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JORDAN

Technical report: Technical assistance mission to the ceramics industry in Jordan*

Prepared for the Government of Jordan
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

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* Mention of company names and commercial products does not imply the endorsement of UNIDO. This document has not been edited.

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THE CERAMIC INDUSTRY IN JORDAN

Jordan has a long history of producing clay based products on a small scale, but it was not until 1975 that commercial production of building products began.

In a relatively short time Jordan Ceramic Industries has developed a very sound manufacturing base for wall tiles and Vitrified sanitary ware, and there are substantial prospects for further development.

There are excellent raw materials in Jordan which are suitable for the manufacture of white ware products including:

Semi - Vitreous dinnerware

Low Tension insulators

Art ware

Technical ceramics for the chemical and oil industries

Floor tiles.

It is essential for the industry to develop utilising local raw materials. Because there is insuficient demand for these materials to warrant a bulk refining facility, the chemical and physical properties of the material vary considerably from batch to batch.

Because of this, and the fact that labour is comparatively inexpensive in Jordan, the industry must be very cautious about becoming over mechanised.

Modernisation is essential but is preferable through evolution rather than the establishment of sophisticated plants.

RAW MATERIALS

The following raw materials are available in commercial quantities in Jordan.

Clay - There are several suitable clays mined in Jordan. Some if beneficiated could be upgraded to international standards and would be suitable for export to neighbouring countries. For example mahis clay is a good kaolin with ideal properties for use in the ceramic industry. More research should be carried out on this material to determine its suitability for export.

The following is a comparison of the chemical analysis of Mahis clay with that of a refined material from an international supplier.

	MAHIS	IMPORTED
Silicon Dioxide %	59.9	45.42
Aluminium Oxide %	23.97	38.92
Iron Oxide %	1.64	0.34
Titanium Oxide %	2.50	1.43
Calcium Oxide %	0.04	0.24

Magnesium Oxide	%	0.09	0.18
Sodium Oxide	%	0.51	0.11
Potassium Oxide	%	0.64	----
Loss on Ignition	%	9.9	13.81

Although the mahes clay is acceptable in the present form the chemical properties could be greatly improved with refining processes. This would lead to a higher percentage being used at the expense of imported materials.

Silica - Is abundantly available in Jordan in the form of Silica Sand.

Granite - Is a very hard material and it requires extensive processing. It can, and is, being used as a substitute for imported feldspar.

More development is required on the granite material with the object of a complete substitution of granite for imported feldspars.

The current sanitary ware body consists of 59% local material and 41% imported. The aim should be to develop a body with 80% local content.

The body used for both once and twice fired wall tiles consists of all local materials.

Labour

The ceramic industry, (with the exception of highly automated plants not recommended for Jordan) is a labour intensive industry.

In most countries there is an even mix of male and female employees and the majority of operations are classed as semi-skilled.

Considering the very short history of the ceramic industry in Jordan the company has developed people with remarkable skills.

It seems that Jordanians adapt well to the industry and are keen to work within it.

Because labour costs are low by comparison with other countries manufacturing ceramics, and manpower is available, there is no financial advantage in developing highly mechanised operations.

Energy

Electricity is consistent and in adequate supply. Costs compare favourably with international standards.

Fuel is a problem. There is no doubt that the cleanest and most efficient fuel for use in the ceramic industry is natural gas, which is not available in commercial quantities in Jordan.

However, the diesel fuel which is available is relatively low in sulphur content and it can be used in conjunction with SEMI MUFFLE KILNS.

Diesel fuel in Jordan costs about 20% more than the international average.

Water is a cause for concern especially in the area around ZARKA.

The critical shortage of water could easily be averted by collecting rain water from the factory roof during the rainy season and storing it in tanks underground.

JORDAN CERAMIC INDUSTRIES

PRODUCTION - The facility consists of four seperate but inter-dependent production units.

Twice fired Tile Plant - Producing 350,000 sq m per year.

This plant is generally in good condition but is in need of minor refurbishment.

Once fired tile plant - Scheduled to produce one million sq meters per year. Built as a turn key project by SACMI of Italy, this plant has only recently been commissioned. Many problems still exist and it will be some time before the full potential can be evaluated.

Sanitary ware - Producing in excess of 2000 tons per anum. Conventional methods are used to produce once fired vitrified sanitary ware.

Artware - A joint venture with the peoples Republic of China. This project is still at the pilot plant stage, but it will shortly be re-located in a purpose built production unit.

Because of the brevity of this mission and the state of change within the tile plants it was decided to confine the activities of the mission to the Production of Sanitary ware.

SANITARY WARE

General Policy

The Market - Jordan Ceramic Industries is the only manufacturers of Sanitary ware in Jordan.

There is a very strong demand for product in the domestic market as well as substantial export opportunities.

These conditions have led to estimates which indicate that the company must at least double production to meet demand, and the construction of a new plant is under active consideration.

The consultant would advise a cautious approach to production increases.

There is ample scope to increase production within the confines of the existing plant at a fraction of the unit cost of building a new plant, and this should be fully exploited first.

It would also be prudent to bear in mind that the demand for sanitary ware runs in well defined cycles. It is better therefore to have increased capacity which can be called upon from an existing plant, rather than to carry the considerable cost of a new plant in a soft market.

Company Image - It is evident, from brief conversations with people in the market place, that the company does not enjoy a reputation for good quality.

This can be explained in part by the notion within Jordan that a product must be imported to be of good quality, but much of the reputation has developed because of the way in which the products are marketed.

Current practice is that three grades of product are sold.

First grade and Second grade are sold together as "commercial quality".

Third grade is sold through the same outlets at a highly discounted price.

The end consumer is often sold third grade product at commercial quality price. These consumers then find fault with the product and complain about quality.

Another factor which adversly affects the reputation of the company is the performance of the assembled units.

The ceramic pieces are despatched from the plant without fittings. This leaves the plumber (or installer) to choose the type and quality of fitting.

Using the lavatory cistern (or tank) as an example. The factory produces and sells the ceramic tank. The flushing properties of the toilet cannot be tested before it leaves the factory because the fittings are not supplied.

In the market place in Jordan there is a wide choice of fittings (devices to fit inside the tank to make the toilet

flush). The price range is considerable and many are unsuitable for installation in the type of toilet supplied by this company.

If the plumber fits an inferior flushing system causing the toilet to malfunction it is always the reputation of the toilet manufacturer that suffers.

The reputation of the company does not portray an accurate image of the quality standards maintained within the plant.

In fact the standard of commercial grade is very close to the quality of imported merchandise.

The following suggestions are offered which may help to improve the image of the company and increase the profit potential.

The Complete Bathroom Concept - ONLY the ceramic pieces are currently offered by the company. These amount to less than 50% of the content of a bathroom.

Most established sanitary ware manufacturers have found it very profitable to sell a complete bathroom package. This involves importing own brand shower trays and baths (acrilic) taps and tank and waste fittings. In this way the quality of the bathroom package can be controlled. This policy also allows the ceramic manufacturer to dictate colour and shade changes (under the present system the ceramic manufacturer must match the colours of the items imported by merchants).

Consider also that if a change in variety is required in the market it is always easier and less expensive to change colour rather than shape.

It is estimated that the non ceramic items involved in the complete bathroom concept can add up to 50% to the sales of the company.

Fittings - No piece of sanitary ware should leave the plant without approved fittings installed.

Brand Name - The brand name or company logo should be applied to commercial quality only. The application should be made using apoxy material at the final inspection stage (after firing).

Third grade (unmarked) should be sold through a seperate outlet. Sales should be made direct to the general public at approximately half the full retail price of the commercial quality.

It must be made very clear to the customer that the merchandise is sub standard.

Catalogue - If the complete bathroom concept is to be adopted it will be necessary to produce a catalogue highlighting the fashion aspects of the industry. The catalogue should be aimed at the end user not the merchant.

THE FACTORY

Health and Safety - Conditions within the plant fall far short of international standards. Dust is a serious problem. The in-

dustry in Jordan is not old enough for statistics to be established on the incidence of lung disease caused by dust inhalation, but in countries with a history in the ceramics industry silicosis is a serious problem.

Below are some of the basic regulations enforced in the industry on an international level.

1- Raw material preparation areas must be separated from production areas by a door or curtain.

2- All operators in body preparation must wear face masks.

3- No food or drink to be consumed in the production areas (canteen facilities must be provided for all workers).

4- Dry finishing of sanitary ware is not allowed to take place in the casting shops.

5- All dry finishing must take place under evacuated hoods with operators wearing face masks.

6- All sprayers must wear masks.

7- No sweeping of floors or surfaces is allowed. All dust must be removed by washing with water or with vaccum machines.

8- Nothing must rest on the floor of the production area.

9- All Raw Material, casting and glazing areas to be washed with high pressure hose after working hours each day.

10- Every production operator to be provided with overalls made of nylon. (cotton retains dust). These to be laundered by the company every week.

11- Workers in the Body preparation casting and Glazing sections to have regular chest X-Rays.

MANAGEMENT - There is a nucleus of managers within the plant who are hard working, conscientious and knowlegable. There is no doubt that the success of the company is greatly enhanced by the activities of these people.

There is however a lack of co-ordination between management structures, and there are no clearly defined job descriptions. This leads to confusion and sometimes even conflict.

The factory manager should have control of all aspects of production including the following; raw material preparation casting, glazing, kilns, inspection, warehouse, mould making.

The factory manager must be the only person instructing the supervisors and the supervisors must be the only ones to instruct operators.

Each member of the management team should have a contract specifying his duties and responsibilities and his line of communication.

Technical department - The technical department should be viewed as a service facility to assist production to increase output, reduce costs and improve quality.

The technical departments (laboratories) are over staffed and in general provide a very poor service.

Routine tests are carried out on raw materials mixes and production processes, but there is confusion in interpreting the results of tests.

A complete review of the tests to be carried out and the frequency of recording must be made.

Guide lines must be set for the limits of acceptability and these must be visible on the record together with current results.

Results should be circulated to key production personnel on a "need to know" basis.

This means that only the results of tests applicable to each department should be sent to them.

For example, tests on the thixotropy and fluidity of casting slip are important to the casting shop supervisor but not to the glaze supervisor.

Many of the current production problems can be reduced if an adequate system of testing and recording is established.

RAW MATERIALS PREPARATION

The methods employed to mix raw materials are conventional. Briefly the hard materials Mahis granite and silica are ground in ball mills and the soft materials ball clay china clay and feldspar are blunged.

The materials are then mixed together by volume in a high speed mixer.

For the record the current body mix is :-

Mahis I	35%
Granite	7%
Silica	17%
Ball Clay	15%
China Clay	10%
Feldspar	16%

This mix is a compromise and does not constitute an ideal body.

The company is utilising as much local content as possible and this is a correct approach

However, the low percentage of Ball Clay (should be at least 20%) is a major contributing factor to many of the problems experienced in casting and drying.

CASTING - The casting shop supervisor has a very difficult but crucial job. In view of the problems created by the shortness

(lack of ball clay) in the body, the casting department achieves remarkably good results.

There are many things that can and are being done to increase productivity in casting, these include:

Vertical casting of wash basins and

pedistals

Semi-mechanised system for casting

Cisterns (Tanks)

Incorporating breather holes in the TRAP on toilet moulds.

By implementing these and other labour saving devices it should be possible to increase casting production by 30%

MOULD MAKING

The factory uses a local gypsum to manufacture moulds. This material compares unfavourably with that available in international markets. Because of this comparison cannot be made between mould life and quality in Jordan and overseas.

There is a well trained and skilfull workforce in the mould making department but the methods used need to be updated.

In particular great benefit would be achieved from the use of flexible and semi flexible materials. (apoxy resin etc).

Specialised training is required in the use of these materials and it would be of great advantage for a specialist consultant to visit the plant for 4-6 weeks.

DRYING - Because of the characteristics of the body, special care is required in drying. It would be normal to employ more air movement, less temperature and lower humidity, and cautious tests should be carried out to achieve this.

GLAZING - Glazing is a problem. This operation is the most skilled in the plant and it requires very careful control of glaze preparation, glaze density and spray gun pressure. This is one of the areas where technical controls should be reviewed as a matter of urgency.

Many of the rejects from the Kiln are as a result of glaze faults.

Some suggestions have been made to overcome these including:-

Reducing the thickness of glaze.

Adding a vegetable die to the white glaze so that coverage can be seen.

Increasing the percentage of opacifier in the glaze.

Waxing the edges of critical items.

FIRING - The kiln is the most important piece of equipment in a sanitaryware factory. Most tunnel kilns have a life expectancy of at least 30 years. Over this period modifications are required to keep up with new technology.

The heimseth kiln was installed in 1976 and is still in excellent condition. However, the kiln has not been modernised and is now considered to be inefficient.

For example in September 89, 197 tons of sanitaryware was fired using 81080 litres of fuel. This is a ratio of 41.2 litres of fuel to one ton of material.

The average within the industry is below 20 litres. It is understood that we have the constraints of using a full muffle kiln and diesel fuel, but much can be done to increase throughput and a careful and scientifically based study should be made.

Suggestions to be considered:-

Increase firing temperature by 30-50 degrees centigrade.

Balance the firing curve.

Speed up kiln.

Reduce space between car deck and placing area.

Consider multi decks using perforated light weight slabs.

Ensure, as far as possible, that all cars have a uniform load. Consideration should be given to converting the firing chamber to an open flame kiln. (if the sulphur content of the diesel remains at less than 1%).

This would allow the opportunity to use high pressure burners. A shuttle kiln (preferably electrically fired) would be a very useful addition to firing capacity.

SELECTION - Final inspection is carried out immediately after firing. The selection operators are well skilled, but there are no clearly defined standards.

Enclosed is a set of standards used in U.K. in 1980 which may be applicable to the Jordanian market.

Conclusion:-

Because of the brevity of this mission, some of the observations made may not be typical of average condition within the plant. Also there may be special local conditions which make some of the recommendations unworkable.

On a personal note, I have very much enjoyed this short mission, complete co-operation and understanding has been received from managers and supervisors within the plant. I would like to record special thanks to:-

Mr. Fathi Hiasat

Mr. Ishaq Al-Ansari

Mr. Khalil El-Far

Mr. Yazied Odeh

I look forward to working with them again in the futre.

Peter J. Batchelor

Ceramic Consultant

PRODUCTION SEPT. 1989
(30 DAYS FIRING)

Pieces loaded onto Kiln (see catalogue for details)

	CAT.NO	PIECES
Wash Basin 570 x 450	3410	1184
" " " "	3420	3357
Squat Pan with tread (small)	4620	7441
" " " " (large)	462	396
W.C. Bella	1130	70
Pedistal Bella	1110	73
Cistern Bella	1140	43
Square Sink	720	347
Urinal	540	80
Small Soap Holder	---	527
Medium Soap Holder	---	805
Large " "	---	728
Toilet Paper Holder	---	865
Shelf	---	814
Nisreen Basin	3430	78
Shower Tray	600	169
Pedestal Venecia	1220	780
Wash Basin Venecia	1210	1024
W.C. Venecia	1230	1532
Cistern Venecia	1240	1262
Bidet Venecia	---	132
Gamma. Squat Pan (Plain)		401
Azraq Square Sink	710	165
Wash Basin Lama	3460	33
Corner Basin	3450	39
Oct Wash Basin (not illustrated)		24
Misc.		8

FUEL (LIGHT DIESEL)

ANALYSIS

Density at 15 degrees centigrade	GM/ML	0.820 - 0.870
Colour	ASTM	2.5 Max
Total Sulphur % wt		1.5 Max
Flash Pont P.M. d.centigrade		55 Min
Viscosity at 100 d. F Sel		45 Max
Pour Point Summer		+5 Max
Winter		-9 Max
Corrosion Copper Classification		No1 Strip
Carbon residue on 10% % by Wt		0.1 Max
Total Acid Number Mg KOH/gr		1.0 Max
Strong Acid Number		Nil
ASH % by weight		0.01 Max
Water Sistillation % volume		0.05 Max
Sediment by extraction % wt		0.01 Max
Diesel Index		50 Min

FUEL CONSUMPTION

SEPTEMBER = 8100 LITRES