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## Dedication

It is our pleasure and great privilege to present the forty- eighth issue of the Academic Journal of Research and Scientific Publishing to all researchers and doctors who published their research in the issue, and we thanks and appreciate to all contributors and supporters of the academic journal and those involved in the production of this scientific knowledge edifice.

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## Table of Content:

Academic Journal of Research and Scientific Publishing | Vol 4 | Issue 48
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# Legal and Judicial Dealings with Artificial Intelligence as an Inventor

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## Abstract:

In this article associated with an opportunity for the court to consider whether artificial intelligence can be an inventor. In this case, the development of AI technology in the United States where AI has already become inventors and innovators. In this article, there are appropriate explanations for the development of artificial intelligence technology in which artificial intelligence technology has been used in various aspects. In this scenario, the detailed concept of artificial intelligence, which was used as an advanced technology in human life, took place. In this context, a legal and judicial approach was taken regarding the innovation of artificial intelligence, and the importance of the research is due to the fact that artificial intelligence has become a reality to a large extent in human life, and it was necessary to clarify whether it should be considered an inventor or not. The research aims to define artificial intelligence and Clarify whether artificial intelligence can be considered an inventor or not, and indicate how the law deals with the innovation of artificial intelligence, and indicate whether artificial intelligence should be considered an inventor? The research adopts the critical analysis approach with the concept of legal personality, artificial intelligence systems, and arguments related to whether artificial intelligence can be considered an inventor or not.

**Keywords:** Artificial Intelligence, Intellectual property, the Copyright, Designs and Patent Act 1988, European Patent Office, DABUS, UKIPO, Open AI's GPT-2, USPTO.

## 1. Introduction:

In order to understand whether an AI can be an inventor or not, it would be useful to first consider how AI Is defined. This is so because much of the issue is also based on the question of personality of the AI in the legal sense, and whether AI is capable of being vested with rights and liabilities in the law. In other words, even if it is considered that AI can be an inventor or be capable of inventing something, in law, an additional context of personality would have to be considered in order to determine the capacity of the AI to be a holder of a patent. Therefore, the starting point of this discussion is related to the nature of AI. In a recent case decided by the Court of Appeal, *Thaler v Comptroller General of Patents Trade Marks And Designs,* the court specifically refused to consider an AI to be an inventor for the purpose of the Patents Act 1977 (*Thaler v Comptroller General of Patents Trade Marks And Designs,* 2021). This case was an opportunity for the court to consider whether AI can be an inventor. At this point, however, the court has decided this question in the negative. As this essay will later discuss, courts in the United States have come to a similar conclusion. Considering the significant developments in the technology field where AI have already become inventors and innovators, the approach of the courts (and the law) to the question of AI inventorship begs the question whether the law needs to be reconsidered since the traditional approach to inventorship does not take into account the recent developments in AI.

The traditional law of intellectual property is considered to be human centric in the sense that it takes a view generally that only humans are capable of the intellectual effort required to create subject matter capable of being treated as intellectual property (J Baldocchi, 2020). This traditional viewpoint is based on the concept of intelligence and creativity, which are seen to be peculiarly human attributes. In addition to this, the recent developments in the AI field, where AI are demonstrating creativity and intelligence and using these attributes to create new inventions, are raising a relevant question about whether the traditional precepts of intelligence and creativity need to be reconsidered since AI are increasingly depicting these attributes. Furthermore, it needs to be considered whether the AI using these attributes, have the capacity to be recognized as inventors. The last mentioned also depends on the concept of personality of the AI and whether law can attribute personality in the legal sense to a machine.

The case of DABUS, an Artificial Intelligence (AI)-inventor, on whose behalf patent applications were made, and refused, in the UK, Europe and the United States, has brought renewed focus on the question of whether an AI can be an inventor. Arguments are made both for and against recognition of AI as inventors. On the one hand, it is argued that AI cannot be an inventor since it does not have the necessary attributes that humans have which can lead to creativity while on the other hand an argument is made that AI is already making inventions that would have received patents had these been made by humans (Shlomit Yanisky-Ravid and Xiaoqiong Jackie Liu, 2017). As this essay will discuss later, there are also relevant economic arguments that are made to support recognition of AI as an inventor. The question whether an AI can be an inventor or not has implications for the law of patents, since this law allows the use of patent for the protection of the inventor's rights in the invention. In the UK, the relevant laws for defining patent and the rights of the patent holders are the Patents Act 1977 and the Copyright, Designs and Patent Act 1988. This is one of the areas that will be discussed in detail in this essay. This essay critically engages with the concept of legal personality, artificial intelligence systems and arguments related to whether AI can be considered to be an inventor.

### 1.1. Research importance

The importance of the research is due to the fact that artificial intelligence has become a reality to a large extent in human life, and it was necessary to clarify whether it should be considered an inventor or not.

### 1.2. Research Objectives

1- Definition of artificial intelligence

2- Clarify whether artificial intelligence can be considered an inventor or not

3- Explaining how the law deals with the innovation of artificial intelligence

4- Statement whether artificial intelligence should be considered an inventor?

### 1.3. Research Methodology:

The research adopts a critical analysis approach with the concept of legal personality, artificial intelligence systems, and arguments related to whether artificial intelligence can be considered an inventor or not.

## 2. Concept of AI

Artificial Intelligence has been defined as "the implementation and study of systems that exhibit autonomous intelligence or behaviour of their own". The two important attributes that are recognised by this definition are the capacity for autonomous intelligence and behavior (K Chitra and B Subashini, 2013). The core feature or characteristic of this definition is the capacity for autonomy. This autonomy feature is for the application of intelligence and creativity. As per the opinion of Wang (2019), the notion of 'intelligence 'while defining AI and explains intelligence as the" capacity of an information-processing system to adapt to its environment while operating with insufficient knowledge and resources". Even if it is considered that AI has the intelligence to adapt to environment and make decisions, the question however remains whether the AI has intelligence in the same way as a human has intelligence and whether the difference in AI intelligence and human intelligence has any implications for the AI to be considered as an inventor. It can also be argued that it is not necessary for the AI to depict the same nature of intelligence as human beings because an AI is essentially an artificial entity and cannot have the same attributes as a human being.

In other words, equalising AI intelligence with human intelligence for the purpose of assessing whether AI can be considered an inventor is inappropriate because they are essentially different natured entities. In literature on AI, there are certain components or essential properties that have been identified as the markers of an AI; these markers include the ability of the AI entity to apply reason, have autonomy, have decision making and problem solving skills, and the ability to respond to new situations. Three elements that are identified as being common to all AI are software, algorithms and data (Wolters Kluwer, 2020). This is important because AI does not have a uniform physical characteristic and while some have humanoid features, others are more in the nature of machines that resemble computers rather than humans. Since AI are not uniform and do not have the same features across the spectrum of machines that are considered to be AI, it is important to identify the common markers of AI. These markers can be identified as software, algorithms and data.

Due to the changes brought forth by the informational technologies as well as robot technologies, AI is increasingly developed as an entity with problem solving skills but these skills are not the same as those exercised by the human entity,

which makes it difficult at least in the legal sense to determine how rights and liabilities can be bestowed on the AI (Bokovnya *et al.* 2020). At the same time, there is an interest in the legal field that AI must be defined and conceptualized because the conceptualizing of rights and liabilities in law will first require the definition of the entity in whom such rights and liabilities can be vested (Sam N Lehman-Wilzig, 1981). In the legal context of recognizing AI as an inventor, a question may be raised as to whether the AI is capable of having rights and liabilities that are associated with inventors under the law. It can be argued that if the AI is not capable of enforcing its rights as an inventor or if the law cannot take actions against AI for wrongs done by it, then the issue of inventorship for AI may be futile. To go back to the issue of intelligence of the AI, it has been accepted that the mechanisms of AI can summarise content faster than the human mind (Andrew Arruda, 2016).. However, does this mean that the AI is intelligent in the same sense as a human being? And even if so, should the AI be treated as a person?

There are two broad objections to treating an AI as a constitutional person, which are that only natural persons should be given the rights of constitutional personhood and that AI lack "the critical components of personhood such as souls, consciousness, intentionality, and feelings" (Lawrence, 1992). Since AI is essentially a machine, it would not have the consciousness and soul like a human person. However, it can also be argued that even corporations do not have souls and consciousness, but the law recognises their personality. Similarly, an AI can be recognised as a legal person even if it does not have human attributes. The reasoning for recognising AI personality can be the same as that for recognising corporation as a person.

An argument is made that AI is not a moral producer although it can be a moral consumer (Torrance, 2009). There is a crucial difference between a moral producer and a moral consumer, which is also relevant to the question of whether an AI can be a moral agent. A moral producer produces the moral action and is capable of producing moral actions or making moral decisions whereas a moral consumer has the capacity to receive moral actions and be considered to have rights and needs recognised and respected by others. Even if AI is considered to have a limited personality in order to be considered to have the capacity to be the bearer of some rights, it is not at this time clear if AI can be the bearers of responsibility to generate moral actions. Related to this point is the argument that AI do have the experience of feelings and emotions and experience of such feelings and emotions (Kurt Gray and Daniel M Wegner, 2012).

It is possible to develop AI that can make decisions, but this does not become equated to human decision making processes since humans learn emotions and feelings because by experience and in this respect are unique in their moral agency. At the very least, it can be argued that AI intelligence is not the same as human intelligence.

Another argument that can be made in favour of AI having the capacity to be treated as persons is that the personality of the AI can be devised in the same sense as the personality of the corporation since the latter is also not a natural person (Solaiman, 2017). It is a principle that has been generally recognized in the law that legal personhood is not necessarily synonymous with or confined to human beings and that in certain circumstances law may extend the notion of personality to artificial entities (*Byrn v New York City Health & Hosp Corp,* 1972). This principle has been used to treat companies as separate legal person with the capacity to have their own rights, property, and liabilities and the Salomon v Salomon case is a good example of this approach (*Salomon v Salomon,* 1897). However, even if AI is considered to be a person for this purpose, the question of whether it can be an inventor would still be one that is contentious, since there is a judicial view that invention involves an "inventive step" that is not obvious to a skilled person in the art, and this suggests that inventive matter is one arising from the mind of a natural person (*Yeda Research and Development Company Ltd v. Rhone-Poulenc Rorer International Holdings,* 2007). Therefore, even consideration of a AI having a personality in law would not be enough to make an argument that such legal person is capable of invention.

It may also be mentioned that even in the case of corporation, a distinction is drawn between human and artificial personality as was noted in People ex rel Nonhuman Rights Project, Inc v Lavery that while the Black's Law Dictionary defines the term person as a human being or an entity (such as a corporation), it notes in the case of the latter that it is recognised by law as having the rights and duties of a human ( People ex rel. Nonhuman Rights Project, Inc. v Lavery, 2014). To put this matter in the more specific context of this essay, a corporation is also not considered to be an inventor, although it can be considered to be an owner of the patent. There is a difference between an inventor and an owner as noted in Beech Aircraft Corp. v. EDO Corp. where the difference was clarified as inventorship being a question of who invented the subject matter while ownership being a question of who owns legal title to the subject matter (Edo Corp. v. Beech Aircraft Corp, 1988).

The question of personhood for the purpose of intellectual property rights have become relevant as the question of who has intellectual property in a specific subject matter has also been raised with respect to a monkey in what has come to be known as the 'Monkey Selfie case' (Naruto v. Slater, 2018). In Naruto v Slater, a question arose as to whether animals can have statutory standing under the Copyright Act. In this case, a wildlife photographer left his camera unattended at an Indonesian reserve and a macaque named Naruto allegedly took several photographs of himself with the camera. The photographer published the Monkey Selfies in a book and identified himself as one of the copyright owners of the Monkey Selfies while also admitting that the photographs were taken by Naruto. People for the Ethical Treatment of Animals (PETA) filed a "Next Friends" complaint against the photographer on behalf of Naruto for copyright infringement. However, in the process of suits and appeals, the conclusion was that the Copyright law does not authorise animals to file copyright infringement suits.

While the law continues to take a traditional and human centric approach to AI and intellectual property, AI continues to evolve in ways that shows it to be increasingly creative and innovative thus begging the question as to whether law is not responding to the changing landscape of AI systems. "Modern AI is now also able to generate a diverse range of sophisticated creative outputs. In November 2019, the Prague Philharmonic performed an AI-generated composition based on an unfinished work by Antonín Dvořák, 115 years after his death. Similarly, algorithms such as OpenAI's GPT-2 language program can generate poetry and other literary works (with varying levels of success). In addition to these creative works (which may in theory be protected by copyright), AI is now increasingly being utilised to produce inventive outputs (which may be subject to patent protection). In fact, AI systems have already generated a wide array of inventions essential that helps to products such as medical devices, kitchen appliances and drug synthesizers" (Bonadio, McDonagh and Dinev, 2021).

Since AI is already in the process of innovating and developing new products and services, question can be raised as to why the law should not recognise the status of inventor for the AI. In the next section, the essay explores the approach of laws and courts to the issue of AI inventorship and critically engaged with the arguments in legal scholarship.

## 3. How do law and judiciary approach AI inventorship:

In a recent case, the Court of Appeal had the opportunity to consider whether an AI can be an inventor and to determine whether an AI is capable of having a patent (*Thaler v Comptroller General of Patents Trade Marks And Designs*, 2021). The judgment of the Court of Appeal in *Thaler v Comptroller General of Patents Trade Marks And Designs* is also central to the discussion in this situation since the case involves an appellant who applied for patents with the UKIPO, but the application listed the AI machine as the inventor of the product. The UKIPO rejected this application using Sections 7 and 13 of the Patents Act 1977. Section 7 of the Patents Act 1977 provides that an application for a patent can be made by 'any person' either alone or jointly with another person and that such patent for an invention can be granted to the inventor or joint inventors. Section 7 specifically notes that the term inventor means the actual deviser of the invention. It is important to note that Section 7 uses the term 'person'. Similarly, Section 13 provides that an applicant for a patent shall file a statement identifying the 'person' or 'persons' whom he believes to be the inventor or inventors and if he fails to do so, the application shall be taken to be withdrawn.

Therefore, the important point is that the inventor is supposed to be a 'person'. The question is whether the term 'person' can be defined in terms of an AI or in other words, whether an AI can be said to have a personality in legal sense. In *Thaler*, the UKIPO did not allow any such construction of the term 'person' and held that the AI is not a person and cannot be considered an inventor for the purpose of the Patents Act 1977. In his appeal to the High Court and later to the Court of Appeal, Thaler was unable to make a case for considering the AI to be a person for the purpose of making an application for the patent. The Court of Appeal held that a machine cannot be considered to be an inventor. Interestingly, in the first paragraph of the judgment, the following is noted:

"At first sight, and given the way this appeal is presented by both parties, the case appears to be about artificial intelligence and whether AI-based machines can make patentable inventions. In fact this case primarily relates to the correct way to process patent applications through the Patent Office and turns on material which was either buried in the papers but ignored in the written and oral argument, or not referred to at all. It is an object lesson in the risks of advocacy being distracted by glamour."

The court's statement suggests that the principal issue in Thaler was not related to whether AI can make patentable inventions but to the process of patent application and that the presentation of the case merely distracted from this issue and instead focused on the issue of the AI as an inventor. With reference to the application itself, the court noted that the applicant, gave the name of the AI machine and indicated that the AI had the right to be granted a patent "by ownership of the creativity machine." Also relevant is the reply given by Dr Thaler to the notification of the UKIPO that the former had failed to identify a 'person' in the application. To this question, Dr Thaler responded in the Amended Form 7 that "the applicant identified no person or persons whom he believes to be an inventor as the invention was entirely and solely conceived by DABUS".

In Yeda Research and Development Company Ltd v. Rhone-Poulenc Rorer International Holdings, Lord Hoffmann considered the meaning of inventor under Section 7 and observed that the term refers to the actual deviser of the invention in contrast with deemed or pretended deviser of the invention (*Yeda Research and Development Company Ltd v. Rhone-Poulenc Rorer International Holdings*, 2007). In University of Southampton's Applications, Laddie J was more specific in saying that inventor is the natural person who "came up with the inventive concept" (*University of Southampton's Applications*, 2005).

Therefore, there is some question about whether an AI can be considered to be a legal person and as such be allowed patent. It may be mentioned that in Thaler, the appellant himself did not make the argument that the AI (DABUS) is a person (whether natural or legal) (University of Southampton's Applications, 2005). Thus, an argument may be made that the Court of Appeal did not have the opportunity to engage more deeply with the issue of personality of AI for the purpose of patent. It may be argued that there is scope for an argument that if AI is considered to be a legal person, there is a possibility for considering the AI as an inventor for the purpose of patent law.

It is notable that the Court of Appeal considered that Dr Thaler was the creator of the AI and was therefore the person who set it up to run to produce the inventions in issue (Thaler v Comptroller General of Patents Trade Marks And Designs, 2021). This brings to consideration another question that whether it is ultimately a human person who should be considered to be the inventor when the human person has been the one who created the AI that finally created the invention.

In Thaler, the Court of Appeal noted the following:

"In my judgment it is clear that, upon a systematic interpretation of the 1977 Act, only a person can be an "inventor". The starting point is section 130(1) which provides that "'inventor' has the meaning assigned to it by section 7 above". Section 7(3) provides that "'inventor' in relation to an invention means the actual deviser of the invention". A dictionary definition of "deviser" is "a person who devises; a contriver, a planner, an inventor" (Shorter Oxford English Dictionary, 5th edition, Oxford University Press, 2002). Section 7(2) provides that a patent may be granted (a) "primarily to the inventor or joint inventors", (b) "to any person or personswho …", (c) "the successor or successors in title of any person or persons mentioned in paragraph (a) or (b) above", but "to no other person.

The above statement should be considered in conjunction with the statement made by Lord Hoffmann in Yeda where he noted that the "inventive step" for the purpose of patent should be something that is not obvious to a skilled person in the art, and this suggests that inventive matter is one arising from the mind of a natural person (Yeda Research and Development Company Ltd v. Rhone-Poulenc Rorer International Holdings, 2007). Therefore, as of this time, there is some judicial opinion that suggests that AI cannot be an inventor for the purpose of patent law.

The Patent Act in the United States does not use the term 'person' but uses the terms 'individual' and 'inventor'. Section 100(f) of the said Act defines inventor as "the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention" but does not clarify who is deemed as an individual. Although the term person has been generally interpreted in the United States to include where relevant, legal persons (FCC v. AT&T Inc., 2011), the court uses the specific legislations where the term person or individual is used to interpret whether that specific legislation uses the term broadly to include legal persons, or narrowly to include only natural persons (Mohamad v. Palestinian Auth, 2012).

## 4. Should AI be considered to be an inventor?

One argument is that AI should be considered to be an inventor because of the features of AI systems and the Multiplayer Model. Furthermore, it is argued that the theoretical justifications concerning intellectual property have become irrelevant and there is a need to reform the patent law since the traditional principles encompassing the patent have has become outdated, inapplicable and irrelevant in the era of advanced automated and autonomous AI systems (Shlomit Yanisky-Ravid and Xiaoqiong Jackie Liu, 2017).

The argument is based on the changes that have been brought into the AI technologies which have led to the greater autonomy of these systems. Indeed, eight of the crucial features identified with respect to AI systems are of the nature that bring AI closer to human intelligence, since AI systems are now "(1) creative; (2) unpredictable; (3) independent and autonomous; (4) rational; (5) evolving; (6) capable of data collection and communication; (7) efficient and accurate; and they (8) freely choose among alternative options." In other words, the new generation AI systems can lead to independently developing inventions. What is more important is that similar inventions, if made by humans, would have presented a fit case for patent. Reform of the patent law (with respect to addressing changes made in the AI field) is also demanded on the basis of the Multiplayer Model, which refers to the inventions created by AI systems and which involve overlapping and independent multiple participants and stakeholders, who are involved in the invention process. These participants include software programmers, data and feedback suppliers, trainers, system owners and operators. The traditional patent law approach is outdated because it is still based on the need to identify a single inventor while the natures of invention processes have changed. In the case of DABUS AI which was listed as an inventor in the *Thaler* case, it is important to point out that the latter has also made an application for patent in the United States for listing DABUS as the inventor (Hopes, 2021).

In the application it is also specified that the invention is a "specially shaped container lid designed for robotic gripping and a flashlight system for attracting human attention in emergencies" for which Thaler cannot be properly listed as an inventor because he "has no background in developing container lids or flashlight systems, [did not] conceive of those two products and direct the machine to invent them." It may also be noted that apart from the UKIPO, which rejected the application of Dr Thaler to list DABUS as the inventor, the European Patent Office also rejected the application. While rejecting the application of patent by Dr Thaler, the European Patent Office stated that it cannot grant the patent to DABUS since the application does not meet the requirement that the inventor has to be a human being, not a machine since legislative history supports the conclusion that the legislators understood an inventor to be a natural person only. In the United States where the application was also made by Dr Thaler, the USPTO released a Federal Register Notice noting that it would take a broad approach to seeing whether an AI can be an innovator but the decision taken by it also rejected the application on the ground that artificial intelligence systems cannot be listed or credited as inventors.

One of the objections that are relevant to the legal contexts of AI being an inventor concerns the enforcement aspect of the rights that are given to the patent holder and the question whether an AI can effectively enforce these rights. The argument is that if the AI is not capable of enforcing the patent through patent infringement it would not make sense to have patent for AI (Yohan Liyanage & Kathy Berry, 2021). Furthermore, AI systems are already showing characteristics that demonstrate their creativity and ability to innovate and create new subject matter. Arguments have been made that since computers are already generating patentable subject matter and overtaking human inventors' as primary sources of new discoveries and inventions, it is only appropriate that AI systems should be given patent rights to inventions (Ryan Abbott, 2016).

Another argument that is made in favour of considering AI systems as inventors is that AI is increasingly being devised as an autonomous entity, which is explained as follows:
"This feature [autonomy] is one of the most important to understand in order to grasp AI systems in general and their departure from the framework of current patent law. Although the definition of autonomous AI system might vary according to the specific industry and from one system to another, we can identify some common characteristics. Degrees of independence and creativity are both relevant. We can say that a device is independent and therefore autonomous to the extent that it accomplishes a high-level task on its own, without external (human) intervention. Human intervention can occur in many phases of the process—observation, orientation, deciding and acting—resulting in different levels of independence" (Shlomit Yanisky-Ravid and Xiaoqiong Jackie Liu, 2017).

An AI is not only capable of making decisions in an independent sense, it also increasingly has cognitive ability, which is an essential aspect of autonomy since the AI can now work independently without human intervention beyond defining goals; this is what happens with algorithms that allow the AI to collect data without human intervention (William C and Sonia K, 2013). In particular, the 3A era systems that are characterised as advanced, automated and autonomous AI system can create and invent products and processes for which patents would have been given had these been developed by humans (Shlomit Yanisky-Ravid and Xiaoqiong Jackie Liu, 2017).

One study makes an argument based on Coase Theorem to determine how economic efficiency can be maximised by allowing AI to create new technologies to obtain the resulting patents is the

optimal policy (W Michael Schuster, 2018). This is an important argument for supporting AI inventorship since it is based on economic efficiency. This argument is also based on the idea that since AI are already involved in invention and their inventions have been patented although not in the name of the AI, it makes economic sense to allow the AI to be listed as inventors since this can also be beneficial for the companies who are investing heavily in the development of innovator AI.

## 5. Conclusion

This essay engaged with the concept of legal personality, artificial intelligence systems and arguments related to whether AI can be considered to be an inventor. The discussion in literature makes a case for recognising the AI as an inventor based on different reasons. There are economic arguments that stress on the need to recognise AI as an inventor as this would encourage the firms developing AI for inventions. There are also legal arguments that emphasise on the need to reform the patent law so that it is able to respond to the new developments in technological field. AI can be recognised as an inventor based on such arguments if the law also changes in response to the technology. As AI personhood is central to the issue of whether AI can be an inventor or not, reference can be made to the recognition of corporations and other legal entities as legal person and similar recognition of legal personality for AI can be made as a first step to recognising AI as an inventor.

## 6. Research results:

1- So far, the status of the inventor has not been given to artificial intelligence

2- Many studies seek to prove whether artificial intelligence has the right to register some patents in its name.

3- Artificial intelligence must be given legal status.

## 7. Recommendations

At the end of the research, we recommend doing more studies and research on the extent of the eligibility of artificial intelligence to be granted the status of inventor, as it has become a key participant in many inventions, as well as changing patent laws to suit the changes of the era.

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# Design and Simulation of Transceiver Antennas in FSO Technology within the 5G Networks

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## Abstract:

There is an urgent need for high-capacity connection with high data transfer rate in densely populated areas due to the rapid growth of mobile communication technologies and the explosion of data traffic. Multi beam antennas have generated a lot of research interest and have been extensively explored for base station applications due to their ability to boost communication capacity and sustain a high data transfer rate. Multi-beam antennas based on Butler matrices (MABBMs) are also appropriate for base station applications because to their advantages of high gain, simple design, and low profile. This paper's goal is to give a summary of the current MABBMs. The presentation of MABBMs includes its specifications, operating principles, design methodology, and implementation. In the final section, the difficulty of MABBMs for 3G/LTE/5G/B5G base station applications is discussed.

The paper is divided into six sections, in the first section an introduction, in the second section base station application standards are presented, the design strategy and operating principles of MABBMs in the third section, and the latest developments in MABBM research for mobile communication systems are addressed in the fourth section, and challenges are presented in fifth Section, and conclusions are presented in the sixth Section.

**Keywords:** Transceiver antennas, Free-space optical, Fifth generation networks.

## 1. Introduction

With the rapid advancement of mobile communication technology and the expansion of data traffic, high-capacity connectivity is urgently required in densely populated places. Two primary conventional strategies are typically used to boost the channel capacity for mobile communications. One is to use wideband or multiband antennas to increase the frequency bandwidth. (LI M et al., 2018), (HUANG H et al., 2020), and the other is to divide a sector into multiple ones by using multibeam antennas (SUDHAKAR et al., 1995), (WINCZA et al., 2017). Additionally, each of the two techniques—wideband/multiband and multi beam operation—can be employed at the same time to further increase the communication capacity. A wideband or dual-band multi beam antenna, for instance, can be used in place of a standard sector base station antenna to increase capacity. Multi-beam antenna technology, one of the foundational elements of 5G communications, is also capable of providing high data transmission rates, improved signal-to-interference-plus-noise ratios, increased spectral and energetic efficiency, and flexible beam shaping. It is widely used for 3G/LTE/5G mobile communication and is a system. the new system for B5G mobile communication. (HONG et al., 2017)

There are various common techniques that have been used to implement the design of a multi beam antenna. An aerial reflector is one strategy. Placing numerous feeds in various positions in front of a reflector aerial will make it simple to obtain multiple beams radiating at various angles. (SUDHAKAR et al., 1995), (CHOU et al., 2018). Using a lens aerial is a different method. (MANOOCHEHRI et al., 2018), (MEI Z L et al., 2012). When a lens is activated by several feeds at various points, the focusing or reflecting function of the lens can vary the direction in which the electromagnetic wave propagates, producing numerous radiation beams. (HUANG M et al., 2014), (JIANG Z H et al., 2012)

Reflector-based and lens-based multi beam antennas, while typically adequate for millimeter wave frequencies, suffer from huge dimensions and are therefore unsuitable for sub-6 GHz base station applications.

Because to the benefits of high gain, low profile, and simple structure, multi beam antennas fed by Butler matrices (WU Q et al., 2018), (HONG et al., 2017), they are expected to be an effective

solution of multi-beam antenna for 3G/LTE/ 5G/B5G mobile communication systems. In this paper, the multi-beam antennas based on Butler matrix (MABBM) technologies are reviewed.

**The structure of this article is as follows.**

The standards for base station applications are covered in part 2. The design strategy and operating principles of MABBMs are presented in part 3. The most recent developments in MABBM research for mobile communication systems are covered in part 4. Challenges are presented in Section 5, and conclusions are presented in Part 6.

## 2. Specifications for Base-Station

Applications A few crucial MABBM parameters should be necessary for real-world base station applications.

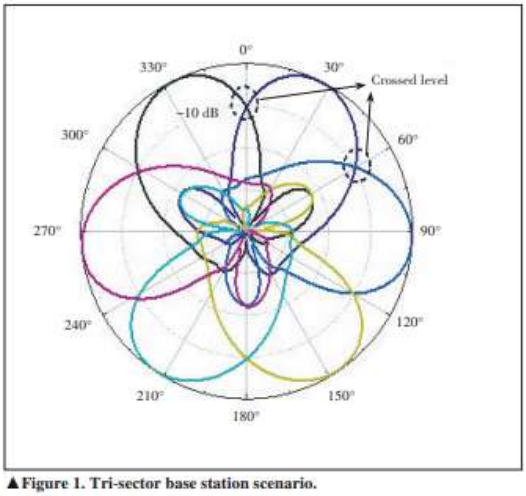
The first is that in order to provide good coverage, multiple beams must maintain a consistent 10 dB beam width of approximately 120° in the horizontal plane.

The second requirement is that for effective communication, the cross level between adjacent beams must be around 10 dB, as seen in Fig. 1.

Signals from two sectors will overlap if it is set too high, resulting in continuous handoff.

On the other hand, if the cross level is too low, good coverage is not necessarily ensured.

The third requirement is that each beam's side and grating lobes must be suppressed at a low level to minimize signal interference with nearby beams.

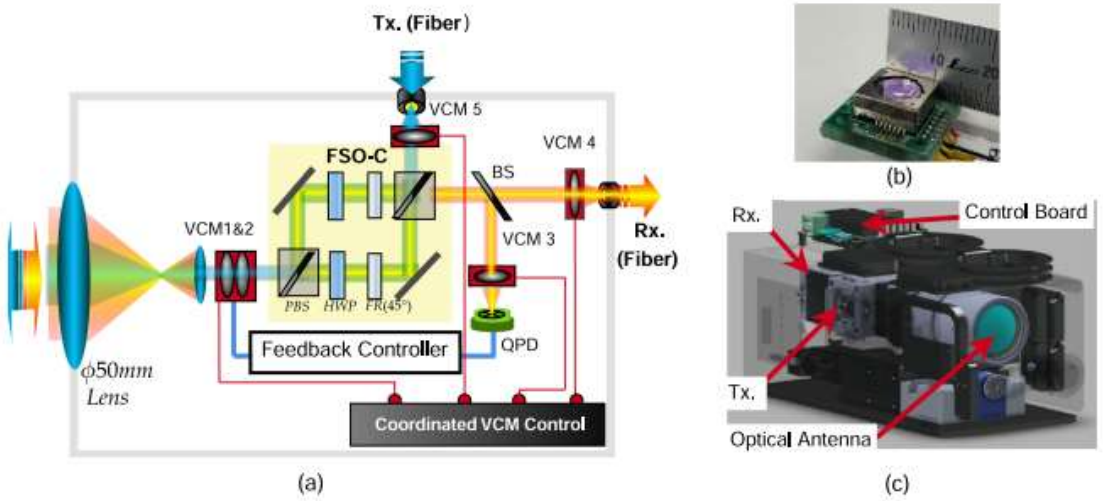



▲Figure 1. Tri-sector base station scenario.

Because of this, base stations in highly populated locations urgently need MABBMs with such performances over a large frequency band or several frequencies.

### A. FSO Transceiver Design

Fig.(a) shows the optical route and system design of our suggested FSO transceiver. In order to effectively regulate the received light deflection angle and fibre coupling, five VCM actuators were built to control the 3-axis position of the lenses located on the receiving and transmitting optical path. Our miniature VCM actuator and lens measure 12 mm * 12 mm * 5 mm and 8 mm, respectively, as illustrated in Fig. (b).




We created a 3-port, polarization-independent FSO-C for the first time, with properties resembling those of a fiber-based optical circulator, to enable fiber-to-fiber and full-duplex transmission. It is made up of a polarizing beam splitter (PBS), a prism mirror, a half-wave plate (HWP), and a 45° Faraday rotator (FR). In this circulator, the insertion loss is less than 0.5 dB, and the isolation between the three ports is greater than 25 dB.

Contrary to the fiber-based optical calculator, which can be installed at the FSO transceiver's receiving port, the FSO-C can enable effective and independent control of the transmitted and received beams, much like the binocular FSO transceiver, which results in a straightforward and adaptable optical path design.

In fact, the FSO-C, especially for narrow beam FSO links and moving platforms, will not only permit full-duplex transmission but will also completely eliminate the effect of the optical aerial roll. The incoming laser beam emitted from the SMF is aligned and extended to the φ2 mm beam by altering the 3D location of the VCM5 lens. Before being transmitted to the air, the collimated beam proceeds via the FSO-C and a 1:7.5 beam expansion process to reach a diameter of about φ15 mm..

A 50 mm lens is used to accept the beam at the receiving end, which is then aligned using VCM1&2 and fed via the FSO-C. The beam is then seamlessly coupled to the fiber core using both the fine tracking module based on VCM1&2 and the fiber coupling module based on VCM4. We used a 10:90 beam splitter and a QPD as a tracking sensor to run the fine tracking module.

In actuality, the QPD sensor performs better than image sensors in terms of response time and beam position accuracy (I. A. Ivan et al., 2012). The lens location (x, y) was initially adjusted so that the laser beam spot is centered at the QPD aperture, and its z-value is utilized to control the beam spot size. We then added another VCM actuator (i.e., VCM3) to concentrate the beam to the QPD sensor. The proportional-integral-derivative (PID) controller used the predicted slanted angle of the received wave front to order the VCMs 1 and 2 in a way that minimized the deflection angle.

We used a commercial VCM actuator in this terminal that was created expressly for use with smartphone cameras, where the control bandwidth was up to 100 Hz. Due to I the closed-loop servo bandwidth, (ii) the used off-the-shelf VCM technology bandwidth (that is developed for smartphone camera), and (iii) the adjustable lens weight, the control bandwidth in our system was restricted to up to 100 Hz. To maximize the bandwidth, the PID controller's parameters were carefully modified in both the x and y axes.

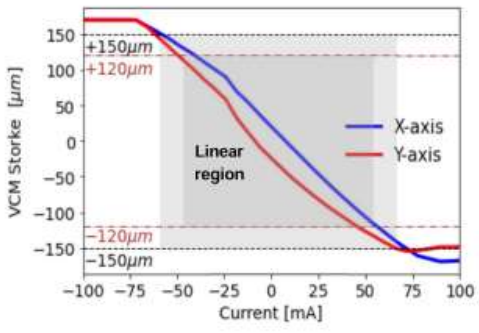



Fig E. VCM actuator stroke vs. applied current.

The response of our VCM stroke (m) to the applied current is shown in Fig. E. (mA). According to the picture, the VCM will travel linearly from 120 m to +120 m, with a full stroke of 240 m, and can even reach 300 m, when the current is changed between 50 mA and +50 mA.

So, we can simply regulate the movement of the lenses to the required position by keeping the VCM displacement at the linear region. For better performance of upward and downward displacement, the hysteresis tolerance and gravity of the lens system have been considered in our design.

The VCM4 z-value was tuned to make the concentrated spot size comparable to the fiber core size in order to provide optimal coupling efficiency. A collimated laser beam of wavelength and diameter DB needs to be coupled onto a fiber with a mode field diameter dF, according to Gaussian optics. , the coupling lens focal length should be

$f = \pi DB\ dF\ /4\lambda$.

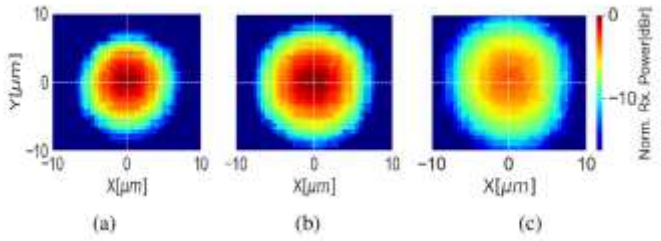



Fig. H. Received optical power profile for different z value of VCM4. (a) z = 0. (b) z = −90 μm. (c) z = −175 μm.

The received optical power profile for VCM 4, which is employed for fiber coupling, is plotted in Fig. H. The power values were obtained using a 10 mm SMF core, by spiraling the x and y axes of the VCM4 lens, and for three different z positions (0, 90, and 175 mm). We can simply control the fiber coupling efficiency for better system performance because of the VCM linearity. In fact, the power profile at the fiber core exhibits Gaussian behavior for the incident collimated beam.

Hence, the power profile size and peak power can be effectively regulated by altering the z value.

## 3. Design Principle and Method of MABBMs

Butler matrix (WANG Y et al., 2018), (DYAB et al., 2018) is a type of passive multiport network that features many phase differences, low loss, a low profile, and a simple structure. It has found widespread use as an aerial feeding network for multi-beam radiation. When an antenna array of M elements is coupled to a N M Butler matrix, the input ports can be simultaneously energized to produce N independent beams pointing in various directions. Here is a detailed explanation of the Butler matrix-based multi-beam antennas' operating principles and design methodology.

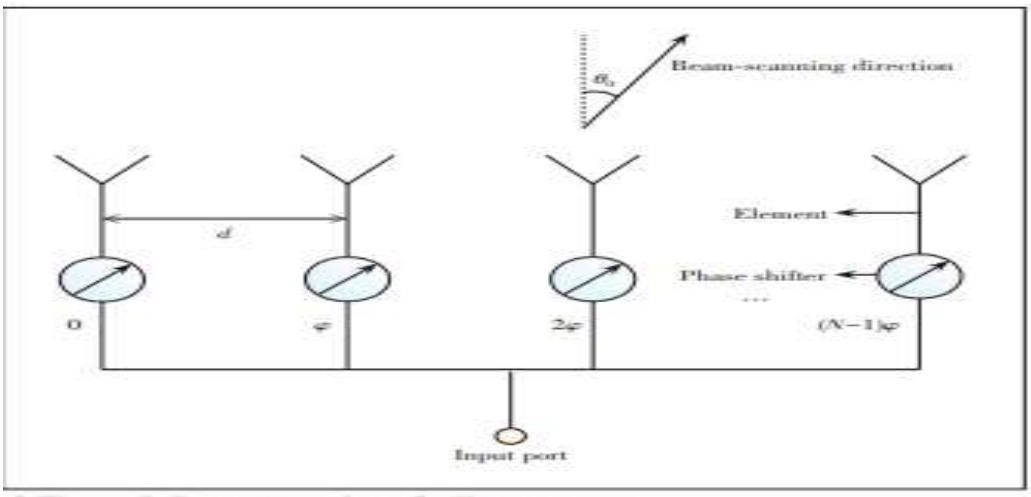
### 3.1 Principles of Operation for MABBMs

An antenna array's mechanism for producing multi-beam radiation is examined using the beam-scanning theory of the antenna array, and the results can be utilized to inform the thorough design of MABBMs. The beam-scanning angle 0 of a linear antenna array can be determined using the comprehensive theory of antenna arrays. (BALANIS, 1996)

$$\theta 0 = \arcsin ( - \varphi \lambda 2\pi d ),$$

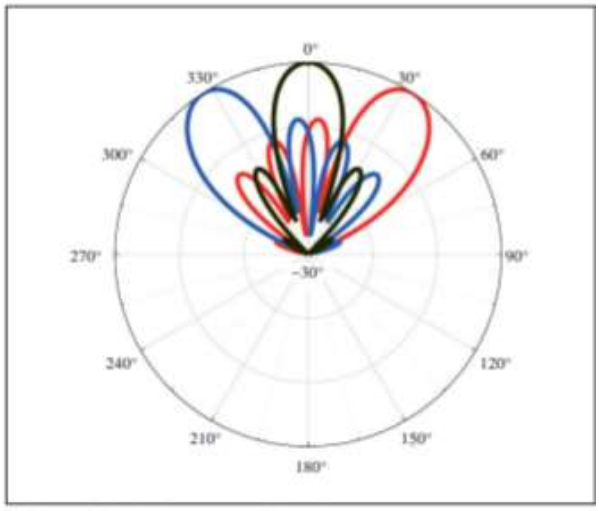
(1) where φ and d explain the phase difference and gap between related neighboring items, and λ illustrates, using the schematic design in Fig. 2, the wavelength connected to the operating frequency in vacuum.

(2) It can be seen from Eq. (1) that the wavelength, which corresponds to the antenna's operating frequency, the phase difference, and the distance d between neighboring elements all affect the antenna array's beam-scanning direction.




▲ Figure 2. Beam-scanning of a linear array.

The beam scanning direction of the array is simply governed by the phase difference of neighboring elements after the working frequency and spacing have been chosen, and various phase differences result in various beam-scanning orientations. An antenna array can radiate numerous beams in various directions when several signals with various phase differences simultaneously excite it, a process known as multi-beam emission. The radiation pattern of a three-beam antenna array powered by a 3 5 Butler matrix at 2.2 GHz is depicted in Fig. 3.

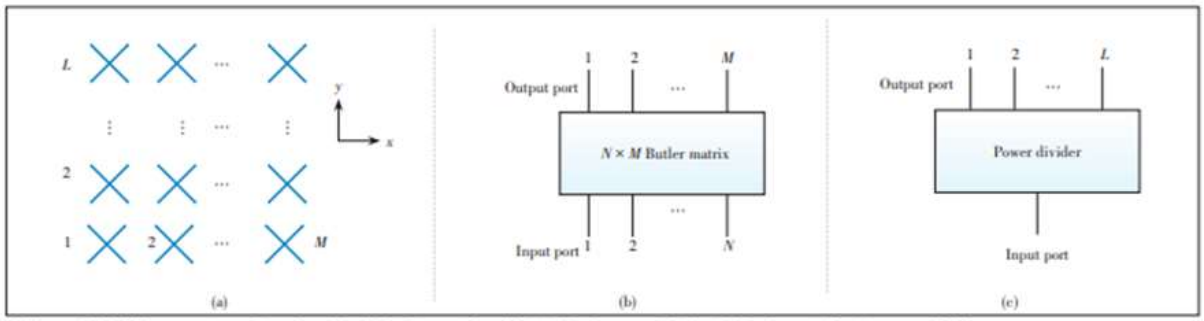



▲Figure 3. Radiation pattern of three-beam antenna array.

A half-wavelength electric dipole makes up the element, and there is a 75 mm gap between each one. The excitation of the array has 120o, 0o, and +120o identical amplitude and phase differences. It is evident that the MABBM has been able to successfully produce 3 beams that point in three separate directions.

### 3.2 Design Method of MABBMs

Two varieties of the MABBMs' multi-beam radiation are used in practical applications: 2D multiple beams in both the horizontal and vertical planes (LIAN et al., 2018), (KIM et al., 2016) and multiple beams in either the horizontal plane or the vertical plane (TAJIK et al., 2019), (SHAO Q et al., 2019). This study presents the design technique of MABBMs with numerous beams in the horizontal plane, which simplifies the analysis without losing generality. Similar design principles can be used to create additional types of 2D MABBMs. According to Figs. 4a, 4b, and 4c, respectively, a 1D MABBM is typically composed of a M L array, N M Butler matrices, and L-way power dividers.




▲Figure 4. Multi-beam antenna based on $N \times M$ Butler matrix with (a) $M \times L$ array; (b) $N \times M$ Butler matrix; (c) power divider.

The design steps of the MABBM can be summarized as follows.

Executing the N–M Butler matrix is the first step. First, the number (N) of an MABBM's radiation beams and Butler matrix's input ports are established.

The number of radiation beams and the communication capacity are correlated, with more radiation beams offering more capacity.

By multiplying the necessary communication capacity by the Butler matrix's number of input ports, one may get the number of radiation beams. The Butler matrix's output port numbers (M), as well as its amplitude and phase difference, are then determined by the side lobe level needed for each beam. Based on the aforementioned rationale, the N M Butler matrix is created to satisfy the bandwidth, amplitude, and phase difference specifications.

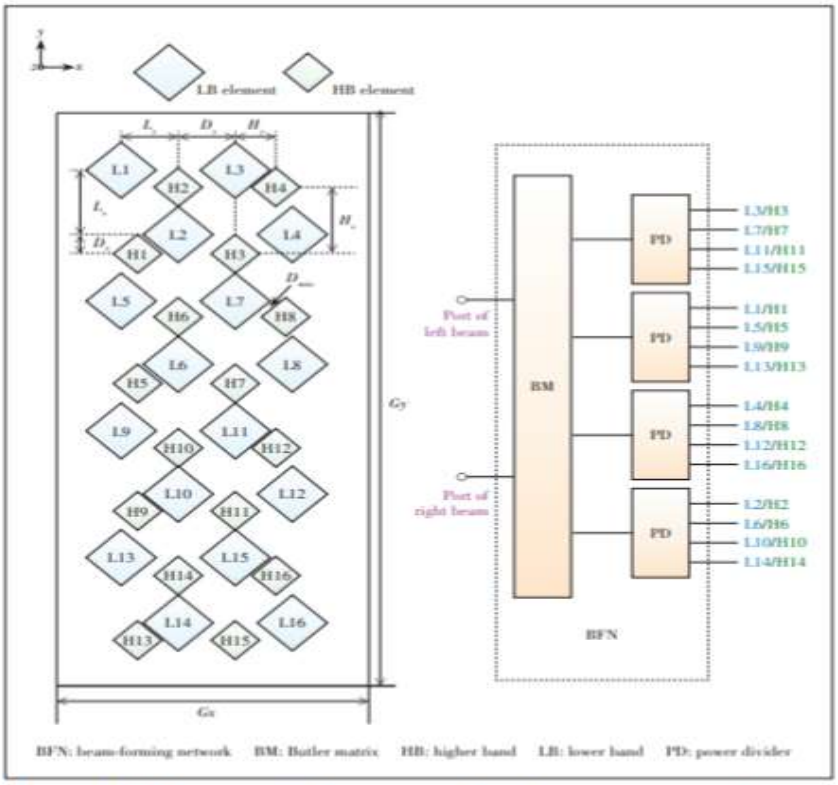
Creating a M–L array is step two. The Butler matrix's output port count (M) determines the number of elements in the array's horizontal plane, and the needed gain (L) determines the number of elements in the array's vertical plane. Also, the cross level between adjacent beams and the spacing between adjacent parts in the horizontal plane both have a significant impact on the coverage area of the multiple beams and should be carefully chosen. On this foundation, the antenna element is created to fulfill the demands of the requisite bandwidth, and the necessary M L array is then put into practice.

Step 3: Implementing the MABBM. For the purpose of implementing the suggested multi-beam antenna, each power splitter's input port is first linked to the output port of the Butler matrix using 50 coaxial cables, followed by the output port of the antenna element in the vertical plane. 4 Recent MABBMs for Base-Station Applications Research Progress Several MABBMs have been proposed recently for use in mobile communication applications.

A small dual band two-beam 4* 8 antenna array with dual polarizations is suggested (ZHANG et al., 2017) for base station applications.

Two 4* 4 sub arrays operating in the 3G (1 710-2 170 MHz) and long-term evolution (LTE) (2 490-2 690 MHz) bands make up this system.

The elements of the two 4* 4 sub arrays are interconnected for size downsizing, as depicted in Fig. 5a.



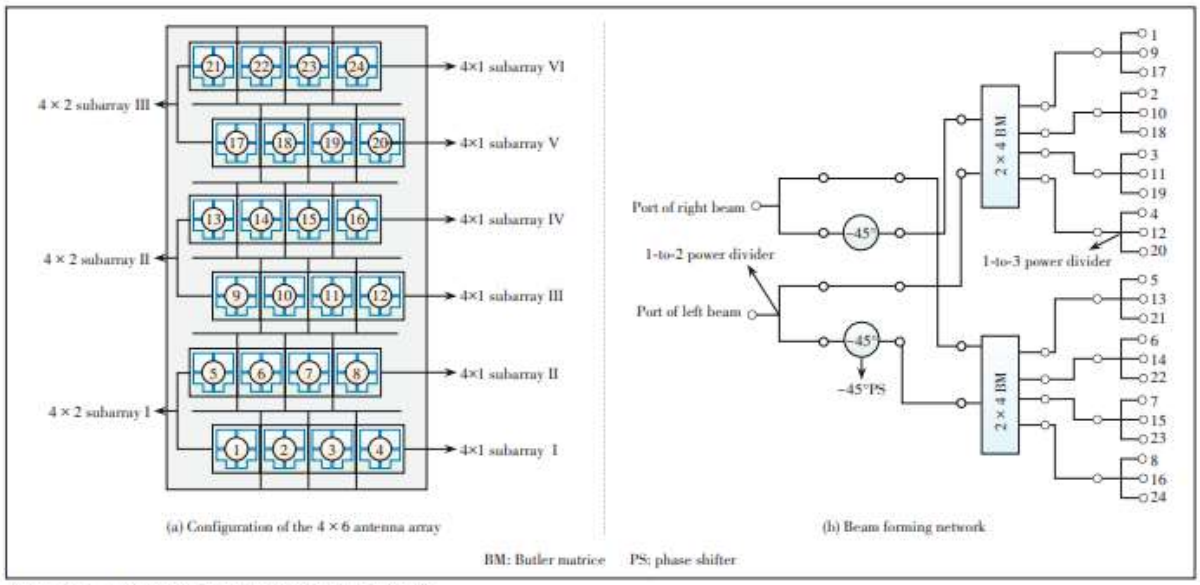

▲ **Figure 5. Dual-band two-beam antenna in Ref. [34]. (a) Elements distribution of the interleaved configuration; (b) Beam forming network diagram.**

By utilizing filtering antennas (DUAN et al., 2016) with out-of-band radiation suppression, the mutual coupling between the elements operating at different bands is suppressed. Beam-forming networks with minimal magnitude and phase imbalances are specifically created for each band in order to provide stable two-beam radiation patterns within the two operating bands.

Fig. 5b presents the beam-forming network's configuration. Four filtering power dividers and a 2 x 4 Butler matrix make up the structure (PDs). The two full bands of the array show a consistent 10 dB beam width approximately 120° in the azimuth plane, and the two beam radiation patterns meet the base station applications' need for coverage of 120° in the azimuth plane.

Moreover, within the two operational bands, 16.4 dBi/15.5 db peak gains and roughly 10 db cross levels at the intersection of two beams are attained.

A wideband dual-polarized 4 6 antenna array with two beams is offered (YE L H et al., 2019) for base station applications. The arrangement of its three 4 2 sub arrays is depicted in Fig. 6a. A wide band crossed dipole is used as the fundamental component to produce 45° dual polarized radiation. The lower and top 4 1 sub arrays for each 4 *2 sub array are out of alignment in the horizontal plane.




▲Figure 6. Wideband two-beam antenna in Ref. [36].

This results in good grating-lobe suppression since the 4 *2 sub array is similar to an 8* 1 sub array with half of the neighboring element spacing.

Certain wideband beam-forming net works with minor magnitude and phase imbalances are developed to achieve stable two-beam radiation with little side lobe over a wide frequency spectrum. Figure 6b displays the beam-forming network diagram. It is made up of eight 1-to-3 power dividers, two 1-to-2 power dividers, two phase shifters (PSs) at 45 degrees, two Butler matrices (BMs), and two 1-to-2 power dividers.

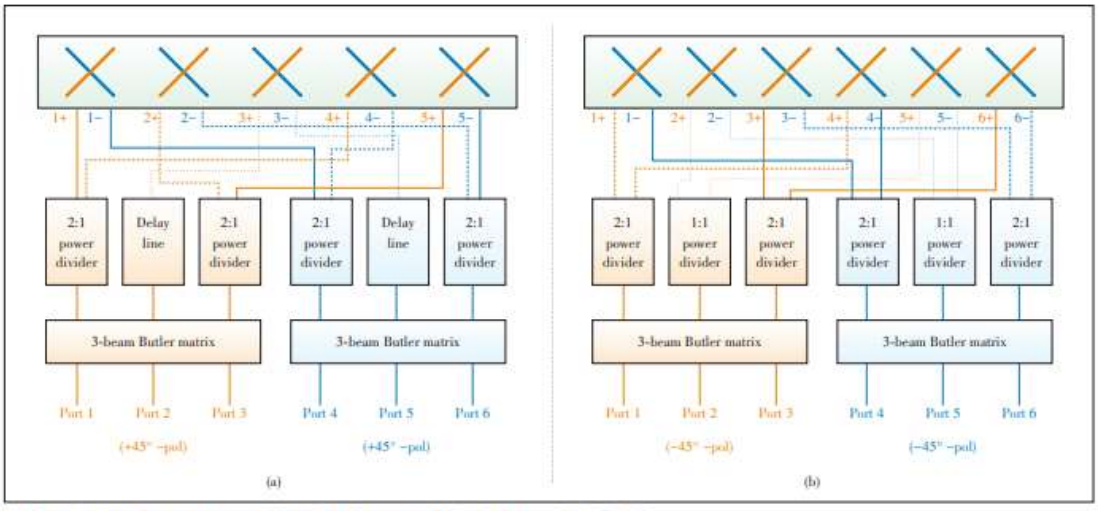
Moreover, the neighboring element spacing is improved to achieve a consistent 10 dB beam width around 120°, satisfying the base station application's need for coverage of 120° in the horizontal plane.

In the horizontal plane, the array's two beams have a constant 10 dB beam width of about 120 degrees and a cross level of roughly 10 dB. For voltage standing wave ratio, the impedance bandwidth is determined to be 56.1% (1.64 - 2.92 GHz) (VSWR)

Butler matrices-based broad band three-beam antenna arrays are reported (ZHU et al., 2019) and used to boost the capacity of 3G/LTE base stations. A wideband 3 3 Butler matrix, made up of fixed wideband phase shifters and quadrature couplers, is the key component of three-beam arrays. Strip lines are used to implement phase shifters and wideband quadrature. 1.7–2.7 GHz.

Beam-forming networks made up of augmented 3 3 Butler matrices and power dividers are suggested in order to increase the number of output ports from three to five or six, as shown in Figs. 7a and 7b, respectively, in order to achieve the appropriate beam width and the necessary crossed level between adjacent beams. With strong impedance matching, high beam isolation, and three-beam radiation in the horizontal plane over the broad frequency range of 1.7-2.7 GHz, dual-polarized, three-beam antenna arrays with five and six elements are created to span the 3G/LTE spectrum.

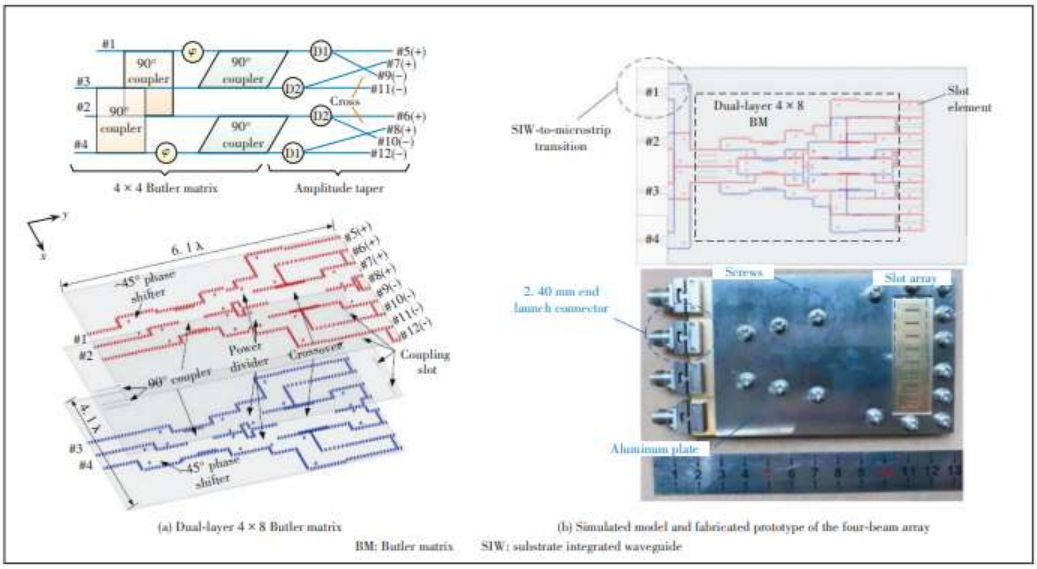
A dual-layer 4* 8 Butler matrix-fed compact four-beam slot antenna array with side lobe level suppression provided by substrate integrated waveguide technology is proposed. (LIAN et al., 2018)




▲Figure 7. Three-beam antennas with (a) five elements and (b) six elements in Ref. [37].

A novel dual-layer structure made up of a 4 4 Butler matrix and an amplitude ta per is suggested to alleviate the issue of the excessive crossovers in the traditional 4 8 Butler matrix,

As shown in Fig. 8a. In order to reduce side lobe level, the amplitude taper is used to transform the four outputs with equal power divisions into eight outputs with unequal power distributions from the four outputs with equal power divisions provided by the 4 4 Butler matrix.




▲Figure 8. Four-beam array in Ref. [38].

To reduce the number of needed crossovers from the original five sets to just one set, the proposed topology of the 4* 8 Butler matrix is used. To attain improved compactness, the 4* 8 Butler matrix can therefore be greatly simplified. In order to produce four-beam radiation with low side lobe level, an eight-element slot antenna array is fed by the suggested BM. The simulated model and prototype are illustrated in Fig. 8b.

By adding two sets of vertical linkages to the standard array layout, a modified topology of a 2D multi beam antenna array (LI Y J et al., 2017) supplied by a passive beam forming network is proposed to significantly boost the communication capacity.

In contrast to the conventional design, the proposed array structure in Fig. 9 may be easily incorporated onto multi-layered planar substrates, which has advantages for millimeter wave applications such as low loss characteristics, ease of realization, and low fabrication cost. The next step is to create a 4 4 multi beam aerial array that can produce 16 beams.

Future millimeter wave wireless systems utilized for 5G/B5G communications might find it advantageous to create the relatively large size 2D multi beam antenna arrays with planar passive beam forming networks using the proposed array topology.

## 5. Challenges of MABBMs

As mobile communication technology advances quickly, mobile communication systems move in the direction of various frequency bands, miniaturization, and low cost, which results in the following

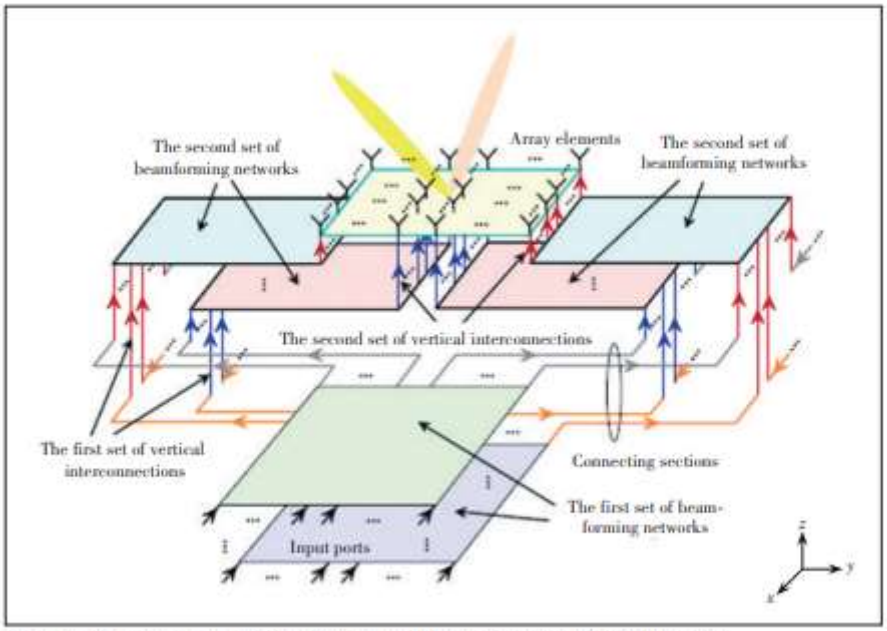



**Figure 9. Configuration of the planar 2D multibeam antenna array in Ref. [39].**

### 5.1. Challenges for MABBMs.

(1) Wideband or multi-band MABBM design Mobile communication technologies including 2G, 3G, 4G, 5G, and B5G will coexist for a very long time in the future in the 5G/B5G era. An MABBM must cover numerous communication frequency bands in order to adhere to the development trend of mobile communication, reduce the number of antennas, and increase the usage of space resources and spectrum resources. Thus, it is extremely difficult to create a broadband or multi-band MABBM with strong impedance matching, high beam isolation, and effective side lobe suppression..

(2) MABBM miniaturization Mobile communication system spacing and cost can both be decreased with the use of miniature MABBMs. The Butler matrix must be smaller, and the space between antenna elements must be closer, in order to miniaturize MABBMs.

Strong electromagnetic coupling and radiation interference would be introduced as a result, leading to issues like deteriorated beam solation and distorted radiation pattern.

Hence, another difficulty is miniaturizing an MABBM with good electrical and radiation performance.

## 6. Conclusions

In summary, this research has reviewed the MABBM technologies. The requirements for base station applications, the operating principles, the design, and the implementation of MABBMs are discussed, and the most recent advancements in research on broadband or multi-band MABBMs are reviewed. The entire MABBM is viewed as a possible path towards the development of high-performance 3G/LTE/5G/B5G mobile communication systems, even though a few related challenges need to be resolved.

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# The Concepts for Better Regulation of Internet Platforms

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## Abstract:

In this article, a critical analysis is made of whether Internet platforms are appropriately regulated and whether there are ways in which Internet platforms could be better regulated. This article argues that there is an argument for a combination of self-regulation and legal regulation rather than just one of these approaches for regulatory purposes. Moreover, the current approach to regulation in the United Kingdom tends towards such a hybrid regulatory approach compared to the American approach that leans more in favor of preserving the free market for digital business. Explaining the laws regulating platforms in the United States, as well as ways to combat abuse. The research concluded several results, including that more laws must be provided to regulate online platforms, and that online platforms represent a basic pillar of human life that needs more regulation in human life, and that it must be reduced The almost absolute immunity of the platforms, and the researcher recommended that more studies and comparisons be done to define the concept of the platform and lay the foundations and ways to organize the platforms and make comparisons between European and Arab countries in the foundations of regulating platforms and mediators.

**Keywords:** Internet, Regulation, technology, defense, act, online platforms, misuse, Cyber-paternalism, rights, legislation.

## 1. Introduction:

The issue of Internet regulation is one that has been a part of discourse around Internet since the 1990s when Internet became increasingly accessible to the public and different viewpoints have been offered on how far Internet can be regulated or even if it ought to be regulated by the state (Laura Denardis, 2014). Even if it is agreed that Internet can be and should be regulated by the law, there are peculiar characteristics of Internet including technology, geographical distribution of the users, and the nature of its content that make it difficult for states to regulate it (Boyle, 1997). There is also an argument made that instead of state regulation, it may be more appropriate for there to be an international approach to regulation of Internet through treaties and other international mechanisms (Judge Stein Schjolberg, 2021). But, this approach is difficult to apply because countries may have different approaches to implementing international law; for example, the United States give constitutional primacy to domestic law over international law unless the latter is ratified (Andrew, 2007). The challenges associated with the regulation of Internet through the medium of international law can be seen in the fact that there is no consensus reflected in any major international treaty for regulation of Internet (Matthias, 2022). At the same time, the permeating influence of Internet may require some forms of regulation for the purpose of providing individuals the protection of the law in commercial and non-commercial activities undertaken on the Internet.

The Internet has existed since 1969, but it was only in the 1990s that it saw significant growth and since then it has gone on to become ubiquitous in the human society. From 1969 to the 1990s, the Internet was a network only used in the United States under the Advance Research Project Agency (ARPANET), which was used by the military, defence contractors, and university laboratories conducting defence-related research, and which later was expanded to connect universities, researchers and others worldwide (Dharmesh, 2020). As such, the question of regulation of Internet was not one that related to protection of the public from harm due to the content available to them from the Internet as there was not much public exposure to the Internet. This is the not the case today. Internet is now easily accessible to significant proportion of the world population, for both commercial and noncommercial purposes. Like any other market space, Internet can be used for both licit and illicit purposes, which begs the question of regulation of the Internet platforms. In ACLU v Reno, the US Supreme Court accepted the nature of the Internet as a "giant network interconnected with a series of smaller networks." (*ACLU v Reno*, 1996) By the 1990s,

and more so today, the Internet is a site of interconnectedness worldwide, where ease of navigation and access to content means that a significant proportion of the world population has access to vast amounts of content and sites.

### 1.1. Research importance

The importance of the research is due to what the Internet represents today as a daily part of human life, in addition to the great role of platforms in the lives of individuals in general, and to the important and significant role these platforms play in providing services and products.

### 1.2. Research objectives

1- Clarifying the concept of the platform

2- Statement of the organization of the platforms

3- Clarifying the most important laws regulating platforms

4- Explain the regulation of platforms in the United Kingdom

5- Ways to combat misuse of platforms

## 2. Method

First, to understand the meaning of the term 'platform', there is no generally accepted definition of the term, and it is a term that is used to distinguish a platform from other forms of online presence, such as, individuals, on the basis of the platform's facilitation of "provision and access to products, information, entertainment, opinions, sales, advertising or other content or services from a variety of sources (Hogan, 2018)." The term platform also becomes relevant to distinguishing between content managed by a platform and content provided by an individual user. The term platform is also used for 'online content intermediaries' (C-324/09). An important question is whether intermediaries are to be considered platforms or publishers and there is often some problem with delineating the scope of the definitions of platforms and intermediaries. The term platform is generally used with respect to all intermediaries, but the term 'platform' does not appear in the relevant European legislation and instead the term 'online content intermediary' is used to describe a subset of 'hosting' providers by the E-Commerce Directive. In L'Oreal v eBay, the term 'active' host was used and may mean something similar to intermediary.

The E-Commerce Directive defines three types of intermediary: 'mere conduits', 'caching providers' and 'hosts' (Mark Bunting, 2018). The EU Commission has proposed the Digital Services Act, which differentiates between Intermediary services (internet access providers, domain name registrars), Hosts, Online platforms (app stores and social media platforms), and large online platforms (platforms reaching more than 10% of monthly European consumers) (Ethan Shattock, 2021).

It can be argued that the first step towards improving the framework on regulation of the Internet would be to clarify on who is to be regulated in terms of platforms because at this time there is little clarity on how platforms are defined across different jurisdictions. In the UK, the term 'online intermediaries' is used and even with the wide scope of actors who come within this definition, it has been suggested that the existing definitions do not effectively delineate the full spectrum of actors that are involved in the internet's architecture and can facilitate and participate in wrongdoing (Jaani Riordan, 2016). Furthermore, Internet regulation is territorially fragmented because different jurisdictions have different definitions of platforms and intermediaries and different standards of regulation, which can either lead to intermediaries being able to avoid liability in some cases and attract liability in others (Catherine Stromdale, 2007).

There are three identifiable characteristics of online content intermediaries, which are that they: operate open marketplaces through direct interaction between suppliers and consumers of information and content; play an active role in matching content to users; and earn revenue by taking a share of the value created by the platforms. Intermediaries do not simply allow people to use their platforms to upload content, but play a role in moderating content and choosing what kinds of content may get promoted over the others. This is one of the reasons why it is important to affix liability to intermediaries. An important point is that intermediaries are in the position to put an end to harmful or illegal activity because of their capacity to detect, prevent and control the means of wrongdoing.

## 3. Discussion

### 3.1. Regulation of platforms

Regulation of platforms of intermediaries also has been thought to be necessitated by the fact that these actors play a role in moderating information and content, as noted recently by the Council of Europe:

"The power of such intermediaries as protagonists of online expression makes it imperative to clarify their role and impact on human rights, as well as their corresponding duties and responsibilities, including as regards the risk of misuse by criminals of the intermediaries 'services and infrastructure… States are confronted with the complex challenge of regulating an environment in which private parties fulfil a crucial role in providing services with significant public service value (Council of Europe, 2018)."

Therefore, there is a justifiable argument in favor of regulating intermediaries or online platforms. The question is how such regulation should be put in effect. At this point, it is also important to also engage with the theory on Internet regulation. The regulation of Internet is made complex by the nature of Internet as a vast, interconnected space without borders. Due to this, it has also been argued that cyberspace as a global electronic social space is a site where national governments do not have a moral right to rule and do not have efficient methods of enforcement (John Perry Barlow, 1996). There are multiple and overlapping systems of rules or 'interleaflet' applicable to Internet, which makes it inappropriate for any state to justifiably claim comprehensive law-making in this area (Chris Reed and Andrew Murray, 2018). In light of this background, two prominent theories of Internet regulation have come to be propounded in the literature on Internet regulation, these are cyber-libertarianism and cyber-paternalism, and they offer contrasting views on Internet regulation. Although both theoretical approaches are premised on the viewpoint that the Internet is a unique form of communication, they offer different answers to the question of how far and in what way Internet should be regulated by the law. Cyber-libertarianism perspective argues that regulation by a state is not appropriate because there are no territorial boundaries on the Internet, and instead of state regulation, it is more appropriate that norms of regulation are defined by the digital community. In other words, cyber-libertarianism approach emphasises on self-governance of Internet. This kind of approach to Internet regulation has been called a "bottom-up private ordering" of Internet, which avoids the need for regulation by a bureaucratic state (NW Netanel, 2000).

The cyber- libertarianism approach has been opposed by cyber-paternalism, which takes forms of cyber-realism and techno-determinism. Cyber-paternalism is essentially an umbrella term that comprises both cyber-realism and techno-determinism. Cyber-realism argues that Internet can be regulated based on traditional jurisdiction and law.

Techno-determinism posits that the idea that Internet cannot be regulated, also termed as Internet exceptionalism, is not based on the impossibility of regulating Internet, but the practical challenges associated with enforcement of regulatory norms in the Internet. Lawrence Lessig, who proposes a cyber-paternalistic approach to Internet regulation argues that by re-reading the traditional regulatory performance with Internet characteristics and architecture, and relating this to the markets, law, and norms around Internet, it is possible to regulate the Internet through state made law (NW Netanel, 2000). The architecture of Internet is unique, but it has a capacity to engender rights and duties, which makes it possible to also regulate the Internet through the architecture of these rights and duties (Chris Reed, 2004). An approach that seeks to take a balanced view to state regulation and self-regulation is proposed by Andrew Murray, which posits that Internet being a site for communication and discourse, only direct legal-regulatory control is not appropriate for regulation, and other actors and stakeholders can also provide means of regulation. Clearly, there is a division in the discourse around Internet regulation, with divergent theoretical approaches on how such regulation can take place. Some approaches deny the ethical basis for such regulation, some accept the power of the state to make such regulation, while some argue for a middle way approach where government and other actors all play a role in norm building for Internet regulation. In the next sections of the essay, a critical and comparative discussion is undertaken on how states have responded to Internet regulation through their laws and policies with the view to identifying how Internet can be regulated and has been regulated in different jurisdictions. The argument is that adopting a middle approach to regulation, where some aspects of regulation are undertaken by the state legislation and other aspects of regulation are undertaken through a self-regulation method offers a more effective and nuanced response to regulation of platforms.

### 3.2. Early statutes on Internet regulation

One of the early statutes on Internet regulation is found in the United States, where the Congress enacted the Communications Decency Act of 1996 with the aim to protect minors from explicit material on the Internet. The law criminalised the knowing transmission of obscene or indecent messages to recipients under 18 years of age. The statute was challenged before the United States Supreme Court in the case of ACLU v Reno, where the court held that there is a difference between Internet communication and the other forms of communication that the Supreme Court had earlier ruled on where First Amendment speech rights had been invoked (*ACLU v Reno*, 1996).

The court was of the opinion that the Communications Decency Act of 1996 lacked precision required under the First Amendment for regulation of the content of speech and it restricted the freedom of speech that adults have when less restrictive alternatives would be at least as effective in achieving the legitimate purpose that the statute was enacted to serve (Ibid).

The above discussed early decision on Internet regulation reflects on some important aspects of Internet as a mode of communication and the challenges that states may face in regulating it because the US Supreme Court invalidated the Communications Decency Act of 1996 in ACLU v Reno. Subsequent attempts to regulate Internet content with the view to protecting children were made in Child Online Privacy Protection Act of 1998 (Vashee, 'ACLU v. Reno). This Act restricts the online collection of personal information from children aged 13 or younger by platforms and require that platforms that maintain chat rooms directed at children must either condition a child's participation on the consent of a parent or guardian or monitor the chat room and censor references to personal information. One of the questions that is raised in this context is whether the law infringes on the free speech rights of children (Charlene Simmons, 2007).

Indeed, the question of free speech rights is an important part of any discussion on Internet regulation because regulation of the Internet hinges on several aspects of individual liberty such as free speech as well as important aspects like equality, fairness, and human rights in general. Internet regulation then becomes an area that requires careful balancing of different interests. Where on the one hand, Internet is a space where individuals may face risks to their privacy and other interests, it is also a space for innovation, access to knowledge and information, and access to opportunities, which makes it a delicate act of balancing for the state. Critics of regulation therefore point to paternalistic attitudes towards individual freedom when state may make regulation that is seen to be impinging on free speech rights; this was seen in the case of Child Online Privacy Protection Act of 1998, which was considered by critics to be an infringement of children's right to free speech, as well as the platforms 'right to commercial speech (Anita, 2001). The criticism hinges on the argument that in the case of children and the possibility of harm in online environments, it is the parents that must regulate the activities of the children and not the government (Melanie, 2001). To go back to the ACLU v Reno judgment, the view of the US Supreme Court also was that a statutory provision that lays financial burden on the speakers because of the content of their speech, is presumptively inconsistent with the First Amendment

free speech rights. Clearly, a paternalistic approach to regulation of intermediaries may lead to difficulties because the intermediaries cannot act as sole gatekeepers to adjudge speech rights and at the same time, a complete lack of regulation can lead to perverse outcomes for the rights of those who are harmed or whose rights are violated because of unregulated content.

### 3.3. Regulation in UK

In the UK, the regulation of online content is done through a primary responsibility of the creator of content to ensure lawful content and the secondary responsibility of a platform operator to remove unlawful content from its website (Lovells, 2018). The principal legislations that have relevance to regulation of the Internet are the Digital Economy Acts of 2010 and 2017 (although these do not provide a comprehensive review of content regulation), the Communications Act 2003 (although this does not include online content or platforms) and the E-Commerce Directive (2000/31/EC). The draft online security bill deals with the responsibility of intermediaries to meet certain standards and subjects Ofcom (the proposed regulator) to regulatory obligations. The object of the Draft Online Safety Bill is to "make provision for and in connection with the regulation by OFCOM of certain internet services; and to make provision about and in connection with OFCOM's functions in relation to media literacy (Draft Online Safety Bill)." The EU E-Commerce Directive (Directive 2000/31/EC) also provides for liabilities that arise out of the functioning of networks and is relevant to the regulation of the intermediaries. The European Court of Justice (CJEU) has considered the issue of intermediary liability in the case of Peterson v Google, where the question before the court was whether Google could be held liable in damages, and be subject to an injunction, for hosting on YouTube videos containing copyright-infringing material. The court's decision was that the operator of a platform is allowed the protections under the E-Commerce Directive unless they have the requisite wrongful knowledge in connection with its hosting of copyright-infringing material. Therefore, an important component to intermediary liability is the wrongful knowledge otherwise the intermediary enjoys protection of the E-Commerce Directive (2000/31/EC). Under the Directive, intermediaries have protection and are liable for illegal content only if they have 'actual knowledge' of it and have failed to act 'expeditiously' to remove or block it (Kightlinger, 2020).

In the UK, there is a growing consensus on the need to find more effective means for regulating intermediaries; for instance, the UK Parliament has stated that in the changing digital world, the existing legal framework is no longer fit for purpose (UK House of Commons, 2018).

A recommendation is also made to appoint a regulator, such as, UK Information Commissioner and communications regulator Ofcom, who is tasked to combat disinformation directly by licensing of content providers and their systems for content moderation (UK Information Commissioner's, 2018). The argument that there should be such state regulation of online content through appointed regulators is that government should not impose the judgement exercise of regulating online content on "online intermediaries, who are inexpert in and not incentivised to judge fundamental rights, and not bound by States' international human rights commitments (Chris *et al.*, 2020)." In the UK, which is bound by European Convention of Human Rights, Article 10 provides the freedom of expression and also lists the restrictions that governments can impose on the freedom of expression. This engenders human rights related to expression. If the online intermediary is only responsible for moderating online content, then there is a possibility that the online intermediary would restrict speech in the name of regulation. Those who argue for statutory regulation argue that online intermediaries cannot be held responsible for regulating content when it involves human rights adjudication, which is not the job of the intermediaries but of the government.

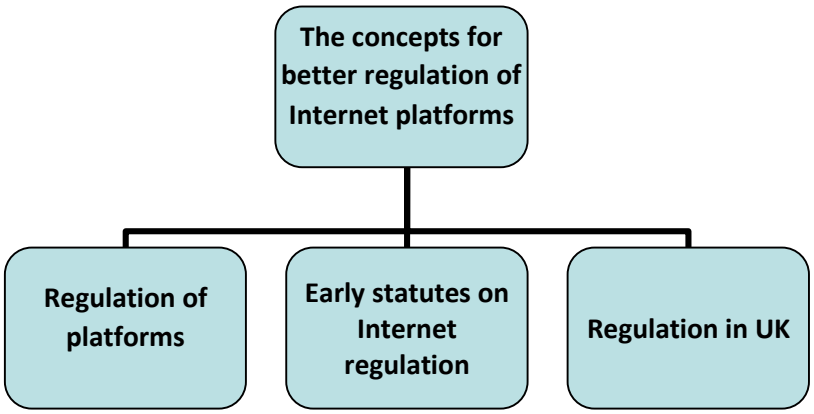


Figure 1. Headings

## 4. Conclusion

In conclusion, the regulation of the Internet is fraught with dilemmas and issues surrounding the conflicting values of free market and innovation of the digital economy on the one hand and the protection of rights of individuals, including children, who may be exposed to different kinds of harms and rights violation on the Internet. Non-regulation of the Internet is not an option considering that this is a market that cannot be left to regulate on its own.

Intermediaries cannot be the sole gatekeepers because they cannot be the appropriate judges of human rights and constitutional rights of the users. Some forms of self-regulation can be useful in creating systems of regulation that can be cheaper to implement and also effective in responding to illicit and illegal content on the platforms. It cannot be the sole method because for certain aspects, there is a need to use governmental regulation. The recent UK government approach is showing a tilt towards using a combination of government regulatory mechanisms, particularly with the Ofcam and the Digital Markets Unit, and self-regulation with the inputs from intermediaries. It is submitted that this approach is likely to be more effective that the near absolute immunity that is seen in the United States with respect to intermediaries or platforms. Any regulation in the form of statutes or policy should also clarify the meaning of platform or intermediaries so that it is clearer as to whom the liability is affixed to. This is not the case at this point. Finally, it is important to reiterate that the issue of regulation of intermediaries involves questions of conflicting values that need a balanced approach, which can be provided by using a combination of self-regulation and formal regulation.

## 5. Research results

1- More laws must be provided to regulate online platforms.

2- Internet platforms represent an essential pillar of human life that needs more organization in human life.

3- The importance of regulating brokers.

4- The need to define conflicting values.

5- The semi-shot immunity of the platforms must be reduced.

## 6. The recommendations

We recommend conducting more studies and comparisons to define the concept of the platform, lay down foundations and ways to regulate platforms, and make comparisons between European and Arab countries in terms of the foundations for regulating platforms and brokers.

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