

## Metal Recycling in the Craft Villages of Vietnam

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Presently, there are actually 1,450 craft villages existing in Vietnam, distributed over 58/61 provinces and cities in the whole country, attracting about 10 million labourers. An average growth rate of the craft villages has recorded 9% per annum while the annual product export value has reached nearly 526 million USD.

Among the production types of the craft village, the waste metal recycling is continuously developed. The number of craft villages taking part in the waste metal recycling are 68. The total output of these craft villages has recorded 1 million tons per annum. The average income of each labourer is 5 times as much as that of a casual farmer. The waste metals including Al, Fe, Cu, and Pb have been recycled with simple technology and manual work on primitive equipment.

For the environmental aspect, the production activities of the metal recycling craft villages have contributed to the solid metal waste reduction, estimated 68,540 - 137,080 tons per annum, reasonably using the natural resources. Besides, due to the backward equipment and technology, and the spontaneousness of the production development, the recycling of the metals has caused seriously local environmental pollution. Thus, the metal recycling activities in the craft villages must be appropriately planned and developed for sustainable development.

Key words: craft village, metal, recycling, environment

### 1. INTRODUCTION

Vietnam has a population of 79.7 million, of which there are 75% (59.7 million) with 14.4 million households living in the countryside [1]. The Vietnamese countryside, playing an important role in the history of developing the homeland, is not only the main supplier of cereals and foodstuffs but also the producer of ancient weapons (swords, long-handled spears, long-handled machetes, ...), working tools, handicraft and fine handicraft articles, and worshipping objects (worshipping statues, drums, gongs, ...).

Apart from agricultural production, which is the main production type, a number of Vietnamese farmers also participate in the production of non-agricultural type with a view to improving their living standard. According to [2], "craft villages" mean rural villages in Vietnam that are existing and working on minor-handicraft and non-agricultural careers, participating at least in 30% village labourers, and making their contribution of at least 50% of the total production value and common income of the village. Craft villages are one of the specific features of the Vietnamese countryside. With a variety of diversified and abundant kinds of products as well as a flexible form of organizing production, Vietnamese craft villages have produced a great deal of goods, solved employment at agricultural leisure and done their bit in the social economic development of the rural areas. According to the result of the national project KC 08-09 [3], the gross value of products in all craft villages has attained 40,000 billion Vietnamese Dong and the export value of 526 million USD. Over the last few years, especially in the period of economic development embarking on an orientation of market economy, many traditional craft villages have been recovered, conserved and

expanded together with a number of new careers have taken shape to meet the social needs. Currently, there are 1,450 craft villages existing in Vietnam, distributed over 58/61 provinces and cities in the whole country, attracting over 10 million labourers, attaining 9% concerning their annual growth rate and contributing 9% in the national GDP. At the present time, with a view to removing the distance between the rural and urban life, the society is showing its concern for the sustainable development of craft villages.

Waste recycling craft villages (metal, paper, and plastics) are of the new type with 30 years of age, belonging to the craft village group being invested. Activities of these craft villages have brought to the decrease of waste amounts, the reduction of material cost, leading to cutting down on the production cost. Beside the positive aspects, the production activities of craft villages, especially of the metal recycling ones, have adversely affected the environment and the community health. This report presents the results of the survey, investigation and study on the production status of the metal recycling craft villages and their effect on the environment, analyzes restrictions regarding the development of social economy and the environmental protection at craft villages as the premises for the elaboration of sustainable development policies for these craft villages.

### 2. THE PRODUCTION STATUS OF METAL RECYCLING CRAFT VILLAGES

According to the investigation results, the total number of the metal recycling craft villages are 68 (occupying 4.7% of the total craft villages existing in Vietnam), distributed unevenly and concentrated mainly in the surrounding provinces and cities of Hanoi

(the North region – 47 villages, the Central region – 8 villages, and the South region – 13 villages). Most craft villages in the Central and South regions come late into being and developing, therefore their scale and sphere of working are not large. That is why, the craft villages in the North part have got a concentrated examination. The situation of economy, labour and production of several typical craft villages are summarized in Table I. The average annual income of each labourer is between 400 and 500 USD, 5 times higher as much as that of a casual farmer, this itself has contributed to the increasing change in economy in the Vietnamese rural areas.

Table I. The Situation of Economy, Labour and Production of Several Typical Metal Recycling Craft Villages

Craft village, province	Number of craft households/ Total of households	Labour, person	Receipts, million USD per annum
Da Hoi, Bac Ninh	1,500/2,500	3,090	4.52
Van Chang, Nam Dinh	615/685	2,992	2.91
Xuan Tien, Nam Dinh	2,015/2,420	4,954	2.84
Da Sy, Ha Tay	626/1,512	2,004	1.01
Tong Xa, Nam Dinh	47/478	701	1.00

The metal recycling craft villages mentioned in Table I have got a strong development and become the centre of iron and steel production, their products can compete with those of industrial producers; most of the rest craft villages have a small or very small scale of production, the greatest part is concentrated in some households.

According to the survey results, production technologies in the metal recycling craft villages are classified in 2 groups: (i) technology group of recycling and processing iron and steel wares (Fig. 1), and (ii) technology group of non-ferrous metal recycling (Fig. 2). The equipment used in craft villages is of backward kind, which is usually out of date and liquidated in industrial establishments; the purchase and repair of such equipment are made for utilization.

The main raw material used in the craft villages is metals collected from out of date and waste ships, boats and motor cars. In addition, metals (iron, copper, aluminum,...) in domestic and building wastes (about 68,450 – 137,080 tons per annum) are collected through the network of itinerant junk buyers. The total output of metal recycled in all craft villages is about 1 million tons per annum. Besides, process of production also consumes a considerable amount of water, coal, electricity [4] (Table II), lubricants and chemicals such as HCl, H<sub>2</sub>SO<sub>4</sub>, NaOH, NiSO<sub>4</sub>,...

Labourers in craft villages in general and in the metal recycling craft villages in particular are not well-trained. They work essentially by experience in the form “handed down from generation to generation”. The production of craft villages is carried out in living

houses, and spontaneously developed and distributed all over the village, which is also a factor making the environmental pollution more serious.

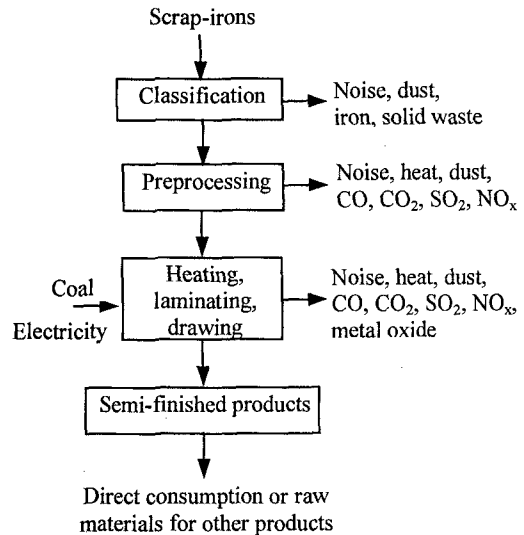


Fig. 1. Iron and steel recycling process with waste stream attached

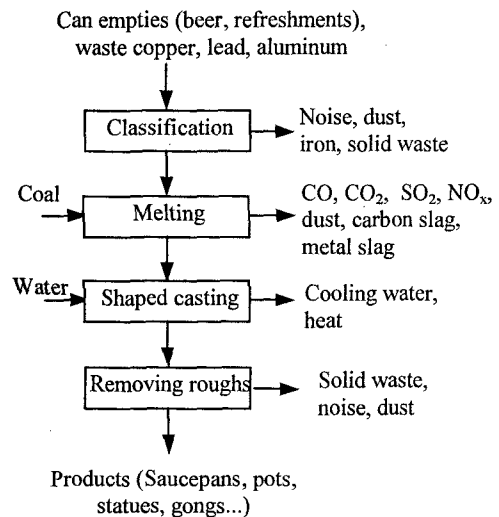


Fig. 2. Non-ferrous metal recycling process with waste stream attached

Table II. Annual Consumption of Water and Energy in Several Typical Craft Villages

Item	Da Hoi	Van Chang	Xuan Tien
Water, 10 <sup>-3</sup> m <sup>3</sup>	700	175	450
Coal, 10 <sup>-3</sup> Ton	270	44.28	250
Electr., 10 <sup>-6</sup> kWh	48	1	1.7

### 3. THE ENVIRONMENTAL STATUS IN CRAFT VILLAGES

In order to evaluate the environment status in the craft villages, samples of waste water, surface water, air, and soil are collected and analyzed according to [5] - the corresponding standards in Vietnam. Equipment used for sampling and analyzing are pH-MA235 (Mettler Toledo), UV-Vis Lamda EZ 210 (Perkin Elmer), and AAS-AAAnalyst 800 (Perkin Elmer). The result shows as follows:

(i) The pollutant contents in waste water exceed those specified in the Vietnamese standard, for instance grease and oil: 0.5 - 1.8 mg/dm<sup>3</sup>, Al: 2.1 - 10.4 mg/dm<sup>3</sup>, Fe: 7.6 - 12 mg/dm<sup>3</sup>, Cu: 1.5 - 3.3 mg/dm<sup>3</sup>, Zn: 0.6 - 8.7 mg/dm<sup>3</sup>, Pb: 0.4 - 0.9 mg/dm<sup>3</sup>, and Cr: 0.8 - 1.87 mg/dm<sup>3</sup>.

(ii) The air at working place contains pollutants with high concentrations, for instance dust: 0.9 - 2 mg/m<sup>3</sup>, acid vapour: 0.4 - 0.5 mg/m<sup>3</sup>, alkaline vapour: 0.7 - 0.8 mg/m<sup>3</sup>, Al: 0.14 - 0.25 mg/m<sup>3</sup>.

(iii) Solid wastes including metal, carbon slag, refuse from the classification stage are found in huge amounts such as 11 tons and 7 tons daily in Da Hoi and Van Chang, respectively.

(iv) Beside that, the noise and temperature at the production establishments are quite high, amounting to 74 - 84 dBA and 31 - 35° C, respectively.

These kinds of waste have not appropriately been managed and controlled. They have directly discharged into the environment, leading to the environmental pollution. The contaminants in surface water are regarded as follows: Cr: 0.97 mg/dm<sup>3</sup>, Zn: 1.60 mg/dm<sup>3</sup>, and grease and oil: 1.8 mg/dm<sup>3</sup>; the contents of Ni and Zn in soil range from 50 to 102 and 93 to 250 mg/kg, respectively.

The polluted environment (air, water, soil, noise, and temperature) has made a severe impact on the community health. Such commonly occurred diseases are trachoma, respiratory disease, skin disease, pulmonary disease, ... (Table III). The average life expectation of the people in these craft villages is 55 - 60 years lower than the national one (68 years) [1]. According to the investigation data, the medical examination result of the inhabitants in Van Chang craft village shows that beside the positive aspects of craft villages, their production activities have seriously influenced the quality of people life.

Table III. The Status of People Health in Van Chang (Total medical examinees: 4,085, diseased people: 3,922)

Diseases and symptoms	Number of diseased people/ ratio (%)
Otorhinolaryngological disease	1,040 / 33.02
Respiratory disease	1,342 / 42.6
Ophthalmic disease	566 / 17.97
Nervous symptoms (headache, insomnia, dizziness, decline in memory)	708 / 22.48
Skin disease	122 / 3.87
Gynecological disease	155 / 4.92
Digestive disease	82 / 2.6
Tuberculosis, cancer	7 / -

### 4. RESTRICTION FOR THE SOCIAL ECONOMIC DEVELOPMENT OF CRAFT VILLAGES

Thus, to develop the social economy and to protect the environment as well as the community health at the same time in the craft villages in general and in the metal recycling in particular, it is essential to have comprehensive solutions on the basis of analyzing the restrictions for the sustainable development of craft villages. The investigation result on the present conditions of social economy and environment shows that there are still a lot of difficulties and obstacles for the sustainable development of craft villages, namely (i) very small production scale - family scale with spontaneous nature, (ii) production in the interest of immediate profits due to the farmer characteristics, (iii) production by experience "handed down from generation to generation", (iv) backward and primitive technology and equipment, (v) limited knowledge, (vi) difficulties in finance, (vii) the traditional customs, habits, village conventions and Acts and Regulations concerning environmental protection have not closely been combined yet, and (viii) the lack of synchronous policies of all management levels.

### 5. CONCLUSION

The production activities of the metal recycling craft villages have dealt with the redundant labour at farming leisure, the living standard of craft farmers has been raised more highly than that of the mere agricultural producers. Craft village activities produce annually nearly 1 million tons of products, satisfying partly the social needs. Craft villages have developed, producing with backward equipment and primitive technology, and non well-trained labourers, without planning; their activities therefore have severely polluted the environment. The pollutants such as Al, Fe, Cu, Zn, Pb, Cr, and grease and oil contained in waste water are at high concentrations. The atmosphere of the production areas contains much dust including metal dust, acid vapour as well as alkaline vapour. Noise and temperature of the environment are quite high at all times. All kinds of wastes are directly discharged into the environment, making severe impacts on the community health.

For the sustainable development of craft villages, it is essential to have a comprehensive policy based on the solution of the restrictions to the social economic development of the craft villages.

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