

On the Product Development Model of Service Innovation in Manufacturing Industry

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ABSTRACT The study objects comprise of manufacturers in transition to manufacturing servitization which Taiwan Government strongly advocates recently. The study conducts in-depth interview with specialized counseling units in addition to supplementing specific internal data analysis through the discussion on the success cases in the application for government counseling. Using qualitative research method, the study expounds the new mode shaping, causes in forming cooperation-strategy model and the association with corporate business model in the development of product service innovation. The model of service innovation development not yet revealed in prior literatures are now unfolded through the specific flow chart of the operation of product development model for the representative manufacturers mentioned in the study, providing an important reference for Asian manufacturing industries in terms of shortening R&D process time. Students of engineering education can apply the concept of manufacturing servitization to assist them with industrial thinking and connect with in-school learning. Such concept can also effectively offer an important discourse for reference during the shifting of manufacturing R&D after the students enter the workplace.

INTRODUCTION

The expansion rate for world's economic trade in 2012 has slowed down, as compared to 2011. The latest estimate of Global Insight Inc. shows that the 2012 world's economic growth will slow down from the 4.14% in 2011 to 3.4%. Additionally, the IMF estimated that the 2012 world's trade volume expansion rate will drop from the 11.4% in 2011 to 7.0%. In particular, the invigoration of booming domestic demand from emerging countries such as mainland China and India remains the factors that drive the world's economic growth. On the other hand, industrial countries show relatively weakened growing momentum due to the limitation in sluggish improvement on unemployment, consumption, and the weak pace of investment. Moreover, European sovereign

debt crisis, unemployment of industrial countries and fluctuations in international raw material prices continue to add variables to the recovery of world economy (Yang 2010).

Apart from peer domestic competition, products made in Taiwan primarily compete with mainland China, followed by overseas Taiwanese companies in domestic and export markets. The massive labor productivity and super minimum wage carried by mainland China pose a grave threat to Taiwanese industries.

Zhang YJ (2014) suggested that there is no existence for so-called conventional industry but industries that are phased out. He mentioned that any industry not knowing the importance of technology upgrade will not become conventional industry living in the past or sunset industry that gradually becomes part of history. He also

stated that the key success for Taiwan industries includes three elements, namely grasping innovation, R&D and marketing, in addition to creating differentiation in production of more value-added products that will dominate the high-end market. Only completely different products plus the most sophisticated production quality will drive foreigners to buy MIT products, and therefore the expensive wage of Taiwan will become a competitive advantage.

Trend in Taiwan’s Manufacturing Servitization

Manufacturing Servitization is the key direction of development for our government and related enterprises, as shown in Figure 1. The manufacturing industry must involve service, product and system to respond to customer demand, with additional consideration of product innovation and application through product extension service, product function service, and integrated solution.

The study analyzes the predicament faced by the promotion of manufacturing servitization in transition with the following findings (Fig. 2).

The manufacturing industry is currently accustomed to taking into consideration of OEM-oriented value proposition strategy with the following two findings:

- It is less likely to propose innovative value proposition and find out profit model from customer demand.
- It is difficult to find out new application fields for manufacturing servitization, limiting the possible dimension of development.

There is difficulty in developing branding under the existing business model, however branding is still the key development for our industries progressing towards servitization. A branding strategy with resilience such as leasing brand is the key focus for the industries to develop (Liu 2013).

In the process transition for servitization, the manufacturing industry faces with new functions

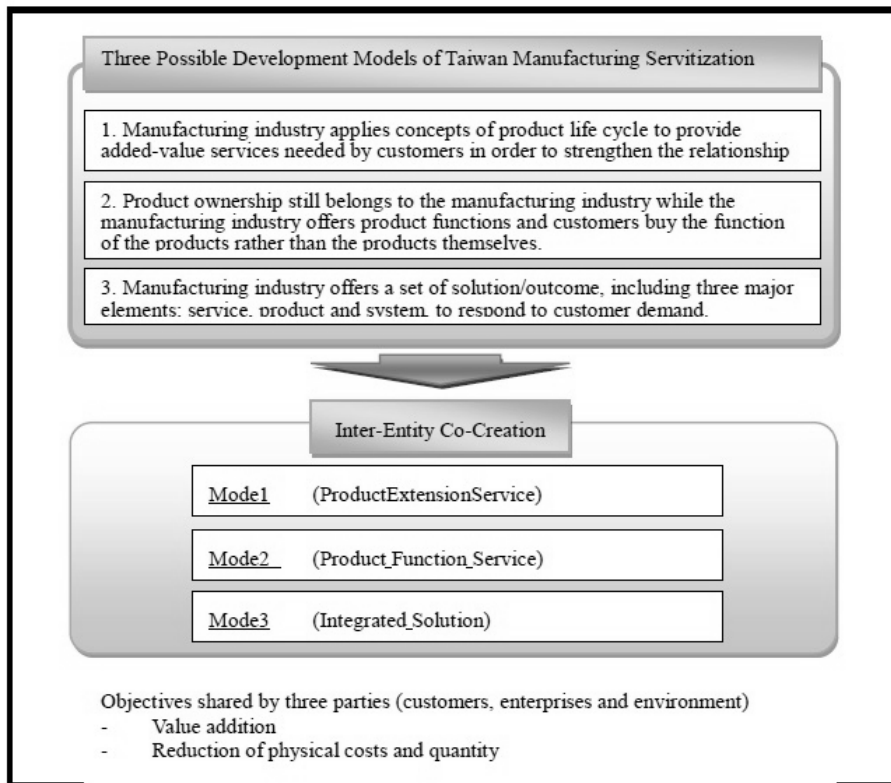


Fig. 1. Three primary possible development models for Taiwan’s manufacturing servitization

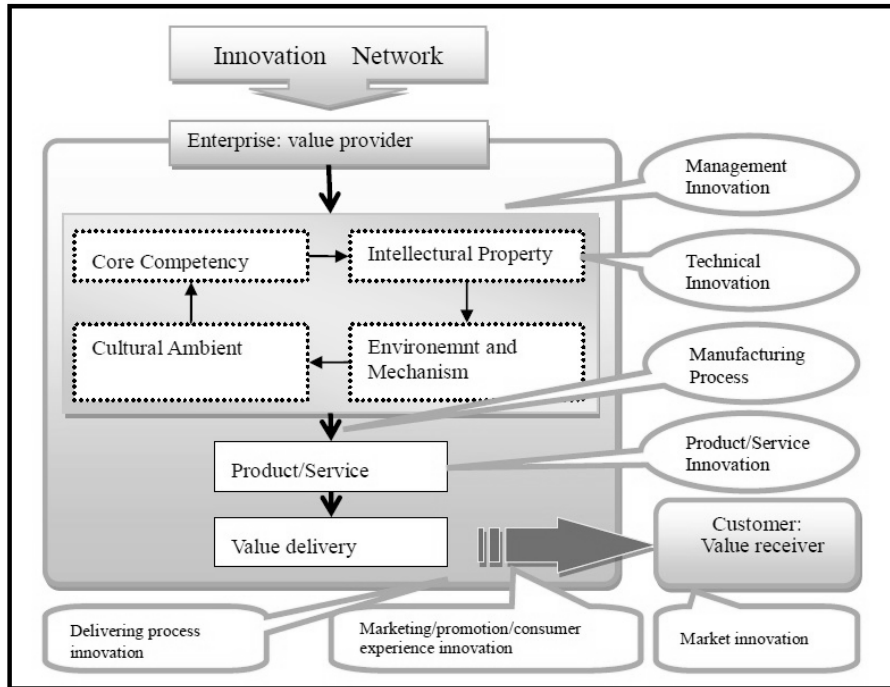


Fig. 2. Expected innovation in strategies and operational model

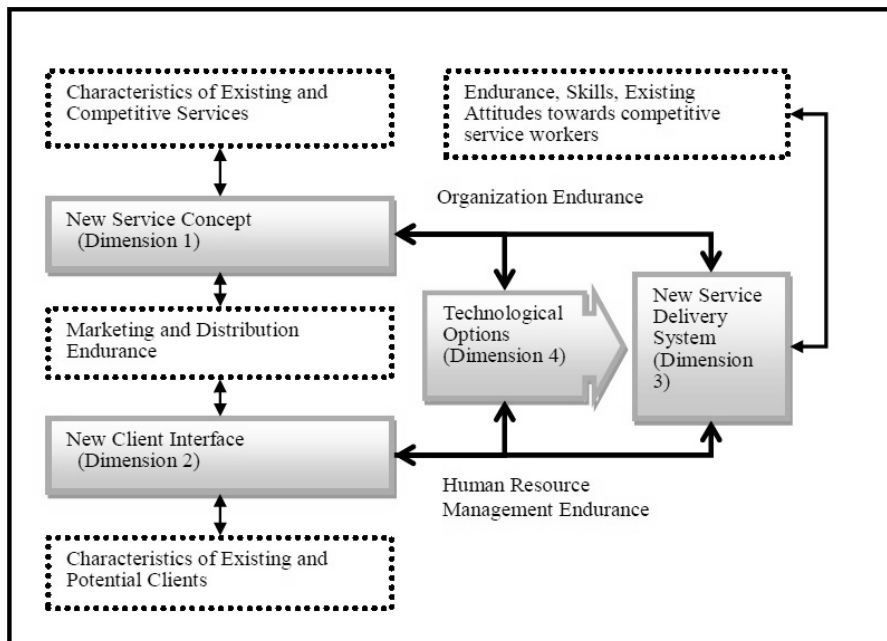


Fig. 3. Service oriented development through new service design concept

generation, process change or development of business division, which corresponds to issues related to organizational reform that offers great challenges to the local enterprises.

For enterprises to develop high-end products such as complex product system, such sysopment work. (2) The existing service development lacks a set of systematic R&D method. (3) Customer demand and viewpoints should be controlled through different research approaches, thereby to provide the service value exceed customer expectations.

The service development center advocates for the mechanism primarily through Service Experience Engineering (S.E.E.) method, as engine to the corporate service innovation by assisting the leading industries with investment and in-depth definition of service innovation related issues, in addition to organizing the service development center to gradually solve innovation related issues and form paradigms of innovation (Hsu 2012).

Promote the Formation Of Technical Service Value Chain through S.E.E.

In addition to organizing specialized service development center, some enterprises already own similar internal service development organization/ department that require government assistance in organizing cross and open service innovation alliance to study and analyze the technology of service innovation demand in different consumers, including: (1) Pre-agglomeration stakeholders who contribute to enterprise cooperation. (2) Use approaches to assist industries reaching consensus in cooperation with the planning the Bluemap for various manufacturing service development. (3) Conducting gap screening and evaluation on various manufacturing service related themes and value chains. (4) Implementation in industries for the acceleration of implementing the process of different innovation manufacturing service development (Hsu 2012). Figure 4 shows relevant promotion mechanism.

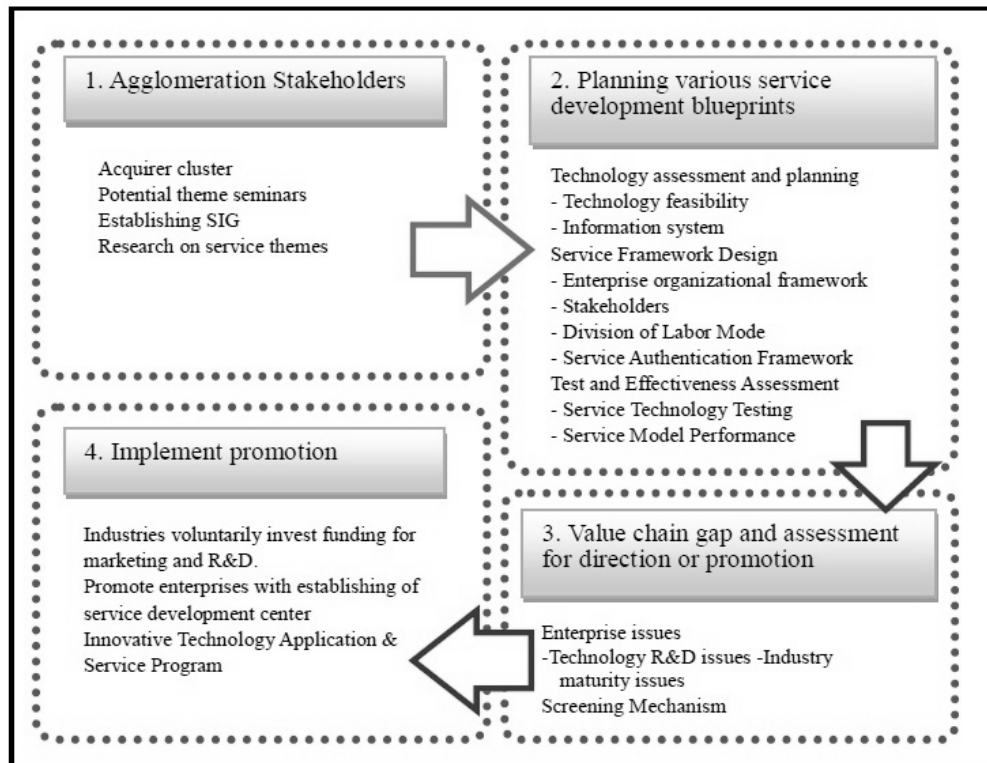


Fig. 4. Diagram for the promotion mechanism in Taiwan's manufacturing application and service

Literature Review

Development Model of Service Innovation Cluster Development Model

Innovative approach originates from innovative concepts. Strategy involving service innovation must first re-review the definition of service, in order to break away from the conventional cognition and imagery space. Moreover, product oriented logistic thinking in manufacturing industry has developed a variety of practical strategic models and management tools, which merit utilization even for service oriented logistic thinking in service industries. The following is a discussion on the service types and new service strategies with proposal of service-customer matrix and added-value-complexity matrix as the thinking tool for service innovation.

The key factor to commercialize service lies on the follows: 1. Discovery of service lesson. 2. Proposal to solve service lessons. 3. Establishment of appeals in service value, followed by 4. Mobilization of service resources. 5. Execution of service commercialization. These five factors are regarded as the procedures and guidelines to service commercialization, which control can be advanced and strengthened through the enhancement of imagination and creativity as well as the application of service science.

Project-Based "Clustering Model" Generated from Clustering Innovation Concept (Gertler 2003). The term, agglomeration, originates from the term, population in biology, which is used to explain and describe the phenomenon of homo and hetero biological clustering that co-exist and are interdependent in a specific area or habit (Bien and Hsu 2013). The concept of industry clusters and emergence of analytical model transform the industrial economic analysis previously emphasizing on the market structure, corporate governance, and enhancement of organization operation efficiency into a comprehensive thinking approach that take into consideration of spatial segmentation, relationship with suppliers, external environment and industry upstream and lower/downstream. Such transformation implies a new emergence of national regional and urban economies (Granovetter 1985; Yang 2010; Wu 2010).

The so-called cluster refers to some specific related industries that gradually evolve into an

interactive connection with economic benefits, whereas an independent and profit-sharing relationship with yet intense competition is developed in suppliers within the cluster (Bien and Hsu 2013) on the other hand divided clustering zone into vertical and horizontal integration, whereas the former refers to the relationship between customers and suppliers and is attributed to the upstream supply chain. The later refers to competitors with production complementarities or alternative products, which scope includes service and financial companies, as well as the related industries. Such classification is also applicable to the average public and private-sectors institutes. Porter build the foundation for the definition of cluster and the Blue map for the development of future organization, however, it was only until in recent years, the benefits induced by such concept of organization types start to gain popularity in discussion.

Arikan (2009) divided the interdependence between clustering suppliers as: upstream/downstream supply/demand relationship, peer cooperation and competition, and common pool resources. Anderson (1994) suggested that the combination of clustering suppliers not only refers to geological combination but the consistent ideas in conceptual combination and construct of vision. Such driving force will urge the suppliers to cooperate closely. Feser and Bergman (2000) combined the two concepts and further defined cluster as an official input-output relationship, buyer-supplier relationship, geographic concentration, industry related organization and a combination with "Coopetition." Suppliers within the cluster not only have common pool resources but can generate industry synergies and maintain production efficiency with flexibility on that specific cluster through interaction and exchange.

To cope with globalized competition environment and to control the business opportunities for Taiwan ECFA, the Small and Medium Enterprise Administration, Ministry of Economic Affairs, R.O.C. launched the "Small and Medium Enterprise Agglomeration Innovation Integrated Service Project" in 2008. Such program combines the service energies from the Industrial Technology Research Institute (ITRI), Institute for Information Industry (III), and the Metal Industries Research and Development Center (MIRDC) to provide comprehensive counseling on small and medium enterprise technology R&D,

innovation operation, and marketing expansion, using agglomeration and cooperation model to accomplish enterprise upgrade and transformation. In sum of aforementioned literature, industry clustering is regarded as an agglomeration economy constituted by a series of upstream, midstream, downstream, and other enterprises or institutes. These industries include services, finance, manufacturing, or other industries with applicable scope including public and private-sector agencies. Agglomeration often extends the tentacles upward (supplier integration) or downward (consumer integration), or horizontal integration to the complementary suppliers now. Strategy-cooperation synergies are created through the structure of integrated values, and therefore extending the clustered service design procedures in the design field.

Service Design

Service design is a process involving 4 D's, namely discovery, definition, development, and delivery, which is related to the understanding of customers, organization and market, and development and idea as well as the transformation into feasible solutions for execution. Service design involves the undergoing service life cycle by providing sustained development. The service could refer to continuous and timely changes.

Service design does not refer to a new specialized designing profession but a new multi-disciplinary professional knowledge platform. What it really means is that service design does not refer to a short-term plan for launching the service to market but a sustained process that integrates new service practices into organization through work camps and projects. In fact, service design can adapt to organization and demand to transform into corporate structure and progress (Deng 2009).

Hence, service design aims to plan and build up useful, usable, desirable, satisfying, effective, and highly efficient service experience, which helps crossing all points of contact and time shifting to understand consumers, market, common pool resources, and in-depth understanding of customer expectation, demand and experience. Service design also contributes to launching opportunities, generating ideas, solving problems, and creating executable solutions by providing meaningful specification, guidelines and

strategies. Moreover, service design generates ideas, develops solutions and creates concepts, using principles of evaluation to validate the optimal concepts and solutions, in addition to discovering explanations and sharing interpretation, complex structure and methods of process. Using prototypes to test the results, service design executes solutions through planning and procedural maps.

Service design creates and builds customer interface to ingeniously connect the details of all service itineraries. The user of methods and tools sustain consistency, satisfaction, usefulness, and feasibility in service experience that conform to successful branding and commercialization. For the companies, service design offers possibilities of value-added creation, differentiation from competitors, effective utilization of resources, and connection with customers through more desirable methods. On the other hand, for customers, service design could represent the improvement on daily life and supply of quality experience (Bien and Hsu 2012).

Service design connects customer desire and organizational desire, which acts as an intermediary that understands how to establish the relationship between customers and organizations.

Service Design Combines Disciplines of Different Professional Knowledge

Design has developed into a strategy that connects with multi-disciplinary fields. Hence, many designers are experts from different fields, including research, technology or communication, join to work together.

Service design usually involves internal and external customers, whereas different people in one institute must also be treated as customers. Service design assures the collective participation in one project with the perception of a customer, while different methods and tool use can guarantee excellent internal and external service experience.

Design (including communication) has long been the intermediary/translator between industry and people, technology and application, and supply and demand. It can be said that market distributors, engineers other people could not facilitate the service design of multiple professional field, who would likely be addressed as the service marketing. However, a design service field offers a very unique task that requires different tools and techniques.

Organizations need to take into consideration of trust, concept of increasing ownership transfer and experience when designing and developing new services. Although the change of payment method does not affect product design, it is one major change in service.

Service contact refers to the interaction occurred between the customers and providers of service organization during the service experience process. It is also the key point and the main link in customer service experience. The service providers become the “representative” of service organization in contact with customers during the process.

The behaviors of contact engaged by service providers are the composition of service products provided by the service organization, while customers also need the assistance from the service provider to complete the primary part of service experience.

This process of contact then becomes the key quality of service products evaluated by customers. In western countries, the moment of contact between customers and service provider is known as the “moment of truth,” namely the moment of interaction discloses the truth of service, whereas the strength and weakness of service quality are determined at this moment.

Service Bluemap

A service bluemap describes the meticulous details that can execute and maintain this service, providing reference as development design for the manager of business development division, designers, and software engineers. Such bluemap can also be used as grounds for managers of service department in the execution of routine services, helping the manager of service department to comprehend the qualities and advantages from the usage to brand management of IT infrastructure.

Bluemap refers to an illustration that transforms service concepts and design thinking into service system through simple and explicit means. Bluemap design is previously a fundamental method to architecture design, which method is adopted by the service industry to carry out the design of service system. The content of service bluemap is further divided into the following according to the degree of sophistication (Fig. 5):

- (1) Conceptual Bluemap: Overall description of the service system.
- (2) Specific Bluemap: Detailed description on certain part of the service system.

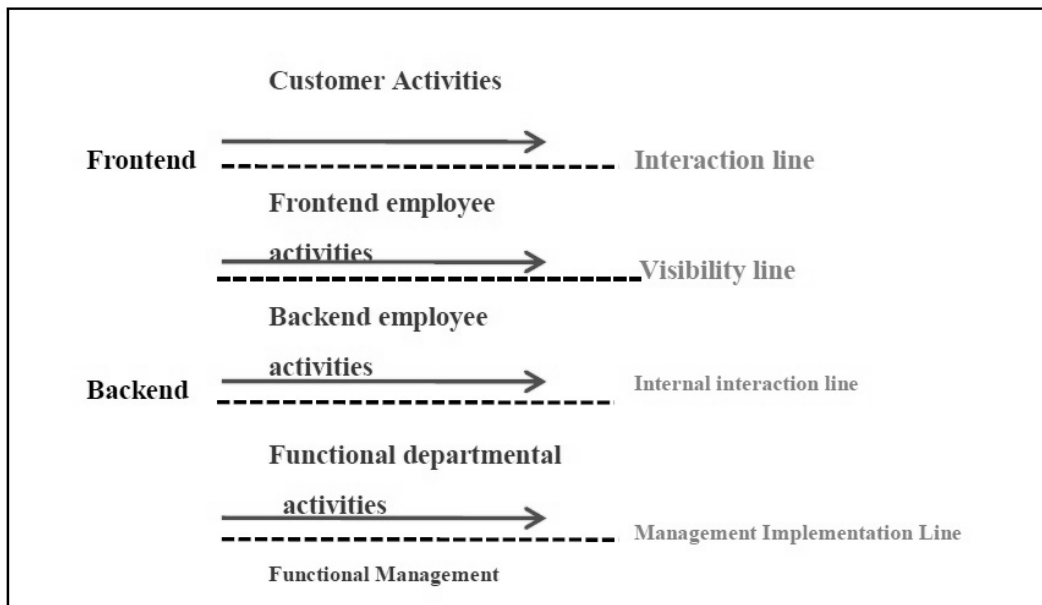


Fig. 5. Simplified service Bluemap diagram

Service Experience Model

For product designers, modeling is the most important factor for development products and determining the style. Service experience model reveals the intangible experience that need to quickly convey the experience and function of services, so that we can conduct effective evaluation on service feasibility, in addition to sharing its concepts with potential users, peers and decision makers. A service experience model supported by commercial projects is usually the R&D stage or consideration set aside for the evaluation of one service.

It is often required to attempt and test how the service concept will be applied in the context of reality since service does not exist in isolated prototype, while testing requires the restructuring of reality and expected framework to assure integrity to service experience, similar to the service that will exist (Deng 2009).

Usually, this implies that service requires the input of a temporary existence, whereas the users naturally use it under the conditions of reality, which sometimes require more efforts to create the space, ambient and the environment. Other times, the mobiles and actors are required to disguise them into hotlines.

RESEARCH METHODS

The study adopts qualitative research method on suppliers applying for subsidies with review and approval from the government agencies, which have been executed and completed. The study collected data from the interview with the person in charge of the internal R&D center and the discussions on internal organization data to obtain more detailed, in-depth and genuine data. The study analyzes the data using qualitative research method, case study, in-depth interview with the experts, expert focus group meeting, and oral data analysis to acquire the outcome and generate conclusion.

For sample selection, due to the consideration of the composition and interaction for manufacturing servitization in product innovation service development, only companies with small scale of capital in NTD5,000,000 were selected to carry out the analytical research. To successfully promote the formation of industry upgrade, Taiwan government commissioned National Science Council for Academic-Industry counseling

application and the CITD from the Ministry of Economic Affairs for conventional industry development program counseling to apply for the implementation. The suppliers emphasize on the transformation of conventional manufacturing industry into modern manufacturing-servitization production model, by assisting the suppliers and R&D and growth with emphasis placed on the formation and building of future industry models. For this reason, the study conducts interview with suppliers that have been approved by the program application, discussing in more details of future manufacturing evolution. Additionally, 16 success counseling cases in line with the service design model of the issues discussed by the study are selected as target samples, supplemented with detailed internal interview and data to comprehensively present the innovation service development model of the products as the key success factor to operation.

Finally, the samples selection includes all personnel in contact with internal organization of the suppliers, who play the key role in the contact and communication with internal development units. Moreover, the discussion of theories and practices involve representative objects.

Tables 1 and 2 refer to the samples of the researchers' actual participation in program execution between 2001 and 2013:

Table 1: Eleven cases of academic-industry collaboration supplier samples approved by National Science Council

<i>Name of Programs</i>
A Study on Experience Perspective Guided Product Design Model, 2003
Development of Experience Oriented Office and Home Furniture, 2004
Establish Innovation Experience and Brainstorming Applications on Quality Kitchenware Design Model, 2005
Global Brand Fashion Design of Taiwan Cultural Boutique – An Example of Cheerful Fashion Goods, 2006
Pursuit of Style and Fun – Innovative Design Development of Fashion Boutique, 2007
Development of Fashion and Luxury Innovative Eyeglass Design, 2008
Digital Simulation Technology Applied on Cabin Design, 2009
Research on Chinese-German Cultural Kitchen System Integration, 2010
Future Family and Kitchen Interactive Space and Relevant Advanced Green Product Design, 2011
A Study on Kitchen Space and Green Lighting Innovation Design, 2012
Application of Innovation Service In-Depth Model on Lock Product Development, 2012

Table 2: Five Cases of Ministry of Economic Affairs CIRD supplier samples

<i>Subsidized or Commissioned institutions</i>	<i>Name of Program</i>
Ministry of Economic Affairs Industrial Development Bureau sponsored 2009 “Taiwan Creative Design” counseling for the innovative design of conventional industries	Multi-Functional Home SPA Massage Series
Industrial Development Bureau sponsored 2009 (CIRD) Conventional Industry Technology Development–Product Design Category	Stylish Home Product Design No.: S09800053-099
Industrial Development Bureau sponsored 2009 (CIRD) Conventional Industry Technology Development – Product Design Category	Future Home Life Aesthetics – Delightful and Practical Product Design No.: S09800053-116
Industrial Development Bureau sponsored 2009 (CIRD) Conventional Industry Technology Development Program – Product Development	Design and Development for Medical Counseling Product Application No.: S09900074-219
Industrial Development Bureau sponsored 2010 (CIRD) Conventional Industry Technology Development Program – Product Development	Design and Development of Sports and Leisure Shoes Product Application No.: S09900074-218

ANALYSIS AND DISCUSSION

Seven Indicators of Manufacturing Servitization on New Product Development Process

Although design is a professional occupation, its effectiveness could not be easily estimated through precise data and methodologies. Hence, design service often faces with multiple challenges in the process of product development, while how to convince the industries into agreeing with your service, accepting your professionalism, and recognizing your work become one great challenge for the industries.

Design service not only includes professionalism in style, color, arrangement and techniques but also need to express several points to customers. Design is an “objective” industry that could not be expressed of energies through technology, productivity and sales, therefore apart from professional knowledge, the use of non-marketing schemes such as reinforcing customer impression on you, stressing your viewpoints and success cases will strengthen customers’ value judgment on your design and works.

In the past, design service mostly emphasized on the deliberation and persistence on work styles, with gradual transfer from the commercial territory of the industries to the backend CAD/CAM, printing, molding and other manufacturing engineering fields at certain point in time, under the intensely competitive market pressure. However, the researchers stress that there are two most important values to design, one is the

innovation trend and the other is the marketing strategy. Hence, even if the industries intend to “transform,” they need to progress towards the frontend “market research” or the very backend “marketing” of the industry chain, and consequently not only can the design professionalism be extended but can also more “explicitly” create values for customers (Arikan 2009).

The following is the development process of “how to development products under manufacturing servitization” with a list of seven thinking using industry transformation to strengthen customer recognition, which is not only used by existing industries to strengthen the value between manufacturing and services but can also be the key indicators applied to product development process (Bien and Hsu 2013).

Preparing Professional and Exquisite Company Introduction and Websites to Win Customer’s First Impression

Introduce your professional services and design styles via written forms and websites. Such introduction includes: brands, design methods, success cases, and awarded works. Not all proprietors have design demand at all time and the best way is to arrange a face-to-face interview by leaving a written document as reference. The company introduction needs to be straightforward and powerful by leaving two to three key points on the website or the written documents. Focus on the design style, cases and media report whenever possible, as the information will leave impression on the customers.

Fully Understand Customer Products and Market, Providing Customers with the Optimal Solutions

Talk with customers using the same language when interviewing them, understand the professional terms of the industry while proposing a set of Design Solution that will meet customer production and market expectation, or least let the customers know that you understand them. For example, what are the domestic and international competitors of the market and what are their product styles and strategies? What is the expectation of consumer market? How to develop potential consumer groups? How do customers create business opportunities through products or service innovation? Such issues require re-study prior to the visit.

Apply Project Management Techniques to Control Design Quality and Emphasize on Professionalism

Most designing departments offer flexible design process and management for the entire project while sometimes without any rules to follow, in the event of meeting customers' demand in rushing for the deadlines. In the past, some customers has played role of designer for on-site design while the designer also agreed. It was inevitable that the customer became the creative director, supervising the work of the designer. As a result, the case failed and the project did not go into mass production, as one of the biggest reason being that the product did not differentiate much from past product creativity.

It is necessary for the designing department to develop a set of project management on the control over time and resources for the projects, as all creativities require project management to control and quality while protecting the industries from defeating themselves due to customer pressure. Such project management must be packaged into maximizing customer interests while showing the competency of the designing department.

Work for Special Market Presentation or Awards to Increase Value Recognition for Services from the Industries

Special performance and awards on the market can improve the brand value of industries to

service providers, strengthening customer trustworthiness in you. In particular, the past achievement of excellent market performance will be most convincing. Such records will help customers value your design process, viewpoints and outcome. For example, famous ASUS and BENQ companies from Taiwan have created rich design performance as a result of reporting on international awards.

Create Media Exposure, List Media Reports, and Produce Third-Person Word-of-Mouth Marketing

Third-person's words are always easily accepted by customers when you and your customer engage in first contact. The media not only represents the third person but the majority of third persons. Hence, manufacturing industry should learn to express them through media exposure, since "service and design" is another industry that needs persuasion. Publicity also serves as a powerful mean apart from the products, design brand, and designers.

Additionally, word-of-mouth marketing is quite important. Statistics show that the first cooperation with customers mostly come from introduction and design companies should participate in social events with interactions to expand the sources of business opportunities.

Publish Works with Solid Context

Creativity requires instruction and most customers hold standards for creativity based on the product patterns of existing market. When the designing department proposes proposition for creativity, several illustration and sample diagram are not enough while a story with life needs to be invigorated into this proposition. An instruction far more superior than existing products and the interpretation of commercial strategy should be provided to help customers enter a new scenario, using story and culture to bring the manufacturing industries closer to consumer service orientation.

Strategy Services

Design projects not only offer pattern design and visual design of products but can also create benefits in marketing and production. For example, the designing department can introduce

new production resources, new technology, special components or materials, funding, and marketing cooperation opportunities for customers. Particularly, the designing department can assist the suppliers obtain relevant know-how and resources for some conventional suppliers stepping into new products and the new market, which not only assure successful mass production of design but obtain more trustworthiness from customers.

In sum, the designing department should focus on creativity capacity as well as strengthening resource management and communication ability in order to design exceptional products and improve the future production and sales likelihood of customers.

CONCLUSION

Finally, the paper highlights and integrates the key for manufacturing industry in transition to servitization for the designing and R&D departments to conduct reverse deduction (Fig.6) through the physical and virtual channel thinking, so that the process of innovation product

development will face with the new trend of future manufacturing servitization more effectively, as show in the following five conclusions:

- ▲ The product development unit of the supplier (designing department) should serve as cluster communication and coordination with definition of role importance.
- ▲ Use service design thinking for manufacturing servitization as the future trend of clustering industry development.
- ▲ Successful clustering development is determined by the integration efficiency of various internal organization chains.
- ▲ Clustering thinking model contains advantages such as value-added creativity, innovation and savings in transaction costs.
- ▲ The flow chart for the product development model operation of representative suppliers in this study is carefully compared with the interview of supplier representative to solve the service innovation development model that has not been revealed from past literature.

Such indicators will provide important reference for the industries with considerably important shortening of R&D schedule.

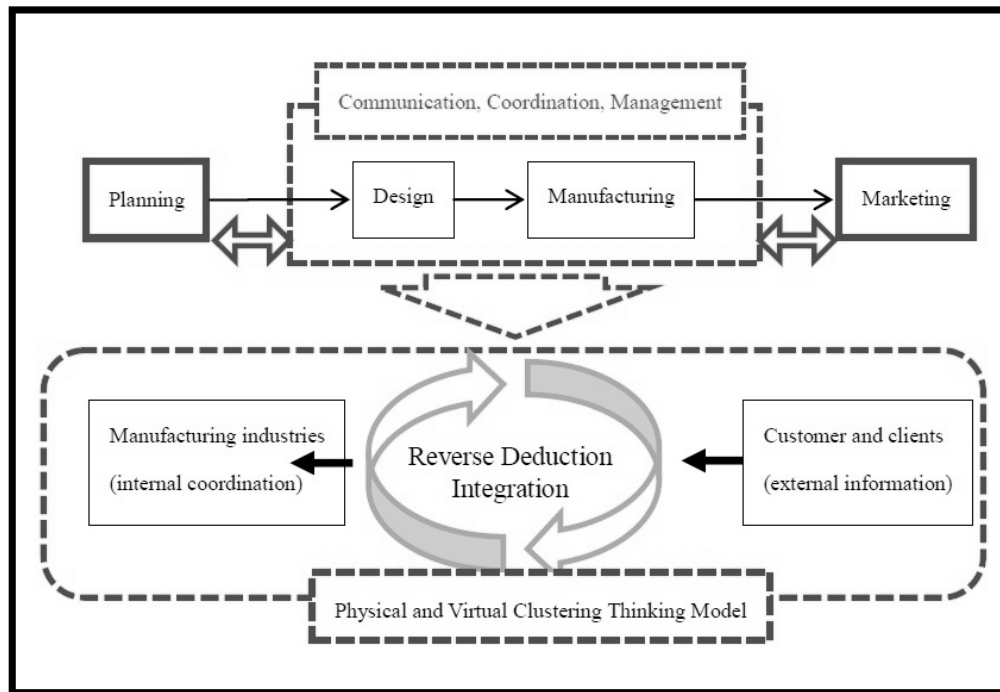


Fig. 6. Innovative clustering thinking model for product development process

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