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INTRODUCTION: INTELLECTUAL PROPERTY AND TECHNOLOGY IN THE 21ST CENTURY

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I. Global Trends

One of the biggest lessons I learnt in law school was that the law never happens in a vacuum, and in these times of geopolitical tension, economic uncertainty, societal stress and technological acceleration, context matters more than ever. Therefore, I hope in this keynote to provide some context to the discussions that will take place over the next two days.

As the Director-General of the World Intellectual Property Organization ("WIPO"), I see three big trends that will shape the future of IP, innovation and creativity.

First, despite growing political tensions and persistent economic uncertainty, intellectual property ("IP") and innovation-related activity remain strong.

IP offices around the world have received over 20 million IP applications each year since 2018, including more than 23 million in 2023. This means that 45 IP applications are now made every minute.

We see similar trends before WIPO's international registries. Since 2014, Patent Cooperation Treaty applications have grown by 30%, Madrid applications by 35%, and Hague applications by 90%.

And we have seen huge growth in the creative economy, which is estimated to be worth more than US$2 trillion, driven by strong growth in sectors such as fashion, film, music and video games.

Investment flows are also mirroring these trends. WIPO's research released last month finds that investments into intangible assets are rising nearly four times faster than investments into tangible assets. And global value of intangible assets is estimated to be in the region of US$70 trillion.

Simply put, what is valuable in our global economy is increasingly centred around IP and intangible assets as innovation, technology, digitalisation and creativity drive growth in enterprises and economies.

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[*] Director-General of the World Intellectual Property Organization. Mr Daren Tang delivered the keynote address on 4 August 2025, on the first day of a two-day conference – *Intellectual Property in the 21st Century: Challenges in the Next Decade* – at the Bukit Timah Campus of the Faculty of Law, National University of Singapore.

Second, the geography of innovation is also changing. Two decades ago, 50% of all IP filings came from Asia, Africa, and Latin America. Today, that number is about 70%.

North-East Asia – China, Japan and the Republic of Korea – has been one of the key drivers of the strong global growth we have seen in IP applications over the last 20 years. But others are also joining in, such as India, Türkiye, Saudi Arabia and Indonesia. Many emerging economies such as Vietnam, the Philippines, Iran and Morocco have also risen significantly in WIPO's Global Innovation Index, with a further 19 countries, mostly in Sub-Saharan Africa and Southeast Asia, now outperforming on innovation metrics in the Global Innovation Index relative to their development level.

Interestingly, WIPO Pulse, our survey of IP attitudes of 25,000 laypersons in 50 countries, shows that attitudes towards IP were more positive in Africa and Asia than in Europe and North America. I think this deserves further investigation and this year we will be conducting our second survey.

All in all, the data shows that IP is increasingly of interest and of importance to the people and governments of emerging and developing economies.

Third, not only is the geography of innovation changing, the very nature of innovation is also changing.

Fundamentally, digital innovation is increasingly driving industrial innovation. One third of all patents filed now relate to digital technologies like AI, 5/6G, quantum computing, Internet of Things, cybersecurity, *etc*. Patent filings linked to computer technology and digital communication have risen by 65% since 2018, with software and data attracting more investment than any other type of intangible assets – about US$600bn last year.

The lines behind software and hardware are blurring – algorithms and codes are now increasingly driving machines, appliances and devices. Think of the car, which is less and less an industrial engine and more and more a computer on four wheels.

We see similar developments in the creative economy. Global music revenues rose nearly 5% last year, reaching close to US$30bn. Growth was fastest in regions like the Middle East and North Africa, Sub-Saharan Africa and Latin America. Today, almost 70% of music revenue comes from streaming, a complete reversal from just 10 to 15 years ago when sales from physical formats dominated.

But these changes are not just manifesting in music, but also in video streaming, podcasting, short video clips – the creative economy is being constantly rejuvenated by digital technology. Digital allows innovators to have fun shaking up the traditional toybox, resulting in game-changing innovations such as ABBA's virtual avatars and Elon Musk's Starlink. And digital has completely blurred the lines between traditional media, social media, gaming, and shopping, enabling the creation of online worlds with vast and lucrative fanbases.

II. The AI Age

Overlaid on these big decades-long trends has been the sudden, explosive emergence of generative AI technologies.

Three years ago, this seemed to open a new chapter for humanity. Almost overnight, ChatGPT became the fastest-growing consumer application in history, reaching 100 million users in just two months from launch.

Bold predictions followed. Bill Gates spoke of a "revolutionary" new era.[1] Reid Hoffman, the LinkedIn founder, declared a "cognitive industrial revolution", with generative artificial intelligence ("Gen AI") the "steam engine of the mind".[2] Venture capitalist Marc Andreessen described AI as "our alchemy, our Philosopher's Stone".[3]

These commentators and others saw the beginning of a bold new age, which would redefine industries, reshape economies, and transform the worlds of work, communication, and entertainment. Goldman Sachs estimated that Gen AI could increase global output by 7% in just ten years.

Three years later, we have come down to earth somewhat.

In June last year, Goldman Sachs dropped a bombshell with a paper entitled "Gen AI: too much spend, too little benefit", which outlined several fundamental challenges.[4]

First, *data*. Early versions of ChatGPT were trained on an immense amount of data, encompassing around 600 gigabytes of web pages, books, and various other sources. But just like all fuels, data is finite. As large language models proliferate, some researchers warn that the well of usable data could run dry by 2026. This will cause the models to "hallucinate" – to make up things – and thus undermine reliability.

Second, *resources*. Initially, this was seen as an input problem, with a gap between the supply of powerful GPU chips needed to power the technology and surging demand. Attention is now turning to outputs, and more specifically AI's energy demands. By 2027, the AI industry could require as much energy as a country the size of the Netherlands. Already, Google's emissions have risen by nearly 50% in the past five years, largely due to its AI efforts.

Third, *uses*. Technology firms have invested around US$1 trillion in AI-related capital expenditure. For this US$1 trillion – and growing – bet to pay off, Sequoia Capital estimates that the industry would need to generate revenues of US$600bn annually.[5] However, there has yet to be a "killer app" that Gen AI has been able to deliver, and surveys of CEOs and senior executives show increasing disappointment with the application of Gen AI to deliver actual productivity gains.

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1 Bill Gates, "The Age of AI Has Begun", *Gates Notes* <https://www.gatesnotes.com/the-age-of-ai-has-begun> (22 March 2023).

2 Jonathan Sperling, "How AI is Fueling a 'Cognitive Industrial Revolution'", *Columbia Business School* <https://business.columbia.edu/insights/digital-future/how-ai-fueling-cognitive-industrial-revolution> (5 April 2024).

3 Marc Andreessen, "The Techno-Optimist Manifesto", *Andreessen Horowitz* <https://a16z.com/the-techno-optimist-manifesto/> (16 October 2023).

4 Goldman Sachs, "Gen AI: too much spend, too little benefit?" <https://www.goldmansachs.com/insights/top-of-mind/gen-ai-too-much-spend-too-little-benefit> (27 June 2024).

5 David Cahn, "AI's $600B Question", *Sequoia Capital* <https://www.sequoiacap.com/article/ais-600b-question/> (20 June 2024).

And as the head of a UN agency, I would like to point out a fourth one – *fairness and inclusivity*. Gen AI models require so much computing power, energy, access to data that all but a handful of the biggest tech companies in the most advanced economies can use it. Its training model often draws on copyrighted material without permission, which has resulted in numerous lawsuits, and moreover, its learning data is drawn exclusively from certain countries.

The practical impact of all these is already quite sobering. A report released last year by the International Confederation of Societies of Authors and Composers or *Confédération Internationale des Sociétés d'Auteurs et Compositeurs* ("CISAC") – the global agency for CMOs – estimates that by 2028, Gen AI music could account for 20% of the revenue of music streaming platforms, resulting in a 24% or US$4bn loss for music creators.[6] The report also estimates that within the TV and radio space, there could be a 22% loss or cannibalisation for music creators. In the audiovisual sector, a US$4.5bn loss for creators is predicted, due to the potential impact of Gen AI on translation, adaptation, subtitling, dubbing *etc*.

On the flipside, digital technologies have allowed for the democratisation of content and the rise of the content creator economy. Today, there are over 200 million content creators worldwide, with nearly 150,000 new tracks uploaded to streaming platforms daily. Gen AI will accelerate this trend, and truth be told, I don't think anyone can control what technologies creators use to express themselves.

III. The Centrality of Human Creativity

In moments like this, we may find ourselves often swinging from the peak of hype to the valley of despair, but I believe that history offers us some wisdom in an age of uncertainty.

When we look back at the history of the global IP system, we see that AI and today's digital technologies are just the latest in a long series of technological revolutions and evolutions that the IP system has encountered since the coming into force of the Berne and Paris Conventions over 130 years ago.

Since the 1880s, the IP system has witnessed an endless stream of technological advances, ranging from cars, airplanes, radio and TV, transistors, PCs, the internet, e-commerce and smartphones. Each time, the IP system has adjusted itself to take into account these new technologies, for example, in the establishment of the WIPO internet treaties in the late 1990s, or in the series of court cases and business models that emerged after the Napster/Grokster file swapping era.

The argument has been made that Gen AI is different because it has the power to replace the human innovator or creator. I beg to differ, not in my capacity as the Director-General of WIPO, but as a musician and an author.

Gen AI remains a skilful replicator, but it lacks the real spark of originality and inventiveness that characterises human innovation and creativity. We can train it

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[6] *Confédération Internationale des Sociétés d'Auteurs et Compositeurs*, "Global Collections Report 2024" <https://www.cisac.org/services/reports-and-research/global-collections-report-2024> (October 2024).

on Monet's paintings to produce millions of paintings in the Impressionist-style, but it would never have the maverick spirit that is required for the leap to Picasso and Cubism. Others like Professor Daron Acemoglu or Sir Roger Penrose have raised broader macro-economic or even philosophical arguments, and caveats on the technology.

All of this is to say that we should therefore see Gen AI *as a tool*, and not elevate it into a new species, give it spiritual agency or deify it. And like any tool, we should help ensure that it is used for good and minimise the risk of it being used in harmful ways.

Whether you share my view, or you tend to a more utopian or apocalyptic take on the impact of Gen AI, I think we can agree on one thing: ingenuity, invention and creativity is a fundamental part of who are as a human species, and technology, as well as the IP system, must continue to protect, nurture and support this, never forgetting to put the human creator at its centre.

IV. WIPO's Role

As the global agency for IP, it is important for WIPO to play a central role in the challenges and opportunities posed by any frontier or emerging technology to the IP ecosystem. In this regard, let me share a few things we are doing to ensure that WIPO and its Members are engaging fully on this topic.

First, as the global forum for IP issues, we have now held 11 sessions of the WIPO Conversations on Intellectual Property and Frontier Technologies, bringing together almost 14,000 people from over 170 countries in the past five years to discuss issues at the intersection of emerging cutting-edge technologies and IP. The most recent session, in April this year, examined the challenge posed to traditional copyright infrastructure by AI.

While there is currently no appetite for any new treaties or binding international norms related to AI and IP issues – certainly not when many countries are themselves figuring out their domestic approach towards these issues – Member States and other stakeholders see WIPO as their big tent to be active, exchange ideas, share best practices and keep abreast of developments at the global level.

Second, we are using the insights gleaned from these conversations to launch concrete initiatives. We are pleased to share that this December, we will be launching the AI Infrastructure Interchange, known as "A-triple-I". This is a dedicated space for exploring technical and operational questions about copyright infrastructure in the age of AI. It will be a neutral forum where creators, rights-holders, developers and experts can exchange ideas and explore practical solutions. Registrations for participation will open soon and you are welcome to join us.

Third, we are going beyond our role as a convenor and forum to a provider of tools and builder of capabilities. For example, we are working with two other UN agencies – the World Health Organisation and the International Telecommunication Union – to mentor and train AI entrepreneurs in Africa to address healthcare problems on the African continent. We are doing a similar mentoring project for AI start-ups in South-East Asia to address agricultural challenges. These intensive programs

typically last 9 to 12 months, which allows us to understand the life or business journey of the beneficiaries, and incorporate IP as a strategic tool for their growth and success, as well as to leverage technology to address real life challenges.

Fourth, the world of innovation is never still, and new cutting-edge technologies will always emerge. As a global IP community, we must therefore be equipped to proactively engage with the future. WIPO is therefore not just helping IP offices to handle day-to-day operational challenges, but also address the development and evolution of the IP ecosystem through the years and even decades.

To do this, we have started a Future of IP workstream, which is designed to build horizon scanning and futures capabilities in IP institutions. In June, we released a Pathfinders report, a synthesis of expert views about how IP-driven innovation and creativity might evolve by the year 2034. Another dimension is about the IP office of the future, where we think about the skills and capabilities required for them to transition from IP registries to innovation agencies, playing a key role in developing the innovation ecosystems of their countries.

While we cannot predict the future, we can and should be disciplined about the way we engage with it. After all, we occupy ringside seats through our work in IP to what the future will bring us.

V. Conclusion

I began by saying that law never happens in a vacuum. Neither does IP nor technology.

In fact, in these two areas, it is critical that we bring a multi-stakeholder and broad-brush approach to addressing the complex issues before us. This is why I am pleased to be with you this morning, so that your voices are added to that of other stakeholders and interested parties, and so that we are enriched in the way we deal with the future of IP.

Opportunities and challenges are just part and parcel of what each new technology brings. Threading these two may mean a variety of paths that need to be walked by all of us.

Perhaps new laws and regulations may be needed – I note that Denmark has recently unveiled a law to give individuals rights over their likeness and their voice.

Perhaps new business practices may be needed, just like the creation of file-swapping 25 years ago helped usher in licensing models that are the backbone of today's content streaming platforms.

Perhaps jurisprudential clarity may be needed, and we are beginning to see some interesting judgments handed down by courts of first instance in key jurisdictions.

And perhaps it means that IP needs to be taken seriously, not just by the IP community, but by the larger business, finance, trade and economics communities, so that we better understand how IP impacts on the larger aspects of our economy and society.

WIPO is committed to work with all Member States and stakeholders on these paths, but through all of these, we must never forget that IP is never an end in itself, but a tool to harness the power of human innovation and creativity to make our world a better place.