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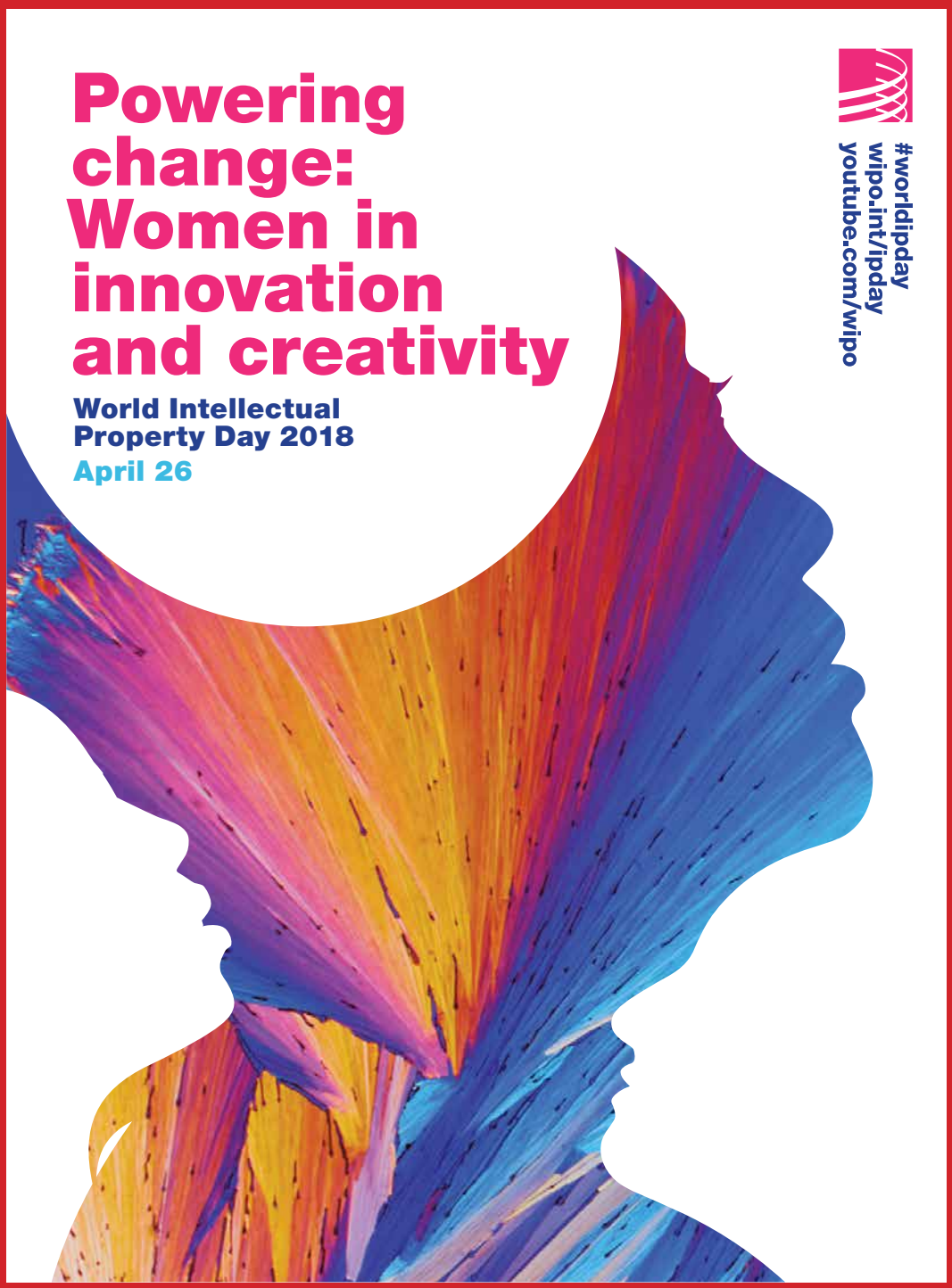

Every day women come up with game-changing inventions and life-enhancing creations that transform lives and advance human understanding from astrophysics to nanotechnology and from medicine to artificial intelligence and robotics.

And in the creative sphere, whether in the movies, animation, music, fashion, design, sculpture, dance, literature, art and more, women are re-imagining culture, testing the limits of artistry and creative expression, drawing us into new worlds of experience and understanding.

The important and inspiring contributions of countless women around the globe are powering change in our world. Their "can do" attitude is an inspiration to us all. And their remarkable achievements are an invaluable legacy for young girls today with aspirations to become the inventors and creators of tomorrow.

This special focus issue of the WIPO Magazine explores why it is important to encourage women in innovation and creativity and presents the views and experiences of just a few of the many remarkable women who are powering change in our world every day.

For more on World Intellectual Property Day, join us on Twitter (#worldipday) and Facebook (www.facebook.com/worldipday).

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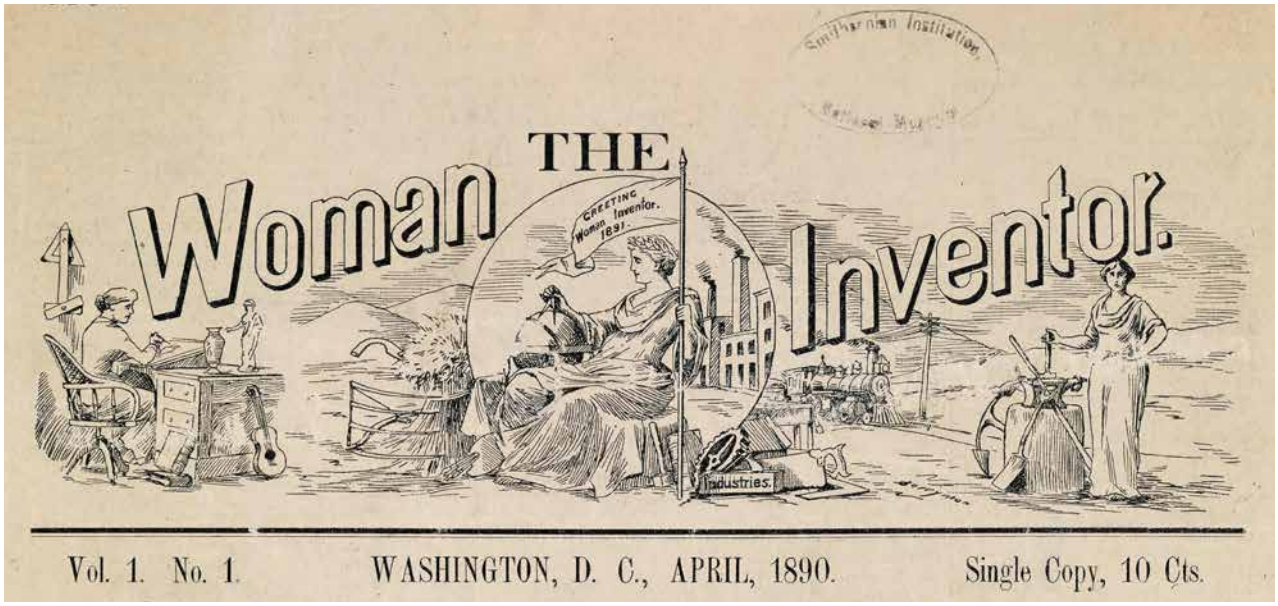
Bridging the gender gap in intellectual property

By **Dan L. Burk**, Chancellor's Professor of Law,
University of California, Irvine, USA



A self-published broadsheet by Charlotte Smith, one of the earliest champions of women inventors in the United States. According to the Women's history blog, from 1855 to 1865, women received on average just over 10 patents per year while men were granted more than 3,760 patents per year.

Intellectual property (IP) law is generally recognized as a means to celebrate and reward the contributions of creative individuals by giving them legal exclusivity over their creations for a period of time during which they may determine who may exploit their work – possibly in return for a fee.

This is believed to generate incentives for creativity not only for the benefit of creators, but also for the general benefit of society. It therefore follows that to the extent that IP law fails to engage or recognize creators, it fails in its essential purpose. Unfortunately, there is growing evidence that it has dramatically failed a large group of creators.

IP AND GENDER: AN HISTORICAL PERSPECTIVE

For much of modern history, and certainly in the early days of legal grants in IP, the formal roles from which IP might arise were closed to women. The creative occupations of artist, engineer, writer, scientist and musician were dominated by men, if not exclusive to men. At that time, social convention frowned on female activity in such professions. IP law, as it developed, followed such social prohibitions. For example, as noted by Professor Shelly Wright, copyright historically encompassed the "fine arts" such as sculpture, painting, literature and music – fields that were male dominated if not exclusively masculine,

with “crafts” such as needlework, knitting, quilting and other “domestic” fiber arts until relatively recently excluded from the canon of copyrightable subject matter.

Similarly, where women developed inventions or creative works outside formal professional settings, social or legal recognition of such work was considered taboo. In some cases, creative works by talented women were circulated anonymously or pseudonymously. This was the case, for example, with Clara Schumann, spouse of the celebrated Robert Schumann, and Fanny Mendelsohn, sister of the widely acclaimed composer Felix Mendelsohn. At that time, acquisition of patents or copyrights was viewed as improper for women. Careful historical reconstruction has revealed clues suggesting patents for inventions produced by female inventors were taken out in the name of a brother, father or husband. For example, when Sybilla Masters developed a way to process Indian corn in 1715 and her achievements were recorded in the patent document, the associated right was issued to her husband. At that time, the prevailing laws stated that women could not own property.

A PERSISTING IP GENDER GAP

Thankfully, social views have changed, and there are now few explicit deterrents to female inventors and creators. But strong evidence of latent gender bias remains. For example, when looking at modern patent filings, it is clear that a substantial gap exists between the number of female and male patent applicants; women are conspicuously absent in every aspect of the patent system. This gap varies somewhat by jurisdiction; patent applications include a female inventor only about 4 percent of the time in German-speaking nations, only 10 percent of the time in the United States, and around 20 percent in a number of Spanish-speaking nations. In no case does the number of patent filings by women approach anything near population parity. Perhaps not surprisingly, studies of patent law practitioners also show the number of female attorneys and agents to be dramatically lower than that of male practitioners.

The most immediate and natural response to such statistical information is to advocate in favor of greater inclusion of women in the technically oriented “STEM” occupational fields, that is, science, technology, engineering and mathematics. Entry and retention of women in these technical fields is notoriously poor despite initiatives to make opportunities available. But these are the fields from which patentable inventions are most likely to arise. With fewer women in STEM fields, one would expect categorically fewer patent applications from women; conversely, if the number of women in STEM fields were to increase, one would expect larger numbers of patent applications from women.

While there are many compelling reasons to advocate increased female participation in STEM areas, and such increased participation would likely boost the overall number of patent applications by women, diminished numbers of women in technical fields is clearly not the sole cause of their lower level of engagement with the patent system.

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Photo: Granger Historical Picture Archive / Alamy Stock Photo

Clara Schumann was an accomplished pianist and composer in her own right, but her work often came second to that of her husband, Robert Schumann. Indeed she was often characterized as her husband's helper.

MORE THAN A NUMBERS GAME

The gender gap in patenting is too complex and intractable to be solved by simple numerical parity. This has been empirically demonstrated in cohort studies that compare similarly situated men and women in STEM occupations. These studies indicate that the women who are already in STEM fields engage the patent system far less frequently than their male counterparts.

Female scientists and engineers are less than half as likely to obtain a patent for their research as their male colleagues. This effect occurs in both academic and industrial settings, although it is less pronounced in the latter. The patenting gap appears to hold true across all ages and all cohorts of women in STEM fields, despite the rising total number of women entering these fields. Indeed, the gap is also evident in sectors like the biological sciences, which have been most amenable to female entry and include a larger number of female researchers. Comparisons of other metrics for research significance, such as research grant awards, do not reveal this gap, and when female researchers do obtain patents they appear to be as significant as those obtained by their male counterparts. Thus, the gap in patenting does not appear to be attributable to the merit or significance of research results.

Such quantitative studies can outline certain parameters of the problem, but are limited in their ability to identify the source of the patenting gap. At some point they must be supplemented by qualitative research to fill in missing details. Ethnographic studies undertaken by a number of researchers indicate a complex of social barriers continue to deter even present-day female inventors from engaging with the patent system. Detailed survey and interview data indicate that women in STEM fields have developed social responses that deter their participation in patenting

and commercializing their research. Female scientists and engineers are less likely than their male counterparts to think about commercializing their inventions, and are less comfortable marketing themselves and their work to potential business partners.

These internalized responses are then reinforced by socially-structured obstacles. Female scientists and engineers are more likely to be excluded from social networks that would enable them to get support for commercializing their outputs; for example, they are less likely to be invited to sit on prestigious scientific boards or advisory panels where they could meet potential innovation partners. And from the other side of the table, there is evidence that essential partners such as venture capitalists and other financiers are less likely to take seriously proposals from female innovators than from their male counterparts.

LACK OF DATA

Evidence therefore suggests that there is a clear and recalcitrant gender gap in patenting, but what of other creative areas? Much less is known regarding copyright, as most of the empirical work done to date on gender in intellectual property has concentrated on the patent system. This is not because copyright poses less of a concern; informal or anecdotal observations regarding the participation of women in the creative industries that thrive on copyright protection – publishing, movie making, music recording – suggest that females in those industries may be no better off than those in technical industries that rely on patent protection.

Rather, patenting more readily lends itself to empirical study because patents only issue after administrative review of a patent application. This generates a considerable body of data which can be easily collected and made available for statistical scrutiny. This is generally not the case in other areas such as copyright. Unlike patents, copyright arises spontaneously upon fixation of an expressive work, and under international treaties such as the Berne Convention for the Protection of Literary and Artistic Works, administrative formalities are not a prerequisite for the grant of copyright. As a result, there are fewer data available to assess use of the copyright system than for the patent system, making empirical assessment of gender in the copyright system more challenging.

According to the Lemelson Center, the feminist reformer Charlotte Smith spearheaded one of the earliest attempts to accurately count women inventors. Thanks to her efforts, the United States Patent Office compiled the first official list of women patentees in 1888


WOMEN INVENTORS

PATENTS

HAVE BEEN GRANTED BY THE UNITED STATES GOVERNMENT

1790 TO JULY 1, 1888.

Photo: Ilbusca / E + / Getty Images

Photo: Olivier Asselin / Alamy Stock Photo

While myriad social factors contributed to gendered outcomes, a particular concern is that IP laws that are ostensibly gender-neutral may put women at a distinct disadvantage. Work by cultural ethnologist, Boatema Boateng, shows that laws to protect traditional crafts and knowledge of traditional weavers in Ghana have unexpectedly reinforced gender disparity within the community.

In the United States, however, the copyright law sets out strong statutory incentives for creators to register their works with the Library of Congress, and these data offer interesting insights. For example, recent pioneering work by Robert Brauneis and Oren Bracha on the registration data generated by the United States Copyright Office for gender trends indicates that registered authors are overwhelmingly male.

This effect differs by category of copyrightable subject matter: it is least pronounced in filings for artistic and textual works and more prevalent in the categories of music and motion pictures, where more than three-quarters of registered works are authored by men. Movies and textual works have shown modest increases in female authorship in recent years, whereas the number of music-related registrations by women has remained static. Unsurprisingly in light of women's participation in the patent system, the lowest rate of female authorship is found in the area of software registrations. The study also discloses several additional interesting patterns in authorship that point to other potential biases in the social structure of creative activity; for example, the data show that coauthors are significantly more likely be of the same gender.

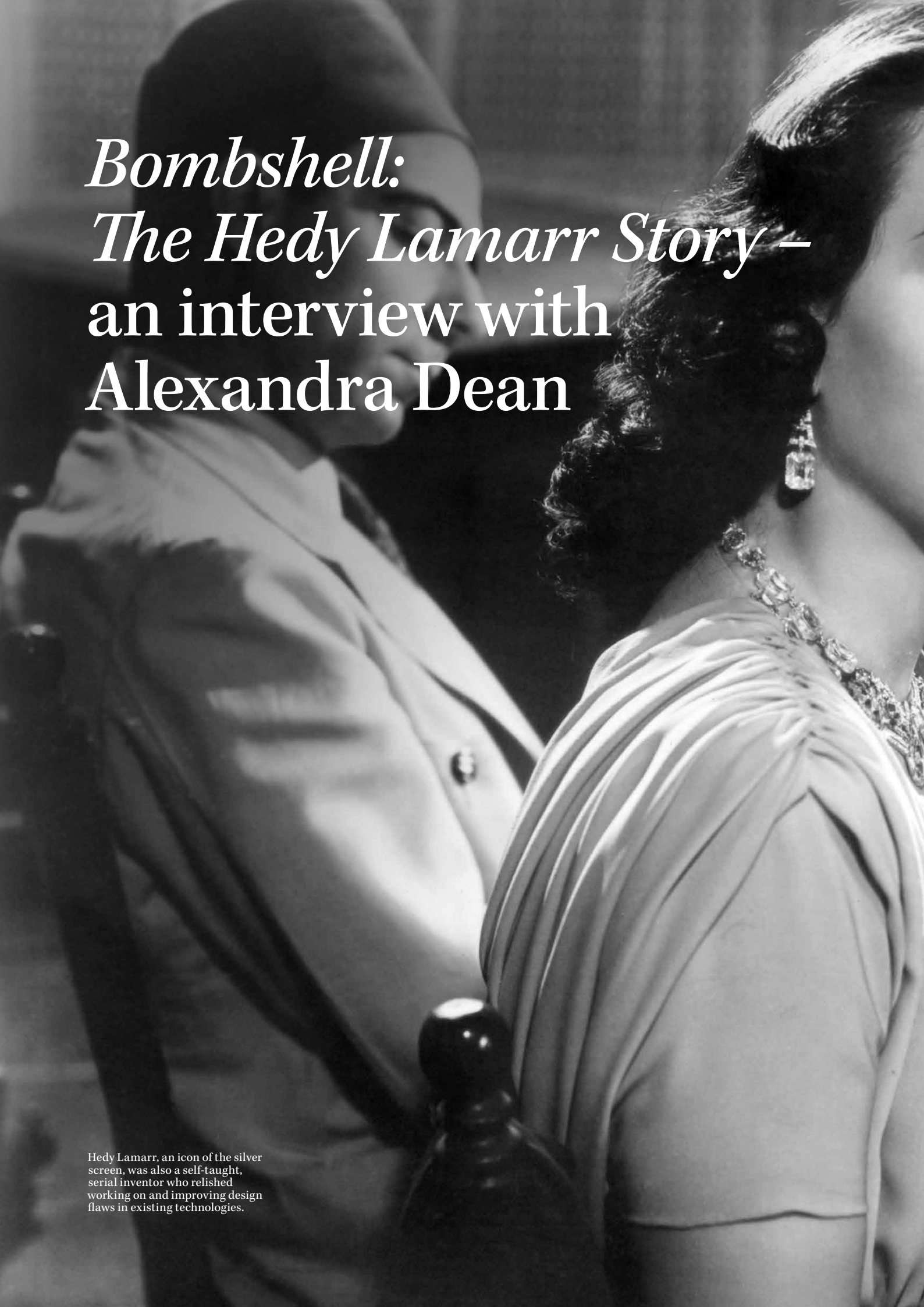
GENDER BIAS IN IP LAWS?

While myriad social factors are at work in generating such gendered outcomes, a particular concern is that IP laws that are ostensibly gender-neutral may put women at a distinct disadvantage. A growing body of legal scholarship is exploring the latent assumptions and unexpected outcomes related to patent, copyright and trademark doctrines.

Beyond that, however, the interaction between IP and other social structures may play out in unexpected ways. Cultural ethnologist Boatema Boateng, for example, discusses the sale of machine-made cloth that incorporates patterns resembling those in traditionally made fabrics. She found that local weavers invoked statutes protecting traditional crafts and knowledge to prohibit the sale of imitation cloth and that those laws appeared to function as intended – that is, until broader perspectives, including gender, were taken into account. On closer inspection, she found that in Ghana, the focus of her study, weaving is traditionally a male occupation, and the infringement claims were brought by male weavers against small business operators who were primarily female. Here we see that an ostensibly neutral law unexpectedly helped to reinforce long-standing gender disparities within the community in question.

While considerable work remains to be done to fully understand the root causes and scope of gender disparities in IP, what we have learned so far suggests various solutions that may help to bridge the gender gap. In this respect, longitudinal comparisons indicate that early exposure to inventors and innovation fosters innovation later in life. Clearly education, information and the provision of role models must play an important role in the uptake and use of IP across genders.

Bombshell: The Hedy Lamarr Story – an interview with Alexandra Dean



Hedy Lamarr, an icon of the silver screen, was also a self-taught, serial inventor who relished working on and improving design flaws in existing technologies.

Photo: Courtesy of Reframed Pictures

By **Catherine Jewell,**
Communications Division,
WIPO

Emmy award-winning journalist, director and producer Alexandra Dean talks about her compelling new documentary, *Bombshell: The Hedy Lamarr Story* – the remarkable tale of a Hollywood star whose natural flair for invention helped shape today's communications technology.

How did Bombshell come about?

My colleague Katherine Drew gave me the book *Hedy's Folly* by Richard Rhodes and I thought it would make an excellent starting point for an investigative documentary. From my work as a journalist, I realized our culture has a big problem funding inventors who do not look like Thomas Edison. I know so many young women with brilliant ideas who want to do great things but can't get funding. So I wanted to reframe the story around gender and explore who invents our world, how and why. We were very lucky that the Sloan Foundation supported our vision from the beginning and gave us a grant that made the film possible.

Why focus on Hedy Lamarr? Who was she?

Everything about Hedy Lamarr appealed to me. Hedy Lamarr was an Austrian-born American actress and one of the most iconic film stars of her day. She is the reason Snow White has black hair and why Catwoman looks the way she does. She changed the look in Hollywood. But at night during the Second World War she was doing something far more important – inventing a frequency-hopping communications system for Allied Forces. That system laid the foundation for the GPS, Bluetooth and Wi-Fi technology we use today.

Tell us more about her inventions.

Hedy met George Antheil at a party in the war years, at a time when she was inventing regularly with the movie director Howard Hughes, who was trying to develop faster airplanes. George Antheil was a brilliant musician with an inventive mind and, like Hedy, he finished school at 15.

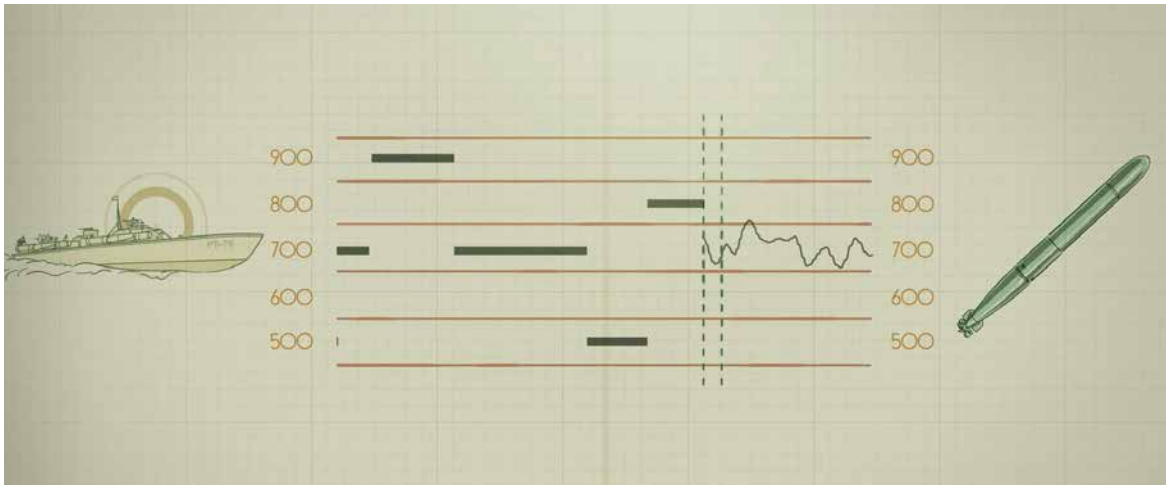
Hedy and George came up with three different inventions. One was a top-secret secure radio guidance system, using frequency-hopping technology, for Allied naval forces chasing down U-boats in the North Atlantic. Hedy was desperate to develop her invention so her mother could get safe passage from London to the United States.

Why did it take so long for her off-screen talents to be recognized?

Hedy never got a penny for any of her inventions. It's hard to know exactly why, but in part it was because inventing came out of her in a completely natural, irrepressible way. Her inventions came from the best part of her; the part that wanted to give something back with no thought of financial gain. Toward the end of her life, however, she did feel very sore that the world had never fully recognized or appreciated what she had achieved. By then she had become a recluse and money was short. But Hedy was very resourceful. And when, in the mistaken belief she had died,

Photo: Courtesy of Reframed Pictures

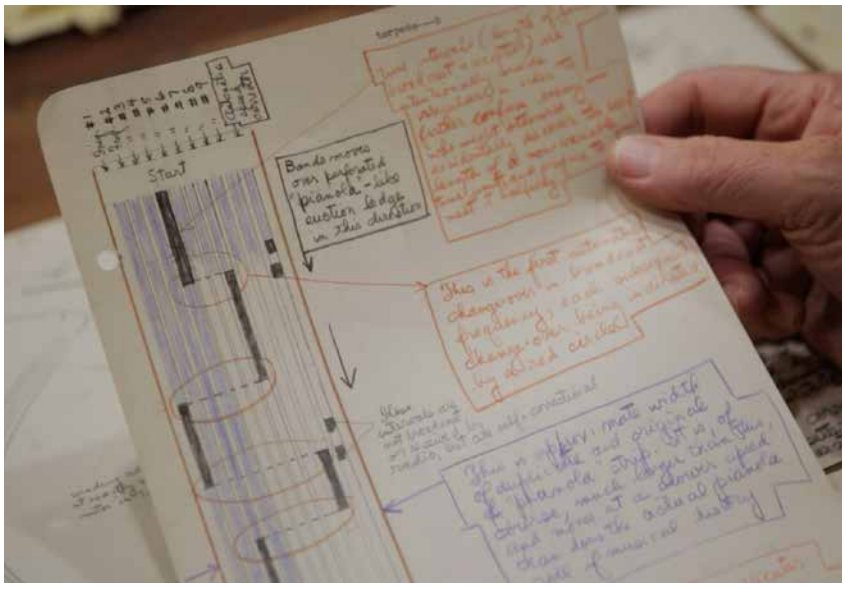
Bombshell: The Hedy Lamarr Story traces the remarkable tale of a Hollywood star whose natural flair for invention helped shape today's communications technology.



Photos: Courtesy of Reframed Pictures

In developing their spread-spectrum technology, which made interception almost impossible, Hedy Lamarr and George Anteil took inspiration from workings of self-playing pianos. It uses 88 different frequencies, corresponding to the number of keys on a pianoforte.

Hedy Lamarr (center left) and George Anteil (center right).



Notes on the frequency-hopping communications system developed by Hedy Lamarr and George Anteil which some believe could have significantly shortened the Second World War.

the graphics company Corel used her image on their products without her authorization, she sued them for USD 3 million and won. Shortly after that she asked the Smithsonian Museum to value the original patent issued for her frequency-hopping invention. Unfortunately, she died before learning that they put its estimated value at USD 6 million. What I love about this is that it meant her mind was worth twice the value of her face.

What happened to her invention?

When Hedy patented her technology, she gave it to the US Navy, but sadly, they didn't take her seriously. They said it was too bulky and not a useful military technology. What they were really saying was that it was unlikely that an actress and a musician had come up with a technology they could use. In actual fact, it was ahead of its time and some say it could have shortened the war by a year or more. And it was the size of a watch face.

She did get some recognition and awards in the 1990s when mobile telephony took off. She also received one from Milstar, which operates military communications satellites that provide secure communications for the US Armed Forces and President. That meant a great deal to her.

And her legacy?

Incredibly, today almost everybody in the world is connected by a communications system related in some way to Hedy Lamarr's invention. We all interact, every day, with something that came from that beautiful mind.

We found evidence that Hedy and George's patent had been handed to military contractors in the 1950s and that the technology was used in military drones and sonobuoys. We know it was used in Milstar satellites and migrated from there to the GPS, Bluetooth and Wi-Fi systems we use today.

But the significance of Hedy's story goes beyond her invention. She was a woman with tremendous natural talent – beauty, brains (obviously) and courage, she had it all. Yet still she was unable to command real authority or respect for her achievements in her elder years. What does that mean for the rest of us? Are women only allowed to be powerful and interesting when they are young and beautiful? That really haunts me. Why don't we let women age more powerfully?

What do you hope people will take away from it?

I ended the film with Hedy reading a poem to her children on their answerphones. She says even if life kicks you in the teeth and the world doesn't recognize your achievements, do it anyway. What's important is that you tried to change the world for the better. That is what you will remember. The applause doesn't matter; what matters is the doing.

I never thought that the film would take off like this, but Hedy's story is really hitting a nerve with the #MeToo and #TIME'SUP movements and the urgent need to get more women into science and technology.

What challenges did you face in making it?

Finding Hedy's voice was the biggest challenge. I began with the book she had written called *Ecstasy and Me*. I thought it was her autobiography but soon discovered she was so disgusted with the way the ghostwriter presented her that she sued him for USD 21 million.

So I needed another, more reliable, source and was incredibly lucky to come across tapes of an interview that Fleming Meeks had done with Hedy for Forbes magazine in 1990. That's when we decided to rethink the project and let Hedy tell her own story. The tapes were a real bolt from the blue.

What is it about inventors that you find so interesting?

The eureka moment of invention fascinates me, and the fact that it is different for every inventor. But it really bothers me that we might only be allowing a certain segment of our population create our world. We really need to draw from all of our best and brightest to create a world capable of dealing with what's ahead. If we don't have a gender-diverse group of people to design our future, what will it look like?

Why have women inventors been in the shadows for so long?

For the same reason so many powerful women have been in the shadows. We are just beginning to wake up to how patriarchal our society is and all the subtle ways that women or people who are from diverse backgrounds are undermined or partially recognized. We may even be

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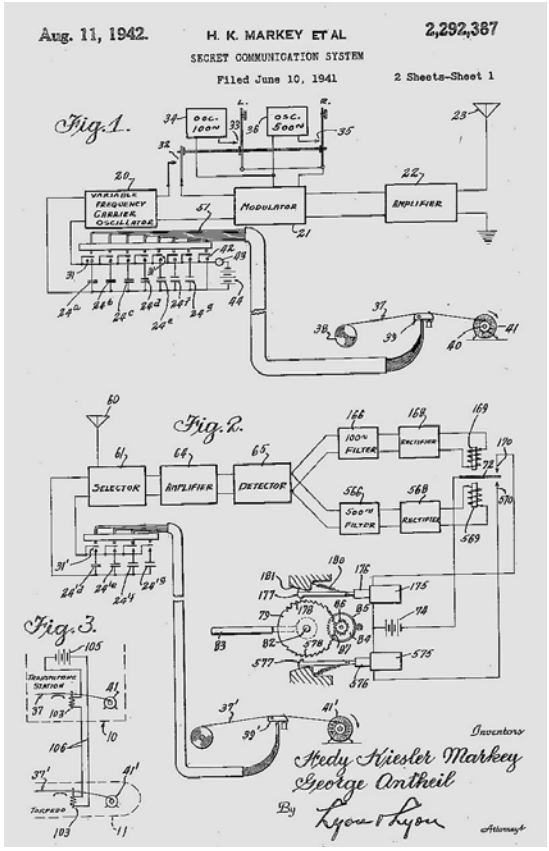
Hedy Lamarr née Kiesler was a naturally gifted inventor. In the early 1940s she teamed up with modernist composer George Antheil to develop a ground-breaking frequency-hopping, torpedo guidance system for allied forces. She gave the patent to the U.S. Navy, and although they didn't use it, the technology subsequently formed the basis of the spread spectrum technology found in many electronic devices we use every day.

Photos: Courtesy of Reframed Pictures


Aug. 11, 1942. H. K. MARKEY ET AL 2,292,387
SECRET COMMUNICATION SYSTEM
Filed June 10, 1941 2 Sheets-Sheet 1
Fig. 1.
Fig. 2.
Fig. 3.
Inventors
Hedy Kiesler Markey
George Antheil
By Lyon & Lyon
Attorneys

holding ourselves back. Every woman around the world needs to be supported as they become more secure in their ability to create and innovate.

I grew up in an era where I was on the crest of a wave that had been created by an amazing group of pioneers before me. I was in the first class at Harvard that was gender balanced. We didn't know it at the time, but my cohort and I had an unbelievable privilege and responsibility.

But as we go forward we still have paths to forge. We haven't even started to tackle what happens to women when they become mothers or when they age, so new revolutions have to come.

So not enough progress has been made?

People assume things are improving but we are regressing. The numbers of women entering science, technology, engineering and mathematics are falling globally.

Most of us haven't thought enough about the world we are inventing right now. The technologies we are inventing today are quite benign, but sometime in the future technology may actually govern our lives. And when that happens, what kind of technology do you want? Do you want it to be like you? Should it be humorous, gentle and empathetic? If so, we need to choose the sort of people who can build that technology, and design the kind of world we want to live in. Too often we just let one kind of person do all our inventing, and that is incredibly dangerous. We have to encourage everybody to design the world we want to live in tomorrow.

How would you like things to change?

Innovation must become more democratic. When I was creating the TV series *Innovators*, it became blindingly clear that those who invent do so because they get a huge check, usually from a Silicon Valley-type entrepreneur. And unsurprisingly, those entrepreneurs back people who remind them of their young selves. But that means anyone else with equally brilliant ideas is being ignored. That isn't democratic, or meritocratic.

What intellectual property lessons does the Hedy Lamarr story offer?

Her story teaches us how important it is to give people ownership of their intellectual property (IP) so they can benefit financially from their invention, and to recognize them for their achievements. Even today, many of those doing the real inventing don't benefit from their IP because their brilliant genius does not lie in IP but elsewhere. If we don't start really looking after our inventors and make sure their IP is protected, fewer people will be drawn to invention. So we need to think about this more carefully.

You have your own production company. What prompted you to set it up?

I felt the need to break out, and it was the most liberating thing I have ever done. With Reframed Pictures, our aim is to reframe the conversation around various issues and explore them through a new lens.

What role does IP play in your work?

IP is at the core of our company. Without it there is no way for us to grow. We needed to own the rights in *Bombshell*; that was actually quite unusual for an independent documentary maker. But if a documentary really speaks to people and for a long time, why shouldn't those who made it be able to build on that success?

It was incredibly difficult to secure all the rights for *Bombshell*. Hedy's films alone were a third of our budget and we also needed to secure rights for all the other snippets that viewers hardly notice. But I found that process really interesting. It gave me a great insight into what we were actually putting into the film, and of course it's an important part of a filmmaker's work.

What next?

I'm doing a series with PBS called *Beautiful Minds* about women inventors who are really changing our world, but have not been recognized. And I am doing a documentary about Niki de Saint Phalle, an incredible artist, who, like Hedy, was ahead of her time and has been largely overlooked. And I am doing a fiction series about Prohibition in Napa.

What message would you give to young women with aspirations to create?

I hope that any young woman watching the film will take heed of Hedy's message: if you want do something, just do it. Follow your passion. Not just for your own sake, but for the benefit of society because you will be part of that new, diverse team of people who will shape our world.

Raging Bull and Fearless Girl – moral rights in copyright

By **Emma Barraclough**, freelance journalist

It's an iconic image for our generation: a fearless girl staring down a charging bull – a symbol of America's capitalist renewal. But does it affect the rights of the man who sculpted the bull? That question shines a spotlight on the issue of moral rights.

THE BACK STORY

Twenty-nine years ago, in the early hours of December 15, 1989, Arturo Di Modica loaded a three-tonne bronze bull onto a truck and deposited it on Wall Street. He had spent two years sculpting the bull in his Manhattan studio. His guerrilla art was his tribute to US resilience and spirit in the aftermath of the 1986 Wall Street crash. New York Stock Exchange officials were not impressed. They called the police, who seized the sculpture. But after a public outcry, city administrators decided to install it close by in Bowling Green, where it has become a tourist attraction for those visiting downtown Manhattan.

The story fast-forwards to 2017, when asset management company State Street Global Advisors commissioned artist Kristen Visbal to sculpt the 110-kilogram Fearless Girl statue. Echoing Raging Bull's own clandestine arrival, the sculpture was sited just before International Women's Day in a publicity stunt to promote a State Street fund consisting of companies that have a higher-than-average number of women on their boards. The sculpture was striking. But what made it more so was the juxtaposition of the girl – hands on hips, chin raised – with Raging Bull.

Arturo Di Modica was upset. He called his lawyers and together they held a press conference declaring that Fearless Girl was an "advertising trick" that impugned the integrity of his work. He demanded the sculpture be removed. But the fact that Fearless Girl is still in place reveals plenty about the US approach to what are known as moral rights in copyright.

DIVERGENT APPROACHES TO MORAL RIGHTS

Moral, as opposed to economic, rights in copyright (see box) originated as a concept in France and Germany and were protected by law in many civil law jurisdictions. Common law countries were slower to follow. That is partly because of their instinctual preference for letting parties make private agreements and partly, in the case of the

Photo: Michael Fitzsimmons / Alamy Stock Photo

The upset surrounding the positioning of Kristen Visbal's 110-kilogram Fearless Girl Statue in front of Arturo Di Modica's three-tonne bronze bull near New York's Wall Street, shines a light on the issue of moral rights in copyright.

Moral rights

People who create lucrative copyright works seldom own full economic rights in them: authors assign their rights to a publishing house in return for royalties, musicians to a record company and directors to a movie studio. But in many jurisdictions people in certain creative fields can claim moral rights in their works, protecting their non-economic interests. Moral rights take different forms and include the following:

- the right to attribution – the right to be recognized as the author of a work;
- the right to object to false attribution – the right not to be named as the author of a work that you did not create;
- the right to object to derogatory treatment of a work – in some countries copyright owners can object to any addition, deletion, alteration to or adaptation of a work that would distort or mutilate the work, or that negatively affects the honor or reputation of the author;
- the right to decide whether the work should be published and in what form.

United States, because of the political clout wielded by copyright owners in the booming US entertainment industries.

Two moral rights, however, had been included in Article 6*bis* of the multilateral Berne Convention for the Protection of Literary and Artistic Works. As countries signed up to the Berne Convention, they were obliged to include provisions on the right of attribution and the right of integrity in their domestic law. But how they do so, and the degree of protection offered, varies from country to country. For example, countries adopt different tests for determining whether a work has been distorted in such a way that it is prejudicial to the author's honor or reputation. In some it is a subjective determination based on the view of the author, while in others it is an objective determination.

Even within the European Union, where copyright rules have been harmonized to a large extent, some countries allow creators to waive their moral rights by contract but in others, such private deals are unenforceable. Some member states grant employees moral rights in works they created in the course of their work; in others, these rights are enjoyed by the employer. In others, "work-for-hire" attracts no moral rights.

When the United States finally acceded to the Berne Convention in 1988, it relied on various provisions of state and federal law rather than enacting a specific moral rights statute in its Copyright Act. The Visual Artists Rights Act (VARA), passed by Congress two years later, expressly provides moral rights for works of visual arts, but the category of works of visual arts accorded those rights is narrow, says June Besek, Executive Director of the Kernochan Center for Law, Media and the Arts at Columbia Law School. VARA only protects paintings, drawings, prints, sculptures and still photographic images produced for exhibition in limited editions of up to 200 copies that are signed and numbered by the artist.

June Besek says there is general agreement that VARA would not protect the Charging Bull sculpture from having its Fearless Girl rival placed nearby. Nor is the spat likely to lead to a groundswell of support for enhancing moral rights in the United States. "I suspect [the public's] sense of whose rights should be protected, and how, was influenced by the symbolic significance of Fearless Girl," she explains.

Berne, TRIPS and moral rights

Article 6*bis* of the Berne Convention for the Protection of Literary and Artistic Works requires signatories to grant authors two moral rights: (i) the right to claim authorship of a work (often known as the right of attribution); and (ii) the right to object to any distortion or modification of a work, or other derogatory action in relation to a work, which would be prejudicial to the author's honor or reputation (sometimes called the right of integrity).

The Berne Convention requires these moral rights to be independent of authors' economic rights and in many countries they remain with the authors even after they have transferred their economic rights.

When member states of the World Trade Organization (WTO) began work on a multilateral agreement on intellectual property in the 1980s (what became the Agreement on Trade-Related Aspects of Intellectual Property (TRIPS)), they recognized that the Berne Convention provides, for the most part, adequate basic standards of copyright protection. They decided that WTO member states must comply with the substantive provisions of the 1971 Berne Convention. However, such was the degree of divergence on the issue of moral rights, member states agreed that they need not be bound by Article 6*bis* of that Convention.

Photo: Michael Fitzsimmons / Alamy Stock Photo

"Technology has given questions relating to moral rights an urgency and relevance," says Sundaran Rajan, visiting scholar at Stanford Law School.

TIME FOR REFORM?

Even if Arturo Di Modica's moral rights claims did not elicit widespread sympathy, is there a case for extending moral rights in the United States? Many believe there is. In addition to the rights of creators, Mira T. Sundara Rajan, a visiting scholar at Stanford Law School, argues that it is ultimately a public interest issue, given that so many important copyright works make it into the public domain. "People can't enjoy a work of art if it is damaged or if they don't know the real identity of the author," she says.

But others are wary. "I believe that moral rights are important – but as the scope of copyright law has expanded dramatically, it is important to note that not all works of art are of equal value," says Irene Calboli, visiting professor of law at Singapore Management University, citing software products, consumer packaging and warranties as examples of work protected by copyright. "The US idea of limiting moral rights to visual art has some merit. Perhaps it should be expanded to films and books as well, but not to architectural work, which is functional as well as potentially being a work of art." She says that in countries such as Germany, which grants moral rights to the architects of buildings that meet a certain aesthetic standard, the courts have been forced to try to balance the practical needs of building owners against the moral rights of architects.

June Besek believes that cultural differences and commercial realities explain some of the historical differences in approach between the United States and Europe when it comes to moral rights. When the United States was considering adhering to the Berne Convention, certain copyright-intensive industries were very concerned about the possibly disruptive effect of granting creators a right of integrity, she says, especially if the law did not allow parties to waive their rights or the ability to waive was significantly limited. "While European scholars argued that their copyright industries flourished with moral rights, there is no question that the US is much more litigious than most other countries."

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But there are signs that the United States is considering its position on moral rights.

In 2016, the Center for the Protection of Intellectual Property at George Mason University co-sponsored a symposium on Authors, Attribution, and Integrity: Examining Moral Rights in the United States with the US Copyright Office, which at the time was led by Maria Pallante. Her interest in the subject saw her recommend further study of moral rights during testimony before Congress in 2014.

"The fact that the US has decided to look at it at all is nothing short of a miracle, especially because there is not much lobby power behind it," says Sundara Rajan, who organized a conference on moral rights in Glasgow, UK, last year, attended by officials from the US Copyright Office. Even so, she doubts that change will happen in the United States anytime soon.

THE DIGITAL IMPACT

One potential driver of reform of moral rights more generally is the changing way we make things. "The number of people who create things is very large now thanks to technology: it allows people to create in a way that they couldn't do before," says Sundara Rajan. "The focus of moral rights is ensuring that someone's work is not edited or adapted in a way that was not intended. The online environment makes it very easy to do that and so technology has given questions relating to moral rights an urgency and relevance."

The arrival of blogs, video-sharing platforms and social media means that everyone can be a published author, performer or photographer whose work can be seen and shared by millions of people. The same digital tools also enable anyone to make music mashups for public consumption or upload literary homages or derivative artworks. But the digital revolution has also seen the development of technology likely to make it easier to attach an author's name to a digital work in a way in which it cannot easily be removed.

June Besek says that these technological changes make it important to consider how best to protect moral rights in the 21st century. She warns that while technology is advancing so rapidly, now may not be the best time to harmonize, despite wishing to see a stronger right to attribution in the United States. "Even those authors who aren't looking for a financial reward for others' use of their works often do want recognition," she says.

Women in Arab cinema: an interview with Hend Sabry

By **Catherine Jewell**,
Communications Division, WIPO

Photo: © Hasan Amin

What challenges face actresses in the Arab region? And what opportunities might they enjoy? Award-winning Hend Sabry (left), one of the most celebrated actresses in Egypt and the Arab region, shares her views on women in Arab cinema.

What drew you to acting?

It was a coincidence really. I was spotted by a director when acting in high school play. I was just 14 years old. Then I discovered that creating another world and making people believe in it is a lot of fun. I love acting because it gives me the freedom to explore and express different aspects of my personality.

What challenges do actresses face in Arab cinema?

We face many challenges. We are paid far less than our male counterparts, and we also get less exposure than they do. There are also far fewer scripts written for female characters. Male characters predominate and remain the motor of Arab cinema. Producers and distributors generally still don't see actresses in the region as powerhouses who can boost box office revenues. Also, women who become professional actors are held to a different standard than men. They are often stigmatized and face many social taboos unlike men.

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Ms. Sabry in *Asmaa* by Amr Salama, which recounts the trials of a young woman with AIDS. "Our role as filmmakers is to offer viewers an opportunity to explore diverse viewpoints and experiences and thereby to help promote more tolerance and understanding among people," says Hend Sabry.

Why are events such as the Cairo International Women's Film Festival important?

Such events are a very good thing because they celebrate the achievements of women. But, in general, I am not a big fan of so-called "woman's film". A film is universal and is designed to trigger emotions, thoughts or discussion of an issue. There is no such thing as a man's film or a woman's film; there are good films and bad films. There are good films about women and bad ones too. We need to celebrate our successes and all the amazing female talent that exists within the Arab film industry. That's the best way to support women in film. We need more beautiful stories about women and we need more writers, both male and female, to create strong female characters for film.

Why did you study law? What drew you to it?

After college, I dreamed of joining the Tunisian Foreign Service and law seemed a good option for such a career. But destiny decided otherwise. After I got my law degree, I moved to Egypt and became a professional actress. That's when I decided I wanted to complement my knowledge of the law, and intellectual property (IP), in particular copyright law, seemed a perfect fit. It allowed me to blend my interest in law with my work as an actress.

Why is it important for actors to be IP aware?

Generally speaking, actors need to understand their IP rights because they are the means by which they can earn a decent living from their work. IP is their bread and

butter. But in some countries, for example in Western industrialized countries, the copyright system is more mature and works more effectively than in others. Unfortunately, in the Arab region there is a lack of IP awareness and with that comes a lack of respect for IP rights. In TV, for example, many broadcast channels in the region take liberties in re-editing TV shows to boost advertising revenue. They seem to think that just because they have purchased an episode of a TV show, they can do anything they like with it, even mutilate it artistically. I am sad to say that people simply don't realize that IP rights are an important means for the acting community to secure a living from their work. This is really disappointing. Things are changing, but slowly. With globalization the world is getting smaller, and with that people are becoming more IP aware, but a lot more needs to be done to raise IP awareness across the region if Arab cinema is to reach its full potential.

Would you like to see the recently concluded Beijing Treaty on Audiovisual Performances enter into force?

I would love to see that, especially in North Africa and the Middle East. When it does it will really bolster the rights of performers in the region and help ensure that they are fairly paid for the use of their works on all platforms. But there is still a lot of work to do. The acting community is not well organized when it comes to IP. We don't have the unions or the knowledge of IP required to strengthen our position. At present, IP laws tend to favor the interests of producers and investors over the artistic contribution of actors.

Photos: Stills from the film Asmaa

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So we need to develop the necessary infrastructure, including databases of audiovisual works that will make it possible for performers to be paid for their creative contribution. Amassing and managing these records is a huge task, but such infrastructural developments are a pre-requisite if we are to see effective implementation of the Beijing Treaty.

Why have you set up your production company?

Tayara is a digital production company, the first of its kind in the Arab world. We create edgy online video content for younger, less traditional audiences. We are re-shaping conventional ideas of advertising in the Arab world and bringing online advertising and marketing to a new level.

What impact is the digital revolution having on Arab cinema?

It's too early to tell. The transition to digital is having a greater impact on TV than cinema at the moment. Now that cinema has established itself as an art form, I don't believe it will die. Literature did not die because of cinema, nor did theatre, which is thriving. The move to digital is undoubtedly changing the habits of audiences. Today, viewers want more control over what they watch, how (preferably without ads) and when they watch it. That's why new platforms like Netflix are thriving. But I don't believe it will kill Arab cinema.

How would you like to see Arab cinema evolve?

I am very optimistic about the future of Arab cinema. Fortunately, there are many very brave male and female filmmakers who every day, push the boundaries of public debate and introduce new perspectives on the issues facing the new generation. The Arab world has many challenges and thankfully there are more and more films that explore these issues. So I am optimistic.

I would love to see more diversity in Arab cinema. When commercial cinema becomes the only viewing choice because it is so widely distributed, we all lose out. We need different film genres because audiences are highly diverse and we need to accommodate those varying interests and preferences. A more diverse cinema means more choice and a richer movie landscape.

What opportunities and challenges do you foresee?

With globalization, the world is becoming smaller every day and people are more connected than ever before. There are real opportunities here because people can access content from all regions.

> "We need to celebrate our successes and all the amazing female talent that exists within the Arab film industry. That's the best way to support women in film."
>
> Hend Sabry

Photo: Claudia Wiens / Alamy Stock Photo

"People are becoming more IP aware, but a lot more needs to be done to raise IP awareness across the region if Arab cinema is to reach its full potential," says Hend Sabry.

Today we enjoy unprecedented viewing possibilities. New platforms like Netflix and Icflix offer opportunities for viewers in the Middle East to watch Colombian novellas, Indian epics and Spanish thrillers. Similarly, viewers in those regions have access to Middle Eastern productions. So there is a huge opportunity here to bring Arab cinema to the global stage and for more and more people to enjoy Arab cinema. In terms of challenges, filmmakers in the Arab world have a tendency to avoid issues that we should be talking about. We tend to fear public opinion. So I would say that self-censorship is our biggest challenge.

Why is it important to encourage diversity and inclusion within the film industry?

A diverse and inclusive culture is very enriching. It creates opportunities to explore different viewpoints and perspectives and promote understanding among cultures. It is our role as filmmakers to offer viewers an opportunity to explore diverse viewpoints and experiences and thereby to help promote more tolerance and understanding among people.

What advice do you have for young women with aspirations to engage in Arab cinema?

Don't get into film for the fame or the money, do it to change society. Do it because you believe in something that you think needs to be expressed on a big screen and

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carried to millions of people. Unfortunately, in our social media-driven world many confuse the love of the art and its expression with the love of being photographed and famous.

What can policymakers and others do to encourage more women to engage in innovation and creativity?

They can help create a more enabling environment for us to be innovative and creative.

How do you choose your roles? Which one did you enjoy playing the most, and why?

I favor socially relevant roles. For example, my role in the comedy, *I Want to Get Married*, tackled the issue of women who aren't married by the age of 20. In the Arab world women who have career aspirations and who don't follow in their mother's footsteps and get married young are under huge social pressure to marry. The series was a huge success. People still talk about it. It really struck a chord. Similarly, in *Asmaa*, I played the role of a woman with the HIV/AIDS virus and the struggles she faced.

Who is your greatest source of inspiration within the film world?

There are many, both men and women. Some, like the famous Egyptian actress, Yousra, inspire me because of the longevity of their careers. Others inspire me because of the roles they play. For example, I love Faten Hamama, a leading light of Arab cinema (and ex-wife of actor Omar Sharif), because of the social and legal issues she addressed in the roles she played in the 1950s and '60s. Her work, and the debate it triggered, helped change the law on divorce at the time. I really respect her for that.

What next?

In June we will begin shooting an independent movie in Tunisia and I am also preparing a TV series for release in Egypt next year.

From brewing to biologics: Biocon's Kiran Mazumdar-Shaw transforms global health

By **Catherine Jewell**,
Communications Division, WIPO

Kiran Mazumdar-Shaw started out as a Master Brewer and now heads up Biocon, India's largest innovation-led biopharmaceutical company. Ms. Mazumdar-Shaw talks about what it takes to establish a multi-billion dollar global business that is transforming global healthcare and the part played by intellectual property.

Can you tell us how you came to set up Biocon?

I graduated as a Master Brewer from the Ballarat Brewing School in Australia in 1975. My aspiration was to pursue a professional career in brewing. I was unprepared for the hostility and gender bias I faced from the brewing industry in India. This rejection saw me turn to entrepreneurship and, quite by accident to set up a biotech start-up, Biocon, in India, where I leveraged my knowledge of fermentation to produce enzymes and biopharmaceuticals instead of beer.

Was it plain sailing from there on?

No! As a 25-year-old woman with no business experience and limited financial resources, I faced huge credibility and perception challenges. In those days, women were not perceived as good entrepreneurs and biotechnology was unheard of as an industry. I dared to start a business in a male-dominated society and in a sector no one knew.

Photo: Courtesy of Biocon

Kiran Mazumdar-Shaw, Chairperson and Managing Director of Biocon, India's largest, fully-integrated, innovation-led biopharmaceutical company.

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The prevailing business ethos favored low-risk ventures based on services and generic drugs and was averse to risk-ridden, innovation-led businesses like biotechnology. Banks were reluctant to lend me financial support. I struggled to recruit people as professionals feared I could not provide "job security". Suppliers told me they were unwilling to give me credit because they had no confidence in my business abilities. I succeeded against these odds because I understood that all challenges can be surmounted with perseverance and ingenuity.

What prompted you to move into the field of biopharmaceuticals?

Having attained success in enzymes, I used my knowledge of biotechnology to try and disrupt the healthcare industry by introducing affordable biopharmaceuticals for patients who needed them the most. These drugs, known as biologics, are developed from living biological sources, such as tissues, cells and proteins. Indeed, biosimilars are to biologics what generics are to proprietary chemically-synthesized drugs. What spurred me on this mission was the realization that a significant proportion of the world's population does not have access to essential medicines and, where healthcare does exist, it is unaffordable. From wanting to "green the world" through eco-friendly enzyme technologies, my mission changed to "heal the world" by developing affordable life-saving drugs for patients across the globe.

Today, Biocon is India's largest, fully-integrated, innovation-led biopharmaceutical company. Our commercial footprint covers 120 countries. We invest up to 15 percent of our biopharmaceuticals business revenue in R&D. In terms of market share, our capacity to manufacture high-quality, affordable biologics puts us among the top three global biosimilar players for insulin. Up to March 31, 2017, we reported revenue of over USD 600 million and aspire to cross the USD1 billion revenue milestone by March 31, 2019.

What is the current focus of your biologics program?

We have a rich pipeline of novel and biosimilar assets. Biocon is committed to developing affordable therapies for unmet medical needs for chronic non-communicable diseases like diabetes, cancer and autoimmune diseases.

What advantages do biologics have over conventional treatments?

The ability of biologics to target, augment or modulate specific proteins and antigens makes them more effective than small molecule therapies for a variety of medical conditions. Biologic therapies such as insulin, erythropoietin and growth hormones have been invaluable in treating diabetes, anemia and renal diseases. More complex biologics like monoclonal antibodies (MAbs), cytokines and therapeutic vaccines, are transforming the standard of treatment for cancer, autoimmune disorders and other chronic diseases. Currently, 10 of the top 15 drugs by global sales are biologics. By 2020 we expect there will be new biologic treatment options for severe asthma, chronic eczema, atopic dermatitis, and familial hypercholesterolemia across developed markets. And by 2022, biologics are expected to contribute 50 percent of the value of the top 100 drug products sold globally.

Unlike small molecule drugs, novel biologics and biosimilars are large, more complex, and target specific and have stringent production protocols. The time, effort and money needed to analyze and characterize a biologic is up to four times higher than for small molecule drugs. The manufacturing process starts with fermentation, followed by a multi-step purification process. And clinical development extends beyond establishing bioavailability and bio-equivalence to include large and lengthy clinical trials and a complex regulatory approval path. The cost of developing a biosimilar is much higher than for traditional chemically-synthesized generics.

Can you say a few words about the role of innovation in Indian biotech?

The Indian biotech sector's ability to leverage recombinant DNA technology has enabled the delivery of genetically-engineered agricultural crops, biopharmaceuticals, vaccines and enzymes. Today, India is the world's largest vaccine producer and its largest supplier of genetically modified cotton.

But if India is to realize its aspiration to build a USD 100 billion bio-economy by 2025, there needs to be greater synchronization of resources, plans, policies and priorities to create a self-perpetuating virtuous cycle of innovation and business growth.

Translating groundbreaking laboratory discoveries into clinical success is a major challenge for the global biopharmaceutical industry. Biocon is therefore strengthening its scientific R&D team and entering strategic collaborations to further improve its effectiveness in this area.

Biocon's campus in Bangalore. The company recently opened a manufacturing hub in Johor, Malaysia. Biocon is harnessing the power of biotechnology to improve access to affordable essential medicines for chronic diseases.

Photos: Courtesy of Biocon

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As one of India's earliest biologics players, Biocon's innovation-led strategy has created a rich pipeline of novel and biosimilar assets. Today, we have a comprehensive portfolio of 10 disclosed and many more undisclosed molecules straddling insulin and insulin analogs, monoclonal antibodies and recombinant proteins, which address therapeutic areas of diabetes, cancer and immunology.

We are also harnessing our novel drug research capabilities to advance oral insulin and the world's only clinically validated anti-CD6 targeting molecule to treat psoriasis in clinics. And we are also exploring the breakthrough potential of immuno-oncology to develop patient-friendly therapies against malignant tumors. Our research in this area spans many platforms and products from conventional peptides and MAbs to novel fusion MAbs and small interfering RNA (siRNA)-based therapeutics.

Tell us more about some of your ground-breaking innovations.

So far Biocon has taken two novel biologics and six biosimilars from "lab to market". These are affordable therapies for chronic diseases.

Our crowning glory has been the approval by the United States Food and Drug Administration (USFDA) of Ogivri™, the biosimilar Trastuzumab we co-developed with

Mylan, in 2017. We are the first company from India to get a biosimilar approved by the US FDA; it is also the first biosimilar Trastuzumab to be approved in the United States. This puts us in an exclusive league of global biosimilar players and means we can provide an affordable alternative cancer therapy for US patients. We launched our brand of biosimilar Trastuzumab, CANMAb™, in India, in 2014, and have since launched it in various emerging markets. Thousands of patients with HER2-positive metastatic breast cancer are now benefiting from this important drug.

In 2017 we launched, KRABEVA®, a biosimilar Bevacizumab for the treatment of metastatic colorectal cancer and other types of lung, kidney, cervical, ovarian and brain cancers.

In 2016, we became the first Indian company to launch a biosimilar Insulin Glargine in Japan, after having launched it in India in 2009. Recently, the European Medicines Agency Committee for Medicinal Products for Human Use (CHMP) recommended its approval in the European Union.

We were, in fact, the first company in the world to commercialize recombinant human insulin (rh-insulin) manufactured through Pichia fermentation technology in 2004. We now offer a comprehensive portfolio of insulin products to millions of insulin-dependent people with diabetes across the world.

On the novel molecules front, we are pioneering the development, manufacture and launch of biologics in India. In 2006, Biocon became the first company in India to launch Nimotuzumab (BIOMAb EGFR®), a novel biologic for head and neck cancer patients. And in 2013, we launched our path-breaking anti-CD6 monoconal antibody, Itolizumab (ALZUMAb™) for psoriasis patients. Thousands of patients in India are benefitting from these affordable therapies.

Photo: Courtesy of Biocon

Biocon invests up to 15 percent of its annual revenues in R&D. Biocon encourages innovation by fostering a collegial atmosphere that enables the free flow of ideas and collaborative research. The company recognizes innovators through a range of incentives, awards and bonuses.

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What inspires Biocon's commitment to affordable healthcare?

Biocon's model of innovation makes affordability a criterion of success. By leveraging the power of affordable innovation, we see "blockbuster drugs" as a means of expanding access to a billion patients. Our business model is centered on the global right to healthcare through affordable biopharmaceuticals.

What role does intellectual property (IP) play in your business?

IP guides Biocon's R&D and commercialization strategy by enabling protection of our inventions and innovations. It also helps build our credibility and can allow us to benefit from a first-mover advantage. IP also enables product positioning, lifecycle management and asset monetization and valuation. Biocon has consistently created intellectual wealth through an incisive IP strategy that recognizes the innovative potential of our products and processes.

What are the advantages of using WIPO's Patent Cooperation Treaty (PCT)?

IP plays a key role in bringing innovation successfully to market and in value creation. The PCT allows innovation-led businesses like Biocon to seek patent protection in more than 150 countries through a single international patent application. As such, it is a cost-effective option. And because the costs of filing national applications are deferred by 18 months it gives us additional time to formulate our patenting and commercialization strategies for target markets.

Why it is important for women to engage in science and technology?

My father, the late R.I Mazumdar, made me believe that as a woman I could achieve just as much, if not more, than any man.

Science is about making the world a better place. Knowledge has no gender. Greater participation by women in science and technology will ensure that the fruits of research are rapidly converted into useful knowledge that can support human progress. It is an important part of a nation's social and economic development.

Diversity and inclusion are business imperatives and are embedded in Biocon's core values. We believe a diverse workplace promotes a culture of innovation and collaboration. For us diversity is more than promoting gender balance, it is about appreciating different cultures, backgrounds, generations and ideas.

Women scientists bring diversity of thought, creativity and innovation to the table. Scientific organizations realize this and that is opening up more opportunities for women scientists. Indeed, every year, the Biocon Academy helps to bridge the gender skills gap in biotech by training significant numbers of life sciences graduates, including women.

Photo: Courtesy of Biocon

Developing biopharmaceuticals (biologics and biosimilars) is a complex process requiring stringent production protocols. The clinical development of biopharmaceuticals is significantly more costly than for traditional chemically-synthesized generics.

Women are increasingly an integral part of India's scientific community. But, it is true, relatively few women rise to leadership positions in science, technology and business because of the gender discrimination that still exists in our society. Many people still believe that marriage and family must take precedence over career. This explains the gender gap in research across disciplines. Studies show that while many women are studying science in India, few are actually *doing* science or pursuing careers in scientific research.

What is the secret of your success?

I never give up. My mantra is "Failure is temporary. Giving up is permanent." This has helped me steer Biocon through the uncharted waters of innovation-led biotechnology research at a time when the Indian pharma industry's focus was on manufacturing and supplying chemically-synthesized generic drugs. I have succeeded because I set out to realize my dream of making a difference to global health by delivering affordable medicines because I was appalled that a significant proportion of the world's population lacks access to affordable medicines.

What advice do you have for women?

If you want to succeed in this field you need a pioneering spirit. Have the courage of your convictions and persevere in overcoming disappointments and failures. Believe in your aspirations and work with a sense of purpose to attain them.

What plans for the future?

I believe with all my heart that the healthcare industry has a humanitarian responsibility to provide affordable access to essential drug for patients who need them through the power of innovation. My vision is that our research program for diabetes and cancer care will transform treatment paradigms. We are working to develop affordable blockbuster drugs with a "Made in India" label that can benefit a billion patients around the world.

Gender equality in African agriculture: an innovation imperative

"We need to leverage the talents of all innovators, including those of women," says AWARD's Wanjiru Kamau-Rutenberg.

Photo: robertharding / Alamy Stock Photo

By **Wanjiru Kamau-Rutenberg**, Director, African Women in Agricultural Research (AWARD), Nairobi, Kenya

President Barack Obama once highlighted the importance of leveraging the talents of Africa's women using the analogy of a football match. He pointed out that any team that decides to only put half its players on the field is destined to lose the match.

Africa is playing a life-and-death match when it comes to food security, especially in the context of climate change and population growth. The need for the talents of a full team is more urgent than ever.

WOMEN IN AFRICAN AGRICULTURE

Women play a central and critical role in African agriculture. Around 62 percent of them are involved in farming. Women do the bulk of the work to produce, process and market food. They are on the frontline of agriculture. Yet when it comes to shaping research agendas, setting priorities, decision-making and leadership in agricultural research and development, women are heavily underrepresented.They account for just 22 percent of agricultural scientists, with just one in seven women occupying leadership positions in agricultural research.

This means we are playing with only half a team. We need to broaden our focus so that we leverage the talents of women and men. We can no longer afford to wilfully leave women on the side lines. We can no longer ignore their innovation potential. We need to embrace their amazing talents, their ability to solve problems and to innovate.

Women have so much to bring to the table. Their insights and perspectives can help researchers come up with effective solutions to address the unique challenges facing Africa's farmers, many of which are compounded by climate change.

UNLOCKING AFRICA'S AGRICULTURAL POTENTIAL

Africa needs to build a robust and efficient agricultural research and innovation ecosystem. Our ability to make African agriculture more productive, profitable and sustainable depends on it.

In a context of climate change, rapid urbanization and rampant malnutrition, we need to ensure that African "agripreneurs," especially farmers, have access to the type of innovations they need to overcome the unique challenges they face. If we are to feed ourselves and build thriving economies, it is imperative that we increase the pace of agricultural innovation. We can no longer afford to outsource our agricultural research needs. We need to leverage the talents of all innovators, including those of women. Only then will we deliver workable solutions that are relevant to the needs of Africa's farmers. We cannot afford to play with half a team!

Innovation has a critical role to play at every step of the agriculture value chain. Take indigenous vegetables, of which there are many in Africa. Many of them are being overharvested in the wild. There is a serious role for agricultural research to expand our knowledge in this area. How do we ensure they are farmed sustainably? How can we help farmers develop thriving businesses around indigenous plants and vegetables? And how can we help consumers understand the nutritional value of these crops? There is a role for innovation at every step.

TOWARD INCLUSIVE AGRICULTURE-DRIVEN PROSPERITY

Recognizing the need to draw on 100 percent of available talent, over the past decade African Women in Agricultural Research Development (AWARD) has been working to promote inclusive agriculture-driven prosperity for Africa. Our aim is to build an agricultural sector that responds to the needs and priorities of women and men across agriculture value chains. Our training programs are helping to build a critical mass of capable, confident and influential women scientists to lead critical advances in agricultural research and innovation.

Through our flagship AWARD Fellowship initiative, for example, we have strengthened the science, leadership and mentoring skills of 1,158 scientists from over 300 research institutions in 16 African countries. The women who take part in these programs are tackling some of the most intractable problems facing farmers.

They include Filomena Dos Anjos, a 2008 AWARD Fellow and a leading animal health scientist from Mozambique. Ms. Dos Anjos is breaking new ground in the health and husbandry of indigenous chicken which are an important source of protein and income in her country. She works with women and young farmers to promote the use of a thermo-tolerant vaccine against the deadly Newcastle Disease, and on brooding and feeding technologies to improve productivity. Her work is helping to strengthen the food security and incomes of these chicken farmers.

In her doctoral research, Phyllis Muturi, a 2013 AWARD Fellow from Kenya, is focusing on high-yielding drought-tolerant varieties of sorghum, a prized crop and food source in Kenya's drylands. "I see significant improvement and conservation of sorghum in Kenya, with research yielding new sorghum varieties that perform far better than their predecessors in terms of grain yield and stem borer attack resistance," she says.

And Yenesew Mengiste Yihun, a 2015 AWARD Fellow and agricultural engineer from Ethiopia, is working with smallholders to improve water management practices. "Research is important to alleviate problems for rural farmers," says Dr. Yihun. "If we produce more, the country will be self-sustained and food secure." Dr. Yihun provides smallholder farmers with practical solutions to

Photo: Peter Alexander / Alamy Stock Photo

"Women do the bulk of the work to produce, process and market food. They are on the frontline of agriculture in Africa," notes Wanjiru Kamau-Rutenberg.

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Photos: Courtesy of AWARD

2008 AWARD Fellow Filomena Dos Anjos from Mozambique examines indigenous chickens. Her research centers on improving the quality and health of indigenous poultry.

Women play a critical role in African agriculture. Around 62 percent of them are involved in farming yet they are heavily underrepresented when it comes to shape agricultural research and development agendas.

Christine Onyango (second from left) Senior Lecturer at the Faculty of Agriculture at Kenyatta University teaches her students about milk processing.

manage their resources more efficiently. "I respect their indigenous knowledge and show them how they can use irrigation to make their efforts more successful," she says.

As a recent review of the gender gap in African agricultural research capacity in the *Journal of Gender, Agriculture and Food Security* (April 27, 2017) confirms, training female scientists in the areas of mentoring, leadership and scientific research has a transformative effect not just on each scientist's own career, but on the performance of their institution.

INTELLECTUAL PROPERTY AS A DRIVER OF AGRICULTURAL INNOVATION

At AWARD we recognize that intellectual property (IP) has a key role to play in ensuring that agricultural research translates into practical solutions that get into the hands of farmers and other actors along agriculture value chains. IP unlocks the transformative potential of agricultural research by making it available to and attractive for private sector players to develop and commercialize technological innovations for widespread distribution and uptake by farmers and others.

The potential of IP to drive the transformation of African agriculture has been recognized at the highest levels of government. In 2016, the African Union Heads of State and Government endorsed the Dakar Declaration on Intellectual Property for Africa. The Declaration recognizes "the importance and relevance of intellectual property for innovation and creativity in the knowledge-based economy." It further emphasizes "the role of IP in advancing innovation for sustainable agricultural technologies, for the use and transfer of environmentally sound technologies, and to help guarantee food security… and combat the negative effect of climate change…" And it calls upon the World Intellectual Property Organization (WIPO), as the global forum for IP services, policy, information and cooperation, "to lead the development of a balanced and effective international IP system that enables innovation and creativity for the benefit of all."

In this context, we need to redouble efforts to ensure that Africa's female scientists have a place at the table and play an active role in shaping the continent's agricultural landscape.

A GENDER GAP IN INNOVATION

Research by WIPO indicates that while globally the number of women using the international patent system has increased over time, it will be decades before we see women patenting their innovations at the same rate as their male counterparts. These data show that in 2015, just one-third of international patent applications filed featured the name of a women inventor. We already know that women are less likely to be named as authors in scientific publications. Now, there is evidence of a yawning gender gap in the use of WIPO's Patent Cooperation Treaty (PCT), which facilitates the process of obtaining patent protection in more than 150 countries.

While more research is needed to establish the extent of the IP gender gap in Africa, the low proportion of women in science and technology across the continent, and generally low levels of patenting activity, suggest that the research done by women in Africa is not finding its way into the hands of those who most need it, the farmers, the majority of whom are women.

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Photo: sanjeri / E+ / Getty Images

"Innovation has a critical role to play at every step of the agricultural value chain," says Wanjiru Kamau-Rutenberg.

Photo: Steve Debenport / E+ / Getty Images

Existing gender gaps in agricultural research and the use of IP have potentially dire consequences for Africa's agriculture and food security. The continent is facing intense challenges. We need to support innovation to find effective solutions. Yet we are saddled with a system that fails to make efficient use of the talents of at least half the population. We have a system that impedes the participation of women in scientific research and fails to support female scientists in the practical application of their research at the farm gate and across agriculture value chains. Much of their research simply gathers dust on a shelf when it could actively support agricultural and agribusiness development across the continent.

WE NEED TO ACT NOW

Gender is attracting a great deal of attention, and that is a good thing. But we still need to find ways to ensure that more women are able to have an equal voice in developing innovative technologies and creative solutions to address the daunting challenges we face. WIPO data suggest that at current rates, we will not see gender parity in the use of the international patent system until 2070. We cannot wait that long!

Our problems are far too pressing. Our survival and future prosperity hinges on making the best use of all the talent we have and leveraging it to produce the technologies we need to boost efficiency, productivity and profitability across agriculture value chains.

That is why in 2017, in a further attempt to move the dial on gender in African agriculture, AWARD partnered with WIPO in holding a regional conference on Innovation and Intellectual Property as Engines for Competitive Agribusiness: Empowering Women Researchers and Entrepreneurs in Africa. The conference brought together over 200 African women agricultural scientists and agribusiness owners. It was an invaluable opportunity for them to learn more about the IP system: how IP information can support their research and how IP rights can be used to ensure that their high-quality research translates into marketable solutions that are widely available at the farm gate. Our participation in this important event, which was organized with the support of the Governments of France, Morocco and Japan, is part of our ongoing commitment to ensuring that the full potential of Africa's talent base is realized.

By utilizing women's talents to the full, we will be better placed to leverage science, technology and innovation to solve the chronic and pressing problems facing the continent, particularly with respect to food security and climate change.

Nursery feeding made simple

By **Mandy Haberman**, founder, Haberman Baby

British inventor and entrepreneur Mandy Haberman is a 21st-century mother of invention. The Haberman® Feeder, the Anywayup® non-spill toddler trainer cup and the Suckle Feeder have revolutionized the nursery industry and brought relief to millions of families around the world. She shares her story and explains how intellectual property (IP) is the backbone of her company.

HOW IT ALL BEGAN

I didn't grow up dreaming of becoming an inventor. I was creative and studied at Hornsey College of Art in the United Kingdom, followed by a degree in graphic design from Saint Martin's School of Art in London. But the drive to create products that solve problems was in my blood. The metamorphosis from graphic designer to inventor took place after our third child, Emily, arrived in 1980. She was born with Stickler's Syndrome and among other problems, had severe difficulty feeding. After four months with a nasogastric tube, it was essential that she start feeding orally to be discharged from hospital. No available bottles worked, so I had to improvise. In my case, necessity really was the mother of invention. When Emily was two years old, I started developing my improvised prototype into a marketable product which became known as the Haberman Feeder. Initially sold by mail-order from my kitchen table, it has now been used for over 35 years in hospitals around the world to help babies with feeding difficulties and improve their families' quality of life.

All my subsequent inventions have begun with the identification of a problem that needs solving. For example, with three small children I was well aware of the inadequacy of trainer cups. Drinks spilled, making puddles and stains everywhere. I spent half my life mopping floors! Watching someone else's toddler run across a friend's cream carpet, leaving a trail of blackcurrant juice in her wake was the inspiration for another invention, the Anywayup® Cup, which seals automatically as soon as it leaves a child's mouth.

My latest invention is the Haberman Suckle Feeder. This, too, was a response to an identified problem: medical research has proven that babies fed by bottle with breast milk or formula are at significantly increased risk of developing obesity in later life.

Self-regulation of appetite is established very early on in life. Bottle feeding typically causes over-feeding and compromises self-regulation, setting a lifetime pattern for over-eating. By 26 weeks of age, 99 percent of babies in the United Kingdom will be using a bottle at least some of the time, so it was important to find a solution. That is why we came up with the Haberman Suckle Feeder. It is designed to emulate breastfeeding, enable naturally paced feeding and reduce the long-term health risk factors for obesity, heart disease and diabetes associated with other bottle-feeders.

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Photo: Courtesy of Haberman Baby

The Haberman® Feeder, the Anywayup® non-spill toddler trainer cup and the Suckle Feeder developed by British inventor and entrepreneur Mandy Haberman have revolutionized the nursery industry and brought relief to millions of families around the world.

THE BUZZ OF INVENTION

Reaching a simple and elegant solution that will make a difference to people's lives gives me a real buzz. I will spend months, sometimes years, working on a project then, when I get that "lightbulb moment," I know I've got it right.

Being an inventor and an entrepreneur suits my way of working. I'm obsessive and will often be awake in the early hours of the morning, writing notes in the dark. I've even been known to jot down ideas while waiting for traffic lights to change. Being an inventor is more of a lifestyle than a career. I literally go with the flow.

THE ROLE IP PLAYS IN OUR BUSINESS STRATEGY

All my inventions have been patented. When I patented my first invention it was a steep learning curve. For the Haberman Feeder I secured patent and trademark rights in the United Kingdom only, but was still able to negotiate a five-year global licensing deal with a Swiss company based on know-how. The product had a strong reputation in the medical world, particularly in the United States. As the expiry date for that initial license neared, I applied for a trademark in the United States for the name "Haberman" and then negotiated a trademark license with their US sister company.

I was more IP aware when it came to protecting my second invention, the Anywayup® cup, a leak-proof children's trainer cup with valves to control the flow of liquid. I acquired a raft of IP rights including trademarks, 3D trademarks and patents. In hindsight, I wish I had also registered design rights, as several of my cups became iconic designs. For this invention, I knew I needed secure patent rights in multiple countries, not just the United Kingdom, so I opted to use the Patent Cooperation Treaty (PCT) to apply for patents in my target markets. This worked well and, in addition to selling products under my own brand, I also exploited the IP through licensing. Approximately 50 million cups are sold each year under license.

My most recent product, the Haberman Suckle Feeder, is also patented in all significant markets. We plan to follow a similar strategy and exploit the IP through licensing in addition to direct sales. Currently, we have licenses in Eastern European countries. Asia and the United States are next on the agenda.

IP has been the backbone of my business for over 35 years. We develop IP, bring the resulting products to market then further exploit those rights through licensing. This allows us to generate significant value from the sales of companies that would otherwise be competitors. And that is one of the great benefits of IP.

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Photos: Courtesy of Haberman Baby

"All my inventions have begun with the identification of a problem that needs solving," says Mandy. Haberman. The Anywayup® cup is a leak-proof children's trainer cup with valves to control the flow of liquid.

CHALLENGES

Building a business based on creating and exploiting IP is challenging, particularly for a start-up with finite resources. Even with patents in place, established, well-resourced competitors have copied my ideas and grabbed market share, devastating the sales potential of my businesses.

The Anywayup® cup was a rapid commercial success. It was a small invention but it answered a very real and long-felt need. About 18 months after its launch, Jackel International (brand name Tommee Tippee), the then UK market leader in children's cups, infringed my patent. Going to the High Court to enforce my rights was an exceedingly difficult decision. When the infringement took place, I was not operating as a limited liability company, so if we lost the case I risked losing my house. Fortunately, we won at first instance and an acceptable settlement was reached shortly before the scheduled appeal. Establishing the validity of my UK patent in court gave me the confidence to deal with infringements elsewhere, and enforcing my rights in the United States led to some very valuable licensing deals.

I now have a reputation in the industry so competitors think twice before infringing my patent rights.

WHY DESIGN MATTERS

We launched the Anywayup® cup in rather a rush. I exhibited my working model prototypes at two nursery-industry exhibitions simply to test the market. To my surprise, we received advance orders worth GBP 10,000, so we had to get into production very rapidly. There was no time or budget to consider aesthetics. Despite that, it was a success. We sold half a million cups in the first year, and the business was in profit.

The Haberman Suckle Feeder designed to enable naturally-paced feeding.

"The best advice that I can give to young women with aspirations to invent, create and set up a business is believe in yourself."

Mandy Haberman, founder, Haberman Baby

While the Anywayup® cup contained breakthrough technology that parents desperately wanted, it looked no different from the ordinary trainer cups available at that time. I felt sure that if it stood out visually from the crowd, sales would grow much faster.

That led me to work with Sebastian Conran to re-design the Anywayup® range. He gave it the necessary "wow" factor and our sales really took off, achieving 40 percent of the UK market. We grabbed market share before our competitors had time to draw breath.

You can have the greatest technology in the world but unless it catches the eye of consumers, they won't pick it up off the shelf.

KEYS TO SUCCESS

My success has been down to six things:

- identifying the right problem to solve;
- having enough awareness of IP to ensure that my ideas were adequately protected in key markets;
- total commitment to bringing the product from concept to market;
- building the right team;
- the courage to enforce my rights; and
- belief in my product and myself.

WHY IS IT IMPORTANT TO ENCOURAGE GIRLS AND WOMEN IN INNOVATION AND CREATIVITY?

Women account for over half the population, and while they are increasingly part of invention teams – female inventorship has risen by 16 percent in the UK in the last 10 years – they rarely patent independently. According to a recent study by the Institute for Women's Policy Research, women held fewer than one in five patents in 2010, and only 8 percent of women are primary inventors.

This patent gender gap seems odd to me because women are naturally innovative. We find practical solutions to problems on a daily basis in family life. The problem is that too few women pursue studies or careers in patent-intensive subject areas. Clearly, more needs to be done to motivate and attract women into engineering, science, computer science, technology and innovation so that they can direct their talents to solving important social and scientific problems.

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Certainly, in the UK there are fantastic resources, such as the British Library's IP and Business Centre, to support innovation and entrepreneurship. Women have no shortage of creative and entrepreneurial ideas. So what is holding them back?

Invention, innovation and entrepreneurship are most often speculative. It can take years of research, development and preparation before a revenue stream is achieved. Where patents are involved, costs ramp up rapidly, often before any income can be derived. This can be managed more easily in established organizations where women will generally work within a team. However, women with young families are frequently micro start-ups, working from home. They pursue their ideas on a shoestring budget and are often self-funded. Financing all of this and childcare costs, in order to free up time to focus on work, is often prohibitive. There are plenty of business support services available but the practicalities and financial scope for women to take advantage of them is often limited.

I would like to see more women being given the support and time they need to develop their IP and bring ideas to market. Perhaps policymakers could develop a way to subsidize childcare support for female inventors and start-up entrepreneurs, beyond that currently provided by the State.

The landscape will gradually change, as generations of girls complete their education with a firm expectation of gender equality. If female role models are given prominence and girls are sufficiently encouraged, more women will no doubt pursue careers in sciences, computer science, technology and entrepreneurship. However, to encourage more young people (male and female) to invent, patent and generally achieve the full value of their creative potential, IP education needs to be seen as an essential part of the curriculum in all subjects where IP features in its various forms – engineering, art/design, computer science, literature, medicine, health sciences, music and more – at all universities, business schools and higher education establishments. It grieves me that year after year, our wonderful design schools publicly display work of significant potential value without safeguarding students' IP.

ADVICE TO ASPIRING INVENTORS

The best advice that I can give to young women with aspirations to invent, create and set up a business is believe in yourself. There will be challenges, pitfalls as well as soaring highs but in the world of invention and entrepreneurship, there are no glass ceilings. The only limits to your ambition are those you impose on yourself. Any problems or difficulties that you might encounter along the way are not gender biased – it's tough for everyone! If you have an inspired idea that you believe in, get out there and do it. You'll never look back.

Women and the international patent system: encouraging trends

By **Bruno Lefeuvre** and **Julio Raffo**, Economics and Statistics Division, **Kaori Saito**, Gender and Diversity Specialist, WIPO and **Gema Lax-Martinez**, University of Lausanne, Switzerland

Women contribute to all fields of creativity and intellectual endeavor, yet their achievements often remain hidden from view.

The gender gap is all-pervasive. Even in advanced economies, women come up against the infamous "glass ceiling," finding it hard to climb to the top; and if they do, they are often paid less than their male counterparts. The gender gap is also evident in education. Although progress is being made in encouraging girls to take up so-called STEM (scientific, technical engineering and mathematical) subjects, and many go on to obtain first and second degrees in those subjects, few of them enroll in or graduate from PhD programs.

If we track women throughout their career as scholars or inventors, the gap expands further. Proportionally fewer women graduating with PhDs take up research work. When they do, they earn less and have a hard time moving up the hierarchy. Evidence also shows that the share of women publishing scientific papers is lower than those employed as researchers. In turn, the proportion of women using the patent system remains low compared with the proportion of scientific papers they publish each year. Some scholars refer to this pattern as the "leaky pipeline."

Recognizing the scale of this gender imbalance, the United Nations General Assembly and its 193 member states adopted the 2030 Agenda for Sustainable Development. That Agenda took effect on January 1, 2016. It underscores that gender equality and the empowerment of women and girls will contribute to progress across all the Sustainable Development Goals and targets.

As a specialized agency of the United Nations, the World Intellectual Property Organization (WIPO) is committed to promoting gender equality in the field of intellectual property and has taken steps to raise the profile of gender equality, and indeed, mainstream it, within the day-to-day running of the Organization. These steps include

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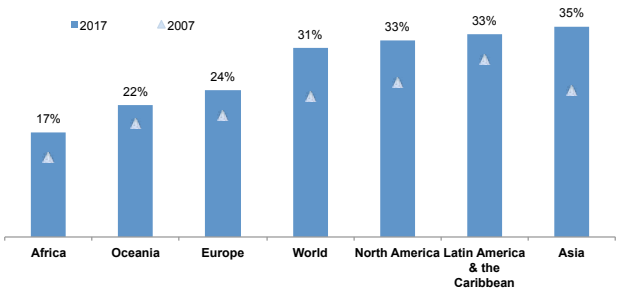
the disaggregation of intellectual property (IP) data by gender as a key performance indicator for policies aimed at promoting innovation and creativity and spurring economic, social, and cultural development.

To achieve this objective, WIPO compiled a worldwide gender-name dictionary which includes 6.2 million names for 182 different countries, with a view to identifying the gender of inventors, designers and other IP users. WIPO maintains and periodically updates this dictionary to increase the global scope of its IP and gender statistics. Research and statistics on patents and gender are reported annually (see the *PCT Yearly Review* and the *World Intellectual Property Indicators*).

WIPO's data on patents and gender reveal a very encouraging trend. Gender participation in the IP system is improving. Virtually all indicators related to gender balance in WIPO's Patent Cooperation Treaty (PCT) or the patent system as a whole show some degree of progress in recent decades. This progress is observed in most countries, in all technical fields and in both academic institutions and companies, although at different rates.

Figure 1: The share of international patent applications with at least one woman inventor by region



All regions of the world have observed an increase in the share of PCT applications with at least one woman inventor named in the application initially filed with a patent office, the so-called "country of origin." Asia, North America, and Latin America and the Caribbean outperform the global average.

Standard economic performance indicators such as GDP per capita do not explain the gender gap. Many middle-income countries, such as Brazil and Mexico, have a better gender balance in international patenting than some high-income countries, such as Canada, Denmark, and Finland. In contrast, Germany, Italy, Japan, and South Africa have the greatest gender gap among the top listed origins.

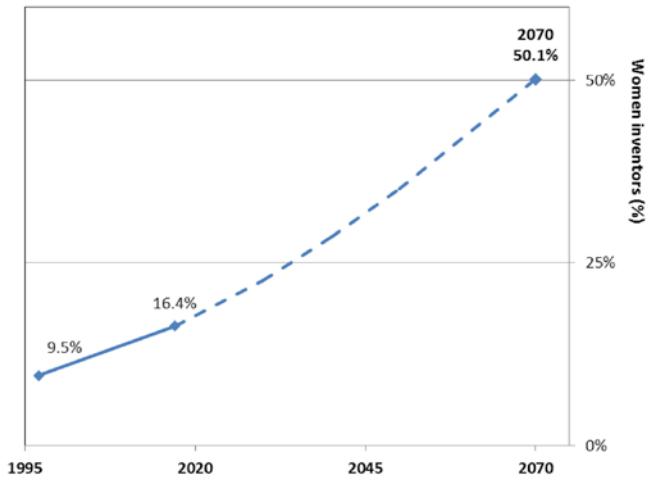
The participation of women in the international patent system varies across technological fields. This explains, in part, the regional and national differences. Technologies related to the life sciences are often among the most gender-balanced fields. Women are more likely to patent in biotechnology (58 percent of international applications have at least one woman inventor), pharmaceuticals (56 percent), organic fine chemistry (55 percent), and food chemistry (51 percent). Conversely, engineering and mechanical-related technologies are among the least gender-balanced. Very few women participate in patents related to mechanical elements (14 percent), engines (15 percent), civil engineering (15 percent), machine tools (16 percent), or transport (17 percent).

The participation of women also varies between the public and private sectors. Universities and public research organizations have a higher share of PCT applications featuring women inventors than the business sector. In 2017, around 51 percent of all PCT applications filed by the academic sector included women inventors, compared to only 30 percent for the business sector. But although the academic sector has the highest participation rate for women, the business sector accounts for the largest absolute number of women inventors.

Within the private sector, the majority of the top PCT applicants saw an increase in the share of PCT applications with women inventors. Those with higher levels of participation by women inventors include LG Chemical, Hoffman-La Roche, L'Oréal, Dow Global Technologies, Henkel, Procter & Gamble, Samsung Electronics, and BOE Technology. The more gender-balanced academic institutions include the Electronics & Telecommunications Research Institute of Korea and Shenzhen Institute of Advanced Technology of China. Outside China and the Republic of Korea, we observe higher participation of women inventors from Tel Aviv University (Israel), the Agency of Science, Technology and Research (Singapore), the *Consejo Superior de Investigaciones Cientificas* (Spain), and the *Institut National de la Santé et de la Recherche Medicale* (France).

Notwithstanding the positive upward trend in the participation of women inventors in the international patent system relative to men, the picture remains far from balanced. Assuming current progression rates, we will not see gender balance in patenting until 2070.

Figure 2: When will we achieve gender balance?



However, the participation of women in patenting is not equally distributed across countries or regions, nor is it equal in absolute terms. In this sense, women patenting in Germany, Japan, and the United States are expected to determine the global progression of gender balance to a great extent in the following decades. Similarly, while some technology fields show more progress than others, patenting in those fields may also be growing faster than others. The growth in patenting in the life sciences and ICT-related technologies, for example, will influence gender balance in future years. Finally, policies that successfully promote gender balance in the business sector – which is responsible for filing the bulk of patent applications – may have greater impact on the overall gender balance than those implemented in academia.

Ultimately, however, gender balance in the patent system is likely to come about as a result of a long social process that accumulates balances and imbalances from previous institutional settings. The nature of the evolution of gender balance in different scientific fields, higher education institutions and the most innovative industries around the world will inevitably shape the gender balance of the international IP system in the future.

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