

# A PARTICIPATORY APPROACH FOR INDUSTRY CHAIN CONSTRUCTION

## ABSTRACT:

Design is the soul of a product and an important strategy for business development. In post-industrial era, design scopes have expanded from the products to industries. Industry chain is an important reference for industrial structure analysis and the development of design industries. However, most industry chains are constructed by experts who apply statistics, relevant literature, and their own intellects. The chains constructed by experts would be rather subjective when applied to unfamiliar industries. Market researches that used to be conducted by researchers now involve consumer participation. Likewise, a participatory mechanism should be established in industry chain construction. The research is conducted to fulfill this purpose.

The process of participatory industry chain construction involves the following five steps: (1) Preparation: study literature, collect manufacture lists, formulate semi-open questionnaires and select interview subjects. (2) Construction of the basic chain: establish the industry chain based on the information collected, and then choose one subject among major suppliers, manufacturers and vendors to conduct in-depth interviews, understand industrial structure, current status quo, key elements and mutual dependence. The interviewees are asked to help modify the contents in the basic chain and recommend three other suppliers/ manufacturer/ vendors for the next interview session. (3) Completion of the industry chain: after snowballing interviews, if only less

than 5% of the contents are subject to changes, it indicates that the chain is close to completion. Otherwise, more interviews need to be carried out. (4) Review industry chain: invite all the interviewees and experts from the industry, government, academia and research sectors to participate in a seminar to review and refine the contents of the industry chain. (5) Confirmation of the industry chain: expand the scale of seminar by inviting experts from other sectors.

Being commissioned to conduct the “Survey on the resources and current status of cultural and creative industries in southern Taiwan” by Council for Cultural Affairs, the researchers took this opportunity to verify the feasibility and usability of the proposed model and presented the industry chains of twelve cultural and creative industries. The research results indicate that on average, 3 sessions of snowballing interviews (which involve about 21 companies) can render nearly completed investigation results. The qualitative construction method of participatory industrial investigation consumes less resource than the quantitative approach adopted by experts. Information of non-formal questions can also be obtained to reflect the mindsets of participating businesses and the current status, problems, demands as well as the vision of the industry. The contents are therefore more close to reality. The final results received unanimous recognition by the review committee members of Council for Cultural Affairs. The committee also regards the research results as a more comprehensive version than the other three. The research result also implies the hidden values and the effects driven by the industry. It was evaluated to be the best among all industrial investigation teams and can serve as a model for future related projects.

**KEYWORDS:** Industrial Design, Industry Chain, Participatory Industrial Investigation, Cultural and Creative Industry

## 1. GLOBALIZATION AND GLOBAL TRENDS

Globalization refers to the changes in the concept of distance and time. It is a “distance effect” which has been reinforced by global communication and mass transportation system (Giddens, 1999). German sociologist Ulrich Beck believes that globalization is the “disappearing of distance” (Beck, 1999). It is a lifestyle “not preferred, not understood” by people. Globalization represents the degree of engagement in political, economic, social and cultural activities across national borders by the population of a nation (Wu & Lin, 2003). Every country has its own history, traditions and cultures, which will affect other countries in various ways after globalization (Wang, 2002). Globalization is a convergence of different cultures. As a result, cultures have become an

indispensable factor in economic development processes (Boger, 2003) and a driving force of globalization.

The competitive factor of nations in the 19th century was military force. It was replaced by technology in the 20th century and culture shall dominate in the 21st century. As the senior official of Department of Culture in Denmark Mikkelsen (2005) suggests, cultural industries have become global industries of growth. These industries are also the key areas of competition and cooperation in the value chain of global industries. According to UNESCO, "cultural industries" are the industries that "use creativity, cultural knowledge and intellectual property to produce products and services with social and cultural meanings". According to this definition, cultural industries are in fact "cultural and creative industry" that combines creativity.

To keep up with global trends, Taiwan government proposed "Challenge 2008: National Development Plan" (GIO, 2002) which specifies cultural and creative industries as one of the key development projects. It is hoped that the development of cultural and creative industries can combine commerce, technology, arts and cultures to create new market values, achieve overall economic growth and improve the quality of life. In 2004, the central government divided Taiwan into four regions: northern, central, southern and eastern regions. Research groups in these regions were commissioned to conduct the "Survey on the resources and current status of cultural and creative industries", which served as a guideline for developing cultural and creative industries in these regions. The College of Planning and Design, National Cheng Kung University was responsible for the investigation in southern region. The authors participated in the research on industry chain analysis, which played an important part in this project.

Most industry chains are constructed by experts who apply statistics, relevant literature, and their own intellects. The chains so constructed by experts would be rather subjective when applied to unfamiliar industries. In addition, relevant literature fails to present the current situations in the industries. Ideally, questionnaires should be as comprehensive as possible. But the return rate is usually low. Questionnaires might be filled in by secretaries or other staff rather than by the key person. Therefore, the results are often unable to reflect the whole picture of the businesses or industries. Furthermore, the questionnaires involve revenues and management strategies. Given the rampant frauds and cheating in the society, it is very difficult to improve the willingness of answering questionnaire and return rate. The massive amount of money and time spent on questionnaires usually fails to render satisfactory results. In constructing industry chains, a standard procedure and method have yet to be established. The results from different research

can hardly be used as applicable historical information. As for the subject industry being described, since the function of industry chain is to present the current situation and structure of a single industry, the chain can be constructed based on statistics. However, the chains cannot reflect corporate alignment and diversification, which are the major trends around the world. This research is conducted in hope of complementing the drawbacks in previous researches.

Targeting on cultural and creative industries, the research analyzes the current methods and drawbacks in constructing industry chains. More effective methods, principles and procedures for participatory industry chain construction are proposed based on the “user-oriented” concept. This research can help related personnel understand the current situation and future development of industries and serves as a strategic tool for industrial growth and sustainable management.

## 2. LITERATURE REVIEW

### 2. 1. DEFINITION OF INDUSTRY AND INDUSTRY CHAIN

Industry refers to a group of companies with the same clients or technologies that form a chain from upstream to downstream (Hung, 2000). Manufacturers, wholesalers to vendors are all engaged in the production or distribution of the same or similar products (Shahid Yusuf, 2005). Industries have three features: (1) mass production: companies engage in mass production or provide services to customers; (2) standard operation procedures: companies use standard operation procedures to ensure the quality of products or services, and (3) self-reliance: manufacturers or providers gain returns directly from consumers through the market mechanism, sustain risks or share profits (Wu, 2005).

In general definition, an “industry chain” is composed of companies which benefit the end users. (Wang, 2005) Handfield (2002) views industry chain, which illustrates the relationships of production and distribution, as an analytical framework for comparisons of various factors and profits. In addition to creating more value and service for customers, businesses must establish an industry chain to create links with upstream and downstream businesses. Businesses in the industry chain can then devote to their specializations, build channels in the market and satisfy the needs of customers (Poirier, 2003). With industry chains, businesses can seek support from different areas and industries, make large amount of profits in a short time and create an environment for sustainable development (Ho, 2003).

## 2. 2. INDUSTRY CHAIN FORMS

Most industry chains are constructed and drawn by experts who apply statistics, relevant literature, and their own intellects. The chains so established would be rather subjective when applied to unfamiliar industries. Standard method, principles and procedures have yet to be established.

Charts can be divided into many categories: matrix chart, tree, ring, net, bridges, process flow, multi process flow, bubble diagram, double bubble diagram and cause-and-effect diagram (Hyerle,2003). Industry chains can be illustrated in various forms. It can be noticed that a majority of industry chains are presented in process flow charts, for its merits of clear representation of structure and procedures. Few are presented with bubble diagrams and nets. No previous research has provided suggestions for the symbols to be used in industry chains. Referring to the chart components in logistics management by Lu (2003) and those in information management by Wu (2004), the basic symbols that can be applied in industry chains are listed as Table 1.

Table 1: Basic symbols that can be used in industry chains.

Symbol	Name	General Description
	Oval	Symbol for content or start
	Rectangle	Symbol for procedure or range
	Dialogue box	Symbol for hints or highlights
	Clouds	Symbol for questions or confusion
	Pentagon	Symbol for data input and output
	Bold line	Line for connection or branching
	Arrow line	Line for connection or indexing
	Dotted line	Line for connection or seperation

Ideal industry chains must include core items and contents as well as divisions of upstream, midstream and downstream. In addition, the relationship, relativity, resources invested in early stages, key success elements, obstacles for industrial development and trends should also be displayed. Market researches used to be conducted by experts, but now consumers are invited to take part in the research process. An urban research scholar (Emily, 2006) points out that having citizens participate in research process will not result in limitations or drawbacks. Allowing citizens to take part in discussions can urge researchers to be more careful in formulating plans. Most

importantly, the real information and substantial information can be obtained. Therefore, industry surveys should also involve the participation of businesses within the industry.

### 3. PROCEDURES FOR ESTABLISHING INDUSTRY CHAINS

Since the quantitative method adopted by the expert approach has many drawbacks, this research proposed a qualitative participatory construction method. Through snowballing interviews and semi-open questionnaires, researchers could gather opinions from industry representatives and business managers. The jointly-conducted industry chain can reflect the mental model of participants as well as the current situations, problems, demands and vision of the industry. The procedure and methods for constructing participatory industry chain consists of five stages:

#### (1) Preparation :

There are mainly three types of preparatory work, namely:

( I ) Studying literature: Reports of industry surveys conducted by the government or related research units and the standard industry categorization for taxing conducted by Ministry of Finance can serve as a reference to understand the categorization and contents of industries. The researchers can determine boundaries of upstream, midstream and downstream in the industry chain.

( II ) Colleting company lists: Company lists can be obtained through governments, unions, associations, websites or yellow books, to name a few. The accuracy of information and the company's willingness in participating interviews must be confirmed through phone calls or e-mail contacts.

( III ) Designing semi-open questionnaires: Questionnaires should include the basic information of companies (names, person in charge, contacts, number of employees, number of creative workers, founded time, capital, revenues, profits, awards, certifications and intellectual property accreditations, etc.), the objectives of companies, organization, management, operation, and problems of industry development as well as industry demands.

(2) Constructing a basic chain :

The basic structure of industry chain proposed in this research is shown in Table 2. According to one's knowledge on the industry, the researcher can decide the types of resources to be invested (for instances, raw materials, tools, workforce, knowledge, capital, regulations and space), the kinds of outcomes to be obtained (namely, products/amenities, artworks/rarities, celebrities/reputation, fashion/culture, revenues/profits, intellectual properties/brands, and landscape/scenic spots), and the boundaries that divide the industry (upstream, midstream and downstream). The resource types, outcome kinds and boundaries can be applied as a basic structure for establishment of an industry chain. The researcher can add or deduct the items in accordance with the attributes of the industry in question. The construction methods will be explained in the next section.

Table 2: Basic development structure of industry chains.

investment in early stages	raw materials, tools, workforce, knowledge, capital, regulations and space
upstream	Based on the gathered data, the researcher
midstream	Uses process flow charts to
downstream	describe the structure and relationships of the industry
expected results	products/amenities, artworks/rarities, celebrities/reputation, fashion/culture, revenues/profits, intellectual properties/brands, and landscape/scenic spots

According to the above basic structure, the researcher constructs a “preliminary industry chain” based on related information and the researcher’s intellect. With the chain as a map, the researcher can ask unions and associations to recommend one company representative from upstream, midstream and downstream of the industry, respectively. The researcher can also select interview subjects from the list of companies in the yellow book. In general, the interview subjects should those who are responsible for large leading companies with a large group of consumers, or those key persons working in companies / art groups that provide highly innovative products or services. Through in-depth interviews, the researcher can understand the structure, development, key elements and interdependence of the industry. The researcher then asks the representatives to revise the contents of “preliminary industry chain”. At the end of the interview, the interviewees are asked to refer three other companies or individuals within the industry as the subjects for the next round of interviews.

(3) Complete industry chains :

Through “snowballing interviews”, the contents of the industry chain can be gradually fulfilled and completed. It is important to transcribe the content of interviews so the researcher can check whether key words or contents are missing. Important sentences and be underlined. The key words or the phrases emphasized or frequently used by the interviewees can be circled and organized. Table 3 is an example of organized transcript.

Table 3: Transcript Sample.

Questions	Answers
What is the process from manufacturing to sales?	The promotion depends on referral or through <u>exhibition</u> , so interested collectors can set prices. Sometimes <u>the Internet</u> can serves as a media for exchanges with consumers or other businesses...
Who is your primary customers and what is the added value of your product?	<u>Temples</u> are the major group of customers. The products are for religious use. Some <u>collectors</u> are also potential customers. The added value of our embroidery products is for consumers to display. These products also contain cultural meanings.

The keywords in the transcripts can be then filled in the “Table of Procedures” (Table 4) in order to produce industry chain. Basically, each key word should be filled in without repetition. When there are repetitions or synonyms, the researcher can only put one key word in the table or create a generic term that can cover the meanings of these words.

Table 4: Sample “Table of Procedures”.

Questions	Answers
Resources invested in early stages	raw materials, tools, human resources, knowledge/information, capital
upstream	materials for artifacts, tools, raw materials, equipments; handmade product by artists
midstream	Contests (add value to human resources, <u>exhibitions</u> (exhibition planning), exhibition venues (cultural exhibition and performance facilities)
downstream	managers, agents, <u>promotion advertisements (campaigns)</u> , channels (domestic and abroad), the <u>Internet</u> , consumers ( <u>temples</u> , <u>collectors</u> ), display and sales of artifacts.
Expected products	art collections, celebrities, fame and reputation, intellectual properties and brands, scenic spots
Core products of the industry	handmade products, contests, exhibitions, managers, agents, sales person of artifacts, consumers

The key information regarding industrial analysis and strategic development such as keys, difficulties, demands and visions are filled in the “Table of Content” (Table 5). The ideas must be presented in precise and concise words. Each sentence should contain no more than ten words in Chinese (or characters in English) to the descriptions so that they can be easily arranged into the chain, or the “map”.

Table 5: Sample “Table of Content”.

Keys for Development	Raw materials, human resources, capital, contests, managers/agents, sales and display of artifacts
Difficulties for Development	Lack of resources, expensive raw materials, lack of human resources and apprentices, lack of new technology and information, lack of promotion in arts, lack of capital in the beginning stages of art creation
Demands for Development	Training artifact talent, promotion by the government, training for marketing talent, improvement in quality
Vision for Development	produce products with local features, integrate artifacts with daily life, create prominent future industry, construct platform for communications, build personal websites for artists, increase exposure, cross-industry alliances and cooperation

After the interviews, the interviewees will be asked to refer three other representative companies or individuals for the next round of interviews. After a complete round of interview, (3 interviewees for the first round and 9 for the following rounds) the comprehensiveness and percentage of changes of the industry chains should be compared before and after the interviews.

The comprehensiveness can be examined with an Examination Table as Table 6 shows. The final industry chain must contain all the items in the table.

Table 6: Transcript Sample.

Items contained in the chain	Complete	Descriptions contained in the chain	Complete
Resources invested in early stages	v	Core items	v
Procedures in the upstream industries	v	Keys for Development	v
Procedures in the midstream industries	v	Difficulties for Development	v
Procedures in the downstream industries	v	Demands for Development	v
Expected products	v	Vision for Development	v

The percentage of changes can be calculated by comparing the changes in the industry chain before and after the interviews. The information before interviews is viewed as 100 points, and the scores of supplemented or changed information are shown in Table 7. If the percentage of change equals or exceeds 5% or 5 points (the percentage is set according to the 95% confidence interval in statistics), the next round of interviews is required. A percentage lower than 5% indicates the information is near completion and the next stage of work can be carried out.

Table 7: Points for changed information.

Information items	Scores
Added or deleted core items or adjustments in key structure	5 points
Added or deleted components of adjustments in branch structure	4 points
Added or deleted details of adjustments in minor structure	3 points
Procedure components remain the same but positions are adjusted	2 points
Other items of information	1 points

#### (4) Review industry chain :

Participatory industry chains are constructed with “snowballing interviews” with companies’ representatives in upstream, midstream and downstream of the industry. Every participant can only provide personal experience based the previous industry chain. To ensure the consistency of the overall viewpoints of all participants, all the interviewees must be invited to a seminar in order to ensure the quality of the industry chain contents and clear up differing opinions. In addition, experts in the industry, government and academia in the region should also be invited to increase objectivity and expand the scope of participation. If the comprehensiveness and percentage of changes of the information in the industry chain meet the requirements described in the previous section, the next stage of work can be carried out. Otherwise, interviews must be conducted with local experts to complement the insufficient information.

#### (5) Establish industry chain:

To reduce the decrease in objectivity resulted from the “local complex”(the collective biased ideology beheld by the experts and company representatives within the region), experts in the industry, government and academia in other regions should be invited to a seminar in order to reconfirm the subjectivity and feasibility of the contents in the industry chain (the applicability of

such methods and contents in other regions). If the comprehensiveness and percentage of changes of the information in the industry chain meet the requirements described in the previous section, the construction of industry chain is completed. Otherwise, interviews must be conducted with experts in other regions to complement the insufficient information. The seminars and interviews can also be used to understand the uniqueness and differences in the industry development in different regions. However, the additional information is only for reference and will not be included in the content, and nor for calculation of percentage of change, of the industry chain.

#### 4. ACTION STEPS AND METHODS FOR CONSTRUCTING PARTICIPATORY INDUSTRY CHAIN

The craft industry is used as an example to illustrate the action steps described above:

Step 1: Construct preliminary structure of the industry chain (Fig. 1).

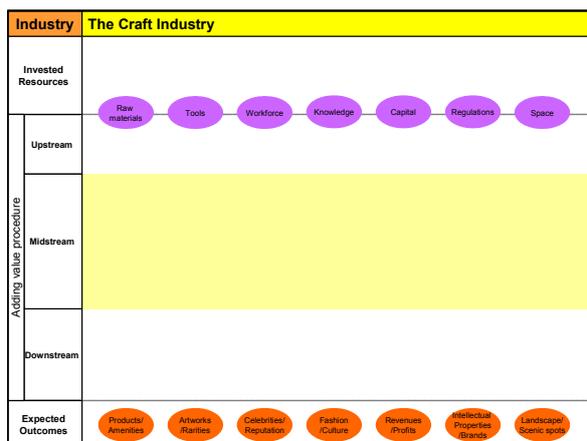


Figure 1: A preliminary structure of the industry chain.

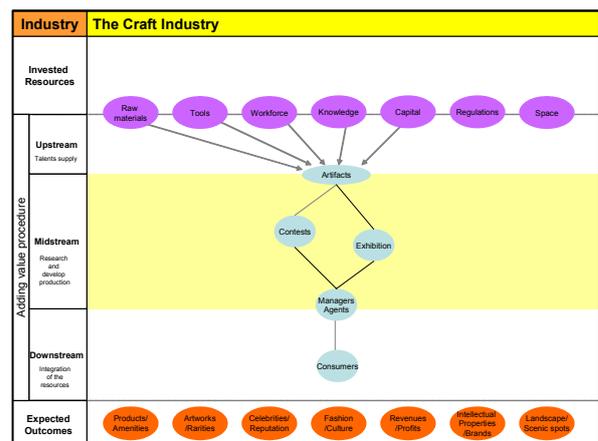


Figure 2: Preliminary industry chain constructed with the intellect of the researcher.

Step 2: Construct preliminary industry chain based on the intellect of the researcher.

Based on the collected information, the researcher can use process flows to describe the structure and relationship of the industry. For example, the “core items” for the craft industry are handicraft works, contests, exhibition, managers, agents and customers (Fig. 2). The relationships between these items can be expressed with arrows or straight lines which form the main structure.

Step 3: Interview one company representative from upstream, midstream and downstream to help revise industry chain

After the interview, key words in the transcript are filled in “Table of Procedures” (Table 4). The industry chain can be drawn or revised based on the additional information in the table. The quantities of items and contents in “Invested Resources” and “Expected outcomes” can be deleted or filled in according to the nature of the industry. If the additional information complements the contents of core items, the information can be expressed with branch lines, for example (Fig. 3), the materials and semi-finished products under the “raw materials” category. In the industry process, items that require cooperation with other industries can be displayed in rectangles or circles.

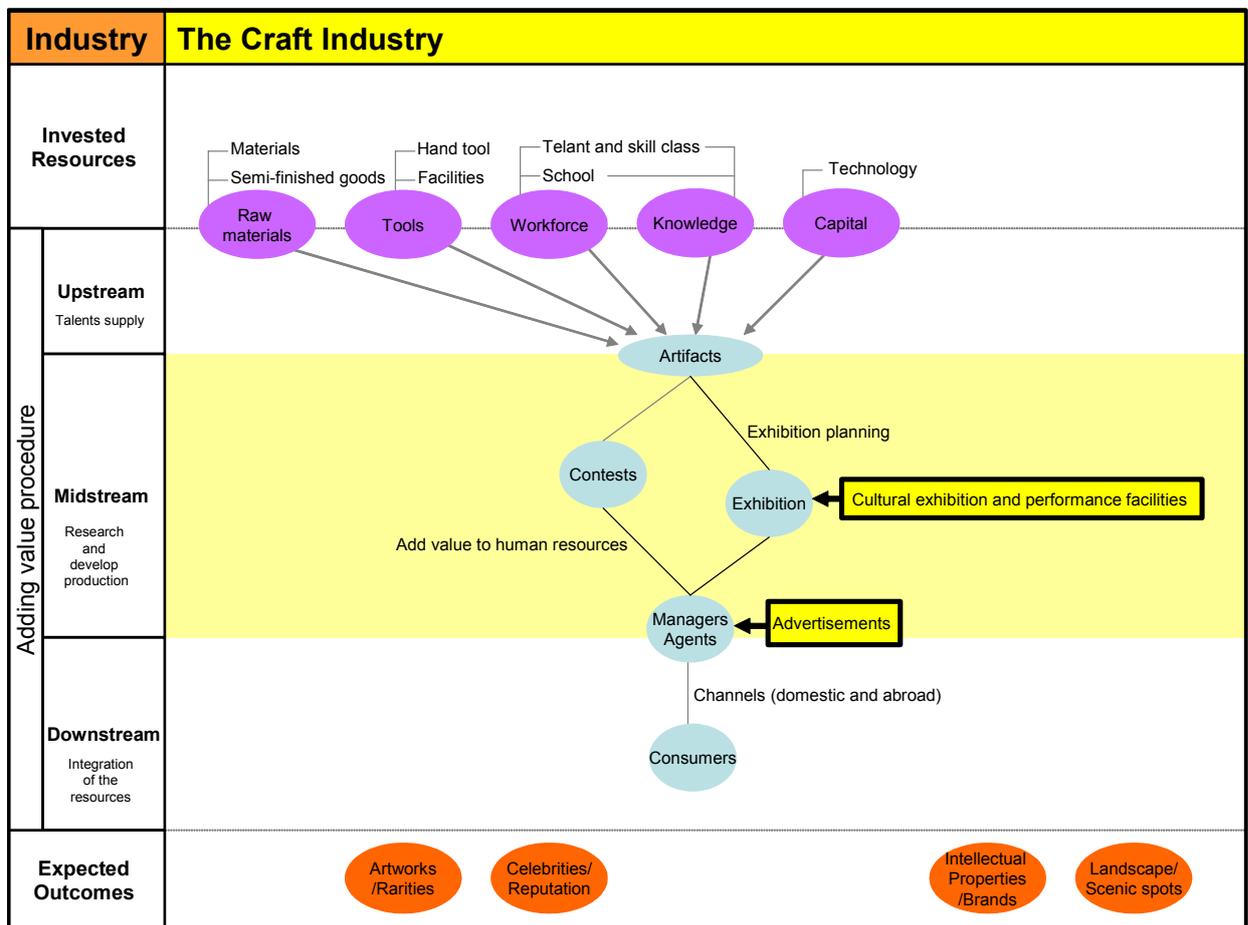


Figure 3: The revised industry chain after the first round of interviews.

Step 4: Industry chain that reflects the intellects of all participants from the industry.

After a complete round of interviews with 9 interviewees, the comprehensiveness and percentage of changes of the industry chain before and after the interviews should be compared. The comprehensiveness can be examined with "Examination Table" (Table 6) to see if contents in all the columns are included. The percentage of changes can be calculated according to "Points for changed information"(Table 7). For example, in comparison with Fig. 3, the additional or changed information in Fig. 4 can be categorized as follows:

(1) One core item is added ("sales and display of artifacts"), scoring 5 points.

(2) One component is added in key structure (an additional line between "contests" and "exhibitions"), scoring 5 points.

(3) Two components are added in branch structure ("temples" and "collectors"), scoring a total of 8 points.

(4) One item is added in branch structure ("exhibition venues" next to "exhibitions"), scoring 3 points.

(5) One detail component is added in ("the internet" is added under "channels (domestic and abroad)" ), scoring 3 points, and the rest can be referred accordingly.

If the percentage of change is more than 5 points, the next round of interviews is required. A percentage lower than 5% indicates the information is near completion. The researcher can then fill in the number of all companies and the interviewed companies in upstream, midstream and downstream of the industry based on the industry list.

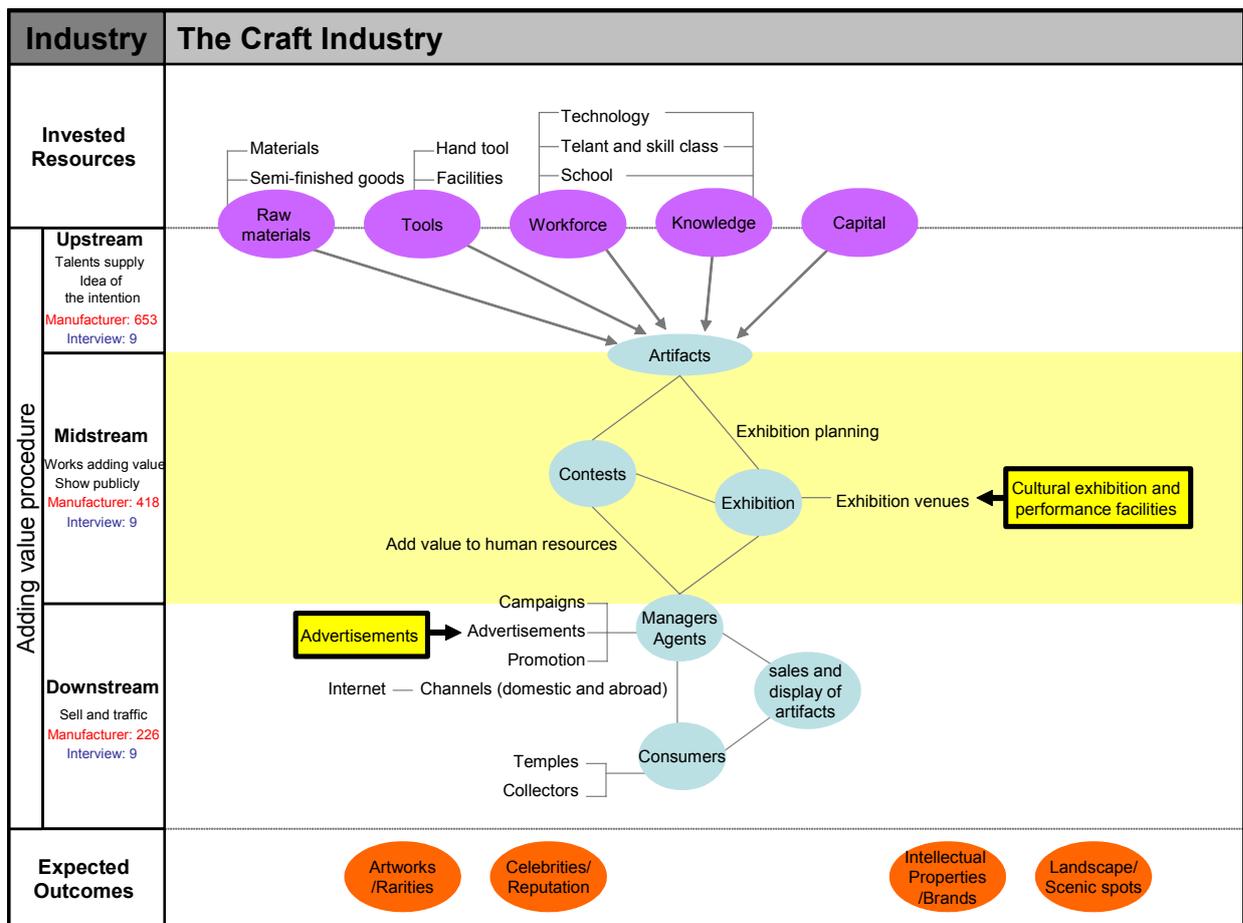


Figure 4: Industry Chain of the artifact industry.

### Step 5: Mark the major contents of “key information”

The last step of constructing industry chain is to arrange the contents in “Table of Contents” (Table 5) in its corresponding positions in the chain. The shapes and colors suggested by this research can be used to present all the contents (Fig. 5) to improve the readability. For example, “keys for development” can be represented with red ovals; “difficulties for development” can be represented with pink dialogue boxes with arch corners; “demands for development” can be represented with light purple clouds; “visions for development” can be represented with light green pentagons.



Table 8: The Major Differences Between “Participatory Model” and “Expert Model”.

Information presented in industry chains	Expert Model	Participatory Model
Resources invested in the early stages	no	yes
Divisions between upstream, midstream and downstream	partial	yes
Display of industry process	yes	yes
Hierarchy between items	partial	yes
Expected outcomes	no	yes
Core items of the industry	yes	yes
Interdependence between different industries	partial	yes
Keys for development	no	yes
Difficulties for development	no	yes
Demands for development	no	yes
Vision for development	no	yes
Important decision-making positions	no	yes
Interdependence with other industries	partial	yes

The comparison shows clearly that industry chains created with “expert model” contain little information about “resources invested in the early stages”, “expected outcomes”, “keys for development”, “difficulties for development”, “demands for development”, “vision for development”, “interdependence with other industries” “important decision-making positions”. “Resources invested in the early stages” is the earliest stage in industry processes. Without this information, it is impossible to capitalize the most important contents and resources of industry development. “Expected outcomes” can be used to discover new markets. Without this information, it is difficult to take advantage of new opportunities and make breakthroughs. “Keys for development”, “difficulties for development”, “demands for development”, “vision for development”, “interdependence with other industries” “important decision-making position” can help clarify the current situation of the industry, formulate strategies and challenge the future. “Important decision-making position” can clearly point out the important timings for industry development or transformation. “Interdependence with other industries” provides industry with the possibilities for cross-industry alliance and diversification to cater to the global trend of compounded innovation.

Industry chains conducted with “expert model” are limited by the quantitative method of “questionnaire statistics”. The most authentic interview information outside the questionnaires can hardly be obtained. However, “participatory” industry chains are constructed by conducting in-depth interviews with industry representatives and are repetitively revised and examined. In comparison, “participatory” industry chains are easier to interpret and contain more information.

Being commissioned to conduct the “Survey on the resources and current status of cultural and creative industries in southern region of Taiwan” by Council for Cultural Affairs, the researchers took this opportunity to verify the feasibility and usability of the proposed model. Four groups of research assistants with different backgrounds (business management, urban planning, architecture, industrial design) conducted the industry chain of three cultural and creative industries based on the proposed procedures and steps. The industry chains cover a total of twelve industries, including visual arts, crafts, designs, brands and fashions, architecture, publishing, advertisement, cultural exhibition facilities, digital recreation, performing arts, radio and television as well as movies. In addition, the questionnaire surveys applied in traditional expert models are also adopted to achieve the same objectives. The research shows that in addition to the first round of interviews, only an average of two rounds snowballing interviews are required to construct complete industry chains. In other words, a complete industry chain can be constructed by interviewing representatives from 21 companies. Due to the common occurrences of frauds in the society, the questionnaires issued by expert model had low return rates of 10-15%, which were insufficient for statistic analysis. The feasibility and effectiveness of the proposed methods were thus evident.

Among the four research groups (northern, central, southern and eastern regions) commissioned by Council for Cultural Affairs, our group was highly recognized by the commissioners and external evaluators. The information collected by our team was much more comprehensive than that by the other three groups, which were collected by expert model. The value and side benefits hidden behind the industry chain can also be shown. The research results of our team were the best and our model can be used as an example for following projects. In general, the qualitative method of “participatory model” consumes less resource than the quantitative methods of “expert model” and can obtain information outside the question, which reflect the intellects of all participants as well as the current situation, demands and vision of the industry. The contents are also more authentic.

## 6. RESEARCH RESULTS AND DISCUSSIONS

Industry chains can help industry analysts understand the structure and interrelations of the industry and provide insights into the difficulties and demands during the development process. It is an indispensable strategic tool for the government to formulate industry policies and for businesses to capitalize opportunities. Through the verification with commissioned researches, the proposed method is proven to be feasible and useful and can be applied to various industries. In comparison with the traditional “expert model”, participatory model has many advantages. The following conclusions can be drawn from the above research:

- (1) “Participatory model” of constructing industry chains is a standardized operation process that allows any researcher with any background to study the industry one is not familiar with. Participatory approach consists of five basic steps: ( I ) preparation, ( II ) constructing basic chain, ( III ) completing industry chain, ( IV ) reviewing industry chain, ( V ) establishing industry chain. The steps of construction include: ( I ) Construct preliminary structure of the industry chain, ( II ) Construct preliminary industry chain based on the intellect of the researcher, ( III ) Interviewing one company representative from upstream, midstream and downstream to help revise industry chain, ( IV ) Industry chain that reflects the intellects of all participants from the industry, ( V ) Mark the major contents of “key information.”
- (2) “Participatory model” constructs industry chains by conducting “snowballing interviews” with representatives from upstream, midstream and downstream of the industry. The opinion and experience of all interviewees can be collected. Through seminars attended by the representatives from the industry, government and the academia within and outside the region, differing opinions can be clarified. The objectivity can be increased and the level of participation can be expanded. As a result, the “local complex” can be minimized to improve objectivity and efficiency.
- (3) Industry chains conducted with “participatory model” can reflect resources invested in the early stages, industry processes, hierarchy between items, expected outcomes, core items of the industry, and interdependence with other industries. Information such as keys for development, difficulties, demands, vision, important decision-making positions and interdependence with other industries can less be observed through traditional “expert model”.

(4) On average, a complete industry chain can be constructed by interviewing representatives from 21 companies. In addition, the standard processes and tools of organizing interview information are proposed for easy operation. The table of examination and the calculation method of percentage of changes are also provided for researchers to understand the comprehensiveness of the industry chain and prevent unnecessary waste of research resources.

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