

Taiwan: A land of creativity



The Republic of China (Taiwan), a nation of 23 million people, is globally renowned for its innovation and creativity. Examples of Taiwan's successful endeavors can be seen not only in the numerous local firms and research institutes helping drive global technological innovation in fields such as biofuels, textiles and wearable devices, but also in the nation's continued outstanding performances at international invention shows.

Over the last three years, Taiwan has won an average of 220 awards annually at the International Trade Fair Ideas-Inventions-New Products in Nuremberg, Germany, the International Exhibition of Inventions of Geneva in Switzerland, and the Invention and New Product Exposition in Pittsburgh in the United States. Taiwan's focus on innovation can also be seen in the large number of invention patents that it has been granted in the United States. In 2013, it was granted 12,118 such patents, giving Taiwan a patent density (the number of patents per million people) of 518, the highest among all nations that received patents in the United States.

Creativity may well be Taiwan's most important economic asset. Across the nation, 178 research and development (R&D) centers have been set up by local companies, while a further 54 have been established by well-known multinational firms. At a time when many countries are seeking to develop knowledge-based economies, the spirit of innovation is flourishing in every sector and industry in Taiwan, and firms are able to take advantage of a large pool of creative talent to propel developments in their respective fields.

Fresh Take on Textiles for Sportswear

Given the global concern over environmental problems as well as consumers' increasing awareness of these issues, growing numbers of companies are seeking to find uses for byproducts of existing production processes. One prominent example of the many Taiwanese firms that have embraced this challenge is Singtex Industrial Co., which uses coffee grounds to produce fabric.

Over 1 billion cups of coffee are consumed globally each day, yet many people are unaware that leftover coffee grounds can be used to make clothing. The inspiration for this idea occurred in early 2005, while Singtex chairman Jason Chen and his wife were drinking coffee at a café. The couple noticed someone collecting coffee grounds for use in the manufacturing of deodorant. When Chen's wife wondered aloud whether coffee grounds could also be used to produce clothing, it motivated the entrepreneur to research this concept.

After several initial failures, Chen successfully weaved coffee grounds into interlaced fibers to create fabric in 2009. The fabric, which can be used to pro-

duce environmentally friendly clothing, has fast-drying, anti-odor and ultraviolet light-inhibiting properties. This unique technology has helped Singtex win dozens of awards, including gold medals at the three larg-

Jason Chen, chairman of Singtex Industrial Co., shows sporting apparel produced using eco-friendly fabric that his company makes from coffee grounds. (Photo by Huang Chung-hsin)



est international invention exhibitions, and orders from 110 of the world's most famous outdoor and sporting goods brands. Today, eco-friendly clothing manufactured using the fabric is worn by participants at the world's major sporting events.

Coffee grounds are not the only waste product being harnessed in this manner. Several companies in Taiwan garnered international attention recently for their use of discarded polyethylene terephthalate (PET) bottles to create textiles for light, absorbent sporting apparel. As the French newspaper *Le Figaro* reports, Taiwan won its own form of world cup during the 2014 FIFA tournament in Brazil, as several competing teams wore jerseys fashioned from made-in-Taiwan recycled PET fabric.

Agriculture Meets Cutting-Edge LED Technology

Taiwanese researchers are joining forces with businesses to launch a technological revolution in the agricultural sector. Strawberry farms in Xiangshan District, Hsinchu City, northern Taiwan, have introduced light-emitting diode (LED) lighting control technology that enables locally grown strawberry plants to bear more fruit while also enhancing resistance to pests and diseases.



LED lighting control systems improve crop growth, seed germination, yield and quality. (Photo courtesy of Industrial Technology Research Institute)

The Industrial Technology Research Institute (ITRI), a government-sponsored research organization, provides farmers with the technology. The institute notes that in contrast with chemical pesticides, the LED lighting technology provides a more

natural method of stimulating plant growth. In cooperation with the berry farmers, ITRI researchers have installed smart LED lighting control systems, which regulate the quality and quantity of the light to create an ideal environment for growing strawberries.

This is a successful case of improving the potential of agricultural industries through the use of innovative technologies. Similar LED technology has also been applied in the cultivation of grapes, water bamboo and other vegetables and fruits, successfully improving crop growth, seed germination, yield and quality.

Promoter of Precision Machinery

While state-of-the-art consumer technologies such as wearable computers are most often highlighted for their technological advancements, innovation remains vital at all stages in the industrial production process. Taiwan is home to a number of companies renowned for providing cutting-edge tools and machinery components to some of the world's largest and most influential technology manufacturers.



Eric Y.T. Chuo, chairman of Hiwin Technologies Corp., a global leader in precision machinery components (Photo courtesy of Hiwin Technologies Corp.)

Hiwin Technologies Corp., which produces various types of must-have precision machinery components such as ball screws, linear motors and actuators, is an example of this vital role that Taiwanese firms play in the global manufacturing chain. Intel Corp., Samsung Electronics Co. and Taiwan Semiconductor Manufacturing Co., the world's top three semiconductor manufacturers, all use parts and technology produced by Hiwin.

Technology is a particular barrier to entry in the precision machinery industry. In order to maintain its position as one of the technological leaders in the field, Hiwin has been collaborating with some of the world's leading universities since 1991. To date, the firm has set up R&D centers in Britain, Germany, Israel, Japan, Russia and Taiwan, and holds nearly 1,500 patents. The company's continuous improvement on its processes and product quality, such as by creating ball screws that run faster and generate less friction, has allowed it to establish a leading position in the precision machinery market.

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Breakthrough in Biofuel Production

Taken together, straw, sawdust, bagasse, and even tree leaves and twigs are seen as a possible alternative energy source that could help reduce or replace the use of fossil fuels. Taiwan's ITRI has discovered new methods of converting these common waste products from the agricultural and forestry industries into the biofuel butanol. Honored at the 2013 R&D 100 Awards, this cutting-edge technology has drawn the interest of several Fortune 500 companies.

Unlike ethanol, a more widely known biofuel that is produced through the fermentation and dehydration of corn or sugar, butanol is made using the cellulose of agricultural and forestry waste and therefore does not impact on food production. The ITRI breakthrough significantly improves upon current biobutanol manufacturing technology by reducing the production process to just two days. The new methodology also allows for the simultaneous conversion of carbon dioxide during the fermentation process to achieve zero carbon emissions.

The innovative technology has now been transferred to Green Cellulosity Corp., which was established by the ITRI in February 2014 at a cost of NT\$150 million (US\$5 million). Green Cellulosity will promote the mass production and subsequent commercialization of butanol, opening a new opportunity in global energy development.

The Industrial Technology Research Institute has improved on the technology used in the production of butanol, a green alternative to petroleum-based fuels. (Photo courtesy of Industrial Technology Research Institute)



Sharing the Fruits of Innovation

Taiwan was ranked 12th in the World Economic Forum's *Global Competitiveness Report 2013-2014*. The authors of the report note that one of the primary reasons for this ranking was the capacity of Taiwanese businesses to innovate, with the nation ranked eighth in this category. Taiwan's continued excellence in innovation can be attributed to the resourcefulness of its people, who constantly absorb new ideas and apply them to a range of practical situations.



COMPUTEX TAIPEI is an international information technology show held annually at the Taipei World Trade Center. (Photo by Huang Chung-hsin)

As the first ethnic Chinese society to achieve democracy, Taiwan is free, pluralistic and characterized by its promotion of education. This has helped make Taiwan a cradle of creative thought.

A stronghold of the world's high-tech industries and an indispensable link in the global industrial chain, Taiwan is also actively pursuing regional economic integration, striving to join the Trans-Pacific Partnership and Regional Comprehensive Economic Partnership. Such links will enable Taiwan's trade partners to share in the fruits of the nation's culture of innovation.