11th World Bamboo Congress, Mexico 2018

Theme: Product Development: Design, Marketing & Costs

Saving Taiwan's bamboo product manufacturing: Design management and trade and industry frameworks versus a cultural industries response

Hungwei Lee; Carolyn Barnes; Gianni Renda
Centre for Design Innovation, School of Design
Faculty of Health, Arts and Design, Swinburne University of Technology, Australia
hwlee@swin.edu.au ; cbarnes@swin.edu.au ; grenda@swin.edu.au

Abstract
This paper discusses the decline of bamboo product manufacturing in Taiwan, which has been inundated since the 1990s by competition from products from low-cost countries. Lacking the skills and knowledge to transform its product offerings and manufacturing models, an impediment to industry revival is a lack of distinction between bamboo craft production and product manufacturing. Although Taiwan has developed a number of world-leading, technologically-advanced manufacturing industries since the 1960s by ending protectionism and encouraging innovation in science and R&D, support for bamboo crafts as an expression of Taiwan's cultural heritage has fostered a traditional cultural policy approach to their preservation linked to community building and tourism, eclipsing the different needs of bamboo product manufacturing. Simultaneously, the slanting of support measures for bamboo crafts towards their cultural significance reflects the idea that experiences and 'cultural' consumer goods represent a subsequent stage of economic and social development to manufacturing. In seeking to develop rich understanding of the challenges facing bamboo product manufacturing, the paper draws on 20 semi-structured, in-depth interviews with representatives of Taiwanese manufacturing companies, and craft and design studios. Analysis of the interview data reveals that policy frameworks and strategic initiatives do not address the structural and capability issues plaguing bamboo product manufacturing.

Keywords
Bamboo product manufacturing, bamboo crafts, Taiwan, design management, cultural and creative industries

Introduction
Taiwan's economic development since the 1960s has been characterised by rapid economic growth and industrialisation prompted by government-led structural change (Galenson, 1979). Specifically, the Taiwan government developed a raft of export-orientation trade and industry policies, tax incentives and infrastructure developments to stimulate high-end industries and international trade (Chen Chiu, 2009). Against this background, the performance of Taiwan's manufacturers of bamboo products such as homewares, blinds and furniture has been in steady decline, companies becoming increasingly unable since the late 1980s to compete with overseas manufacturers on product price, quality or range (Cheng and Won, 2010). The livelihoods of workers, company owners and bamboo farmers are in serious jeopardy as a result.

Most bamboo products manufacturing in Taiwan is undertaken by companies that can be classed as Original Equipment Manufacturers (OEM), businesses that produce components marketed by other manufacturers. These are typically small to medium-size enterprises (SMEs) that lack the capacity, capability and incentive to address major external challenges. Most factories have the means to manufacture only basic bamboo goods for the domestic market (Ko, 2011). The few companies with equipment to undertake more sophisticated, larger-scale production lack the knowledge of how to develop their product ranges through product innovation (Gao, 2012). Only those who produce swords from Taiwan's prized Makino bamboo for the Japanese bamboo sword market have thrived, an example that suggests that the road forward for Taiwan's bamboo industry is to leverage the special qualities of Taiwanese bamboo, to establish a modern, high quality bamboo products industry (Kuo, 2014).

A range of government policies and programs has supported the production of bamboo goods. The Family Subsidiary Employment Program (1960) and the Living Rooms as Factories Program (1972) have provided assistance to small, labour-intensive businesses to convert 'the surplus labour of communities and families into productive work'(Liu and Hwang, 2009), reducing the effects of economic restructuring for groups of older workers, especially women (Hsiung, 1996). Such measures have been largely unsuccessful in stemming industry decline. The main focus, moreover, has been on supporting bamboo craft production, which requires quite different support measures to manufacturing. The paper examines the challenges the bamboo products manufacturing faces to survive and what strategies might make this possible. A main consideration is the scope for design management strategies and Design-Led Innovation (DLI) to have an impact.

Within the business model of successful manufacturing companies, DLI is a central component in the creation of functional, aesthetically-desirable products (Gemser and Leenders, 2001) that capture market value (Verganti, 2008). DLI is only possible when management supports and is actively engaged in the coordination of New Product Development (NPD) (Kyffin and Gardien, 2009, Swink, 2000). Most Taiwanese bamboo product manufacturing companies lack not only design management expertise, but basic awareness of design. Bucolo and Matthews (2011) argue that transforming such traditional manufacturing companies to accept the value of design requires a difficult internal culture shift; moving a whole industry to embrace DLI is a significant challenge. An increasing number of countries internationally, however, have advanced design integration and innovation policies and programs to reinvigorate struggling industries. Chui (2009) shows how a combination of industrial policy and investment incentives transformed Taiwan's textile and garment industry from a minor and insignificant industry at the end of WWII to its current position as 'a world leader at the frontier of fibre and new material development. (p. 512)'

The decline of bamboo product manufacturing

Government economic liberalization policies introduced in 1987 accelerated a shift from Taiwan being a source of cheap manufactured goods to high-tech industries in Taiwan, driving employment choices and the increasing preference for university education. Young Taiwanese no longer accepted work connected to manual labour, creating a shortage of workers for Taiwan's bamboo industries where skills and knowledge were typically gained through apprenticeship or attending vocational colleges (Lee et al., 2010). At the same time, tertiary design schools have favoured modern materials and production techniques, removing exposure to bamboo from the curriculum with the result that there is little interest among design graduates in designing contemporary bamboo products (Weng, 2012).

From the 1990s, bamboo products received support from two phases of government policy and programs. The policy of 'Comprehensive Community Building' (1994), which sought to deal with economic decline in Taiwan's regions, and the 'Cultural and Creative Industry Development Act' (2002), which sought to promote new industries creating high-value creative content and services or old industries creating cultural products (Kuo, 2014). The second stage began with 'Challenge 2008 – National Development Plan', setting out a national strategy for cultural workers, academia and

government to collaborate — as in other major economies — to add creativity-based innovation to an established economic base in manufacturing (Liu and Hwang, 2009). This intention was consolidated in 2010 when the Council for Cultural Affairs officially unveiled the 'Development of the Cultural and Creative Industries Law' in Taiwan's Legislative Yuan.

The emergence of creative and cultural industries policy in Taiwan provided access to programs to support and promote Taiwan's heritage bamboo culture at a regional, national and international level. While embracing industrial modernisation, East Asian nations have resisted many of the cultural and social dimensions of Western-style modernisation. Where creative industries policy in Anglo-European countries tends to focus on new, emergent creative industries, government support for the bamboo goods sector in Taiwan was linked to preservation of the artisanship and traditional cultural values enshrined in heritage bamboo crafts. Until comparatively recently, bamboo was a primary element in everyday life in Taiwan, featuring as a construction material, a food, a source of fibre and a cultural inspiration. Its importance to Taiwanese life is reflected in the saying 'To live without bamboo is vulgar.' in the bamboo plant in Chinese culture representing high-mindedness, integrity, loyalty, modesty and restraint.

Support initiatives to promote interest in bamboo artefacts have included competitions, exhibitions and festivals, awarding and certifying the technical skill and creative vision of master bamboo artisans and artists, branding and marketing bamboo products, including through online service platforms, and skills training programs for citizens to popularise bamboo crafts. The publicly-funded Taiwan Design Centre and National Taiwan Craft Research and Development Institute have initiated collaboration between craftspeople, the vocational training sector, tertiary design departments and manufacturers, for example, a 2007 program that matched leading designers with craft studios and manufacturers to undertake new product development (Hwang and Kao, 2010). After several funding rounds, one design — the 'Bamboo 43' chair designed by German industrial designer Konstantin Grcic and made by the Taiwanese bamboo master craftsman Chen Gaoming — achieved wide recognition at the 2009 Maison & Objet Expo, Paris. The chair, however, was a handmade prototype, there being no method for manufacturing the chair, its exhibition thus representing a missed opportunity to market Taiwanese bamboo products (Gau, 2012).

The focus on bamboo crafts over product manufacturing

The literature on bamboo crafts and product manufacturing is primarily linked to the role of creative and cultural industries in community development in Taiwan's regions. Little or no distinction is made between crafts and product manufacturing, with bamboo crafts being the main focus. Publications support the development of local industries around bamboo crafts to promote Taiwanese cultural heritage or to boost local tourism in Nantou County, Taiwan's centre of bamboo forestry, craft and tourism (Cheng and Won, 2010, Tsai, 2005, Qiu, 2012). Government support for these industries is seen as staving off negative effects of internationalization by restoring community economies, community life and core cultural values (Hwang and Kao, 2010). Lin (2004) argues that encouraging local industry around bamboo, especially if supported by life-long learning in heritage crafts, addresses regional social issues through the provision of meaningful work.

Significant barriers to revival remain in the lack of a training pipeline to replace ageing craft and manufacturing workers (Lee et al., 2010) and low design literacy among craft studios and manufacturing companies (Lin, 2012). The literature identifies a range of problems post-production such a lack of branding (Chang and Hsu, 2012, Wang and Hung, 2011, Weng, 2012) and the plagiarism of designs (Cheng and Won, 2010). Hsieh and Guan (2011), for example, argue for a national brand for Taiwan's bamboo products to create an emotional link with consumers and better protect copyright.

The literature is broadly critical of the value of exhibitions as a revival strategy for Taiwan's bamboo products. Weng (2012) accepts that exhibitions and trade fairs are standard ways to promote new products to retailers and consumers, but Hsieh and Guan (2011) argue it is an expensive option. Qiu (2012) concurs, reasoning that it provides limited exposure for products while Hsueh et al. (2012)

argues participation in exhibition does not offer an industry-wide solution to local and global marketing. Qiu is a rare voice in arguing that promotional efforts are inadequate to changing the circumstances of Taiwan's bamboo goods, measures directed to economic and industry conditions being also needed. Misdirected policy and support measures suggest that the auxiliary government units responsible for creative and cultural industries development in Taiwan lack the understanding of the state of Taiwan's bamboo-related industries required to plan effective industry-renewal strategies (Hsueh et al., 2012). Gao (2012) noting that much of the existing industry data is outdated, limited in its scope or poorly analysed, providing a weak guide to the ongoing feasibility of bamboo product manufacturing.

Design Management Capability in SMEs

Promotional and marketing strategies are largely futile in the absence of relevant manufacturing capability and effective design management. The New Product Development and Design-Led Innovation literatures have much to contribute on the role of design and design management in sustaining individual businesses and industries. Chiesa et al. (1996), however, note the breadth of management practices and processes that need to coordinate to foster improved company performance, these spanning product innovation, the product development process, process innovation, technology acquisition, leadership, resourcing, systems and tools, and increased competitiveness. Erica et al. (2013) similarly stress that NPD cannot be seen and treated as a discrete event or a series of steps or stages, but is a continuous strategic process in leading companies and advanced industries.

Cases studies provided by Moultrie et al. (2007) show that NPD and design management skills are generally weak in SMEs. Product development typically relies on previous experience and gut feelings rather than research, with professional design services often regarded as expensive and unnecessary. They identify six activities typically in need of improvement in SMEs: 1) market learning; 2) setting design targets; 3) product specification; 4) prototyping to reduce technical risks; 5) maintaining the design vision; and 6) a structured development process, grading the integration of design into NPD against four maturity levels — none, partial, formal and culturally embedded. Kim and Kang (2008) link the success of product development to return on investment, based on a cost objective, and the maintenance of competitive market position, based on quality objectives. While many SMEs are wary of the expense of employing consultant or staff designers (Moultrie, Clarkson & Probert; 2007), Koten (2009) notes this is surprising given the array of tasks and responsibilities designers carry out beyond specific design activities, these including the roles of interpreter, coordinator and facilitator in support of the NPD process. Kim and Kang (2008) underscore designers' role as a bridge between manufacturing and technological expertise and customer needs in the NPD process. Mozota (2003) argues that an effective design team in an NPD process works in a cross functional way with other professionals, coordinating research and development, production and marketing activities. Figure 1 sets out these relationships.

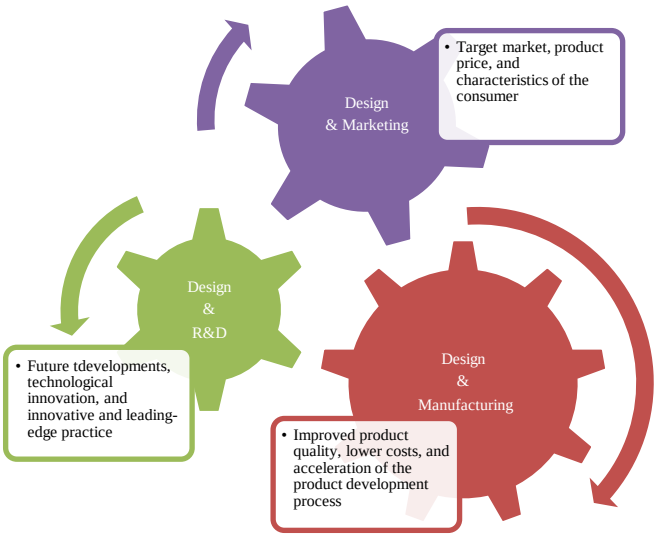

Figure 1. Cross functional relations of the design and design management in NPD

Pettigrew et al. (2015) provide a set of strategies to overcome resistance to DLI in NPD in SMEs, including an initial audit to identify potential gains, a champion to lead the change and develop capability, a pilot approach to reduce risk, demonstrate value and gain engagement, employee involvement, education and training to engage the whole organisation, proactive communication to ensure rapid and dynamic feedback, and a holistic vision to provide alignment between all of these. Beyond the factors shaping innovation and NPD capability within firms, relations with suppliers, distributors, customers and other businesses in a sector are vital to successful functioning of firms and industries as a whole.

The view from the bamboo industry

The qualitative interviews were held with mixed group of industry representatives, comprising manufacturing companies (n=10), bamboo craft studios (n=6) and product design studios (n=4). The interviews were audio recorded, transcribed in Mandarin and then translated into English. Descriptive coding, summarising the main topic of a passage, was used to extract evidence from the interview transcripts (Saldana, 2013). Ryan and Bernard (2003) describe the analysis of interview data as a multi-step process that begins with coding the material, followed by abstracting from the codes to identify common, salient and significant themes in relation to the research question that move in sequence from the codes to basic themes and organising themes to a global theme. As an indication of how this proceeded, Table 1 sets out the relationship between the *organising themes* of 1) limited manufacturing capacity and product quality, 2) workforce and management issues, 3) issues of cost structure and market conditions, and 4) product development and marketing and the *basic themes* linked to these.

Table 1. Organising and basic themes emerging from the interview data

Organising Themes	Basic Themes	
Limited manufacturing capacity and poor product quality	Broken industry chain Poor bamboo agronomy Poor manufacturing conditions and equipment	Poor production management Poor product quality control
Workforce and management issues	Lack of job opportunities No use of product design	No concept of teamwork
Cost structures	High material costs High production costs	High salary costs High marketing costs
Market conditions, product development and marketing	Consumer resistance Strong international competition Limited product range	Lack of product innovation Lack of design management expertise

On the theme of limited manufacturing capacity and poor product quality, participants highlighted the broken industry chain, with little or no integration between manufacturers, materials suppliers, distributors and the marketplace. Due the basic nature of product offerings, competition from plastic products was identified as a problem. Manufacturers highlighted the shrinking market for bamboo products, which made them reluctant to invest in manufacturing equipment and new employees. As one manufacturer commented, '*With no market future and high financial constraints, I have no confidence to invest in the business.*' One designer linked the problems to the structure of the manufacturing industry, arguing, '*The industry is comprised of Original Equipment Manufacturers and traditional craft studios, which means that the majority of people involved have no knowledge and skills in product design.'* Another designer expressed the opinion that it would be difficult to increase manufacturing activity, expand sales and develop existing and new markets when '*The industry focuses on creating fine-craft and traditional product lines.*'

Comments from manufactures revealed why they do not employ designer or marketing managers in their businesses or make use of external design and marketing services, one explaining, *'Designers cannot guarantee that designed products will be successful in the marketplace and there is no market demand for new products'*. Other industries in Taiwan have innovated or moved labor-intensive manufacturing overseas to low cost countries, shifting to capital- and knowledge-intensive manufacturing as local labour has become increasingly expensive (Chen Chiu, 2009). Bamboo products manufacturers have let labour market conditions become a barrier to innovation and value-adding, one manufacturer commenting, *'Wages are already very high. We do not want to commit ourselves to other spending when the results are unknown'*. The designers interviewed, however, were generally disparaging of manufacturing standards, arguing that unless product quality and manufacturing technology were at least raised to international benchmarks, bamboo products manufacturing was unlikely to survive as an industry.

As set out in Table 2, the interviewees identified a lack of alignment between government policy and support initiatives and the actual needs and situation of industry. The representatives of manufacturers, in particular, argued that harsh regulatory frameworks across the industry chain had made the operating environment for their businesses very difficult. An example was the merging of regulations for harvesting bamboo and wood, which had made the supply of bamboo for manufacturing uncertain. In a vicious circle, the uncertainty had reduced the number of manufacturers, affecting bamboo producers and making material supplies even more precarious.

Table 2. Government policy and support initiatives

Organising Themes	Basic Themes	
Challenging regulatory frameworks	Inappropriate industrial production laws Unsupportive copyright laws	Limited technology transfer
Poor research and strategy	Neglect of needs of micro and small firms Narrow promotional strategies	Lack of research into new technologies
Structural dysfunction	Lack of a long-term promotion plan No coordination between business units	Business units lack skills and knowledge
Disconnection between industry needs and tertiary education	Neglect of skills bamboo industry needs No relevant training in high schools	Limited exposure to bamboo manufacturing in universities Poor skills and knowledge for industry

The manufacturers saw government efforts to support bamboo industries as lacking coordination and poorly aligned to their needs, noting the far closer relationship of the publicly-funded Taiwan Design Centre and National Taiwan Craft Research and Development Institute and craft and design studios than the manufacturing sector, especially in respect of inclusion in programs. One commented, '*It would be better if government agencies attempted to relate to and benefit manufactures.'* The manufacturers were critical of the focus on promotional activities for existing products, the bulk of activity focused on fine-craft goods where the main needs for the manufacturing sector were development strategies for value adding and industry chain development. One manufacturer noted

that once a number of Taiwanese manufacturers moved to China to enable labour-intensive hand production to continue, the remaining SMEs found the production and supply chain that had previously functioned was broken, hastening the downward spiral of manufacturing.

The small Taiwan market for bamboo products meant the manufacturing sector needed assistance to move to export-oriented, high-volume, high-quality production, government efforts to build exports by branding and promotion, including through e-commerce platforms seemed misplaced when manufacturing lacked the technological capabilities, industry structures and labour market conditions to operate at any significant level in the international marketplace. The designers stressed the need for a focus on design-led innovation to drive competitiveness and programs to stimulate learning among manufacturers. The manufacturers and representatives of craft studios were especially critical of the failure of Taiwan's education system to supply the suitably-qualified workers to sustain the bamboo craft and product manufacturing, one commenting, '*The government should not have closed the Bamboo Skills Training program at Zhushan Senior High School. Once that happened, there was no longer a younger generation to work in the industry*.' Despite manufacturer's stated reluctance to hire staff with design and marketing expertise, they were critical of the tertiary education for not training design graduates with expertise in bamboo, feeling that tertiary education across Taiwan was skewed towards businesses training and select high technology industries.

The focus on socio-cultural outcomes and values

As set out in Table 3, although interviewees were generally critical of policies and programs supporting bamboo products manufacturing, their comments highlighted the cultural and social dimensions of bamboo industries for the Taiwanese. One interviewee explained how for the Taiwanese '*Bamboo products have a lot symbolic significance in our life memories. The Taiwanese like to surround themselves with bamboo decorative arts and to use bamboo products in their daily lives.'* A manufacturer reminisced how, '*We* [Taiwanese] *learned about the spirit and cultural meaning of bamboo at school. Bamboo was around us in our neighbourhood. Every time we miss our hometown and family, we think of bamboo.'* Another commented that for older Taiwanese citizens, leaning bamboo crafts, with their traditional cultural and social resonances, '*makes people feel happy and keeps them busy with mind and hand so they do not worry about getting Alzheimer's Disease.*' Interviewees also stressed the status and appeal of bamboo as a sustainable material that preserves the environment in being biodegradable and not degrading water and soil systems.

Table 3: The focus on socio-cultural outcomes and values

Organising Themes	Basic Themes	
Contribution to local economy	Import substitution Business opportunities	Employment opportunities; teaching craft skills
Networking	Heritage network Policy network	Social network International network
Benefit to humanity	Physical benefits Psychological benefits	Self-cultivation
Value of bamboo products	Aesthetic appreciation Authenticity and humanity of bamboo objects	Contribution to quality of life Symbolic value Sustainable material

The importance of bamboo forestry and crafts to the economic survival and quality of life of local communities was acknowledged, with the representatives of craft studios recognising the value of programs around bamboo tourism. They believe that this promotes bamboo crafts to the Taiwanese, enabling craftspeople to earn income from increased sales of their work and teaching hobbyists craft skills. Initiatives to promote bamboo fine-crafts on the world stage were especially valued by this group of interviewees, one of whom stressed the significance for his practice of international networking opportunities. The craft studio representatives highlighted the unique characteristics of Taiwan's Makinoi bamboo, one interviewee explaining that '*The altitude and climate in Taiwan is responsible for the quality and toughness of Makinoi. The fact that Taiwanese craftsmen can use it to make such good swords for the Japanese market is the main thing keep the bamboo business in Taiwan going.*'

Future prospects for bamboo product manufacturing in Taiwan

As set out in Table 4, the interview participants expressed agreement that after three decades of government support for bamboo crafts, targeted measures to redress the decline in bamboo product manufacturing in Taiwan were urgently needed. A main theme raised by participants was the far greater potential of product manufacturing to maintain and create job opportunities than craft production. However to achieve this participants agreed that bamboo manufacturers needed confidence in the prospects of their businesses and the industry as a whole.

Table 4. Future prospects for bamboo product manufacturing in Taiwan

Organising Themes	Basic Themes	
Contribution of bamboo industry	Create job opportunities Foster collaboration across industry Improve market position	Expand product range Develop self-reliance
Input from design industry	Increase material knowledge Conduct market research	Develop products capable of manufacture
Contribution of non-government organizations	Build industry networks Create opportunities	Conduct technological research Conduct industry promotion

Some participants, however, argued that industry should not rely on government for funding support, one interviewee commenting that the manufacturing sector '*needs to raise their ambitions for their businesses to secure the future of bamboo manufacturing.*' The designers, with their more detached view of product development and manufacturing, generally took the position that an inter-company network should be formed to take some responsibility for improving company and industry performance. It was though that such networks could be effective in helping individual companies to upgrade their manufacturing equipment and process and to foster diversification and specialisation in product offerings to stave off the detrimental effects of head-to-head competition between companies.

Table 5 sets out participants' views on the needed forms of government and non-government support for bamboo product manufacturing. The participants from manufacturing companies saw government units and non-government organisations as having little appreciation of the impact of government policy and changes in industrial and trade structures and labour market conditions on bamboo product manufacturing as an express consequence of their focus on the development of bamboo crafts and tourism as cultural and creative industries. Policies and programs needed to be less exclusively focused on the cultural significance of bamboo goods, with research institutes being less concerned with the public exhibition of bamboo crafts and designed products and more focused on research and development into bamboo-related materials, products and manufacturing equipment and processes in collaboration with companies, thus helping to drive innovation-driven change in a sector comprised largely of SMEs.

Table 5. Forms of government and non-government support

Organising Themes	Basic Themes	
Contribution of central government	Poor policy frameworks A lack of funding	Foster global networks and coordinate national effort
Contribution of local government	Poor policy implementation Funding focused on local bamboo craft and tourism	Coordinate local effort
Input from education sector	Design management training Skills training	Industry research Negotiate international collaborations

Conclusion

Taiwan's bamboo products manufacturers have struggled and continue to struggle to navigate the formidable tide of economic, industrial and market change that has occurred since the late 1980s. Analysis of the qualitative interview data shows that there is currently limited prospect for the different groups involved in bamboo crafts and product manufacturing to come together with government to ensure that bamboo goods will not only continue to be made in Taiwan, but can

flourish in terms of design, manufacture and market penetration. The bamboo craft sector has the greater chance for survival. For bamboo product manufacturing to continue to exist, will require the product design industry and tertiary design academics to partner with companies to enable organisational learning and knowledge distribution across the sector on developments in design, manufacturing and non-traditional forms of bamboo such as laminated bamboo.

There is scope for hope here. Yue-Ming's case study (2005) on company performance and inter-organizational networks in Taiwan's world-leading bicycle industry examines how it has thrived since the 1980s, when the government ended protectionism, despite having access to only a small national market and being comprised substantially of SMEs. Yue-Ming (p. 69) reports that both the industry's competitive edge in the international market and the success of individual firms has been enabled by companies working together to foster organizational learning and synergistic technology development and marketing. If improved firm performance is fostered through supportive company networks, such partnerships could be useful in helping Taiwan OEMs and other SMEs involved in bamboo product manufacturing to undertake the urgent injection of design, design management and innovation in manufacturing processes into their companies, resulting in wide-scale industry modernisation.

Bibliography

1. BUCOLO, S. & MATTHEWS, J. 2011. 'Design led innovation: Exploring the synthesis of needs, technologies and business models'. *In Proceedings of Participatory Interaction Conference 2011.*
2. CHANG, S.-H. & HSU, C.-H. 2012. 'Local cultural design strategies used in the global market [在地文化應用於全球市場的設計策略研究]'. *Emotional design and art workshop [感性設計與藝術創作研討會]*. Taiwan.
3. CHEN CHIU, L.-I. 2009. 'Industrial Policy and Structural Change in Taiwan's Textile and Garment Industry'. *Journal of Contemporary Asia,* 39**,** 512-529.
4. CHENG, H.-L. & WON, H.-J. 2010. 'The Strategies of Local Industrial's Structure Transformation and Space Renovation [地方產業轉型再生與空間再造策略之研究_以南投縣青竹竹文化園區為例]'. *19th Architectural Society Research Papers.* ROC Institute of Architecture.
5. CHIESA, V., COUGHLAN, P. & VOSS, C. A. 1996. 'Development of a technical innovation audit'. *Journal of Product Innovation Management,* 13**,** 62.
6. CHUI, L. C. 2009. 'Industrial Policy and Structural Change in Taiwan's Textile and Garment Industry'. *Journal of Contemporary Asia,* 39**,** 512–529.
7. ERICA, P., SAM, B., CARA & CARA, W. 'Influencing innovation in SME's: from designer to transitional engineer'. *In:* IN DAVIDSSON, P., ed. Proceedings of the Australian Centre (ACE) for Entrepreneurship Research Exchange Conference, 2013 Brisbane, QLD. QUT Business School, 1-13.
8. GALENSON, W. E. 1979. 'Economic Growth and Structural Change in Taiwan'. New York: Cornell University Press.
9. GAO, Y.-F. 2012. *'The Development, Transformation and Cultural Creativity of Bamboo Craft Industries in Jhushan Town [竹山竹工藝產業的發展轉型與文化創意]'*. PhD, Yunlin University of Science and Technology , Taiwan.
10. GEMSER, G. & LEENDERS, M. 2001. 'How integrating industrial design in the product development process impacts on company performance'. *The Journal of Product Innovation Management,* 18**,** 28-38.
11. HSIEH, M.-H. & GUAN, S.-S. 2011. 'Applying "Associative Forced Relationship of Formative Elements" in Artistic Commodities Design [形態聯想組合法應用於藝術商品設計]'. *Journal of Design,* 16**,** 57-73.

12. HSIUNG, P.-C. (ed.) 1996. *'Living Rooms as Factories Class Genderand the Satellite Factory Systemin Taiwan'*, Philadelphia: Temple University Press.
13. HSUEH, S.-L., HSU, K.-H. & LIU, C.-Y. 2012. A Multi-Criteria Evaluation Model for Developmental Effectiveness in Cultural and Creative Industries. *Procedia Engineering*, 29**,** 1755-1761.
14. HWANG, S.-H. & KAO, Y.-F. 2010. 'Study on redevelopment and transformation of Taiwan craft Industry [臺灣工藝產業在發展與轉型之研究]'. *Journal of Science and Technology*, 19**,** 49-58.
15. KIM, B.-Y. & KANG, B.-K. 2008. 'Cross-Functional Cooperation with Design Teams in New Product Development'. *International Journal of Design*, 2**,** 43-54.
16. KO, I.-C. 2011. *'The study of bamboo materials in product design [竹材料應用於產品設計之研究]'*. Master, Tatung University, Taiwan.
17. KOTEN, H. V. 2009. 'Beneficial appropriation and corporate exploitation- Exploring the use of ethnographic methods in art, craft and design'. *Craft & Design Enquiry*, 1**,** 1-34.
18. KUO, H.-H. 2014. *'An Action Approach of Collaborative Team Teaching Based on Constructing An Empowerment Model for Bamboo Craft [以協同教學建構竹工藝培利模式之行動研究]'*. Master, National Yunlin University of Science & Technology in Taiwan.
19. KYFFIN, S. & GARDIEN, P. 2009. 'Navigating the innovation matrix: An approach to design-led innovation'. *International Journal of Design*, 3**,** 57-69.
20. LEE, L.-S., CHANG, L.-T., LIN, K.-Y., LEE, Y.-C. & LIN, S.-W. 2010. 'A Study of the Function Map for Cultural and Creative [竹藝類文化創意專業人才功能地圖之研究]'. *Arts education*, 19**,** 29-57.
21. LIN, H.-M. 2012. *'The Study on Production Model of Modern Bamboo Design [以竹材探討現代工藝設計之產品化模式]'*. Master, Southern Taiwan University of Science and Technology.
22. LIN, Y.-W. 2004. 'Taiwanese Crafts and Its Research Issues - A Post-colonial Perspective [台灣工藝研究的議題－一個後殖民文化論述的觀點]'. *Journal of design*, 9**,** 1-12.
23. LIU, C.-H. & HWANG, S.-H. 2009. 'Craft Design Efforts to Promote Cultural and Creative Industries in Taiwan'.
24. MOULTRIE, J., CLARKSON, P. J. & PROBE, D. 2007. 'Development of a Design Audit Tool for SMEs'. *Product Innovation Management*, 24**,** 335-368.
25. MOZOTA, B. D. 2003. *'Design management : using design to build brand value and corporate innovation'*, New York, NY, Allworth Press.
26. PETTIGREW, D., THURGOOD, C. & BUCOLO, S. 2015. 'Design led growth: lessons from Lean'. *R&D Management Conference* https://www.researchgate.net/profile/Clementine_Thurgood/publication/283996937_Design_led_growth_lessons_from_Lean/links/564abe8408ae127ff986c1d9.pdf.
27. QIU, Y.-F. 2012. *'The Development Strategy of Industrial Local Cultural Museum －A Case Study of Chutung Grand Bamboo Curtain Cultural Museum [產業型地方文化館之發展策略研究 －以竹東筐城竹簾文化館為例]'*. Master, Da-Yeh University.
28. RYAN, G. W. & BERNARD, H. R. 2003. 'Techniques to Identify Themes'. *Field Methods*, 15**,** 85-109.
29. SALDANA, J. 2013. *'The coding manual for qualitative researchers'*, London, UK, Sage.
30. SWINK, M. 2000. 'Technological innovativeness as a moderator of new product design integration and top management support'. *Journal of Product Innovation Management*, 17**,** 208-220.
31. TSAI, T.-Y. 2005. *'Study on Investigation of Bamboo Forest Management Situation and Its Development Feasibility into Leisure in Jushan Area [竹山地區竹林產業經營現況調查與發展休閒產業可行性之研究]'*. Master, National Chung Hsing University.
32. VERGANTI, R. 2008. 'Design, Meanings, and Radical Innovation: A Metamodel and a Research Agenda'. *Journal of Product Innovation Management*, 25**,** 436-456.

33. WANG, H.-H. & HUNG, J.-L. 2011. 'A Metaphorical Method for Product Design in Cultural and Creative [文創商品的隱喻設計模式]'. *Journal of Design,* 16**,** 35-55.
34. WENG, C.-C. 2012. *'Bamboo design and creation of qualia research [竹材設計與感質創作之研究]'.* Master, National Taiwan University of Arts.
35. YUE-MING, S. W. 2005. 'Inter-organizational Network and Firm Performance: The Case of the Bicycle Industry in Taiwan'. *Asian Business & Management,* 4**,** 67-91.