Expanding Taiwanese Industrial Robot Penetration in Europe and the US

Chung-Hung Huang*

Industrial Economics and Knowledge Center (IEK), Industrial Technology Research Institute (ITRI), Taiwan

(**Received 11** October 2013; **Published on line** 1 December 2013)

*Corresponding author: yyhuang@itri.org.tw

DOI: 10.5875/ausmt.v3i4.311

Abstract: Most of Taiwanese robot manufacturers contract sales and after sales service to their European or American distributors, thus isolating them from the end-user market and increasing the difficulty of responding quickly and accurately to end-user requirements, and indirectly restricting opportunities to discover niche markets. Taiwan enjoys significant market share in Europe and the Americas for Cartesian Coordinate and single-axle robots, but still faces strong competition from Japanese and German products. In the low-end market, Taiwan is challenged on price by companies from mainland China. To address these issues, this research recommends robot manufacturers businesses base product development more closely on market demand and adopt a product differentiation strategy to develop products with potential for niche markets. First, businesses should survey demand in European and American end-user markets to obtain guidance for the development of robotic products that better fit the actual needs of European and American end-users and to gain insight into potential niche market for Taiwanese products. Developing products in response to market demand means more than producing single models but also the systemic integration of processing, production efficiency, product yield rates and system responsiveness. By developing a satisfactory production system, Taiwanese industrial robotics manufacturers can enhance their visibility and create new business opportunities.

Keywords: Single-axle robots; multi-axle robots; differentiation strategy; systemic integration

Taiwan manufacturers have reach a certain level of quality in the production of Cartesian Coordinated robots but such types of robots have their limitations, e.g., they cannot perform complex random spatial movements and cannot spin. Such capabilities are useful during job switching in narrow spaces, such as in automobile assembly and welding. Such tasks require multi-joint robots, which are classified as Swing-Type, four-joint, five-joint and six-joint robots according to the number of joints they possess.

The largest scale standardized used of multi-joint robots is in the wiring equipment stations of automobile manufacturing plants where tasks are repeated in a set sequence to assemble each component. The second largest scale application is currently found in factories producing semiconductors flat-panel displays, where robots are mainly used in loading, unloading and moving materials. Such plants often use SCARA Type robots, which are mainly multi-joint in structure with additional capability for straight movement along the z-axis. The joint axes of the turning axle are basically parallel to each other, thus such robots have less freedom of movement than six-axle joint robots, but are simpler in structure, more stable and more agile compared to Cartesian Coordinated robots.

In recent years, some businesses and research institutes in Taiwan have been attempting to develop standard six-axle joint robotic arms but all but a very few attempts have failed due to technology and component bottlenecks. For example, some are unable to cut the cost of the coder used to control motor precision. Thus, Taiwanese firms are nearly absent from this market, dominated by firms including FANUC, Yaskawa, ABB, DENSO, EPSON and Mitsubishi. Aside from R&D capabilities, another challenge facing Taiwanese businesses is that that the market for industrial robotics features a high degree of brand lock-in because of the high learning/integration curve involved, and because integrating products from multiple manufacturers usual increases the cost and complexity of operations and repairs. The trend is more obvious in large scale buyers such as automobile assembling plants, semiconductor plants and flat panel display plants, which feature highly automated production using hundreds or even thousands of machines. Such operators are wary of accepting new robotic products because of the potential for disrupting production efficiency. Even after one has developed comprehensive and stable mechanical and electronic production systems, the developer has to solve cost problems stemming from the need to import components including high class reducers, specialized bearings, motor coders, etc. Furthermore, the incumbents have leveraged their long experience and economies of scale to reduce costs. Newcomers will find it hard to overcome such asymmetrical competition conditions. Even if one could somehow achieve both high quality and low price, customers may be reluctant to give orders to an untested firm for such mission-critical equipment. In addition, the market is highly competitive and incumbents are offering significant discounts or preferential terms that newcomers will be hard-pressed to match.

Taiwan robotic manufacturers should treat their domestic market as a test field to gain a deeper understanding of market demands in preparation for expanding into the American and European markets. Taiwan's complete and closely-knit industrial cluster provides local machine tool businesses with a high degree of international competitiveness. To facilitate the further upgrade of Taiwan industrial robots, domestic developers must begin by developing key components as well as engaging in the aforementioned product differentiation. The following recommendations are also made for Taiwan manufacturers exploring potential expansion into European and American markets.

Chung-Hung Huang is a researcher in the Machinery & System Research Division at Industrial Economics and Knowledge Center. His research interests are focused on industry analysis for automated machinery and equipment.

- **Continue national level research projects: compensate for the lack of R&D funding faced by small and medium sized enterprises (SMEs) by pursuing long term and integrated research projects, thereby accumulating industrial robotic technical expertise.**

Technical expertise in industrial robotics develops slowly over time and requires expertise in software-hardware integration, organizing the development of key components, combining system modules and the accumulation of basic technologies.. Given their limited R&D capability, SMEs must rely on national level long term and integrated research projects to effectively build the base for Taiwanese industrial robot technology and to for the continuous accumulation of technical expertise needed to catch up with international market leaders.

- **Domestic academic institutes should conduct research on important export markets and establish a comprehensive overseas market information platform to help local businesses seize business opportunities.**

Many industries in Taiwan are constrained by the small size of the domestic market, and the acquisition of overseas market information and the development of overseas sales channels is especially important for Taiwanese industrial robotic manufacturers. Establishing a comprehensive information platform for the global industrial robotic market would provide timely information including:

1、 Demand and requirements in different application fields.
2、 Overall global market outlook and relevant governmental policies.
3、 Profiles of local manufacturers and major competitors.
4、 Opportunities for Taiwanese robotic or component businesses to develop in European and American markets.

Establishing such an information platform would provide complete market intelligence for Taiwanese robotic or component businesses, thereby helping them discover and seize business opportunities.

- **Leverage Taiwan's industrial clusters and supply chains to promote the local development of key industrial robotic components and thereby enhance the importance of Taiwanese components in the global market.**

Manufacturers relying on traditional technologies are hard-pressed to compete in today's fiercely competitive international markets. Taiwan's industrial robotics and automated equipment manufacturers should leverage Taiwan's industrial advantages to increase the added-value of Taiwanese products and thus maintain Taiwan's competitive edge in the international market. For example, Taiwan's machine tool industry the market leader in Asia in terms of pre-tax net profit. The industry is based on SMEs and thus responds to market change with greater flexibility and speed, while the completeness of the industry's supply chain allows local machine tool firms to outsource component processing, thus reducing direct investment costs which, in turn, reduces indirect costs such as utilities, labor, marketing, management and transportation.

- **Develop products based on actual end-user requirements and explore potential niche markets.**

In the past, Taiwan's robotics manufacturers used technologies developed by major international robotics firms as their benchmarks for technology development. The Japanese market leaders, on the other hand, mostly develop technologies based on feedback from end users, thus developing products that fit the requirements of the user markets.

The 2012 Automatica conference proposed the following themes for future consideration in industrial robotics R&D: operational safety, automation of manufacturing process controls, green and energy saving equipments, and increased ease of interaction between users and robots.

This shows that for major robot producers like Japan or the EU, end-user requirements are the key issue in industrial robotics R&D. In the past, these major producers focused on developing customized robots and products specific to end-user requirements, while continuing to developing high end products. This paper recommends that Taiwanese producers move quickly to establish a foundation for new business opportunities by focusing their R&D efforts on the end-user market to develop products that closely meet end-users requirements.

Most Taiwanese robot producers outsource sales and after sales service to their European or American distributors, leaving them with a poor understanding of the end-user market, thus making it difficult for them to design products based on user requirements, and thus limiting their ability to discover and exploit niche markets. Taiwan enjoys a high market share in Europe and the Amerias for Cartesian Coordinate and single-axle robots, but still faces strong competition from Japanese and German products. In the low-end market it is challenged by the cheaper products from mainland China. To address obstacles faced in the development of multi-axle robotics, this research recommends that producers base their development on market demand and adapt a product differentiation strategy to develop products with niche market potential.

First, businesses should conduct surveys on the end-user requirements in Europe and Americas to forecast potential market demand. The survey results can be used to develop robotic products that better fit the needs of European and American end-users and to discover niche markets for Taiwanese products. Such development extends beyond one-off models to systemic product integration including integration processing, production efficiency, product yield rate and system responsibility. By establishing an effective production system, Taiwanese industrial robotics businesses can enhance their visibility and create more business opportunities.