

Chapter 5

Production Analysis

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I. Sizes of Bosang Umbrellas

Bosang Umbrellas are produced in a variety of sizes ranging from 5 inch to 60 inch in radius of the umbrella. Umbrellas of each size are used for different purposes

Size	Purpose
5 inch	Souvenir
20 inch	Home Decoration and to protect sunshine or rain
60 inch	Home Decoration and to protect sunshine or rain

II. Components and Materials of Bosang Umbrella

The Components of Bosang Umbrellas can be divided into 2 major parts which are umbrella frame and covering materials. Materials used for each part of umbrella are selected basing on their attributes and characteristics in accordance with the functions and the purpose of use of those particular parts. There are also a number of alternative materials for each component.

a. Umbrella Frame

Umbrella Frame consists of the following components

Upper and Lower Heads of Umbrella

Upper Head of Umbrella is located on the top of umbrella handle. It is the component to which all the ribs is mounted. Lower Head is located on the bottom where it is mounted with all the struts of umbrellas. Both upper and lower heads have similar figures and are made from soft wood such as Kraton, Mokman or other soft wood which have low shrinking rate when become dried and easy for grooving.

Rib

Rib is an important component of the umbrella frame because it serves as the holding frame on which the Sa paper will be pasted. Another function of ribs is to control the opening and closing of the umbrella. There are 2 types of ribs which are short and long ribs. Generally, rib is made of bamboo because it has high durability and strength and can be easily cut into small-thin pieces.

Strut

The component that is used to connect the ribs to the umbrella frame is called Strut. Generally, struts are made of bamboo because of its high durability and strength (The same wood as ribs)

Stem

Stem is the connector part of the umbrella frame and handle. It is a slider part when opening or closing the umbrella. Mostly, it is made from palm leaf.

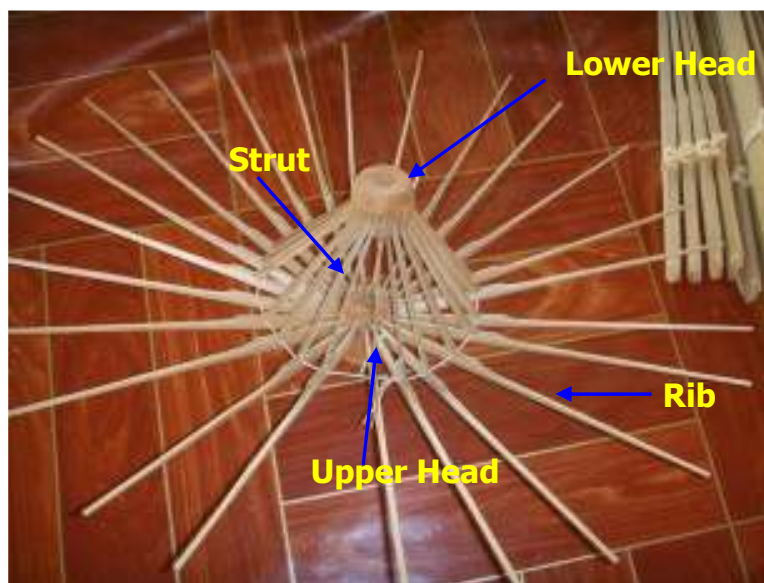
Umbrella Handle

For umbrella of small sizes, the handle is generally made of soft wood locally known as Poi because of its characteristics and high availability. For large umbrellas, bamboo is used to support the weight of the umbrella. The wood material is sharpen by a knife into the designed shape of handle.

Bolt

The function of bolt is to prevent the umbrella from returning to the close position. Spring and sharpened bamboo are used to make bolt for umbrella of small and large sizes respectively. Drill a hold in the umbrella handle and put the bolt into the hold and nail it together.

Figure 5-1 : Components of Bosang Umbrella Frame



Source: Above picture was taken at Umbrella Making Center 1978 Co., Ltd. on 7th Oct 2005.

b. Covering Materials of Bosang Umbrella

There are various types of materials which are used to cover the umbrella frame such as paper, silks, rayon and many other materials. This study focuses only on locally made paper called Sa paper. Sa Paper has a botanical name as *broussonetia papyrifera*. It is made by a complex process from the bark of the mulberry tree. Sa paper is wafer-thin but it is also extremely smoothed by hand during each application until it is taut and even.

Figure 5-2: Sa Paper



Source: Above pictures were taken at Ton Pao Village on 7th Oct 2005.

III. Production Process of Bosang Umbrella

The Production process of Bosang umbrellas can be classified as the process-focused process. Each work cell produces components of the umbrella separately and then supplies the components into the assembly process. As shown in Figure 5-3, the whole process can be divided into 7 main processes as follows:

1. Umbrella Upper and Lower Heads Making Process
2. Sa Making process
3. Rib &Strut Making Process
4. Umbrella Handle Making Process
5. Umbrella Frame Assembly Process
6. Umbrella Covering Process
7. Painting Process

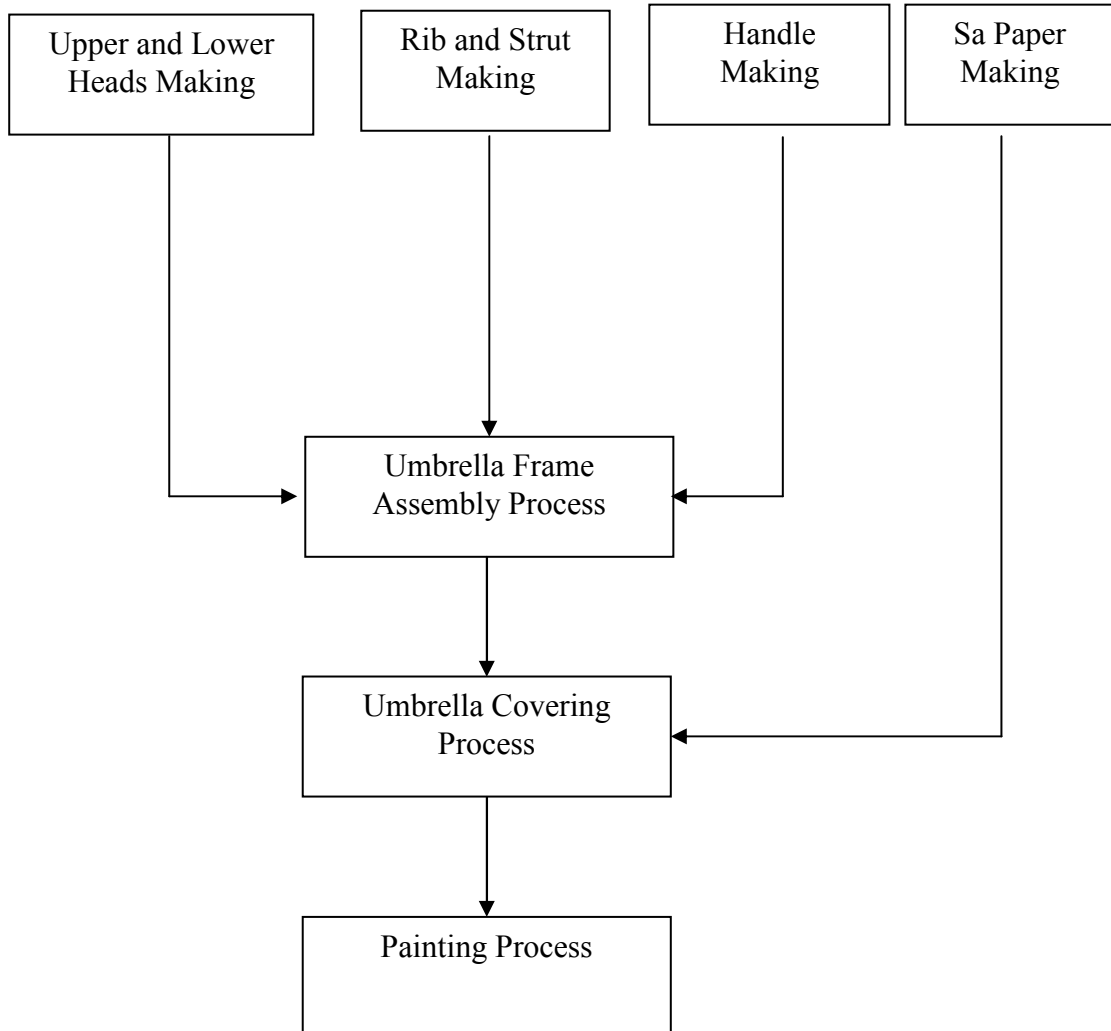
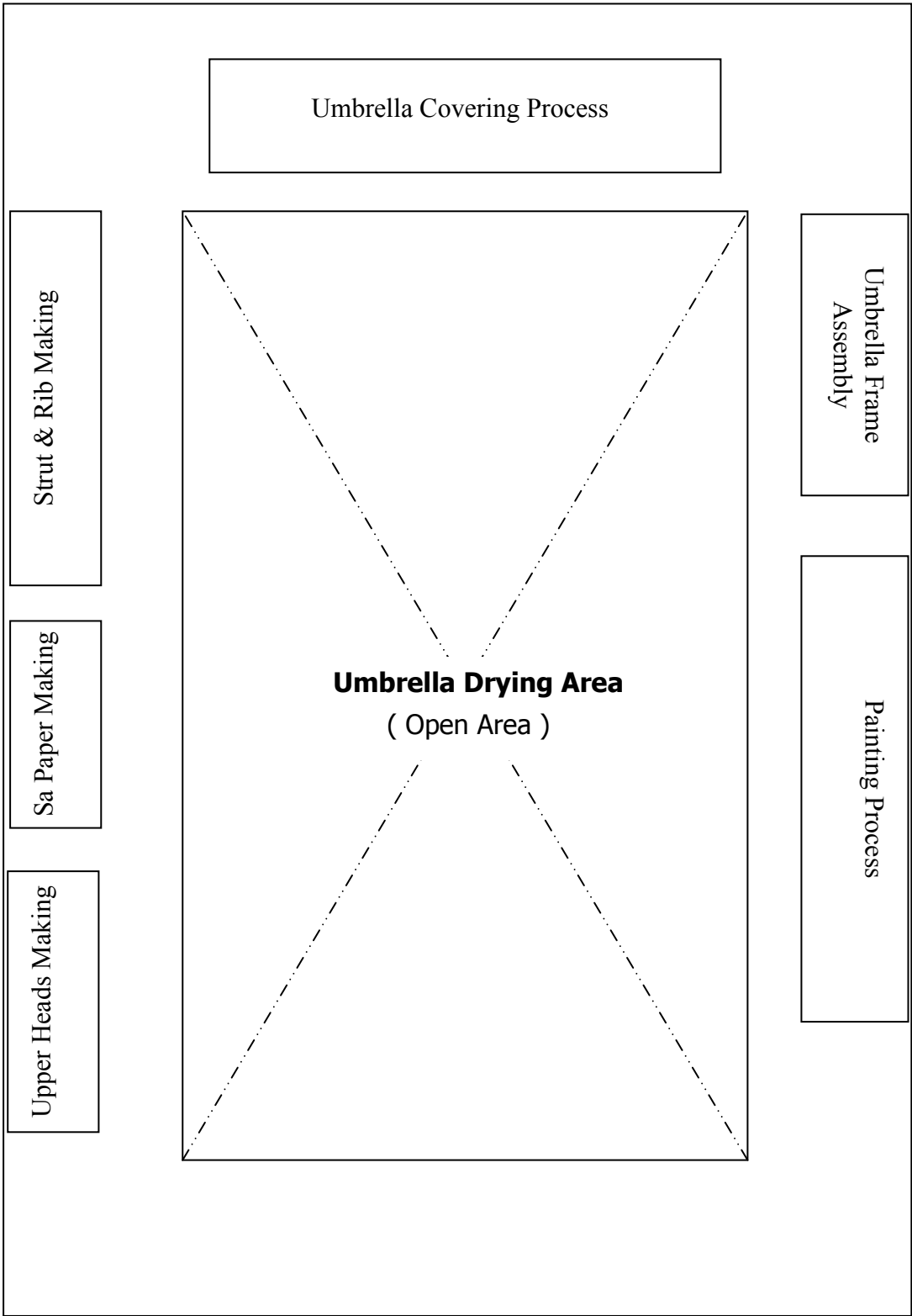
Figure 5-3: Production Process of Bosang Umbrella

Figure 5-4: Umbrella Production Process Layout at Umbrella Making Center 1978 Co., Ltd.



1. Umbrella Upper and Lower Heads Making Process

Upper and Lower Heads Making is the first process of the umbrella making. Upper and Lower heads are made of soft wood such as Kraton, Moke using simple lathe machine inherited from precedent generations. Sticks of kraton wood with dimensions between 3 – 5 inches are cut down into pieces of length between 5-8 inches and then are drilled before being fed into the lathe machine. The work piece is mounted firmly onto the lathe machine and skilled workers control the cutting tool to shape the stick wood into the acute or obtuse heads or other shapes of the upper head as designed. One wood stick can be used to make 4-5 heads and then, after the lathe operation, the stick is cut to separate for each head and tail. Then make grooves into the upper heads according to the number of ribs and struts.

Figure 5-5: Umbrella Upper and Lower Heads Making Process



Source: Above pictures were taken at Umbrella Making Center 1978 Co., Ltd. on 7th Oct 2005.

2. Sa Paper Making Process

Mostly, the Sa Paper used for making umbrellas at Umbrella Making Center is purchased from villagers in neighboring areas. There are many villages such as Tonpao which make Sa Paper to supply to the umbrella makers. At the Umbrella Making Center, the production of Sa paper is demonstrated mainly as part of the entire process for the purpose of attracting tourists.

Sa Paper Making process

1. First soaking the bark of mulberry tree in clean water for about 24 hours.
2. Boil the bark with caustic soda in the proportion of 1 kilogram of caustic soda per 16 kg of Sa bark in the 200 liters tank by using several kinds of ashes for about 3-4 hours and rinse it with clean water
3. Beat it with mallet until tender.
4. Spin the bark using whirling machine for about 5 – 10 minutes
5. Thereafter, the fibers are put into a water-filled tank and stirred with a paddle until the fibers are suspended in the water.

6. Then, the fibers are sifted with a screen and dried in the sun for about 1 hour .
Once dried , sheets of paper formed can be peeled off easily

Figure 5-6: Sa Paper Making Process



Source : Above pictures were taken at Umbrella Making Center 1978 Co., Ltd. on 7th Oct 2005.

3. Rib & Strut Making Process

Rib & Strut are made from bamboo because it has high strength, durability and beauty compared to other kinds of wood.

Rib Making

1. Cut the bamboo into pieces of certain length based on the sizes of the umbrella
2. Split the bamboo into small pieces and scratch off the joint of the bamboo with a knife
3. Rip the bamboo into 8 – 9 pieces and use a sharp knife to shape each piece into the rib by tapering one end of the piece and split some part of the other end for insertion of strut.
4. Drills 2 holds, one at the end for threading string to hold it with upper heads and the other hold at the middle to hold it together with struts.

Strut Making

1. Sharpen the bamboo until it become throughout flat for insertion into the umbrella head and ribs
2. Use a driller to make 2 holds on it, one for threading with the lower head and the other with ribs.
3. The hold at the end of the strut should be drilled using singed steel instead of a driller to prevent the bamboo from being broken.

Figure 5-7: Rib and Strut Making Process

Source: Above pictures were taken at Umbrella Making Center 1978 Co., Ltd. on 7th Oct 2005.

4. Umbrella Frame Assembly

To assemble the umbrella frame, ribs, struts, upper and lower heads of umbrella are threaded together with a tough string as described in the following procedures:

1. Thread a string into the holds of all ribs and struts.
2. Wind the string into the hold drilled in the process of upper and lower heads making.
3. Put the ribs into every groove of the upper head (one rib per one groove) and struts into the grooves of the lower head in the same manner.
4. Bind the string tightly.
5. Then the umbrella handle is put through the lower and upper head.

Figure 5-8: Umbrella Frame Assembly Process

Source: Above pictures were taken at Umbrella Making Center 1978 Co., Ltd. on 7th Oct 2005.

5. Umbrella Covering Process

After the umbrella frame components are assembled into the complete one, the next step is to cover this frame with the covering material which, in this study, is Sa paper. To ensure the Sa paper is tightly held with the umbrella frame and will not be peeled off when the umbrella become wet, a special adhesive substance is required. The adhesive used in this process is made of a mixture of paste and persimmon fruit secretion. The secretion of the persimmon can be obtained by pounding a certain amount of persimmon fruit in a gigantic mortar using a large pestle. Then ferment the pounded persimmon fruit for a period of 2-3 months before it can be used as a mixture.

To cover the umbrella with Sa paper, apply the special adhesive substance onto the ribs of umbrella frame for 2 times and then cover it with the Sa paper. Then trim the Sa paper to the edge of the umbrella frame. After that, expose the umbrella frame to sunshine until it is dried out. Finally, apply pure paste and dry it in sunshine again.

Figure 5-9: Umbrella Covering Process



Source: Above pictures were taken at Umbrella Making Center 1978 Co., Ltd. on 7th Oct 2005.

6. Painting Process

Painting is the final process of umbrella making. It is a very important process because it attracts interest of tourists. The painting work is performed by experienced workers who have developed their drawing skill since childhood. Painters use 2-end paintbrush with water or oil paint to draw pictures of creature, flowers and other design such as roses, birds, dragons etc. onto the umbrella.

Figure 5-10: Painting Process



Source: Above pictures were taken at Umbrella Making Center 1978 Co., Ltd. on 7th Oct 2005.

IV. Analysis of Bosang Umbrella Production Process

Umbrella Making Center's production system employs a large number of people throughout the production process. It is useful to study whether each worker is, on average, performing their job efficiently. There are several approaches traditionally used to identify the performance of the production process.

a. Capacity

Production capacity is the output of a production system in a given period of time. It is normally expressed as a rate such as the number of tons of steel that can be produced per week, per month or per year. For many companies, measuring capacity can be straightforward: It is the maximum number of units produced in a specific period of time. In case of Umbrella Making Center, determining capacity is quite difficult because there are various types and sizes of umbrellas which require different production time. However, to simplify the measurement of capacity, this study determines the capacity of Umbrella Making Center as the maximum number of umbrellas produced in a month regardless of their sizes and types.

In 2005, on average, Umbrella Making Center produced 4,500¹ umbrellas of various sizes and types a month. However, that number should not be taken as capacity because it is not the maximum output. The management of Umbrella Making Center estimates that 6,000² umbrellas can be produced each month once

^{1,2} From interview with Mr. Kiattipong Pipatjariya (Personnel Manager) on 5th November 2005

full resources including materials and manpower are applied into the production process.

b. Labor Planning

Labor is an important factor involved in a production process. Umbrella Making Center employs approximately 70 workers³ (both permanent and temporary) throughout the whole production process. Workers are assigned to each step of the processes basing on their skill and experiences. The number of workers assigned to each process depends on the time spent on that process. Nevertheless, most workers can perform many different tasks and can be transferred between processes in case of shortage of workers in some processes.

Table 5-1: Allocation of Workers in the Production Process.

Process	No. of Workers (Person)
Upper and Lower Heads Making	5
SA Paper Making	6
Rib & Strut Making	10
Umbrella Handle Making	5
Umbrella Frame Assembly	14
Umbrella Covering	14
Painting Process	16

Source: From interview with Mr. Kiattipong Pipatjariya (Personnel Manager) on 7th October 2005

Since the demand for Bosang umbrellas quite fluctuates over seasons, the manpower needed to be employed in the production process should varies as well. Umbrella Making Center should forecast the demand for each period and try to arrange the manpower to meet with the changing demand by controlling the number of temporary workers. This can prevent the problem of under or over staffing

c. Productivity

The concept of productivity is widely used in many industries. It is regarded as one of the most important indicators of the efficiency of the production system. Basically, productivity is measured as a ratio of output per input. However, businesses may define output and input differently. For this study of umbrella making, the concept of productivity is adopted by defining it as the number of output of umbrella per man hour.

$$\text{Productivity} = \frac{\text{Umbrella Output (Unit)}}{\text{Labour Hour}}$$

³ From interview with Mr. Kiattipong Pipatjariya (Personnel Manager) on 5th November 2005.

In case of Umbrella Making Center, approximately, the output of umbrella (in various sizes) per day is 150 units⁴ while the number of worker employed in the production department is around 70 persons. On average, each worker works 8 hours a day.

Hence, the productivity of Umbrella Making Center's production process can be calculated as follows:

$$\begin{aligned}\text{Productivity} &= \frac{150}{70 \times 8} \\ &= 0.27 \quad \text{Units/Hour}\end{aligned}$$

d. Efficiency

Efficiency is another important indicator in analyzing the production process. It measures the workers performance on their job compared with the targeted standards set by the management.

$$\text{Efficiency} = \frac{\text{Actual Output}}{\text{Effective Output}}$$

For Umbrella Making Center, we calculate the efficiency is calculated as follows:

$$\text{Efficiency} = \frac{\text{Umbrella Output}}{\text{Effective Umbrella Output}}$$

Since there is no standard output of umbrella set by the management of the Umbrella Making Center, we cannot calculate the efficiency of the production system at present.

V. Production Process Layout Analysis

According to Figure 5-4, umbrella production process layout at umbrella center can be classified as process-oriented layout because it focuses on each process rather than products. Workers and equipment are organized into small groups called *work cells*. Each work cell produces only single component or a group of related products to supply to the assembly process. Process-oriented layout is suitable for production of Bosang umbrellas which has a variety of types and sizes because it has a relatively high degree of flexibility as compared to other layout designs. This kind of layout also allow for customization of products to meet with the changing requirement of the customers. Once the umbrella design or sales volume changes, these work cells are reconfigured to accommodate the changes. Other advantages of Process-oriented layout are as follows

⁴ From interview with Mr. Kiattipong Pipatjariya (Personnel Manager) on 7th October 2005

1. Reduced work-in-process because the work cell is set up to provide a balanced flow of components from process to process.
2. Reduced raw material and finished umbrella inventories because less work-in-process allows more rapid movement of material through the work cell.
3. Reduced direct labor cost because of improved communication between employees, material flow and improved scheduling.
4. Less floor space required because less space is needed between processes to accommodate work-in-process inventory.

However, the umbrella production process of at umbrella making center is designed partially in a way to demonstrate tourists and visitors on how Borsang umbrellas are traditionally produced. Therefore, the layout design of each process or work cell are lined up continuously into the U-shape as shown in Figure5-4. This leads to some inefficiency of the production process since the distance between each process might be greater than it should be, hence, causing waste or unnecessary motion of workers or materials during the process.

VI. Inventory Management

To accommodate the fluctuated production plan which is set to meet changing demand for umbrellas and to minimize the cost of holding inventory, effective inventory management is crucial. Inventories of Umbrella Making Center are categorized into 3 types: Raw material inventory, work-in-process inventory and finished umbrella inventory.

a. Raw Material Inventory

Raw materials are inventories that have been purchased but not processed. Since most of the raw materials for making umbrellas at Umbrella Making Center are purchased from the local suppliers who are able to deliver the materials within a very short time after receiving orders, Umbrella Making Center usually maintain very low inventories of raw materials. This is consistent, to some extent, with the just-in-time inventory approach which aims at reducing the cost of holding inventories by storing the minimum inventories necessary to keep the production system running perfectly. This means that the exact amount of raw materials will arrive at the moment when they are really needed.

For umbrella making, major raw materials can be roughly divided into 2 categories which are (1) materials used to make umbrella frame such as bamboo, Kraton wood and other soft wood and (2) covering material such as Sa paper, silk etc. In general, Umbrella making center uses materials ordered from its reliable suppliers whom it has been dealing business with for quite a long time, hence this helps reducing the risk of supplier variability in quality, quantity and delivery time.

b. Work-In-Process Inventory (WIP)

Work-in-process inventories are components or raw materials that have undergone some changes but not completed. In the umbrella making process, WIP inventories are considered to be the components of umbrella sit idle during each process such as struts, ribs, upper and lower head etc. Since the cycle time (the time it takes for a product to be made) of umbrella making is quite short, the level of WIP inventories is low. However, the umbrella making center sometimes prepare and stores lots of the assembled-covered umbrella frame in advance and when there is demand for umbrella of particular design it puts the painting on these umbrella frames which are also regarded as WIP inventories. With this approach, it can fulfill customer order more quickly and efficiently at the expense of increase in inventory level.

c. Finished Goods Inventory

Mostly, Umbrella Making Center employs the made-to-order approach which means that it will produce the umbrellas based on the customer requirement and orders. This approach helps the Umbrella Making Center to reduce the level of inventories, hence improve cash flow and financial performance of the company. As well, the made-to-order approach is very useful in customizing the umbrella to better suit with the customer's wants. Since most of the umbrellas produced at Umbrella Making Center are exported to other countries, it does not store so many umbrellas for sales at it outlets.

Figure 5-11: Umbrella Inventories



Source: Above pictures were taken at Umbrella Making Center 1978 Co., Ltd. on 7th Oct 2005.

VII. Environment Management

Although Bosang umbrella making process appears to have preserved most of its traditional process and methodology since early times, a concerning reality is that the umbrella making activities still inevitably generate, to some degree, pollution especially water pollution. The problem concerning the environmental issues is the fact that the workers of umbrella making center are not well educated about these issues.

a. Water Pollution

Water pollution is the most important issue. Lacquer and painting materials such as oil paint used in the painting process are the major sources of water pollution. Most umbrella makers in Bosang village use plain water to clean paintbrush and other painting equipment dirtied with the water or oil paint. Then, the waste water is released to environment without receiving proper treatment. Considering the large number of umbrella makers at Bosang, the amount of the water pollution generated by these makers can adversely affect the environment quality in the neighborhood areas.

b. Air Pollution

Air Pollution such as dust can be resulted from the process which involves in the grinding works such as upper and lower heads making process. In addition, lacquer also causes the air pollution because it can evaporate into the air. If the painting process is located in a closed area where by the circulation of the air is not allowed, these can have a substantial negative impact on workers.

For Umbrella Making Center, the air pollution is not a serious problem because most of the umbrella production process is out-door, hence, the air ventilation is good enough to dilute the pollution.

VIII. Current Problems

1. The current production process layout of Bosang Umbrella making center is designed partially for tourism purpose which is to demonstrate the whole umbrella making process to tourists. To accommodate this purpose, the production process layout is organized into the U-shape with each work cell lined throughout the process. In the production aspect, this can reduce the efficiency and productivity because some work cells are not located in appropriate locations and might be too far from other work cells than they should be. Hence, this lead to unnecessary motion of workers or components which is considered as waste since it does not add any value to the product.
2. There is no production flat-rate or efficient output rate of umbrella set by the management of umbrella making center to benchmark with current output.

Therefore, the management do not know whether or not the workers are performing their jobs efficiently or whether there are some problems occurring.

3. There is no written standard operation procedure (SOP) to control each production process of umbrella making center. This can results in unstandardized works as workers may perform the same task in different manners based on their own skills. As well, without SOP, new workers can learn to do their jobs only by either observing the current workers doing the job or On-the-job training. Thus new workers tend to take a long time to understand the method of umbrella making and may be confused because there is no standardized process.

4. There is no standardized method for controlling the quality of umbrellas in terms of strength, covering material and color or painting. This may lead to dissatisfaction of customers because they might not get good umbrellas as expected.

IX. Conclusions

Bosang umbrella making has demonstrated the tradition wisdom of Bosang villagers about how local resources can be used to invent a product which has become renowned among tourists from all over the world for its exquisite and superb characteristics. The Bosang villagers still use the traditional way of making umbrellas they have long inherited from their precedents. However, to meet with the increasing demand and more specific requirement for Bosang umbrellas, the traditional way of making umbrellas still has some drawbacks and needs further improvement to ensure greater productivity and quality.

For Umbrella Making Center 1978 Co., Ltd. which is a major manufacturer of Bosang umbrellas, the recommendations for improvement of the production process are provided in the Recommendations section of this study.

X. Recommendations

1. The umbrella making center can substantially improve the productivity by reorganizing the production process layout. The new layout should not be the U-shape as the current layout. Instead, work cells which make each component should be located close to the work cells that use those particular components to assembly the umbrella.

2. The management should try to determine the efficient output rate so that the efficiency of the production process can be calculated. The management can set the efficient rate by counting the output of the umbrella produced by a certain number of skilled workers. This allows the management of umbrella making center to monitor the performance of workers by comparing the current output to the efficient output.

3. The management should hold a meeting with skilled workers of each process and then write in details the standard operation procedure for every process. Then the management has to educate the employees about the new SOP which will be used as a solid operation guideline for them to follow. Furthermore, the SOP document should be given or made accessible to workers who operate in related process to allow them to study the SOP. This can help the umbrella making center ensure the standardization of the umbrellas and increase efficiency of workers.

4. Umbrella Making Center 1978 Co, Ltd. should perform final inspection of quality of every umbrella produced to ensure the customer will get good quality umbrellas. It might be necessary to develop a final inspection check sheet which details about what and how to check whether the umbrellas meet with standard.

