the opt-out, which could come at a significant cost both in terms of time and money to develop, although is likely to be one-off for existing works. Rights holders operating in the EU are likely to already have done this to comply with Article 4 of the recent EU Copyright Directive, so we will ask for indicative costs as part of the consultation.

This option is likely to bring about compliance costs and more significant changes to rights holders' business models than under the previous legislative options. The impact is likely to be even more significant given the TDM commercial market's growth potential.

TDM Users

Users of the existing exception would have a familiarisation cost with the new exception. They would also need to ensure that any new projects would need to ensure that works under the opt-out were not included. AI systems may make this easier than other TDM techniques by training systems to recognise opt-outs.

Benefits

TDM Users

Users would be expanded beyond businesses to individuals capable of using TDM and/or AI for a wider set of uses, including journalism and citizen engagement. Users will likely have significant reductions in their licensing costs, which may incentivise more TDM and AI development.

This option would have a significant positive impact on users. Because of the broad scope of the exception, users would no longer require TDM licences for scientific research purposes or other

commercial uses including business analytics, market research etc. Industry estimates the value of the commercial TDM scientific research market (in Europe) to be worth more than €56 million by 2019³². The use of TDM is also increasing outside the life science and pharmaceutical industry, including in sectors such as financial services, market research, business analytics and chemical manufacturing. Users in these sectors are likely to benefit and face decreased costs in the process of TDM, decreasing the costs necessary to produce research or products which use TDM in these sectors.

AI Service Providers

A TDM exception for all uses with opt out could increase the demand for AI products which can learn to recognise the opt-out of works. This should positively impact the revenues and sales of these providers.

Option 4: Total TDM exception - no opt out

Introduce a TDM exception for any purpose, with no rights holder opt out. This option would apply to both copyright works and databases, commercial and non-commercial uses, allowing copies to be retained as long as necessary, require lawful access, no contract override (including website terms and conditions), and allow rights holders to take reasonable measures to maintain the security and stability of their system.

Costs

TDM Rights Holders

Removal of licensing income - This option would result in the removal of most licensing income from works used for the purposes of any TDM (licences might still be desirable if they offer additional value to licensees).

This option would have a significant negative impact on rightsholders. Because of the broad scope of the exception, STM³³ publishers (amongst other rights holders) would no longer be able to license TDM for scientific research purposes to commercial players, which represent an essential market for them, notably in areas such as life science and pharmaceutical. Industry estimates the value of the commercial TDM market (in Europe) to be worth more than €56 million by 2019.³⁴ The use of TDM is also increasing outside the life science and pharmaceutical industry, including in sectors such as financial services and chemical manufacturing. This option would not remove rights holders' ability to generate revenues from selling access to their content if they add value to the potential TDM.

Deals between STM publishers and corporate users usually include TDM as part of comprehensive agreements covering a whole series of usage rights and added value services mentioned above. TDM usage can no longer be subject to licence alone. Rights holders may try to compensate the value lost because of the legislative intervention by raising licence fees for access and other uses/value added services. It is not clear whether and to what extent they would manage to do so. Nevertheless, access to journals will still be limited by subscription in many cases and TDM will enhance the value of a subscription.

This option is likely to bring about compliance costs and more significant changes to rightsholders' business models than under the previous legislative options. The impact is likely to be even more significant given the TDM commercial market's growth potential.

³² Source: STM

³³ STM refers to: Scientific, Technical and Medical (Publishing group)

³⁴ Source: STM

Benefits

TDM Users

Removal of licensing expenditure - Users would be expanded beyond businesses to individuals capable of using TDM and/or AI for a wider set of uses, including journalism and citizen engagement. This option would result in the removal of all licensing of works used for the purposes of any TDM. Users would be relieved of any administrative burden of licensing and the associated cost (unless they chose to take out a licence because of additional benefits offered by the rights holders).

This option would have a significant positive impact on users. Because of the broad scope of the exception, users would no longer require TDM licences for scientific research purposes or other commercial uses. Industry estimates the value of the commercial TDM scientific research market (in Europe) to be worth more than €56 million by 2019³⁵. The use of TDM is also increasing outside the life science and pharmaceutical industry, including in sectors such as financial services, market research, business analytics and chemical manufacturing. Users in these sectors are likely to benefit and face decreased costs in the process of TDM, decreasing the costs necessary to produce research or products which use TDM in these sectors.

AI Service Providers

A TDM exception for all uses with no opt out could increase the demand for TDM by AI Service Providers. This should positively impact the revenues and sales of these providers.

There may also be wider impacts as a result of the policy changes proposed by all of these options (for example, benefits to society). These wider impacts will be examined after consultation.

³⁵ Source: STM

Section C: Patents

Table 2: Differences between the proposed policy options

	IPR available for AI assisted inventions	IPR available for AI devised inventions	Maximum length of exclusive rights	Transparent that AI has devised the invention
Option 0	yes	no	20 years	no
Option 1	yes	yes	20 years	no
Option 2	yes	yes	20 years	yes
Option 3	no	yes	< 20 years	Yes (but subject to consultation)

Note: A maximum length of exclusive rights of 20 years correspond to a standard patent.

Option 0: Make no legal change (do nothing). UK patents are available only if a patent applicant can identify a human who qualifies as inventor of the invention claimed in a patent application. Patents are only available for AI assisted inventions,³⁶ not AI devised inventions.³⁷ This means that patents will not be available if the patent applicant asserts that AI, not a human, meets the test for inventorship. For some inventions, it may be unclear to the patent applicant if the contribution of a human meets the test for inventorship if AI is employed.

This scenario is the counterfactual, where UK patents are available only if a patent applicant can identify a human who qualifies as an inventor for the invention claimed in a patent application. This represents no change from the status quo so there are therefore no associated costs or benefits within the scope of this analysis.

As noted above on p.13, this option reflects current law on inventorship and entitlement as interpreted by the Court of Appeal.

Patent policy options 1, 2 and 3 would lead to the protection of AI devised inventions by intellectual property rights.

Regarding intellectual property right ownership, the change in law brought by policy options 1, 2 and 3 could change the incentive of AI service providers to seek ownership of intellectual property right with parties using their services.

Option 1: “Inventor” expanded to include humans responsible for an AI system which devises inventions. Under this option patent protection would be available for inventions devised by AI, in addition to AI assisted inventions. The person(s) responsible for making the arrangements necessary for the AI to devise the invention would be identified as the inventor(s). Responsible persons could include the AI programmer, the person responsible for defining objectives for the AI, the person who constructs data sets for training the AI, the user of the AI or the person who recognises the applications of AI outputs. The consultation seeks views on which persons are most appropriate. As a human inventor is identified, patent rights will always belong to a person.

³⁶ AI assisted inventions are defined in the Glossary (p.39).

³⁷ AI devised inventions are defined in the Glossary (p.39).

As patents would be available for both AI assisted and AI devised inventions, there is less risk for the patent applicant if there is a legal dispute over inventorship compared to the status quo. By continuing to require a human be named as inventor, this option retains similarity with other countries' patent systems. However, it would not be necessarily transparent from a patent application that AI had devised the invention. Many firms choose to patent across multiple territories, so retaining a requirement to identify a human inventor could prove beneficial to many as this simplifies their route to obtaining a patent elsewhere.

There are two channels of impact of the proposed change in the IP system (*Figure 5*).

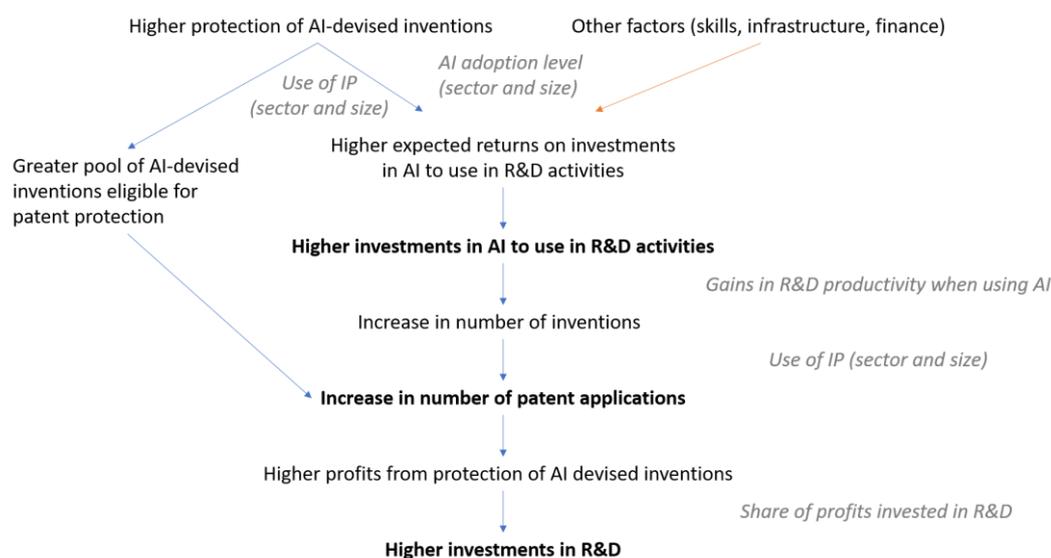
First, it may lead to higher expected returns on investments in AI to use in R&D activities, and as a result higher investment in AI to invent. The changes will mean that patents will be available whether AI assists or devises invention, so will give confidence for those looking to invest at the outset of an R&D programme. If inventions devised by AI can be protected by a patent, patent holders can be more certain to make returns at the point of commercialisation. As a result, inventors will be more confident in using AI to invent and investors in investing in any R&D that involves AI, thereby leading to an increase in investments in AI to use in R&D activities.

The use of AI is expected to increase productivity leading to an increased number of inventions relative to traditional R&D activities^{38,39,40}. Several respondents to the government's AI Call for Views argued that the use of AI may enable organisations to increase the pace of inventions and reduce R&D costs relative to relying solely on human inventors. An increased use of AI in R&D activities translates into an increase in the number of inventions, and thereby an increase in the number of patent applications.

Second, the proposed change in legislation provides more certainty about patenting AI assisted and devised inventions for actors that are already using AI to invent. As a result, it is possible more inventors will apply for patents. As the current AI adoption by UK firms is low, this impact would be limited in the short-term but may increase in the future.

Firms would then yield higher profits from the protection of AI-devised inventions and, assuming they re-invest part of their profits to R&D, more innovation.

Figure 5: Impacts of policy option 1



³⁸ McKinsey (2017), A future that works: automation, employment, and productivity.

³⁹ Damioli (2020), The impact of artificial intelligence on labor productivity.

⁴⁰ Alderucci (2020), Quantifying the Impact of AI on Productivity and Labor Demand: Evidence from U.S. Census Microdata.

Note: Assumptions are written in grey.

Costs

Inventors

A study commissioned by the IPO in 2013 shows that patent thickets are particularly present in ICT-related technologies (particularly Telecoms, Computer technology and Audio-visual) based on EPO patents between 1981 and 2009.⁴¹⁴² Because this policy option allows patents for AI devised inventions it may lead to more patents being granted potentially contributing to patent thickets. While patent thickets already exist within the current patent system, a higher use of patents to protect AI-devised inventions may intensify the problem of patent thickets if AI accelerates the pace of inventions. This could then lead to a winner-takes-all effect where first AI adopters could intensify their patenting activity and protect a wide range of inventions. This would in turn make it more difficult for new entrants to innovate without infringing other patents or having to pay significant cross-licensing fees. As a result, policy option 1 may lead to hindering competition and limiting follow on innovation. The cost of seeking and maintaining patent rights may limit this problem.

Depending on uptake for this option, and its impact on patenting trends, the IPO may see an increase in workload due to a higher number of patent applications. If this is the case, and if focus remains on reducing pendency times, the IPO may incur additional staffing costs. However, economies of scale due to the presence of fixed costs within the organisation may mitigate this impact. Furthermore, IPO applicant's fees are based on a cost recovery model. In such model, any variation in costs of operation would be reflected on applicants' fees affecting all inventors not just those working with AI. As a result, while the extent of these impacts is not immediately clear at this stage, we expect them to be relatively small.

Courts

The courts may see a small, transitional rise in case numbers as the new definition of inventor is tested by parties who have patent inventorship and ownership interests.

IPO

There may also be transition costs for the IPO to adapt to the evaluation of AI-devised inventions.

Benefits

Inventors that are or may become AI users

Individuals or organisations that use AI in their innovation programmes are potential applicants for AI devised patents, and therefore would be the main beneficiaries of this policy option. There is the potential for any actor undertaking R&D to use AI now or in the future, and so we expect AI users will mainly consist of private companies, research laboratories and universities. Furthermore, patents are not used uniformly across sectors, and we expect that sectors that currently rely the most on patents will be the most affected by a change in patent legislation. The group of AI users that will be affected by policy option 1 is therefore those that use AI to invent and those that would use AI if they had more incentives to do it, who also use patents to protect their invention.

⁴¹ Hall, B. H., Helmers, C., Von Graevenitz, G., Rosazza-Bondibene, C. (2013). *A study of patent thickets*. Intellectual Property Office UK.

⁴² In this study, patent thickets are measured as the number of firm triples. A triple corresponds to "a group of three firms in which each firm has critical prior art limiting claims on recent patent applications of each of the other two firms".

The role of IP in incentivising investment in AI is not clear. The IPO is currently commissioning a study to analyse the drivers of investments in AI and the role of the IP system.⁴³ There is also uncertainty about the rate at which firms will adopt AI to invent.

In both cases, whether an invention leads to a patent application will depend on the sector and for firms on their size and industry. We expect the benefits to be concentrated in existing patent-intensive firms and industries – larger firms and firms in manufacture of transport equipment, pharmaceutical and biotechnology and electronics industries.

AI service providers

AI service providers, i.e. firms that sell AI services to other organisations, would also indirectly benefit from the introduction of this policy. Current AI service providers correspond to AI algorithms developers, cloud services providers and data providers.⁴⁴ Current AI algorithms developers and providers include researchers, spinouts, start-ups, and large tech companies.

Even if AI service providers are not using AI to generate inventions, they will benefit from a larger customer base if the UK patent system gives more innovators the confidence to invest in AI collaborations or AI products across different technical sectors. The size of the impact on the UK economy of a higher demand for AI services depends on where AI developers are based, where they employ labour and where they invest.

Inventors

According to some responses from the government's AI Call for Views, some firms choose trade secrets if they do not think they can obtain patents. We therefore assume that under option 1, AI users will use more patents rather than trade secrets to protect their invention. This increases the available prior knowledge for inventors to build on and develop follow on innovations through licences or after IP rights expiration.

Legal advisers, including patent attorneys

Under option 1, an increase in the number of patent applications will increase the workload and revenue for patent attorneys who help clients to obtain patents.

These benefits can be measured based on the cost of patent attorney associated to the application of a patent.

Courts

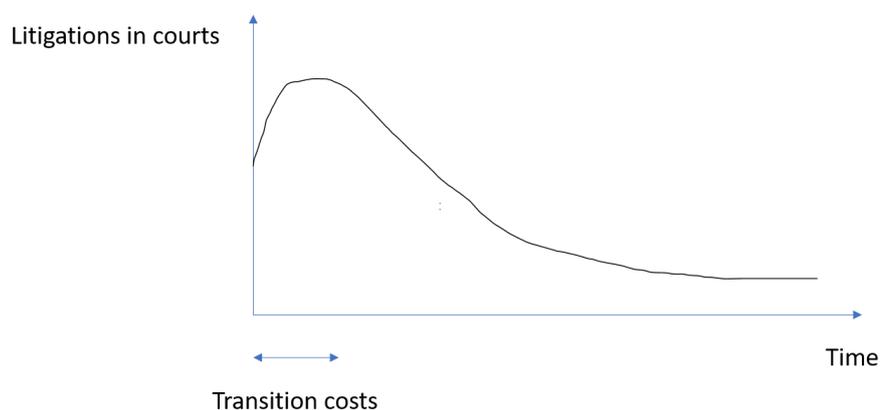
Introducing policy option 1 will provide more certainty that granted patents meet inventorship and entitlement rules if AI is used in R&D. This should reduce the incentive for patents to be challenged and so litigation in the courts is less likely. The courts may see a small, transitional rise in case numbers as the new definition of inventor is tested by parties who have patent inventorship and ownership interests (Figure 6).

The benefits from avoiding litigation associated with AI-devised inventions can be estimated based on the cost of recent cases such as the DABUS case.

⁴³ Government response to call for views on artificial intelligence and intellectual property, published on 23 March 2021: <https://www.gov.uk/government/consultations/artificial-intelligence-and-intellectual-property-call-for-views/government-response-to-call-for-views-on-artificial-intelligence-and-intellectual-property>

⁴⁴ The main cloud service providers are Microsoft Azure, Amazon Web Services, Google Cloud, IBM Cloud, Oracle Cloud Infrastructure, CloudLinux.

Figure 6: Evolution of the number of litigations in courts due to less uncertainty on protection of AI devised inventions



Option 2: Allow patent applications to identify AI as inventor Like option 1, patent protection would be available for inventions devised by AI as well as AI assisted inventions. Unlike option 1, it would be clear from the patent application if AI had devised the invention. Responsible persons would be entitled to the patent rights. These could be the same set of people as for option 1, but the consultation will seek views on which persons are most appropriate.

We would expect many of the same actors to be affected by option 1 and 2 as the same set of people entitled to own a patent in option 2 are potentially the same as the responsible humans that could be named as inventors in option 1. The increase in patent availability under option 1 and 2 compared to the status quo are very similar and so provide the same incentive effect. The main difference from option 1 is that option 2 makes patents available for applicants who do not want to name the responsible human as inventor when an invention is devised by AI.⁴⁵ Option 2, however, could change perceptions about the UK patent by removing the need to name a human inventor.

This option may be perceived less favourably by firms which patent globally, and we hope to hear views on this at consultation. There may be limits on the extent that legal changes to UK law proposed in policy option 2 will benefit AI users, if patent laws in foreign markets important for UK business do not allow patents to protect AI-devised inventions. By explicitly identifying AI as an inventor, this could make it less straightforward for firms to patent the same invention in other territories. There would be administrative costs in doing so, and there may also be a perception of legal risk if the same inventor could not be named in all territories.

We know that it is important for many firms to patent across multiple territories because the vast majority of patents valid in the UK are granted through EPO, where firms can choose for their patent to be valid across multiple European countries. There are also many firms which patent globally using the Patent Co-operation Treaty (PCT). Where possible, businesses may choose to protect these inventions by trade secret rather than make the invention public in a UK patent which can be copied in foreign markets.

Because of this potential behavioural impact, we first want to understand whether policy option 2 leads to an increase in the number of patents in the UK to calculate the costs and benefits. This

⁴⁵ The UK IPO has received two patent applications where the applicant wanted to name AI rather than a human as inventor.

depends on the likelihood of firms to adopt AI to invent and on the patent strategy of firms that use AI to invent given the incompatibility this change in legislation introduces with other IP systems (particularly the EPO). We assume that the decision to patent in a given jurisdiction depends on (i) the importance of patent protection relative to other forms of protection, (ii) whether the invention can be patented in the jurisdiction, and (iii) the expected revenues in the jurisdiction as well as in other jurisdictions. For instance, if a firm is expecting high revenues when selling its new product on the EU market but is not able to patent at the EPO, it might choose another route than patenting to protect its invention both in the EU and in the UK to avoid disclosing the invention.

As a result, only part of the costs and benefits of policy option 1 that derives from an increase in the number of patent applications may be incurred when considering policy option 2. We will do a sensitivity analysis on how this affects costs and benefits.

Option 3: Protect AI-devised inventions through a new type of protection Under this option we would create a new patent-related right with fewer rights than currently provided by a patent. This new right would protect inventions which fail to qualify for patent protection, on the basis that a human does not qualify as inventor. This new right would protect AI devised inventions and operate alongside the current human-centric patent system which protects AI assisted inventions.

The consultation will seek views on how a new right that sits alongside the current patent system could provide an appropriate incentive to invest in AI for use in R&D whilst addressing potential competition issues.

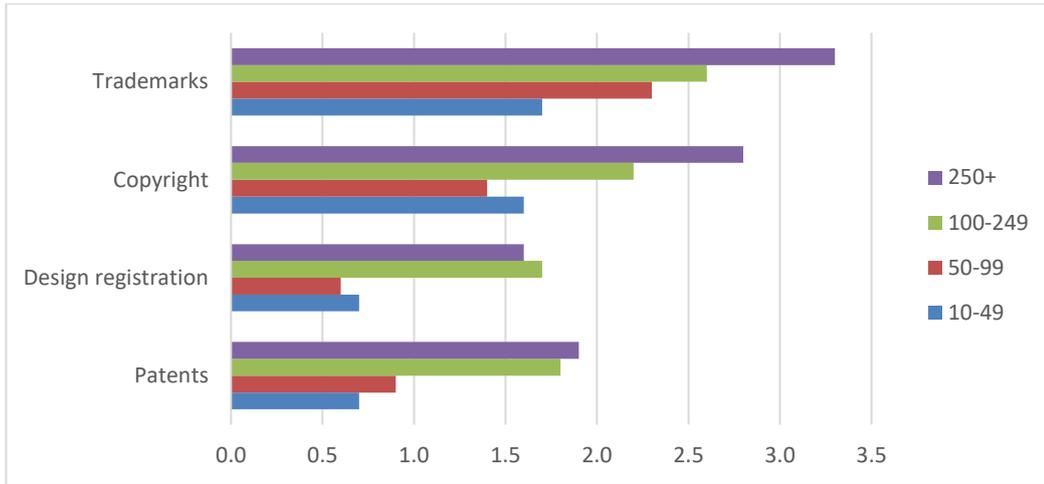
Because this option is not fully formed at this stage, we cannot provide a precise estimation of the costs and benefits. However, because option 3 provides more rights than the status quo but less than option 1 & 2 in terms of the protection of AI devised inventions, we expect the costs and benefits will be less than option 1 & 2. The stakeholders that will be affected are not expected to be different than for policy option 1 & 2.

There may also be wider impacts as a result of the policy changes proposed by these options (e.g., benefits to society). These wider impacts will be examined after consultation.

Impact on small and micro businesses

Small and micro businesses are an important source of dynamic innovation and creation within the UK economy and contribute to growth and trade. We assume that the decision to apply for an intellectual property right by a firm of any size is net positive, i.e. the expected costs of applying for and maintaining the right are outweighed by the expected benefit. Therefore, we assume that policy changes in this space do not impose net costs on small and micro businesses, but it may affect the decision on whether to apply. Data from the ONS innovation survey 2019 shows that UK small businesses are less likely to use IP rights particularly for patents (Figure 7), which makes them also less likely to be impacted.⁴⁶

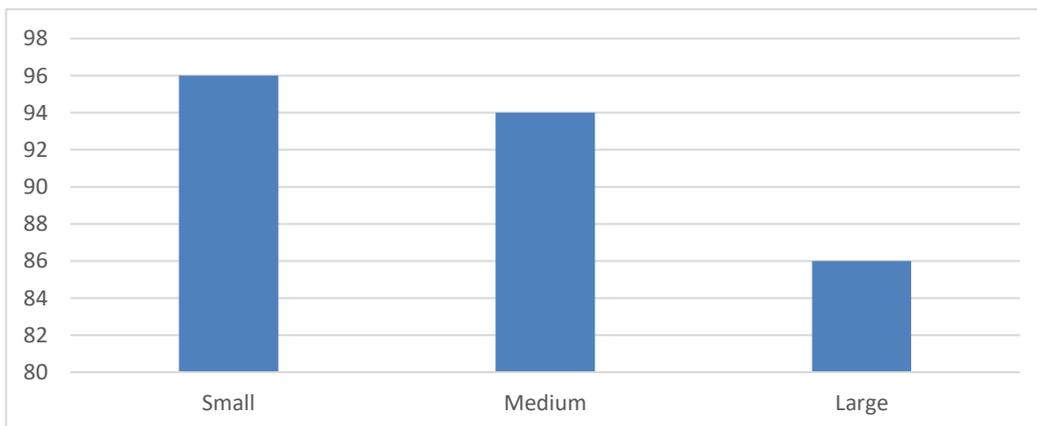
Figure 7: Percentage of firms rating as "highly important" protection of broader innovation (2016-18), by type of protection and firm size



Source: ONS, 2019 innovation surveys

Small firms are less likely to adopt AI relative to medium and particularly large firms (Figure 8).⁴⁷ There does not appear to be any evidence available on whether the use of AI differs between small and micro firms, but we might expect the existing trend to continue into this segment (the smallest firms having the least adoption of AI systems).

Figure 8: Percentage of firms that don't use any AI system, by firm size



Source: Eurostat, Digital economy and society database

In analysing the likely impact of these proposals on small and micro businesses we consider two groups.

⁴⁶ ONS, 2019 innovation surveys

⁴⁷ Eurostat Digital economy and society database

- on the supply side those investing in developing AI, and
- on the demand side those who may benefit from using AI.

Those small firms currently investing in developing AI may find it easier to grow their business because of some of the policy changes proposed. Navigating the licensing environment around text and data mining may be more challenging for a smaller firm than a large one. Therefore, simplifying the licensing environment may be of particular benefit to those who are smaller mainly because they have significantly fewer resources available to cope with regulatory change and ongoing compliance costs. Increased consumer demand for AI products and services, may create new markets within which small and micro firms can compete and grow.

If the productivity gains from more widespread adoption of AI are as set out in the assessment in the background section (an estimated 1.31-22% increase in UK output by 2030), then it is likely that some of this benefit would accrue to small and micro firms. The creation of products and services using AI would be likely to offer productivity gains to small and micro firms.

The government will develop and refine this assessment in light of consultation responses, we would encourage respondents to indicate the size of their business by number of employees in their response to the consultation to assist in refining this initial assessment.

There is a relative lack of data available with regards to the uptake of AI technologies among micro businesses in the UK. There is data on the aggregate benefits of AI to the economy but there is little in the way of detail as it pertains to just how much of the potential benefits that will be shared by SMEs.

Wider Impacts

This section will cover Wider Impacts on the following three areas: 1. Creativity, 2. Innovation, and 3. Competition.

1. Creativity

Wider Impacts of Computer-Generated Works Options on Creativity

Creativity (the production of creative works) occurs and is promoted through the exchange and creation of new ideas, and also new forms of expression. However, CGWs have the quality of being produced at significantly cheaper costs than HGWs. Furthermore, CGWs can be produced almost entirely by capital inputs (e.g., computers), whereas HGWs production require significant labour inputs (e.g., humans). Here we can see that if CGWs come to dominate particular marketplaces for artistic works (e.g., paintings) in which HGWs compete – this might put competitive pressure on the humans creating HGWs. This pressure could adversely or positively impact the creativity of humans creating HGWs.

If HGWs are not able to compete on price with CGWs, we may see human creators exit the marketplace of creative works (e.g., paintings). Subsequently, human creators may not be willing to produce works if they are not willing (or able) to produce HGWs at low enough costs to compete with CGWs.

However, the above is highly speculative as we do not find any evidence of HGWs *currently* facing significant competitive pressure from CGWs. Firstly, it is not well understood to what extent HGWs and CGWs are substitute goods. Consumers may prefer to consume works produced by people instead of machines, which diminishes the idea that they are substitute goods. Lastly, human

creators are not always purely driven by profits and will still continue to produce creative works for the purpose of expression despite the reduced profit motive.

Overall, it is unclear what impact the CGW Options 1 and 2 would have on creativity.

2. Innovation

Wider Impacts of Text and Data Mining Options on Innovation

The TDM policy options provide increasingly wide exceptions and permissions above the current TDM exception. Option 1 provides the narrowest exception out of all new options, while Option 4 provides the widest exception out of all new options.

Innovations occur and are promoted through the exchange and creation of new ideas. Researchers, whether researching for commercial or non-commercial purposes, are capable of creating and exchanging new ideas when they are more able to use tools to analyse the greatest quantities of information. The widest TDM exception is provided by Option 4 and would provide researchers (and other users) to use TDM tools with the fewest restrictions.

Providing researchers with the capability to analyse the greatest quantities of information, would increase the opportunities for researchers to explore information and subsequently spot new ideas, which could spur innovation. This would be especially true in R&D intensive sectors such as Pharmaceuticals.

Option 4 should provide the greatest benefits for innovation because it allows for the greatest flow of information through TDM use. Options 3, 2, and 1 should provide less benefits for innovations, because they allow for less flow of information through TDM use.

Wider Impacts of Patent Options on Innovation

Policy option 1 may limit innovation as it may lead to more patents being granted for AI-devised inventions, potentially contributing to patent thickets. A greater use of patents to protect AI-devised inventions may intensify the problem of patent thickets if AI accelerates the pace of inventions. This could then lead to a winner-takes-all effect where first AI adopters could intensify their patenting activity and protect a wider range of inventions. This would in turn make it more difficult for new entrants and firms relying on in-licensing⁴⁸ to innovate without infringing other patents or having to pay significant cross-licensing fees. As a result, policy option 1 may lead to limiting follow on innovation. This effect is amplified in cases where innovation is particularly cumulative, where only a few entities own pieces of knowledge that are the building blocks for other inventions and prevent others from accessing it through patents.

Patent policy option 1 may also have a positive impact on innovation through two main channels.

First, it may lead to higher expected returns on investments in AI to use in R&D activities, and as a result higher investment in AI to invent. Under this option, patents will now be available for both AI assisted⁴⁹ and AI devised inventions⁵⁰, which, in turn, leads to less uncertainty regarding patentability of inventions where AI has contributed and to higher expected returns on investment in R&D projects using AI. As a result, under option 1, firms would have more incentives to invest

⁴⁸ Cockburn, I. M., MacGarvie, M. J., Muller, E., 2010. Patent thickets, licensing and innovative performance. *Industrial and Corporate Change* 19, 899–925.

⁴⁹ AI assisted inventions are defined in the Glossary (p.39).

⁵⁰ AI devised inventions are defined in the Glossary (p.39).

in such innovative projects. An increase in investment in innovation would then have a positive effect on innovation.

Furthermore, the use of AI is expected to increase productivity leading to an increased number of inventions relative to traditional R&D activities.^{51 52 53} Several respondents to the government's AI Call for Views argued that the use of AI may enable organisations to increase the pace of inventions and reduce R&D costs relative to relying solely on human inventors. In that case, an increased use of AI in R&D activities would then translate into an increase in the number of inventions, other things held constant, and thereby an increase in the number of patent applications.

Second, even if the proposed change in legislation cannot be linked to increased investments in AI, it provides more patents and legal certainty for actors that are using AI to invent. As a result, more inventors will apply for patents enabling them to yield higher profits from the protection of AI-devised inventions. Assuming part of these profits is then re-invested in R&D project, option 1 would positively impact innovation.

As the current AI adoption by UK firms is low, this impact would be limited in the short-term but may increase in the future as more firms use AI to invent.

Patent policy option 2 may be perceived less favourably by firms which patent globally. By explicitly identifying AI as an inventor, this could make it less straightforward for firms to patent the same invention in other territories. There would be administrative costs in doing so, and there may also be a perception of legal risk if the same inventor could not be named in all territories. As Patent policy option 2 introduces transparency about AI devised invention but no significant difference in the availability of patents for AI devised inventions compared to option 1 it is likely to have less impacts on innovation relative to option 1. Firms that aim at commercialising their inventions globally may not change their behaviour based on changes in UK patent law proposed in option 2. Furthermore, UK innovative firms are more likely to export as 35.2% of broader innovators⁵⁴ are exporters while on 12.4% of non-broader innovators are exporters.⁵⁵

Patent policy option 3 also leads to a divergence from other jurisdictions and therefore is likely to have a more nuanced impact on innovation relative to option 1 at least.

Furthermore, Patent policy option 3 provides less extensive exclusive rights than a patent. As a result, it would be favourable to follow on innovation. However, AI adoption implies change and thereby uncertainty. It is also costly for firms as they need to invest in new skills and adapt their infrastructure and processes to use this new technology. Therefore, limiting exclusive rights may disincentivise firms from investing in and adopting AI if they know their returns on investments will be more limited than by using traditional technology. This in turn may lead to a negative impact on innovation.

3. Competition

Wider Impacts of Text and Data Mining Options on Competition

⁵¹ McKinsey (2017), A future that works: automation, employment, and productivity.

⁵² Damioli (2020), The impact of artificial intelligence on labor productivity.

⁵³ Alderucci (2020), Quantifying the Impact of AI on Productivity and Labor Demand: Evidence from U.S. Census Microdata.

⁵⁴ Broader innovators are firms that (i) introduced a new or significantly improved product (good or service) or process, (ii) engaged in innovation projects not yet completed or abandoned, (iii) introduced new and significantly improved forms of organisation, business structures or practices and marketing concepts or strategies, and/or (iv) engaged in activities in areas such as internal research and development, training, acquisition of external knowledge or machinery and equipment linked to innovation activities.

⁵⁵ 2019 ONS innovation surveys.

This IA currently does not note any definitive implications for the Text and Data Mining (TDM) options on competition for TDM services. Internationally, there are at least 34 pieces of purpose-built software dedicated to text mining, and a much greater number of purpose-built software dedicated to data mining.

Increasing the accessibility of TDM by broadening the current exception would likely increase the demand for TDM services and software. This is an assumption that has been made and can be seen in the section on Cost-Benefit Analysis. However, we are unable to say whether an increase in the demand for TDM services would increase **or** decrease competition among these competing services and software.

If TDM services benefit significantly from network effects (e.g., as with social networks and search engines), we may see certain TDM service providers dominate the market for TDM services. However, we do not have any evidence that TDM services benefit to the same extent from network effects as the aforementioned services. Therefore, these options may impact competition, but this will in small part depend on to what extent TDM services benefit from network effects.

Wider Impacts of Computer-Generated Works Options on Competition

We assume that Computer-Generated Works (CGWs) can be considered as a substitute good for Human-Generated Works (HGWs). For example, images generated by a computer algorithm can be indistinguishable from an image generated by a human.⁵⁶ Furthermore, as CGWs are currently afforded Intellectual Property Rights (IPRs), CGW-owners can demand royalties from such works. This means that in addition to competing against HGWs, CGWs also have commercial values derived from the IPRs.

Option 1 (removing IPRs for CGWs) would mean that the would-be owners of CGWs are not able to demand royalties from use of their CGWs. This would decrease the commercial value of CGWs, which may limit the production of CGWs. This limit in this production may result from the fact that commercial investors may not be willing to invest in the production of CGWs if there is can be no direct profit (royalties) made. If CGWs are not produced to a sufficient extent, then HGWs may face less competition with CGWs in the relevant marketplaces.

Relative to Option 0, this option would decrease the competition that HGWs face, as the commercial viability of substitute goods (CGWs) are reduced.

Option 2 (replacing the IPRs for CGWs with a new alternative protection) also reduces the commercial value of CGWs, which may limit the production of CGWs. However, in this option, some amount of commercial value is retained for CGWs as this option retains a limited period of copyright protection. Hence, in Option 2, it is likely that the commercial values of CGWs are decreased relative to Option 0 but higher than in Option 1.

Relative to Option 0, this option would decrease the competition that HGWs face, as the commercial viability of substitute goods (CGWs) are reduced. However, this option would provide more competitive for HGWs than option 1 would, as the commercial viability substitute goods (CGWs) in this option is higher than in option 1.

Wider Impacts of Patent Options on Competition

⁵⁶ <https://cdn.openai.com/papers/jukebox.pdf> page 1, column 2, row 7

All patent options lead to an increase in intellectual property rights and hence monopoly power for a limited period of time.

Because Patent policy option 1 lead to patents being granted for AI-devised inventions, there is the potential to contributing to patent thickets. Patent thickets tend to be particularly present in ICT-related technologies (Telecoms, Computer technology and Audio-visual).^{57 58}

While patent thickets already exist within the current patent system, a higher use of patents to protect AI-devised inventions may intensify the problem of patent thickets if AI accelerates the pace of inventions. This could then lead to a winner-takes-all effect where first AI adopters could intensify their patenting activity and protect a wide range of inventions thereby making it more difficult for new entrants to innovate without infringing other patents or having to pay significant cross-licensing fees. This may lead to higher barriers to entry thereby creating a negative impact on competition. The cost maintaining patent rights (yearly renewal fees) may limit this problem.

As for innovation impacts, Patent policy options 2 and 3 are likely to have a more nuanced impact on competition than option 1 because there is transparency about AI devised invention.

Furthermore, because Patent policy option 3 provides fewer exclusive rights to inventors, it also limits the risk of concentrating those rights to a few entities and thereby is less likely to negatively impact competition.

Monitoring and Evaluation

The evaluation strategy will be set out at the time of policy decision based on the policy options selected. We will complete a post implementation review where we will ask for both quantitative and qualitative evidence of impact on the policy objective.

IP forms an important part of the business environment for creative and innovative firms, so adjustments to the system could change business behaviours. However, wider economic factors will also play a role in incentivising investment in AI this makes ascribing causation of policy impact more challenging. Other influencing factors include taxation or tax incentives; the availability of a workforce with the appropriate skills to work with AI; and the necessary infrastructure and availability of business or research funding.

⁵⁷ Hall, B. H., Helmers, C., Von Graevenitz, G., Rosazza-Bondibene, C. (2013). *A study of patent thickets*. Intellectual Property Office UK.

⁵⁸ This study is based on EPO patents between 1981 and 2009 and patent thickets are measured as the number of firm triples. A triple corresponds to “a group of three firms in which each firm has critical prior art limiting claims on recent patent applications of each of the other two firms”.

Glossary: AI terminology used in this document

AI-devised inventions and AI-generated creations are often the result of the contribution of different actors including AI developers, data providers and AI users.

AI is sometimes subdivided into two groups in function of its level of human input. The term soft AI refers to when AI assists the human (similar to the use of computers and software) and has an insignificant contribution to the invention/creation. Strong AI corresponds to when AI generates the invention/creation, and the human has an insignificant or no contribution. These are two extremes and, in many situations, the contribution of the AI versus the human is not as straightforward. In recognition of this, the impact assessment uses the terms AI assisted, AI generated, and AI devised instead.

	Copyright	Patents	Summary
AI assisted	Creation by a human author who uses AI as a tool	Invention devised by a human inventor using AI as a tool	Human uses AI as a tool
AI generated	Creation of a work generated by AI in circumstances such that there is no human author of the work.		Human is not identified
AI devised		Invention devised by AI inventor.	Significant contribution of AI, but human may or may not be identified