Flexible Display Patent Landscape and Implications From the America Invents Act

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Abstract

Developments in flexible display technology are expected to create significant new market opportunities for consumer electronic and commercial products. The potential economic impact of these new products is evidenced by the rapid growth around the world in patent application filings directed to flexible display technology areas. At the same time, changes to U.S. patent law, practice, and strategies have been triggered by the enactment of the Smith-Leahy America Invents Act. This article describes the patent landscape for flexible displays and ways in which newly enacted changes in patent law can facilitate the development of flexible display patent portfolios.

I. Overview of the Flexible Patent Display Landscape.

a. What Are Flexible Displays?

Flexible displays are displays that can be bent, rolled, folded and/or twisted in many different configurations. As early as the 1970s, flexible display technology was used in e-paper displays, which were used to mimic the pliant properties of paper but with the capacity to display digital images.[1] Today, largely led by Asian companies, research and development has moved past early e-paper display technology and has rapidly evolved into new materials, manufacturing methods, control means and integration schemes. Today's applications of flexible displays are predominately in consumer electronic products such as mobile devices, TV screens, and similar video and multimedia products.

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[1] The technology behind e-paper was pioneered in the 1970s by Nicholas Sheridan at the Xerox Palo Alto Research Center.

In mobile devices, as compared to their glass-enclosed counterparts, flexible displays can prevent cracking and shattering when the device is dropped. In addition, as compared to its glass-enclosed counterparts, flexible displays are lighter and thinner, thus making it an attractive display option for thinner and lighter mobile devices.

In consumer electronic devices, flexible displays can be integrated as a curved display in TVs to enhance a user's immersive experience. Particularly, the curved display can provide a wrap-around viewing experience, thus immersing the user as if in an amphitheater. The user's viewing experience is also enhanced since, due to the curved display, the distance from the user to any point on the display can be the same. Thus, as compared to flat-display TVs, those with flexible displays can provide more realistic images with reduced color or image distortion.

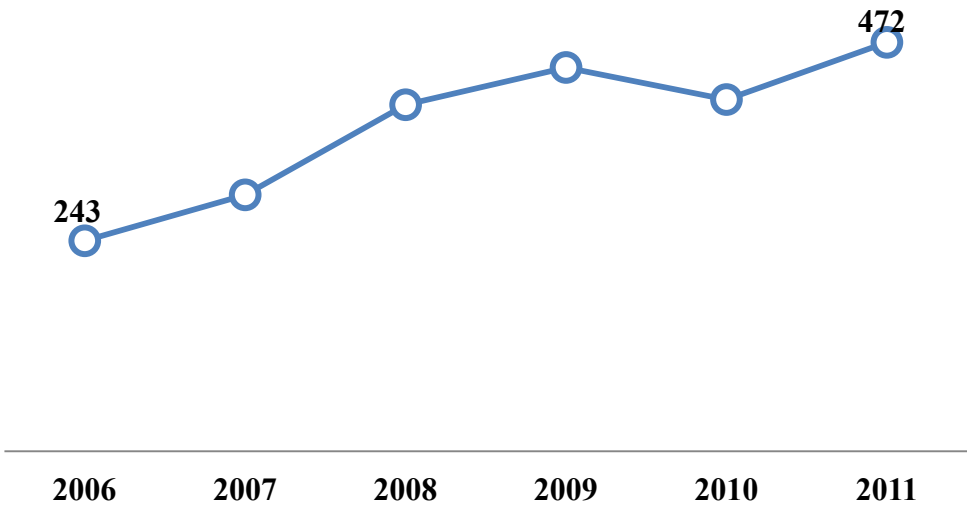
Mobile devices and TVs are just two of the product categories in the rapidly-growing list of applications of flexible displays. The patent landscape of mobile device and TV flexible display applications, as well as other flexible display applications, are discussed in detail below.

b. Who Are the Flexible Display Patent Holders?

i. Scope of flexible display patent landscape analysis.

This article explores the patent landscape of flexible displays for worldwide patent applications filed between 2006 and 2012. The flexible display patent applications were identified using a keyword search in the Derwent World Patents Index title field.[2] Though the authors recognize that the keyword search may not provide an exhaustive list of flexible display patent applications, it does however provide insight on general trends in this technology space. For example, from Fig. 1 below, it is apparent that new flexible display patent application filings nearly doubled between 2006 and 2011, reflecting significant activity in flexible display research and development.

Fig. 1 Flexible Display Patent Application Filings Between 2006 and 2011



[2] *See* Derwent World Patents Index, at http://thomsonreuters.com/derwent-world-patents-index/.

Three aspects of the flexible display patent landscape are explored in the sections below:

- Flexible display patent landscape by location.
- Flexible display patent landscape by company/manufacturer.
- Flexible display patent landscape by technology area.

ii. Flexible display patent landscape by location.

The United States and Europe trail Asia in flexible display patent application filings. Fig. 2 illustrates flexible display patent application filings for the top 10 locations.[3] Korea, Japan, Taiwan and China account for over 80% of the patent application filings. Among the Asian countries, South Korea dominates the flexible display patent landscape with over 1400 patent application filings, which accounts for 50% of the flexible display patent application filings among the top 10 locations. This is over four times the number of patent application filings in the United States. Europe, United Kingdom and Germany trail South Korea and the United States and cumulatively account for approximately 2% the flexible display patent application filings among the top 10 locations.

Fig. 2 Number of Flexible Display Patent Application Filings for Top 10 Locations

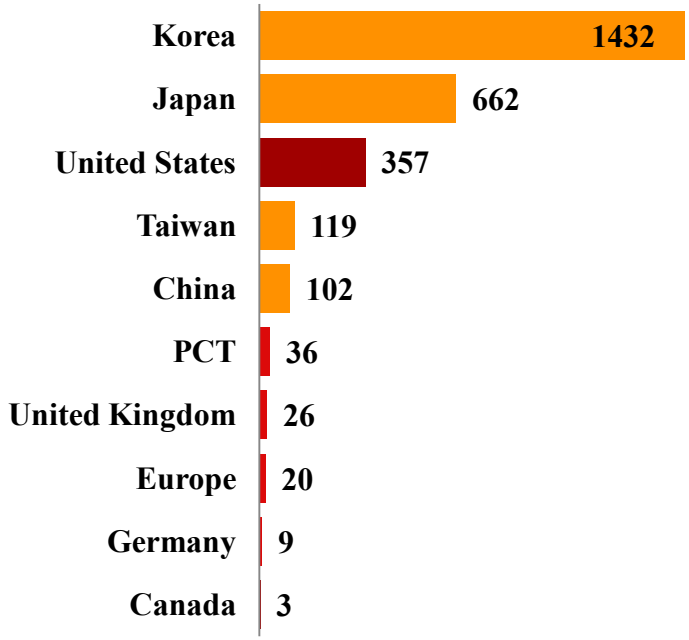


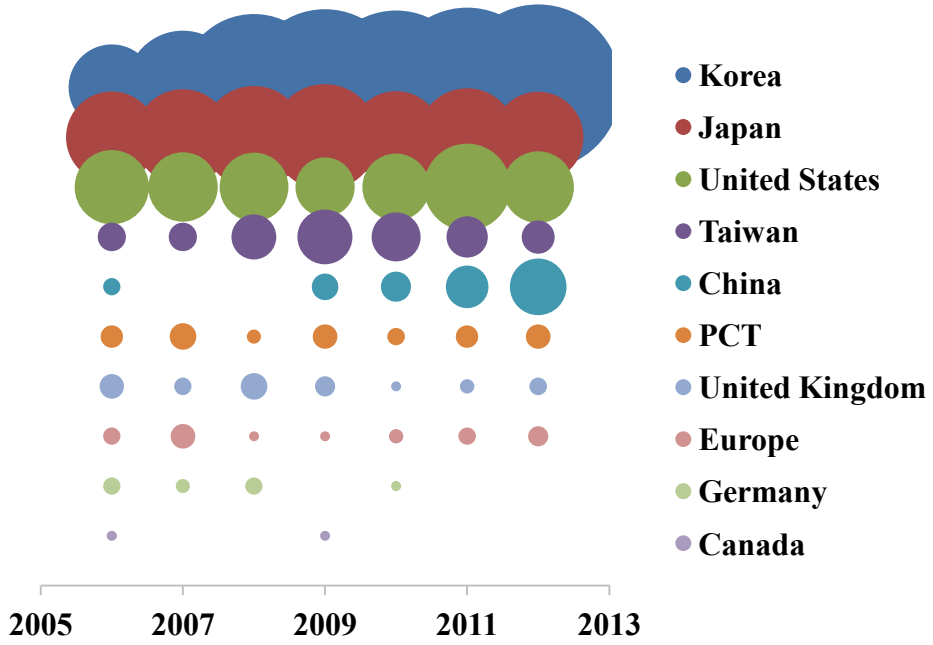
Fig. 3 illustrates a timeline of flexible display patent application filings for each year between 2006 and 2012 in a cloud representation. Larger clouds represent a higher number of flexible display patent application filings than smaller clouds. For example, based on the search criteria used for this study, South Korea has had the largest number of flexible display patent application filings year-over-year, followed by Japan. Though the United States has a consistent number of flexible display patent application filings year-over-year (as indicated by the relative similarities in

[3] Patent Cooperation Treaty (PCT) patent application filings are included and treated as a filing "location" for the purposes of this analysis.

size of its cloud representations for the same time period), the United States trails South Korea and Japan.

The other top 10 locations trail Korea, Japan and the United States. From 2007-2009, China had no flexible display patent application filings. Similarly, in 2009, 2011 and 2012, Germany also had no flexible display patent application filings. Further, between 2006 and 2012, Canada had a statistically insignificant number of flexible display patent application filings. In fact, for 2007, 2008 and 2010-2012, Canada had no flexible display patent application filings.

Fig. 3 Timeline of Activity for Top 10 Locations



Referring to Fig.3, the compound annual growth (CAG)[4] for flexible display patent application filings can be assessed. With regard to year-over-year growth, the relative size of each cloud for China and Korea increased the most as compared to the other locations. This indicates a positive CAG for these locations. The relative size of each cloud for the United States is approximately the same, thus indicating minimal CAG. On the other hand, Germany shows a negative CAG as indicated by its cloud representation year-over-year (including statistically insignificant flexible display patent application filings in 2009, 2011 and 2012).

[4] The CAG refers to the year-over-year growth rate of numerical values over a specified period of time. The CAG is calculated by taking the nth root of the total percentage growth rate, where n is the number of years in the period being considered.

iii. Flexible display patent landscape by company/manufacturer.

Samsung Display Co. and LG Display Co., both South Korean companies, lead in flexible display patent application filings among their Asian counterparts. According to the illustration in Fig. 4, Samsung and LG account for over 50% of the patent application filings for the top 10 Asian patent applicants. Fujifilm is a distant third to Samsung and LG. It has less than a third of the number of patent application filings as LG and approximately a quarter of the number of patent application filings as Samsung.

Fig. 4 Number of Flexible Display Patent Application Filings for Top 10 Asian Applicants

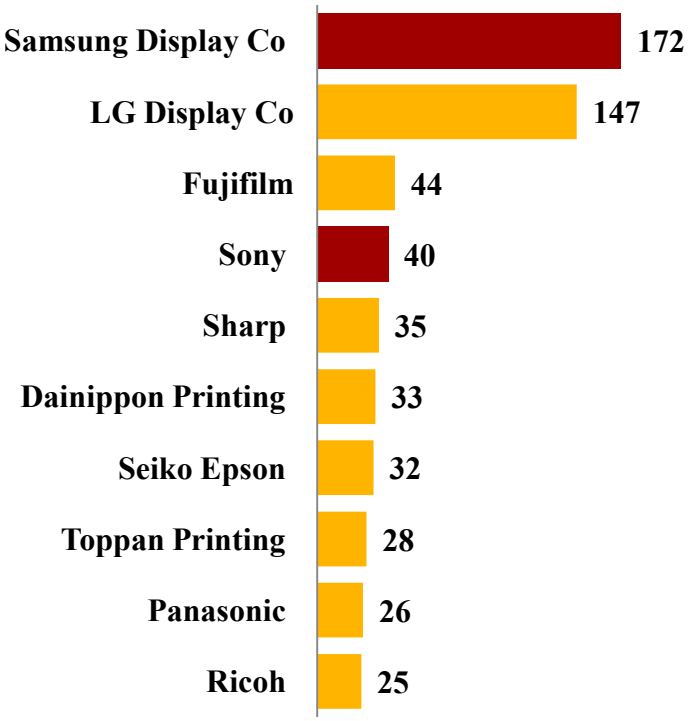


Fig. 5 illustrates a timeline of flexible display patent application filings for each year between 2006 and 2012 in a cloud representation for the top 10 Asian patent applicants. Similar to the cloud representation in Fig. 3 above, larger clouds represent a higher number of flexible display patent application filings than smaller clouds. From 2006 to 2012, Asia's top 10 patent applicants filed flexible display patent applications every year during the time period of this study. Among Asia's top 10 applicants, Samsung had the highest CAG while, on the other hand, Seiko Epson had the lowest CAG.

Fig. 5 Timeline of Activity for Top 10 Asian Applicants

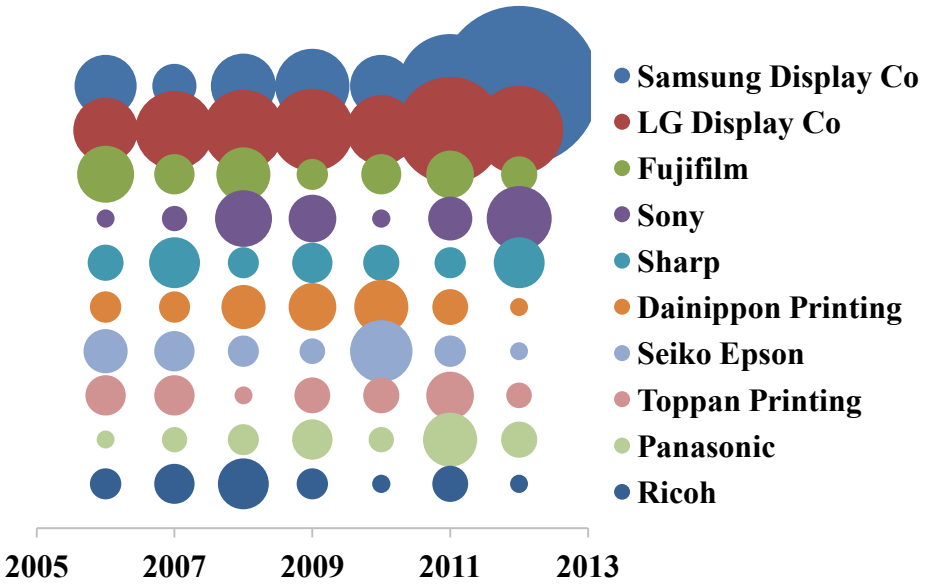


Fig. 6 shows that, among U.S. and European companies, Polymer Vision Ltd.[5] and Apple Inc. lead the pack in flexible display patent application filings among their counterparts. Research In Motion Ltd.[6] is a close third to Apple and a distant third to Polymer Vision. Nokia Corp., Immersion Corp., Hewlett-Packard Co. and Plastic Logic Ltd. round off the top six US-EU flexible display patent applicants. Since closing its doors in late 2012, it is anticipated that Polymer Vision will not maintain its top flexible display patent applicant status.[7]

[5] Polymer Vision was founded in 2006 (as a spin-off from Philips Electronics) with its headquarters in Eindhoven, the Netherlands. *See* http://investing.businessweek.com/research/stocks/private/snapshot.asp?privcapId=10091425. In 2009, Wistron Corp., a Taiwanese manufacturer, acquired Polymer Vision. *See* http://www.plusplasticelectronics.com/consumerelectronics/wistron-winds-down-polymer-vision-69544.aspx.

[6] Research In Motion changed its name to Blackberry, Ltd. in 2013.

[7] In late 2012, Wistron closed Polymer Vision but retained its intellectual property. *See* http://www.plusplasticelectronics.com/consumerelectronics/wistron-winds-down-polymer-vision-69544.aspx.

Fig. 6 Number of Flexible Display Patent Application Filings for Top 10 US-EU Applicants

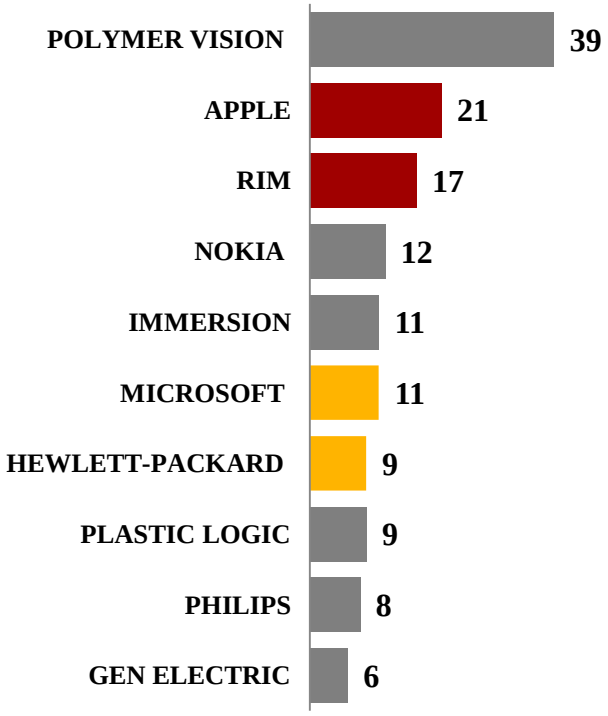
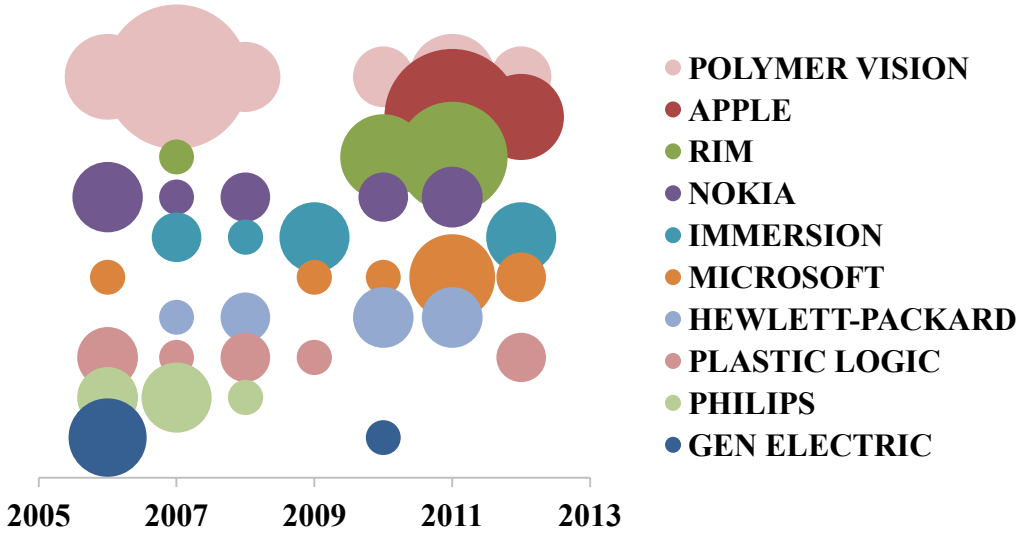


Fig. 7 illustrates a timeline of flexible display patent application filings for each year between 2006 and 2012 in a cloud representation for the top 10 US-EU patent applicants. Similar to the cloud representation in Fig. 3 above, larger clouds represent a higher number of flexible display patent application filings than smaller clouds. Unlike Asia's top 10 applicants, the US-EU top 10 applicants did not maintain filing of flexible display patent applications for each year of the study period. For example, Apple did not file its first flexible display patent application till 2010, whereas RIM had flexible display patent filings in 2007 and 2010-2012 but no patent filings in 2006, 2008 or 2009. However, Apple has the highest CAG and RIM has the second highest CAG among the top 10 US-EU flexible display patent applicants.

Fig. 7 Timeline of Activity for Top 10 US-EU Applicants



iv. Flexible display patent landscape by technology area.

As illustrated in Fig. 8 below, among flexible display product areas, flexible display patent applications are mostly directed to mobile phones. Among the top 10 product areas for flexible displays, mobile phones account for over 30% of the flexible display patent applications. TV, video, and multimedia devices are second to mobile phones and account for over 20% of the flexible display patent applications. Laptop/portables/personal digital assistants (PDAs) and e-books/e-paper round off the top four product areas associated with flexible display patent applications.

Fig. 8 Number of Flexible Display Patent Application Filings per Technology Area

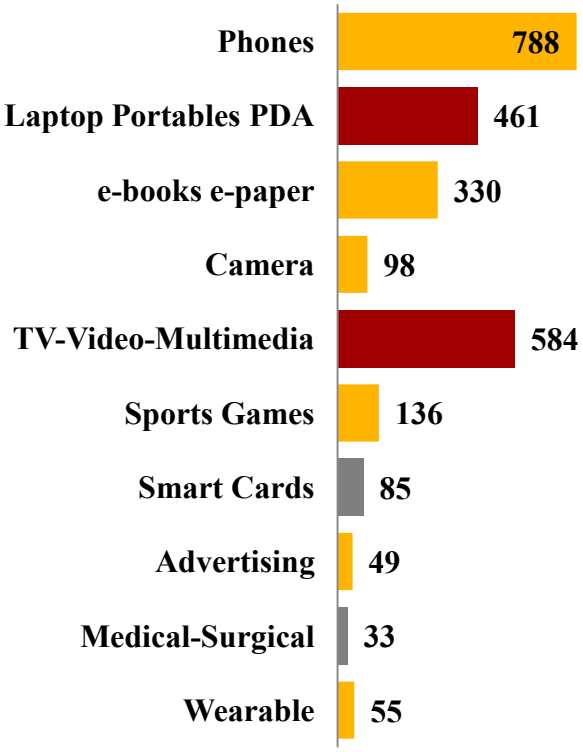
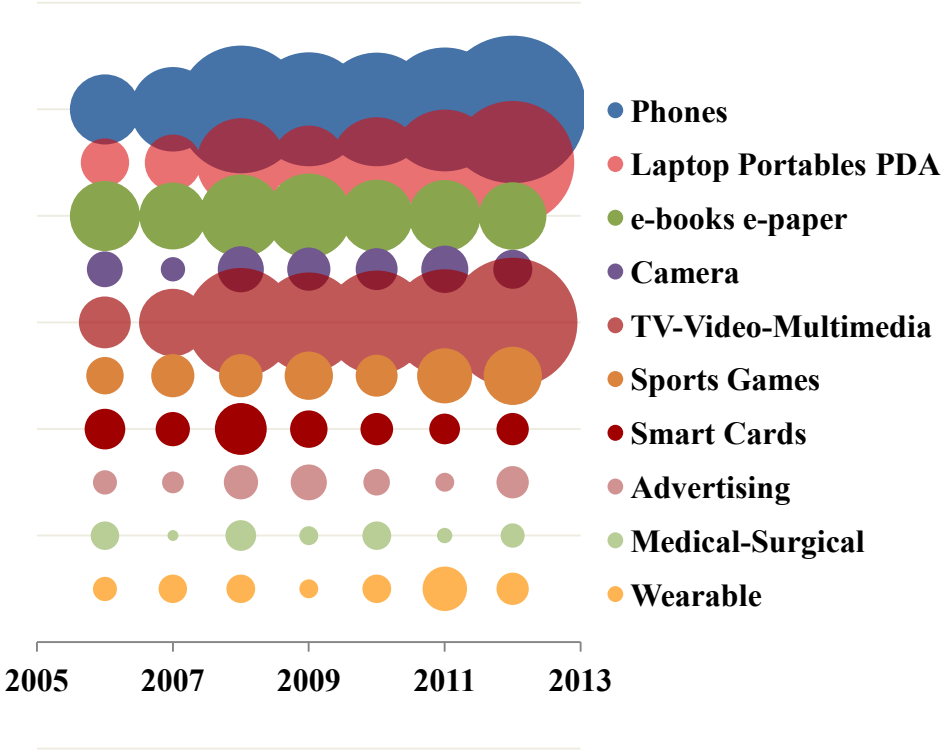


Fig. 9 illustrates a timeline of flexible display patent application filings for each year between 2006 and 2012 in a cloud representation for the top 10 product areas for flexible display patent applications. Similar to the cloud representation in Fig. 3 above, larger clouds represent a higher number of flexible display patent application filings than smaller clouds. From 2006 to 2012, flexible display patent application filings were maintained year-over-year for the top 10 product areas. Among the top 10 product areas for flexible display patent applications, laptop/portables/PDAs and TV, video, and multimedia product areas with the highest CAG, with mobile phones having a CAG not too far behind. The smart card and medical-surgical product areas have the lowest CAG.

Fig. 9 Timeline of Activity by Technology Area



c. Summary of Flexible Display Patent Landscape.

Among the top 10 locations filing flexible display patent applications, Asian countries are the most active and dominate the patent landscape over the United States and Europe. Of the top Asian countries, South Korea dominates the flexible display patent landscape. Samsung and LG, both South Korean companies, lead in flexible display patent application filings among all applicants considered in this article (including the United States and Europe). For example, Samsung's flexible display patent application filings are quadruple the number of filings by the top US-EU patent applicant Polymer Vision.

Further, the majority of flexible display patent application filings are directed to mobile phones and TV, video, and multimedia devices. These product areas account for over 50% of the flexible display patent landscape. This is no surprise as the top Asian and US-EU flexible display patent applicants sell consumer electronics in these product areas—namely, Samsung, LG, Apple, Blackberry (formerly known as RIM) and Nokia.

II. The America Invents Act and How It Can Help Both New and Existing Players in Flexible Displays

Section I is jam-packed with information about which companies and which regions of the world have been active in developing and filing patent applications for flexible display technology. The data also shows the extent to which different market segments or product categories are being targeted by patent application filings. Generally the patent landscape data presented above shows that South Korea is the leading country, Samsung is the leading company, and the mobile phone is the leading product category, in terms of the number of patent application filings in the period from 2006 through 2012. The data further shows several product categories, including for example, wearable electronics and advertising, where relatively few patent applications have been filed. Put differently, section I's data shows that the patent landscape for flexible displays is focused on mobile devices and TV, video, and multimedia devices. But areas such as flexible displays for consumer products (*e.g.*, wearable electronics) and commercial products (*e.g.*, large-format advertising displays) seem to have much less patent coverage.

Referring to Fig. 8 it can be seen that of the 10 technology categories, the top 4—phones, laptops, e-books, and TVs—account for over 80% of the patent application filings. Fig. 8 further shows that the remaining 6 categories of flexible display technology account for less than 20% of the patent application filings. That is, the burst of flexible display-related patent application filings over the period of section I's data has primarily been related to mobile phones, TVs, and similar display devices. On the other hand, several up-and-coming product categories, including wearable electronics and commercial/professional displays for advertising and medical technology, have had relatively few patent application filings.

The America Invents Act (AIA) was signed into law on September 16, 2011, and all of its features are now effective. The AIA is intended to modernize patent law in the U.S., provide lower fees for small inventors, options for exceptionally fast patent prosecution, and greater certainty in the validity of issued patents This section II summarizes some of the key parts of the AIA and how it can benefit both new and existing players in flexible displays.

a. How the AIA Facilitates Patent Portfolio Development

The AIA can facilitate patent portfolio development by reducing the costs for certain applicants such as individuals and universities, accelerating the examination of patent applications, and eliminating the threat of an interference challenge.

1. Micro-entity status

One of the new features of the patent system created by the AIA is the micro entity status. The micro-entity status provides a 75% reduction on most of the U.S. Patent and Trademark Office's (USPTO's) standard large entity fees. In turn, this enables those facing cost pressures and constraints, such as individual inventors and universities, to seek patent protection at lower costs than large entities (*e.g.*, corporations). Entities developing flexible display technology, should investigate whether they qualify for the reduced fees afforded to micro-entities.

To qualify for the 75% fee discount, the patent statute as amended by the AIA requires that an applicant certify that it:

> (1) qualifies as a small entity, as defined in regulations issued by the Director;[8]

[8] See 37 C.F.R. § 1.129 for the rules promulgated by the USPTO.

(2) has not been named as an inventor on more than 4 previously-filed patent applications, other than applications filed in another country, provisional applications under 35 U.S.C. § 111(b), or international applications filed under the treaty defined in 35 U.S.C. § 351(a) for which the basic national fee under 35 U.S.C. § 41(a) was not paid;

(3) did not, in the calendar year preceding the calendar year in which the applicable fee is being paid, have a gross income, as defined in section 61(a) of the Internal Revenue Code of 1986, exceeding 3 times the median household income for that preceding calendar year, as most recently reported by the Bureau of the Census; and

(4) has not assigned, granted, or conveyed, and is not under an obligation by contract or law to assign, grant, or convey, a license or other ownership interest in the application concerned to an entity that, in the calendar year preceding the calendar year in which the applicable fee is being paid, had a gross income, as defined in section 61(a) of the Internal Revenue Code of 1986, exceeding 3 times the median household income for that preceding calendar year, as most recently reported by the Bureau of the Census. (35 U.S.C. § 123(a).)

And the statute further requires the applicant to certify that (1) the applicant's employer, from which the applicant obtains the majority of his or her income, is an institution of higher education as defined in section 101(a) of the Higher Education Act of 1965 (*See* 20 U.S.C. § 1001(a)); or (2) the applicant has assigned, granted, conveyed, or is under an obligation by contract or law, to assign, grant, or convey, a license or other ownership interest in the particular applications to such an institution of higher education. (*See* 35 U.S.C. § 123(d).)

2. Prioritized examination

The post-AIA patent world provides prioritized examination for applicants that desire a particularly quick path to patent issuance. Prioritized examination is available for newly filed patent applications in exchange for an additional fee. This process is referred to as "Track One." According to the USPTO, if applicants need to move their ideas quickly through the patent application process:

> Track One prioritized examination will allow you to get a final disposition within about twelve months. The USPTO offers Track One for prioritized examination of your utility and plant patent applications. Track One gives your application special status with fewer requirements than the current accelerated examination program and without having to perform a pre-examination search. Prioritized examination is available for a fee at the time of filing an original utility or plant application. A single request for prioritized examination may be granted for a Request for Continued Examination (RCE).[9]

In other words, the Track One process reduces the pendency of patent applications thus allowing patents to issue sooner than otherwise possible. This provides several advantages to applicants seeking to develop patent portfolios directed to flexible display technology including enforcing the patent at an earlier date. Other advantages may include establishing a patent valuation sooner, or licensing the patent at an earlier date. An issued patent is almost invariably considered to be a more valuable asset than a pending patent application.

[9] www.uspto.gov/patents/init_events/Track_One.jsp; 26 May 2014.

3. First-inventor-to-file

Before the AIA, the U.S. patent system awarded a patent to the first inventor of a particular invention. When there was a dispute as to who was the first to invent, an expensive proceeding known as an "interference" was conducted to determine which of the competing claims for priority of inventorship was correct. The time and cost, not to mention the uncertainty, of interference proceedings were a significant economic hardship on parties involved in such disputes.

Under the AIA, the first-inventor-to-file now receives the patent. The change from rewarding the first-to-invent to the first-inventor-to-file eliminates the need for costly and time-consuming interferences. As a result, a benefit is afforded to both large companies and individual inventors as greater certainty with respect to the ownership of patented inventions is provided. From a business perspective, the greater certainty regarding ownership and elimination of costs required to defend priority of inventorship should result in increased patent valuations, and increased willingness to invest in ventures based on their patent portfolios.

b. How the AIA Facilitates Removing the Threat of Invalid Patents

New proceedings created by AIA to challenge the validity of issued patents—*e.g.*, post-grant review, *inter partes* review, and covered business method (CBM) review—have been widely written about in the literature. CBM review is typically not applicable to the materials, manufacturing processes, and methods of operating flexible displays. But post-grant review and *inter partes* review are both applicable to flexible display patents that are believed to be invalid. Use of these proceedings, as well as their conduct at the Patent Trial and Appeal Board (PTAB) of the USPTO, is relatively new and evolving.

Anyone considering contesting the validity of a patent with these proceedings should consult with attorneys knowledgeable in this area of the law and experienced in practicing before the PTAB. The AIA has provided the legal means to challenge the validity of patent claims before the PTAB for much lower costs than litigation in federal district court.

The changes in U.S. patent law initiated by the AIA can help innovators develop patent portfolios as well as defend themselves from the assertion of potentially invalid patents. In all of these circumstances it is important to consult with legal counsel in developing strategic business plans.

III. Summary

While the 2006-2012 flexible display data analyzed herein does not yet reflect the impact of the AIA on U.S. patent filings, it appears that U.S. filings in this nascent field are stagnant at best.[10] And since Asia has operated under the first- to-file system for decades, it is unlikely that Asian patent filings will be impacted by the AIA. Thus, flexible display data beyond 2012 will likely trend as these charts predict unless incentives such as micro-entity status, prioritized examination, and first-inventor-to-file take hold. Whether protecting flexible displays, 3D printing, or {insert your technology-du-jour here}, without chess-based creation (*i.e.*, high-quality patent drafting coupled with enforcement-ready prosecution strategies), checkers-based patent portfolios (*i.e.*, those created merely for mutual deterrence) may prove to be a waste of corporate assets. The confluence

[10] And the rampant anti-non-practicing entity (NPE) movement in the United States may amplify the chilling effect on U.S. patent filings in general.

of patent creation commoditization and the heightened scrutiny of claims by courts[11] and in USPTO contested case proceedings may wipe out entire checkers-based portfolios.

So learn to play chess! Those parties deciding whether to file patents in the up-and-coming flexible display product categories noted above should employ the necessary resources to fully protect their inventions. Draft patent applications with well thought-out glossaries, copious clear figures, and claim sets of varying scope with patentably distinct dependent claims. Use the USPTO Track One process and in-person examiner interviews. Front-loading costs in this manner can accelerate prosecution (*i.e.*, avoid protracted examination) and limit unnecessary estoppel creation.

[11] For example, the U.S. Supreme Court provided a significant re-formulation of the test for claim "definiteness" under 35 U.S.C. § 112(b), in *Nautilus, Inc. v. Biosig Instrument, Inc.*, on June 2, 2014.