Josbarko Enterprise (Case Study No. 2)

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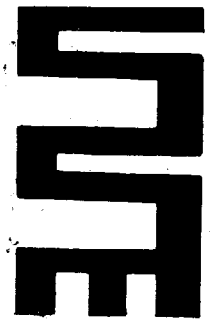

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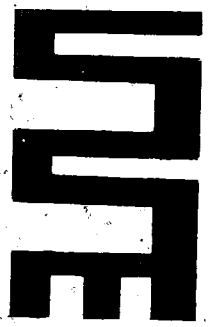

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FOREWORD

Economic development depends essentially upon the emergence of individuals with genuine entrepreneurial qualities. Lack of progress in Ghana can be largely attributed to a dearth of this vital ingredient. While this country abounds with skilful traders who are adept at taking a fast profit in almost any economic climate, those who are far-sighted enough to build a productive enterprise of lasting strength are few and far between. In a decade of small industry development projects the Technology Consultancy Centre has encountered less than a handful of such men. This case study tells the story of one of them.

In the present economic environment in Ghana there are some problems which even the most gifted entrepreneur cannot solve alone. For this reason the Technology Consultancy Centre has developed a technology transfer mechanism to assist the entrepreneur and to promote new small-scale industries. This case study tells the story of how the Technology Consultancy Centre first started the manufacture of steel bolts and nuts in Kumasi and later assisted Mr. Barimah Kwaako to establish this activity at his own workshop.

It is always difficult to decide at what point in time to publish a case study. In this instance Mr. Kwaako started his enterprise by purchasing machine tools from the TCC under a hire purchase agreement. The agreement covered a two year period and was fully paid by August 1981. This was the point chosen to end this narrative. The story is told in the hope that it will encourage other institutions to become involved in technology transfer and in the hope that more entrepreneurs will be persuaded to take advantage of opportunities to establish manufacturing industries.

J. W. Powell
Kumasi

September 1981

TECHNOLOGY CONSULTANCY CENTRE

The Technology Consultancy Centre (TCC) is a semi-autonomous wing of the University of Science and Technology, Kumasi, Ghana. Its purpose is to provide a channel through which the expertise of the teaching faculties of the university can be applied by means of research and consultancy to the solution of problems from industries large and small, governmental and private. Much of its work has been concerned with small-scale and informal industries and falls into that category known as Appropriate Technology.

The TCC was established on the 11th January 1972. It employs a professional core staff of 10 and a total staff of 85. Its annual budget is about ₵2.5 million ($0.8 million). It operates workshops on the university campus and at Suame Magazine in Kumasi and plans to open workshops at Tamale in the Northern Region. It operates a fleet of six vehicles and has mounted projects in most parts of Ghana. It uses its physical resources to establish pilot projects which are designed technically by consultants from the faculties of the University. Most projects arise out of requests for help brought to the TCC by clients. Most projects are funded by grants from the Government of Ghana or overseas aid agencies. Notable past projects have been concerned with the manufacture of soap, caustic soda, paper glue, weaving looms and hand-woven textiles, palm oil presses, farm implements, glass beads and beekeeping.

Kumasi

The City of Kumasi is the capital of the ancient Kingdom of Ashanti and the present Ashanti Region of Ghana. It is the second city of Ghana after the national capital, Accra. It lies at 6° 42′ N, 1°38′ W and is surrounded by tropical forests. Kumasi is the home of Ghanas only technological university, its largest informal market (Kejetia) and its largest informal industrial area (Suame Magazine). This Case Study is concerned in part with the interaction of these three institutions.

Ghanaian Currency

The unit of currency used throughout this work is the Ghanaian Cedi. The Cedi is tied to the United States dollar with the rate of exchange

$1.00 US = ₵2.75

In August 1981 the relationship to the pound sterling was given approximately by

£1.00 = ₵5.0

but this exchange rate was floating.

History of The Project at the TCC

Early in 1972 when the TCC had just begun, a survey of Ghana's largest informal industrial area at Suame Magazine, Kumasi, revealed an unsatisfied demand for steel bolts and nuts. The demand came from carpenters building wooden lorry bodies and fitters repairing vehicles of all types. At that time the Magazine consisted of more than one thousand workshops most of which were engaged in some aspect of vehicle repair or rebuilding. The work of more than 5,000 craftsmen constituted an immediate market for any local producer of steel bolts and nuts.

A few craftsmen had started to produce some bolts and nuts. One group consisted of blacksmiths who made coach bolts by hand forging and hand threading. The quality was poor and did not meet the needs of the wooden lorry body builders. A second group consisted of lathe turners of whom there were only seven at that time. The lathe turners produced special bolts and nuts for vehicle repair. Typical products included lorry wheel bolts and spring centre bolts. These were produced only to order and there was no evidence of any quantity production of standard items for stock and general sale. The prices charged were very high.

Steel bolts and nuts of a quality to meet general engineering requirements cannot be made in any viable quantity by hand methods. The centre lathe can produce any type of precision screwed component but it is not suitable for the fast production of large quantities of identical items. However a closely related machine, the capstan lathe, is ideal for producing batch sizes of up to about 1,000. It was thought that capstan lathe operation could be quickly learned by those Suame apprentices and ex apprentices who had already learned to operate a centre lathe. So in August 1972 the TCC embarked upon a project to test the viability of an industry using capstan lathes to produce steel bolts and nuts for the Kumasi market.

From an engineering point of view the introduction of the use of capstan lathes was of more fundamental importance than the production of bolts and nuts. Clearly, if market demand changed, the machines could be switched to producing other items such as pins and bushings of great variety. However as there was a considerable demand for bolts and nuts of all types and sizes this was judged to be a suitable product on which to base the introduction of the new technology.

The project began in the Mechanical Engineering Workshop of the Faculty of Engineering and employed two Suame apprentices. In February 1973, with the arrival of machine tools from England, purchased with a grant from Barclays Bank International Development Fund, the project was transferred to the TCC workshop and five trainee machine operators were employed. The initial equipment of the unit consisted of two capstan lathes and a milling machine. Over the next three years the unit expanded to employ five capstan lathes and a centre lathe, two milling machines, a drilling machine, a blacksmith's forge, a powered hacksaw and ancillary machines for grinding lathe tools and

milling cutters. At its greatest size in 1976 the unit employed 15 machine tool operators.

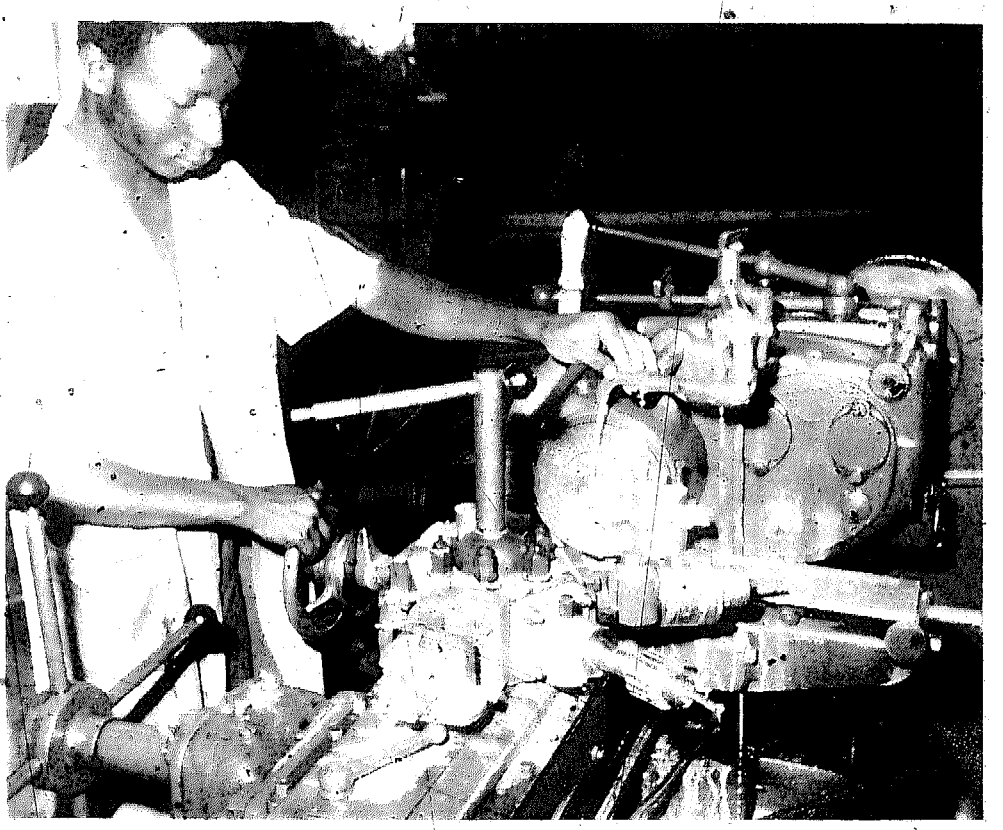
The methods of manufacture are well known to any mechanical engineer. Bolts were threaded and parted on the capstan lathe. Coach bolt heads were forged by hand using specially shaped tool-steel dies. Hexagon bolt heads were produced by milling. Hexagonal section steel bars for nut production were also produced by milling as only round-section bars were obtainable in Ghana. Nuts were drilled and parted on the capstan lathe but threading of nuts was found to be faster when undertaken on a drilling machine using a tapping head. Both nuts and bolts were blued by heating and immersing in old engine oil. At its best, the quality of product could be said to be of international standard.

The Steel Bolt Production Unit of the TCC was equipped mostly with used machine tools. This reduced capital costs and more closely identified with the informal industrialists who invariably depended upon the acquisition of second hand machines. The aim was to find an appropriate technology for the local industry which existing craftsmen could both afford and master. The technology was intended to be suitable for integration into the existing informal industrial environment in technical, economic, social and cultural terms.

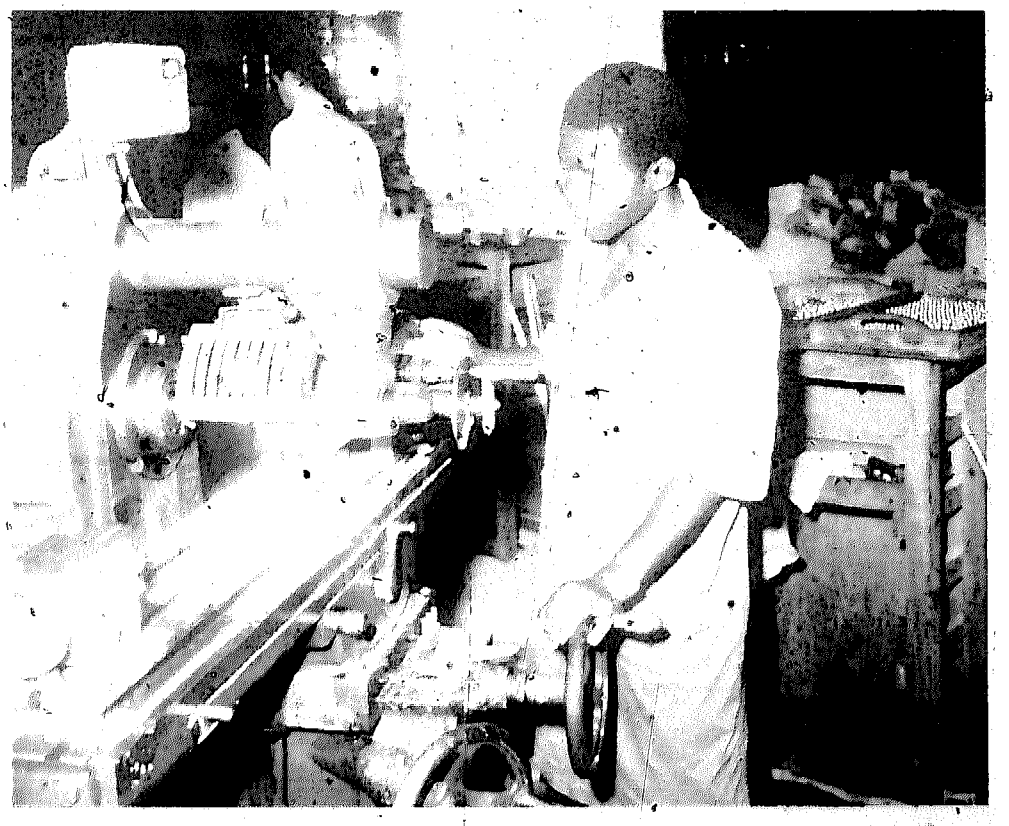
The Steel Bolt Production Unit operated on the university campus for exactly eight years. During that time it produced over 200,000 bolt and nut sets which it sold for ₵240,000. For the first few years the unit made small losses but it later made profits which ensured that overall it was self-supporting. It provided approximately 80 man-years of employment and training from which some 50 individuals benefited. The aim throughout was to seek all means of transferring the project off campus and into the small-scale or informal industrial sector.

The main impediment to the transfer of technology was the non-availability of machine tools. The Government was petitioned to provide the TCC with an import licence with which to import machines for resale to small industries. The scheme was approved but was never implemented. The TCC also sought the help of various international agencies but there was little enthusiasm for the importation of used machine tools. When no help was forthcoming the TCC took the decision to sell two of its own capstan lathes. This move, initiated early in 1977, enabled coach bolt production to start at two small workshops situated near the university campus at Anloga, Kumasi.

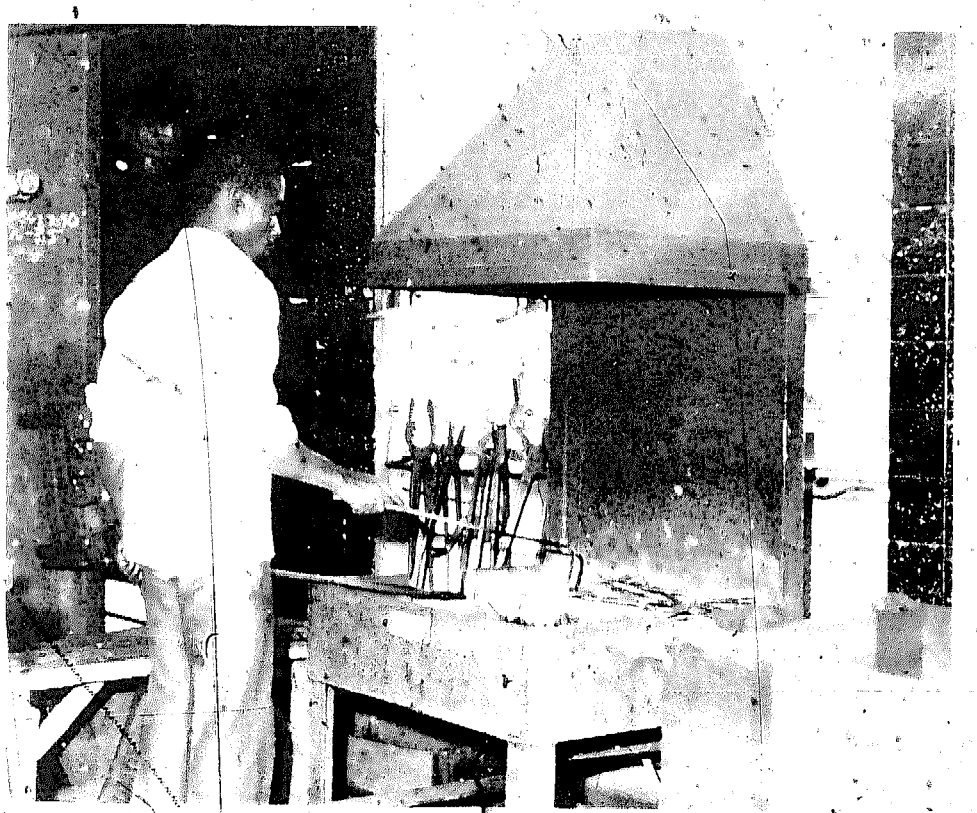
It proved to have been a mistake to have separated the two capstan lathes. Researches conducted by Mr. J. D. Russell of the Department of Economics and Industrial Management showed that the minimum size of unit that was economically viable consisted of two capstan lathes and a milling machine. An attempt was made by the TCC to persuade the two entrepreneurs to combine their operations with the incentive that the TCC would provide the necessary milling machine. Although the entrepreneurs were from the same tribe they could not agree on any



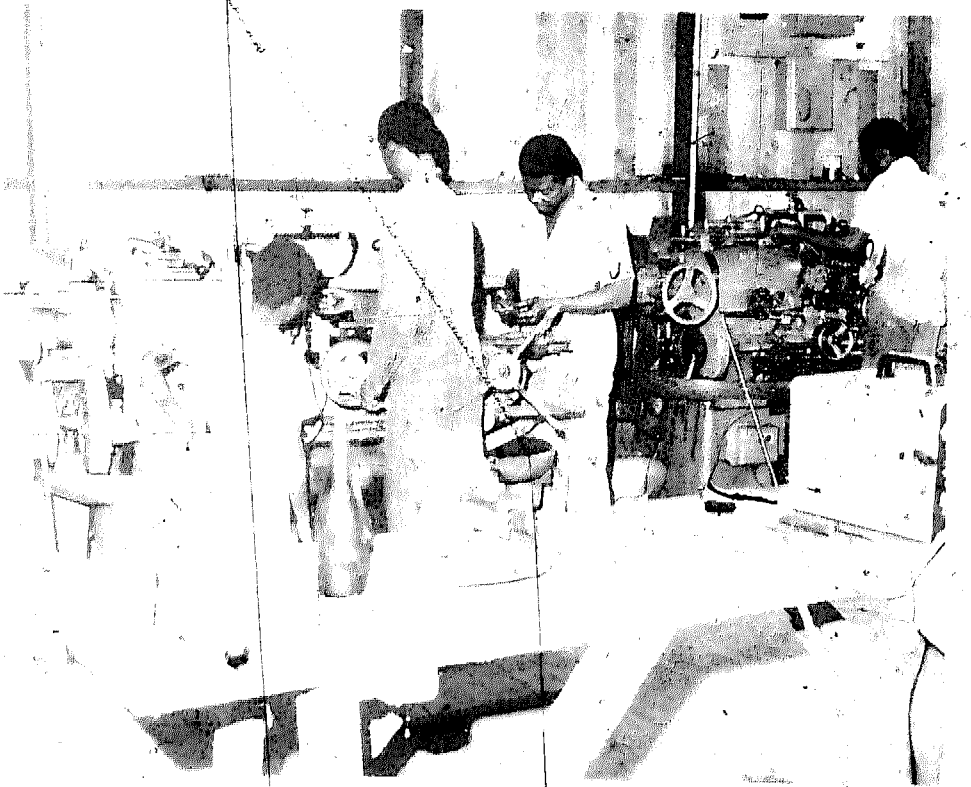
Capstan lathe operator producing nuts — TCC Workshops 1974.



Milling hexagonal bolt heads at the TCC Workshop 1974.



Forging coach bolts; bolt heads being heated in locally made blacksmiths hearth at the TCC Workshop 1974.



Two capstan lathes at Josbarko Enterprise. Mr. Kwaako is second from the right.

partnership arrangement and the scheme fell through. The TCC has often encountered a lack of trust which has defeated attempts to form partnerships of this kind. This factor was encountered again in the case under study.

In 1978 the TCC renewed its appeal for funds to enable it to import used machine tools for resale to informal industries in Kumasi. This time the appeal was answered by Intermediate Technology Industrial Services of Rugby, England, who contributed an amount of £20,000. The machine tools ordered with these funds arrived in Kumasi during the period June to August 1979. During the following year the machines were resold to four small workshops in Kumasi, three of which used them to produce steel bolts and nuts. One of these was known as Josbarko Enterprise owned by Mr. Barimah Kwaako.

The Client

Mr. Joseph Barimah Kwaako was a pharmaceutical laboratory technician. He left his post at Mbrom Hospital in 1975 to find a business to pursue in self-employment. He first made contact with the TCC in August 1976 when he started to buy bolts and nuts produced by the Steel Bolt Production Unit. These he took to Accra and sold to companies making fishing boats. One of his customers was Kofifoh Boatbuilding Company Limited who manufactured ocean-going diesel-powered fishing boats in the 10 to 20 metre range. Kofifoh subsequently became the largest single user of TCC bolts and nuts. Although they eventually found their way directly to the TCC it was not before Mr. Kwaako had accumulated a useful capital sum for the further development of his business.

Mr. Kwaako formed the ambition to have his own workshop producing steel bolts and nuts. At the time the possibility seemed to be remote and Mr. Kwaako was warned of the difficulties which surrounded the acquisition of machine tools. He was also advised that as he had little or no engineering knowledge he would be wise to seek a partnership with a skilled mechanical technician. In the meantime it was agreed to take Mr. Kwaako's son into the TCC workshop where he would be trained in all aspects of the work. Mr. Kwaako Junior underwent training from September 1978 to October 1979.

The TCC employed a technician who also wanted to start his own steel bolt manufacturing business. He was one of the men to whom the TCC had sold a capstan lathe in 1977 and he had been producing in his spare time with some degree of success. It was felt that his technical skill combined with Mr. Kwaako's marketing knowledge and general business acumen would make a powerful combination. Efforts were made to bring the two men together. The chances were slim however as they were not even of the same tribe. Each decided to continue to go his own way.

When late in 1978 it became clear that funds would be available to allow the TCC to import some used machine tools, four entrepreneurs

were selected to participate in the project. Three were technical men who had a good knowledge of machine tool operation. The TCC decided to include Mr. Kwaako as he seemed to possess outstanding entrepreneurial talent. It was reasoned that even though he and his employees would require more technical training and guidance his special qualities would ensure success in the long run. This indeed proved to be the case.

As soon as he knew that he was to be offered a chance to purchase machine tools for his business Mr. Kwaako set about the establishment of his workshop. He acquired a plot of land belonging to his father-in-law at Ashanti New Town, Kumasi, about half a mile from Suame Magazine. He came to the TCC for advice on the size and construction of his building. A mason was employed to put down a solid concrete floor and a carpenter put up a light and airy wooden structure of 65 square metres area. A three-phase electricity supply was connected to the building. All these actions may seem commonplace when viewed from an industrialised country. In Ghana in 1979 they required a power to move mountains. All materials were in short supply and the problem of obtaining cement alone would have daunted many of Mr. Kwaako's compatriots. Such tasks required enormous energy and tireless patience as one quest after another involved endless tours of the city and waiting in numerous queues to see petty bureaucrats or the clerks of trading companies. Some of these trails were shortened by a letter from the TCC to the official concerned but many were not. Mr. Kwaako decided to give up his trading activities entirely while he concentrated upon the many tasks involved in establishing his workshop. The TCC warned him of the danger of giving up his source of income as well as damaging his market but Mr. Kwaako pursued his objective with singleness of purpose and he was probably right in his decision. In the end he possessed a functional and attractive workshop which stood ready to receive the machine tools when they arrived. He had also seriously depleted his financial resources.

The Production Unit

As soon as machine tools became available the project became the immediate concern of Mr. Kevin Davis of the Canadian International Development Agency (CIDA) who was attached to the TCC as Senior Technical Advisor. Mr. Davis produced a floorplan for Mr. Kwaako's workshop (see figure) and supervised the preparation and installation of the machines. The work was completed towards the end of September 1979. Production began in October under the supervision of Mr. Samuel Arthur who was seconded from the TCC workshop for an initial three month period. Mr. Arthur was a Suame Apprentice who had joined the Steel Bolt Production Unit in February 1973. A year later he became an official university apprentice and when he completed his apprenticeship in 1979 he was appointed a Technical Assistant. Under Mr. Arthur's able supervision the production got smoothly underway and deliveries commenced in November. Mr. Kwaako took a close interest in every aspect of the work and operated each machine in turn until he felt that he had mastered it. He showed a surprising aptitude and was soon devising

ways to speed up the work and increase efficiency. Mr. Davis reported that Mr. Kwaako always listened to advice and carried into effect the recommendations that were made to him.

The production unit consisted of two capstan lathes, a milling machine, a drilling machine and a lathe tool grinder. It was supplemented by a welding set as material shortages had by that time necessitated the welding on of separate bolt heads. The bolt heads were screwed as well as welded to ensure adequate strength. Bolt heads and nuts were made by the same processes prior to assembly with the bolt shank.

Initially Mr. Kwaako employed a labour force of five. Of these, two operated capstan lathes, one the milling machine, one tapped nuts on the drilling machines and one welded the bolt heads. Mr. Kwaako spent most of his time in the workshop alternating with his machine operators, chasing progress and solving problems. As the months passed, however, he found it increasingly necessary to spend time out of the workshop in pursuit of orders and raw material supplies.

Marketing and Supplies

In the early stages the TCC gave a great deal of support to the new enterprise. Not only Mr. Kwaako's machines but also his consumable tooling came from the TCC. He also sold all of his finished products to the TCC as they were produced to sub-contracted orders from his old customers the boat builders in Accra. It was thought to be prudent to preserve for some time the impression that the TCC remained the manufacturer as indeed it did in respect of many of the orders received.

It was in respect of raw material supplies that Mr. Kwaako first became independent of the TCC. Obtaining suitable steel rods had always presented difficulties. In the early 1970s steel rods had been produced from recycled scrap steel by Tema Steelworks, a division of Ghana Industrial Holding Corporation (GIHOC). At first these were sold at about one third of the price of imported steel rods but prices were increased steadily until there was little advantage in buying the local material. However, by that time imported rods had all but disappeared from the market. At the same time the locally produced rods became reduced in size range and the quality deteriorated. The rods became more and more oval in section and undersize on mean diameter. Some of them were too hard to machine and all rods had to be tested with a file before sending them to the machines in order to avoid costly tool breakages. Finally Tema Steelworks closed for extensive rehabilitation and its products disappeared from the market. From that time onwards the main source of raw materials became the scrap metal dealers of Suame Magazine who sold at the black market price of about three times the legitimate market level. However building contractors were still able to obtain small and infrequent supplies of steel rods for concrete reinforcement. Mr. Kwaako contracted with some of these to collect all of their off-cuts. By this means he ensured a reasonably adequate supply

of raw material.

Mr. Kwaako also made strenuous efforts to diversify his supply of tooling. He managed to keep himself supplied with welding rods and a few items such as drills and hand tools. He was lucky to buy an electric welding set from someone who had recently returned with it from overseas. However in other directions he was not so fortunate. Supplies of items such as lathe parting tools smuggled into Ghana from Ivory Coast or Togo proved more elusive than he at first supposed. The TCC remained his only source of supply for thread cutting tooling such as die sets and machine taps as well as milling cutters and capstan lathe collets. Thus the industry remained dependent to this extent upon the foreign exchange resources of the TCC.

Mr. Kwaako did not remain solely dependent upon the TCC for orders for his products. Although he suffered from having broken contact with his old customers, once his production was flowing reasonably smoothly he started going out renewing his contacts and finding new customers. In the first five months all of his output was sold to the TCC. Over the next six months he managed to sell 33% of his products to other customers. After that all sales were made to outside customers directly.

Ghana adopted metric standards in 1975 and since that time the TCC had concentrated on the manufacture of metric standard threads. Mr. Kwaako followed this practice and during his first nine months of production he produced M6, M8, M10, M12, M14, and M16 thread sizes. These were all standard metric coarse threads (SIC) and the number denoted the diameter of the thread in millimetres. Bolts of various lengths were produced from 60mm to 250mm. Table 1 provides an analysis of bolts and nuts produced during the first two years of production.

Table 1

Analysis of Bolts and Nuts produced by diameter
September 1979 — August 1981

Nominal Diameter mm	*No. of Bolts Produced*	*%*	*No. of Nuts Produced*	*%*
6	600	1	600	1
8	2,024	4	2,274	4
10	9,310	18	10,610	19
12	33,963	66	36,223	65.5
14	1,200	2.5	1,200	2

16	4,480	8.5	4,480	8
18	36	—	36	—
TOTAL	51,613	100	55,423	100

*Most bolts and nuts were produced with Metric Coarse threads. In this analysis, bolts with inch sizes are included as the nearest metric equivalent i.e. $\frac{3}{8}$" = 10mm, $\frac{1}{2}$" = 12mm, etc.

It can be seen that the most popular bolt sizes were M12, M10 and M16. These three sizes accounted for 92.5 per cent of production. This accords with the experience of the TCC. It is remarkable that a very large percentage of demand can be met with the capability to produce as few as three different diameters. In the days of producing British Standard Whitworth (BSW) threads the TCC found that about 90 per cent of demand consisted of $\frac{3}{8}$ and $\frac{1}{2}$ inch sizes only. These sizes correspond roughly to the M10 and M12 sizes now produced. The lengths of bolts required varied considerably but it is a simple matter to vary length on the capstan lathe. An even greater degree of standardisation is attainable with nuts as their length does not vary. Mr. Kwaako was quick to realise that when business was slack there was much to be gained by stock-piling nuts of M10 and M12 sizes. Then when orders were received he could produce very quickly using both capstan lathes for bolt production and drawing from his stock of nuts.

Mr. Kwaako's bolts and nuts like those of the TCC were used for a variety of purposes. Initially the largest demand came from the boat-building industry but later substantial numbers were demanded by timber mills and goldmines and for building construction and vehicle and machinery repair. Most of Mr. Kwaako's production has been of hexagonal headed bolts. However he has also produced coach bolts with hand forged heads. The TCC has experienced a steady demand for these bolts for wooden lorry bodies and farm gates. Once again the popular sizes are M10 and M12.

Mr. Kwaako has concentrated on standardised products for general use and has avoided special purpose bolts required in small quantities. Thus he does not seek to compete with the centre lathe turners of Suame Magazine. In some ways when material supplies are scarce it is more profitable to make a few special items than to attempt mass production. However, provided that he can maintain an adequate supply of raw material Mr. Kwaako would appear to be right to seek to exploit his advantage of being able to quickly produce large batches of identical products. At the time of writing Mr. Kwaako's ability in this respect was unique amongst the small and informal industries of Suame Magazine and Kumasi generally. Moreover, a technical innovation has enabled Mr. Kwaako to considerably extend his product range.

Tangential Threading Dies

During eight years of steel bolt production at the University all threads were cut using radial die heads on the capstan lathes. The die sets used in radial heads have a short life as they can only be resharpened a few times before they have to be discarded. A long search for a more appropriate threading device resulted in 1980 with the introduction of tangential die heads. The thread cutting chasers used in these die heads can be reground to resharpen them many times and so they have a much longer life than the radial dies. This is a considerable advantage in a Third World situation in which all imported tooling is scarce.

Tangential dies confer another advantage. Unlike radial dies which are fixed with regard to thread pitch and bolt diameter, the use of tangential dies permits a given thread form and pitch to be cut on any diameter of bolt within the capacity of the die head. This is clearly seen from the table of thread pitches for standard metric coarse and metric fine threads.

Bolt Diameter	*Thread Pitch mm*	
mm	*Metric Coarse*	*Metric Fine*
6	1.0	0.75
8	1.25	1.00
10	1.50	1.00
12	1.75	1.50
14	2.00	1.50
16	2.00	1.50
18	2.50	1.50

It can be seen that 14 popular bolts can be produced with a stock of only 7 sets of chasers of pitch 0.75, 1.0, 1.25, 1.5, 1.75, 2.0 and 2.5mm. In fact even more can be done as, for example, metric fine bolts of 20mm and 22mm diameters also can be cut with the 1.5mm pitch metric-form chasers. Thus a much greater variety of bolts can be produced from a given stock of chaser sets than can be produced from a corresponding number of radial die sets.

Mr. Kwaako was also able to extend his range of products to include British Standard and Unified Bolts. In the case of British Standard Whitworth (BSW) and British Standard Fine (BSF) bolts, 6 sets of chasers are able to produce 17 popular sizes. In the case of Unified Coarse (UNC) and Unified Fine (UNF) bolts, 8 sets of chasers can produce 16 popular sizes. Overall, Mr. Kwaako could produce 48 different bolt sizes and thread forms from a stock of 21 tangential chaser sets instead of requiring 48 radial die sets of considerably shorter useful life and comparable initial cost. Thus the introduction of tangential die heads represented a significant adaption of the technology to the local situation. At the end of his second year of production, Mr. Kwaako was converting completely to tangential die heads and had extended his product range to include British Standard and Unified bolts and nuts.

Financing

It has already been stated that Mr. Kwaako was able to finance the construction of his workshop from his savings made largely from trading in bolts and nuts produced at the TCC workshop. The investment made in the building was estimated to be ₵22,000.00.

The TCC drew up a list of equipment and machine tools which it was estimated would be needed to start the enterprise. This schedule was communicated to the client in a letter dated 24th August 1979 and a copy is included as Appendix A. The total cost of all the items amounted to ₵41,588.00. Mr. Kwaako then told the TCC that he had exhausted his resources in building the workshop and that he wanted to enter into a hire purchase agreement for the whole of the amount. The TCC reconsidered its position with regard to the extent of the financing it could provide. Its Economic Adviser, Mr. J. D. Russell, suggested that if the milling machine, the powered saw and some accessories were deleted from the initial schedule the TCC's commitment could be reduced to ₵22,496 which was judged to be an acceptable risk. The TCC then incorporated this suggestion in a second offer dated the 7th September 1979 and included in Appendix B. The TCC offered to operate the milling machine at its workshop in exclusive support of Mr. Kwaako's operations until such time as he could afford to purchase it.

Mr. Kwaako accepted the second offer and signed the hire purchase agreement with the TCC on the 12th September 1979. The agreement is included as Appendix C. However he was very anxious to have the milling machine in his workshop from the outset in order to control the whole manufacturing operation and he raised a loan from within his family to effect its purchase outright. The terms of the family loan were not divulged. The TCC loan was repayable by an initial deposit of ₵5,000 and then, following a three month period during which no payments were made, 21 monthly payments of ₵1,000. Thus the total repayments over a period of two years amounted to ₵26,000. This represented an interest rate of 18.5% which was the current rate charged by the commercial banks to prime customers of good credit rating. It was argued by Mr. Russell that the new enterprise should operate from the outset under realistic commercial conditions. The terms of the loan were realistic but no commercial bank would finance the Business.

A branch of the Social Security Bank opened in Kumasi at Suame in 1978. The manager contacted the TCC and informed the Director that the bank would be interested in financing projects which enjoyed the help of the university. He asked for a list of names of TCC clients who might need finance for their businesses. All the people included on the list were invited to the opening ceremony of the bank at Suame. Mr. Kwaako was among them. He followed up the overture by seeking a loan with which to start his business in 1979. Although the Social Security Bank gave substantial help to another TCC client they declined to help Mr. Kwaako. The story had a sequel some months later when the business was in full production and the bank saw the cash flow that was

being generated. They then offered Mr. Kwaako the finance that he had previously sought. Mr. Kwaako took some delight in turning down the offer and informing the bank that the TCC had helped him in his hour of need.

Mr. Kwaako kept strictly to his repayment schedule and appeared to have little difficulty in doing so. During the period April to June 1980 he was able to pay the TCC an extra amount of ₵3,865 for the purchase of a powered hack saw. He also purchased his welding set from another source for ₵1,500. This was a most encouraging development as it demonstrated Mr. Kwaako's determination to plough back profits into the expansion of the business. He stated that it was his intention to continue doing so for at least five years. In this respect he was unique in the experience of the TCC. Most projects progressed only slowly, or at worst failed, because of premature profit-taking by the entrepreneur. Society expects the businessman to manifest his success visibly in the form of a car, large house, etc. The pressure comes through his extended family which also expects the entrepreneur to accept wide responsibilities included in the education of nephews and nieces. In resisting these pressures Mr. Kwaako exhibited the same strength of character that he exhibited in many other ways.

During his second year of operation Mr. Kwaako continued to expand his business at every opportunity. He acquired his first tengential die head and invested in extensive tooling to add British Standard, Unified and Metric Fine bolts and nuts to his range of products. Early in 1981 the demand for his products increased and he asked the TCC for the loan of a third capstan lathe. This was installed at his workshop in May 1981. No charge was made for the hire of this machine during the period of payment of the original hire purchase agreement. When this agreement expired in August 1981 Mr. Kwaako was given the option to purchase the machine or to pay a monthly hire charge. He opted to purchase the machine for an amount of ₵5,000.00. He also at this time purchased a new Oxford RT 250 oil-cooled electric welding set from the TCC because his original air-cooled set overheated when operated for more than a short period in a tropical climate.

At this time (August 1981) Mr. Kwaako also asked the TCC for a tool and cutter grinding machine, a second milling machine and a centre lathe. A new Clarkson tool and cutter grinder was available from TCC stock and this was allocated to Mr. Kwaako. This machine enabled him to regrind his own milling cutters and threading dies and made him independent of the TCC in this respect. However no other machines were available for his project at that time.

At the end of the two year period of his original hire purchase agreement Mr. Kwaako had succeeded in meeting all his commitments to the TCC (see Appendix D) and had also acquired a quantity of additional machines and equipment. The extent of his success can be judged from the fact that although he could not obtain any bank loan to start his business in 1979, by August 1981 both the Social Security Bank and the

Ghana Enterprise Development Commission were willing to finance a further expansion of the business. However such further expansion was conditional upon the availability of machine tools from the TCC or from some other source.

Pricing Policy

In Ghana, as in many developing countries, there are two markets. In the formal market, constituted by the Ghana National Trading Company (GNTC) and some large stores operated by expatriate companies, prices are either controlled by government legislation or related to international levels. In the informal market prices are determined strictly in accordance with what the market can bear. In recent years very few goods have been available through the formal market. By various means, most commodities, especially imported ones, have been diverted through the informal or 'black' market.

When the TCC started to produce steel bolts and nuts in 1972 these items were available in the formal market to the extent that the formal market price tended to be regarded as that ruling. The TCC, pricing its products according to cost of manufacture and with a profit margin of 10 to 15 per cent, found that using Tema steel it could sell below the formal market price. However it was also at that time possible to buy steel rods in the formal market. During the following three or four years the informal market came to dominate the supply of both steel rods and imported bolts and nuts. TCC prices were forced well above the level of the formal market but this fact had ceased to be of much practical significance. A few imported products were available from time to time at the expatriate stores but these were usually quickly purchased and resold through the informal market. Thus it was effectively in the informal market that the TCC found itself operating and here its prices remained competitive. This was the situation in which Mr. Kwaako began producing in the last quarter of 1979.

The TCC published a price list of all its products and this was revised at intervals as costs increased. Mr. Kwaako adopted this price list and sold all of his products in accordance with it. In this decision he was undoubtedly influenced by the fact that most of his initial production was sold to the TCC for resale at TCC prices. Even when this was not so he possibly felt himself to be in competition with the Steel Bolt Production Unit. However the TCC made it clear to all its clients that when they had developed the capacity to supply the market the TCC would withdraw and leave them with only strictly commercial competition.

The TCC raised its prices twice as costs rose. Each time a new price list was issued, Mr. Kwaako adopted it as his own in spite of the fact that his production then exceeded that of the TCC. However when he finished paying for his machine tools in August 1981 Mr. Kwaako announced his intention to set his own prices because of the continuing increase in the

cost of raw material. This was regarded as a healthy sign of maturity and independence.

Production and Sales

Production and sales figures for Josbarko Enterprise for the first two years of operation are given in Table 2.

Table 2

Josbarko Enterprise — Production and Sales
September 1979 — August 1981

Production and Sales

Quarter	*Sub-Contract from TCC*		*Other Customers*		*Totals*	
	Bolt Sets	¢	*Bolt Sets*	¢	*Bolt Sets*	¢
Sep. - Nov. 1979	1,508	4,094	—	—	1,508	4,094
Dec. 79 - Feb. 80	4,335	16,909	1,400	5,795	5,735	22,704
Mar. - May 1980	6,000	24,425	1,624	4,708	7,624	29,133
Jun. - Aug.	1,900	4,380	3,880	16,129	5,780	20,509
Sep. - Nov.	—	—	4,670	15,371	4,670	15,371
Dec. 80 - Feb. 81	—	—	4,700	14,571	4,700	14,571
Mar. - May 1981	—	—	7,486	34,072	7,486	34,072
Jun. - Aug.	—	—	14,110	54,604	14,110	54,604
Totals	13,743	49,808	37,870	145,250	51,613	195,058

No products were finished or sold during September and October 1979. Sales started in November. For most of the two year period under review Josbarko Enterprise possessed a capacity to produce 4,000 bolt and nut sets per month. This level of output was approached in February 1980 and achieved in March 1981. When in June 1981 a third capstan lathe was added capacity was increased to 6,000 bolt and nut sets per month. This level was achieved in July 1981. Neglecting the first quarter

with its teething problems, quarterly output ranged from 39% to 80% of capacity with an average of 55%. This can be regarded as satisfactory when it is realised that few industries in Ghana have been able to exceed 20% of capacity in recent years. Factors which limited output at Josbarko were labour problems and shortages of materials. There was also some shortage of orders during the six months following the end of TCC sub-contracts in July 1980. However by mid 1981 Josbarko had an advance order book extending to four months full production.

CASH FLOW AND PROFITABILITY

The cash flow for Josbarko Enterprise for the first two years of operation is shown in Table 3.

Table 3

Josbarko Enterprise — Cash Flow
September 1979 — August 1981

Cash Flow	*Sep-Nov 1979*	*Dec 79 - Feb 80*	*Mar-May 1980*	*Jun-Aug 1980*	*Sep-Nov 1980*	*Dec 80 - Feb 81*	*Mar-May 1981*	*Jun-Aug 1981*
Inflow Sales	4,094	22,704	29,133	20,509	15,371	14,571	34,072	54,604
Equity	45,000	—	—	—	—	—	—	—
Total	49,094	22,704	29,133	20,509	15,371	14,571	34,072	54,064
Outflow — Direct								
Wages	2,000	4,980	5,740	4,970	4,894	4,745	5,400	6,650
Materials	3,320	4,297	4,150	6,037	1,637	9,660	10,300	21,920
Consumables	755	2,361	1,809	2,080	2,643	1,387	4,283	4,985
Services	16	673	150	307	447	431	184	75
Sales Expenses	750	1,358	1,853	852	1,070	2,192	2,480	2,976
Indirect								
Building	22,000	742	—	226	—	700	360	—
Machinery	16,950	2,000	7,000	4,365	3,000	3,000	3,000	3,000
Tools	—	1,338	500	660	97	—	265	5,592
Tax, Rent, etc.	—	—	—	50	200	—	—	—
Total	45,791	17,750	21,202	19,547	13,988	22,115	26,272	45,198

Net Quarterly Flow	3,303	4,954	7,931	962	1,383	7,544	7,800	9,406
End Quarter Cash Position	3,303	8,257	16,188	17,150	18,533	10,989	18,789	28,195

The first year's results can be regarded as satisfactory for a new manufacturing enterprise. By the end of August 1980, Josbarko had invested ₵53,283 in capital assets and had ₵17,150 cash in hand. Its liabilities at that time in equity capital and loans amounted to ₵45,000. The profit on the year's trading was ₵25,433. This represents a return on capital of 56.5%. Allowing for capital charges at the current bank interest rate of 18.5% leaves a net return on capital of 38%.

In the second year Josbarko Enterprise encountered a more difficult cash flow situation caused by escalating raw material costs. During the first year raw materials had cost roughly the same as labour. In the second year raw material costs doubled to become the dominant factor in the cash outflow. After trading roughly in balance for six months, Josbarko suffered its first net cash outflow in the second quarter of its second year's trading. The position was restored in the next quarter and further progress was made in the last quarter of the year. However the raw material supply problem had come to dominate Mr. Kwaako's thought by the end of his second year's trading.

During his second year of trading Mr. Kwaako increased his cash on hand by ₵11,045, paid off the balance of ₵12,000 which he owed to the TCC for his machine tools and invested a further ₵1,060 in his building. He thus made a profit of ₵24,105 which represented a return on his investment of 53.5% and a net return of 35%. He thus succeeded in substantially maintaining the level of profit of his first year but after allowing for inflation (around 70%) his real return was much lower. This was the effect of the raw material constraint.

Although the level of profitability of Josbarko Enterprise would not have satisfied a trader its financial position was much stronger than it might seem to be. Much of Mr. Kwaako's profits were invested in machine tools and equipment which if offered for sale would command a price much higher than their book value (here assumed to be the purchase price including interest on the hire purchase agreement). It is the practice of successful traders to hold their profits by investing in land and buildings. Manufacturers such as Mr. Kwaako can pursue the same policy by investing in machine tools. Where these can be obtained at formal market prices the benefits in terms of potential capital gains are much greater. Thus while Mr. Kwaako had no intention of disposing of his machine tools their possession conferred a substantial degree of security and was a source of much satisfaction. Overall, Mr. Kwaako was well satisfied with the progress of his business over the first two years of operation.

Employment and Labour

Throughout most of the first year of production five machine operators were employed at a monthly wage of ₵200. A part-time welder was also employed. For the first three months Mr. Kwaako drew no salary from the business but from January 1980 he paid himself a salary of ₵800 per month. The wages paid were higher in December when a Christmas bonus was paid to all the workers.

Josbarko Enterprise provided six full-time jobs and one part-time job. Thus the technology could be said to provide workplaces at a capital cost of approximately ₵7,000 ($2,500). This is at the capital intensive end of the spectrum of technologies transferred by the TCC but it is by no means capital intensive by international standards.

Not only did the project provide employment but it was skilled or semi-skilled employment commanding a relatively high wage. The work was not without interest, especially with job rotation as practised at the TCC workshop, and a certain amount of prestige attached to the operation of powerful and complex machines. However it cannot be said that the work was popular. This was evidenced by the rapid labour turnover experienced throughout the project and the relatively few individuals who remained at the work for any length of time. The Ghanaian temperament seems not to be well adapted to the discipline of continuous machine tool operation. In the centre lathe workshops of Suame Magazine the machines lie idle for much of the time. Even when work is in progress the machine is operated by one man while at least four apprentices stand and watch. This system ensures that no one person works continuously at the machine.

There is no doubt that the employment preferred by Ghanaian workers consists of short periods of activity, even intense activity, interspersed with longer periods of rest and conversation. Work is regarded as a social activity. There are difficult problems to be solved in adapting the use of machine tools to combine high utilisation with a contented workforce. The workforce in the main appears to be introverted in that there is little response to incentive bonus schemes but the pace of work is intensified by strict supervision. However, as discipline is increased so is labour turnover. A solution may lie in the fact that an employee identifies not with a company or with an institution but with an individual. The boss is regarded as the village chief or the head of the family. Consequently, where the proprietor of an enterprise can be constantly present to supervise and encourage the workers the work proceeds much better than otherwise. Thus Mr. Kwaako and entrepreneurs like him should be able to achieve better results through their presence in the workshop than can be achieved in an institutional situation like that at the TCC.

The employment and control of labour presents severe problems to the would be industrialist in Ghana. This may well be a powerful factor in shaping the almost universal preference for trading rather than manufacturing. In all, paid employment salaries are regarded as very low

and the lure of high wages in oil-rich Nigeria is an ever present factor. There is a tendency, which is very widespread amongst young men, to seek employment which provides training in a practical skill and, when it is judged that enough has been learned; to abscond to Nigeria. The TCC has lost numerous workers from all of its projects in the way. Entrepreneurs have little means at their disposal to stem this haemorrhage which has come to be regarded as an inevitable fact of life.

Another factor promoting a high labour turnover is the high incidence of pilfering. Tools, finished products and raw materials are constantly dwindling away and when an offender is caught, as they frequently are, the only practical recourse is instant dismissal. It is a painful decision to dismiss a man who has just acquired a useful degree of skill but it is a decision which must frequently be faced. A manufacturer like Mr. Kwaako is very vulnerable to pilfering. If he should lose only one or two essential items of tooling his production could be brought to a halt for several months while he searched for a replacement or waited for one to arrive from overseas. The same result could arise from breakages. The high labour turnover keeps the average level of skill low and the rate of breakage high.

Ghanaian entrepreneurs tend to employ only members of their own tribe and sometimes only members of their own extended family. This is because there is greater trust and loyalty between people of the same tribe or family and the policy reduces some of the human problems mentioned above. Mr. Kwaako's labour force consisted initially of four Ashantis and a Wala man from north west Ghana. All were young men not long from school. Of the Ashantis, one was Mr. Kwaako's son who had been trained at the TCC workshop and another was described as his nephew although the precise relationship was not clear. In employing a stranger Mr. Kwaako was exhibiting an enlightened attitude. When he encountered labour problems they did not at first involve the Wala.

Mr. Kwaako's first problems began in June 1980. On the 25th, the two Ashanti workers not related to him collected their pay and left, presumably for Nigeria. Five days later his son was sent with money to buy welding rods and was not seen again. He too was presumed to have left for 'Agege'. Thus Mr. Kwaako's labour force was reduced to two at the beginning of July and this undoubtedly contributed to the low production achieved in that month. He recruited one new worker in July and two more in August but one of these soon left. All were Ashantis.

It is a characteristic of Ghanaian labour that some men are often lost at the Christmas and Easter holidays. At these times it is customary to visit the home village which may involve a long journey and this unsettling factor often prevents the return to the old employment. It was at Christmas 1980 that the Wala man left Josbarko Enterprise in this way. By January 1981 only one of the original workforce remained. His loyalty and experience was recognised by a doubling of his salary to ¢400 in February 1981. In that same month Mr. Kwaako lost his welder. Like

all those before him he stopped coming to work after receiving his pay. He gave no notice of resignation either verbally or in writing.

When Mr. Kwaako reviewed the salaries of his employees in February 1981 he raised the two men who had joined him in July and August 1980 to ₵250 per month. One of these two was the welder who left at the end of that month. In March he took on an apprentice whom he paid a subsistence allowance of ₵150 per month. In that same month Mr. Kwaako increased his own salary to ₵,100 per month.

In June 1981, Mr. Kwaako raised the salary of his senior man to ₵500 and the next month he raised his second man to ₵300 and the apprentice to ₵200. Also in July, he recruited a more experienced worker who was paid ₵350 but was raised to ₵400 in August. Thus at the end of the period under review the workforce of Josbarko Enterprise was composed as follows:

One man with 24 months service was paid ₵500 per month
One man with 13 months service was paid ₵400 per month
One man with 2 months service was paid ₵300 per month
One apprentice with 6 months service was paid ₵200 per month

During its first two years of operation Josbarko Enterprise provided 10.25 man-years of employment, including Mr. Kwaako's own two years. More employment would have been provided but for the instability of the workforce. Of those who left, the son had served the TCC and his father for 22 months and the Wala man had served for 16 months, two others served for 10 months, another for 8 months and one man left after only one month. Thus the average period of service was 11 months. The corresponding figure for 50 employees of the TCC's Steel Bolt Production Unit over an eight year period was 19 months. However the situation has deteriorated considerably in recent years and recent TCC experience has been worse than Mr. Kwaako's.

A factor which is important to the efficiency of a manufacturing enterprise is the average degree of skill and experience of the workforce. In the beginning, Mr. Kwaako employed only one trained man; his son. Table 4 shows the average level of skill expressed in terms of months of practical experience gained with the enterprise at the beginning of each quarter-year period. It is seen that an average of one year's practical experience was never quite achieved.

Table 4

Josbarko Enterprise — Practical Experience of Workforce and Labour Turnover

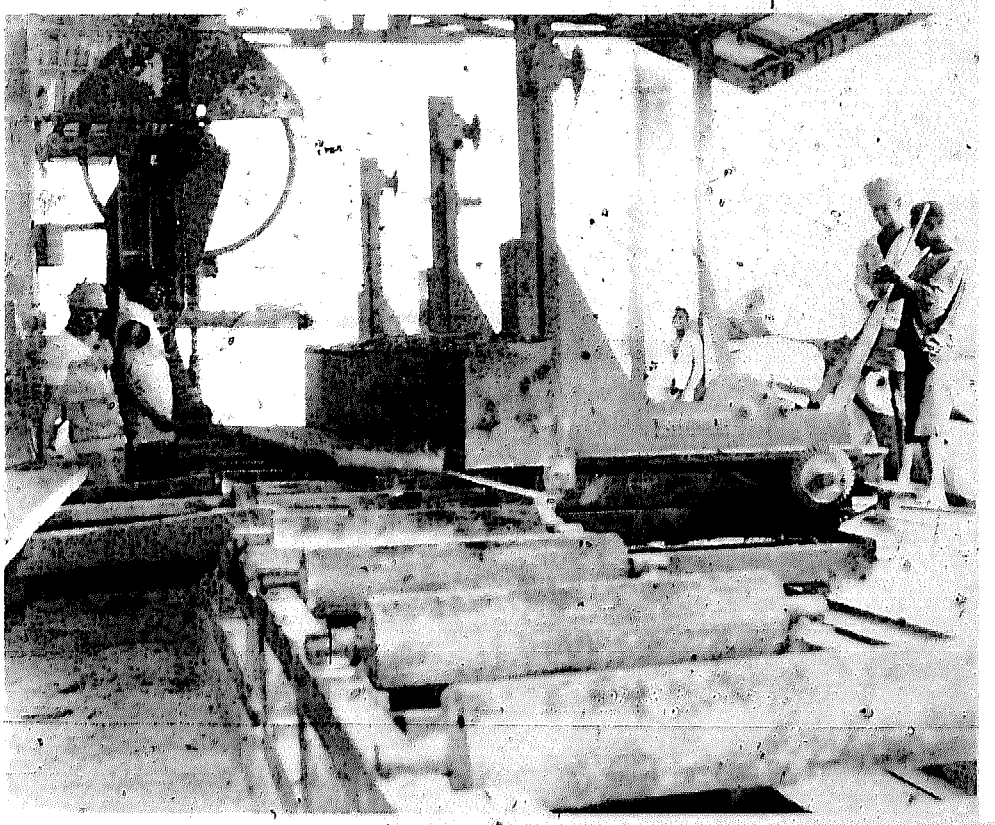
Quarter	*Average Length of Service of Workforce — Months*	*Number Leaving during Quarter*	*Number Joining during Quarter*	*Number of Full-Time Employees*
Sep. - Nov. 1979	2.4	—	5	5
Dec. 79 — Feb. 80	5.4	—	—	5
Mar. - May 1980	8.4	—	—	5
Jun. - Aug.	11.4	3	3	5
Sep. - Nov.	5.6	1	—	4
Dec. 80 — Feb. 81	9.8	2	—	3
Mar. - May 1981	11	—	1	3
Jun. - Aug.	11.3	—	1	4
1st Sep. 1981	11.3			4

In view of the inexperience of his workforce Mr. Kwaako's achievements were all the more remarkable. Apart from the first three months when the TCC seconded an experienced technician to supervise the work, Mr. Kwaako served as his own workshop supervisor. He showed great fortitude in returning time and time again to the ab-initio training of new recruits.

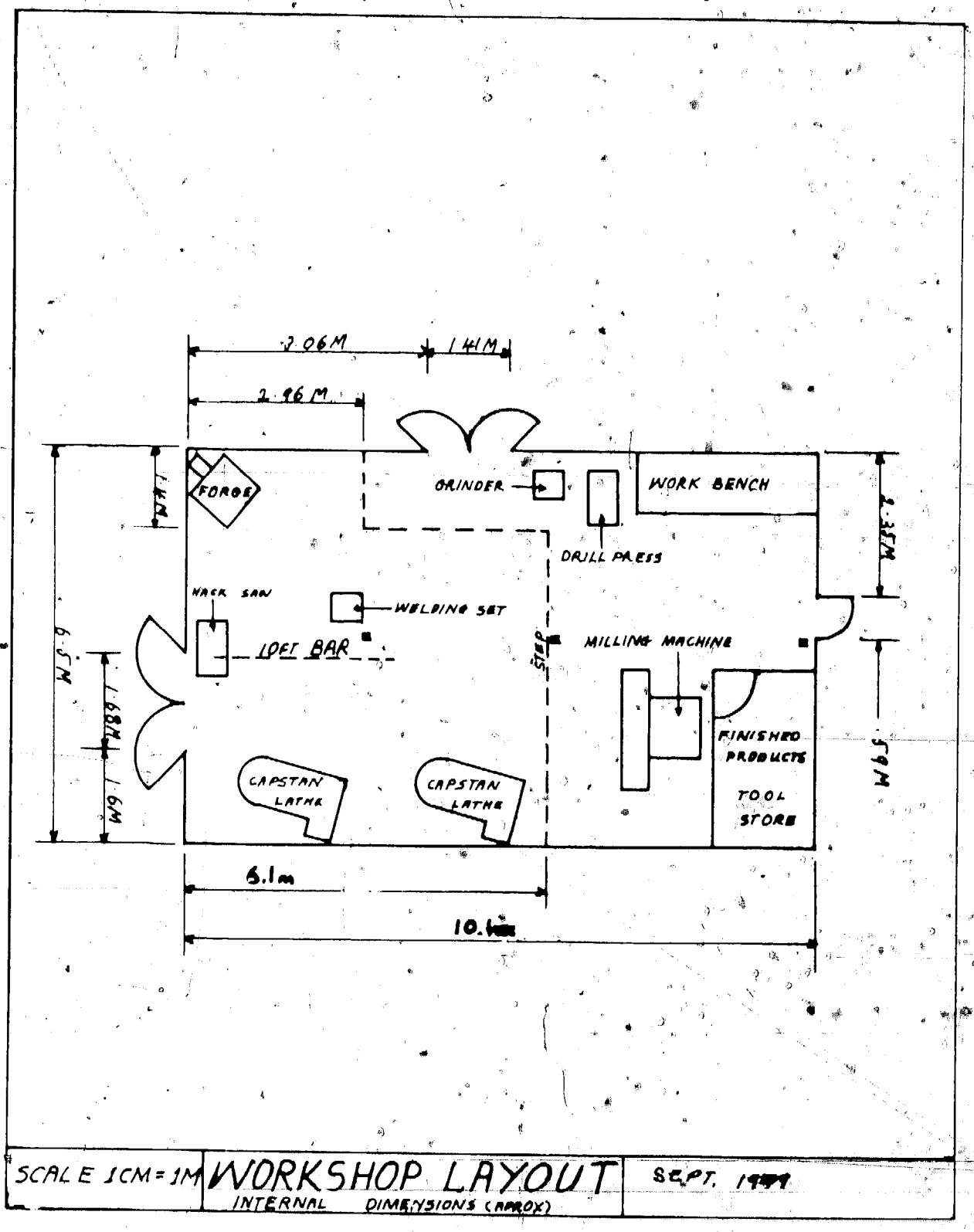
Absenteeism was also a severe problem. It was mentioned by Mr. Kwaako as a main reason for lost production. In the month of June 1981, a typical month, 16 man-days were lost out of a possible total of 66. This level of absenteeism (25%) was comparable to that suffered by the TCC.

Although Mr. Kwaako was in many ways a good employer, paying fair wages, providing good working conditions and being present in the

Milling hexagon bar at Josbarko Enterprise 198.



Kumasi has more than thirty sawmills and they constitute a large part of Josbarko's market.


2.06M
1.41M
2.96 M.
FORGE
GRINDER
WORK BENCH
DRILL PRESS
HACK SAW
WELDING SET
LOFT BAR
STEP
MILLING MACHINE
FINISHED PRODUCTS
TOOL STORE
CAPSTAN LATHE
CAPSTAN LATHE
6.1m
SCALE 1CM = 1M
WORKSHOP LAYOUT
INTERNAL DIMENSIONS (APROX)
SEPT. 1989

workshop for most of the time, he was not able to maintain a stable workforce or to avoid the high labour turnover and absenteeism which had afflicted the TCC's own operations. A significant improvement in the labour situation is unlikely to arise unless the economy of the country takes a marked turn for the better. Mr. Kwaako's problems are the problems of Ghana generally and he should not be judged too harshly on this issue.

Wages and The Cost of Living

In September 1979 when Josbarko started to employ labour the legal minimum wage in Ghana was ₵4 per day or ₵84 for a month of 21 working days. In paying his unskilled trainees a monthly wage of ₵200 Mr. Kwaako was exhibiting a generous attitude and taking a chance on the men rapidly becoming skilful enough to justify this level of reward. The minimum wage had remained unchanged for several years and many felt that an upward revision was overdue. However no move was made until early in 1981 when the legal minimum wage was increased to ₵12 per day, back-dated to 1st November 1980.

The trebling of the minimum wage was more than most manufacturers could bear. Many formal sector industries were forced to make men redundant while informal industries attempted to ignore the legislation. Mr. Kwaako was caught between these two extremes. Wishing to operate in a formal way after the example of the TCC yet unable fully to justify the new wage rates he compromised by raising his most experienced man to well above the new minimum wage and giving two other employees a wage rate only just below it (₵11.90). Only the apprentice remained at a rate substantially below the minimum wage (₵7.14) and this fact was accommodated by calling the remumeration a subsistence allowance. All wages were raised again in July and August 1981.

It is doubtful if anyone in Ghana in 1981 could feed himself on ₵12 per day. At the black market exchange rate for the Cedi the minimum wage had a value of only $0.27 or £0.15 and this was generally held to be a reliable measure of its real purchasing power. For example, a 155 gm (5½ ounce) tin of mackerel sold for ₵12 to ₵14 and a dozen eggs for ₵27 to ₵36 in August 1981. Local vegetables such as yam, plantain and rice were relatively little cheaper. How people survived was a mystery known only to the individual. However, everyone seemed to be involved in trading, many people were doubly employed in various ways e.g. as night watchmen and taxi drivers, and many supplemented their incomes in ways which are best left unprobed.

Perhaps most people who took paid employment did so only to gain a little seed capital for the month's trading. Those subjected to discipline which kept them at their workplace throughout the day felt themselves to be the victims of discrimination since they knew that the majority of those employed in the Civil Service and public institutions spent long hours away from their offices and workshops. The aim seemed to be to

collect the monthly pay with as little expenditure of effort as possible, thus conserving energy for the more lucrative activities after hours. Productivity was inevitably very low and absenteeism was high. There were no monetary rewards which the employer could afford to offer in the way of bonuses or overtime work that could substantially affect the welfare of the employee. Certainly there was little possibility of raising basic wages to a level where a man would not feel the need for a supplementary income and could thus give his whole effort to the enterprise.

Mr. Kwaako, like many other employers, was searching for an answer to this problem. However, he did not regard it as seriously as did the TCC consultants and he certainly regarded it as a lesser problem than that of obtaining raw materials. He had increased wages as much as he felt was justified by the progress of the business and he perceived an improvement in the situation. As at August 1981 he had not lost a man for six months and the level of skill of his workforce was as high as it had ever been. His tolerant attitude to life and people enabled him to sympathise with workers who were absent because of sickness or death in the family. In Ghanaian society it never occurs to anyone to count how many grandmothers' funerals a man attends. Thus in the local socio-cultural context the labour problem was not as acute as it might appear to be from a Western viewpoint. Mr. Kwaako had learned to live with the problem and to contain it within, what were for him, tolerable limits.

A Manufacturing Entrepreneur

There are about a dozen small industries in Kumasi with a machine tool capacity similar to that of Josbarko Enterprise. However their mode of operation is quite different. The proprietors are content to let their machines lie idle for much of the time while they wait for clients to bring them work to do. They stock very little material for the material is often brought with the job in the form of a brake drum to be skimmed or an axle to be rethreaded. Most of their work is related to the maintenance of motor vehicles and as the transport business is highly lucrative very high charges can be made. These high charges compensate for the low machine utilisation and underemployment of staff. This mode of operation has its own logic. The scarcity of materials constitutes little or no constraint, wear and tear on imported tooling is minimised and the workforce is not alienated by the pace or discipline of work. Machine utilisations of 20 to 30 per cent have been justified on the grounds of not wearing out the machine. The machine tools are regarded as capital assets which will appreciate in value and which are unlikely ever to be replaced; hence the need to preserve them for as long as possible. Another factor is the income derived from apprentices. Apprenticeship fees can represent a significant part of a machine owner's total income. It is a factor which is almost independent of the level of machine utilisation but is proportional to the life of the machine. These factors all conspire to promote low productivity and high unit costs.

There is no doubt that the Ghanaian temperament is well adapted to trading. In many ways the attitudes of typical small manufacturers are derived from a trading tradition. This is especially so in relation to the exploitation of scarcity. Little attempt is made to expand businesses to increase production and profits are invested in buildings and land rather than in more machines, equipment or materials. Increased production is viewed as a means of working harder for the same reward, or even less reward if greater availability forces down prices. Thus while many realise that the economy at large would benefit from increased productivity there are few entrepreneurs who see any personal gain resulting from it.

The TCC has assisted several one-time traders to become manufacturers. In almost every case the entrepreneur's aim has been to control the supply of a scarce commodity rather than to produce in any quantity. Mr. Kwaako came into manufacturing from trading. However, in his determination to produce at the highest possible rate and to plough back profits to expand his business he is a manufacturing entrepreneur much more akin to the Western prototype. This study has highlighted his problems in relation to tooling, materials and above all, labour. So far he has operated profitably. It will be interesting to see if he will continue to overcome the difficulties that lead to a divergence between his own interests and the broader interests of the national economy.

Review of Progress

This case study written when Josbarko Enterprise was only two years old may seem to be somewhat premature. However the project as a whole was 9 years old and Mr. Kwaako has been developing his enterprise with help from the TCC for some five years. The record of production for the whole project over the eight year period to August 1980, when TCC sub-contracted production ended, is given in Table 5.

Table 5

Sales of Steel Bolts by TCC 1973-80
(All data in bolt and nut sets)

Year	*Production by TCC*	*Josbarko and Sub-contracted Production*	*Total Production*
72/3	6,532	—	6,532
73/4	15,268	—	15,268
74/5	29,624	—	29,624
75/6	29,657	—	29,657
76/7	37,657	Some production not recorded	37,657 +
77/8	34,745	Some production not recorded	34,745 +
78/9	28,000	2,890	30,890
79/80	22,887	31,503	54,390

The experience of 9 years suggests a steady market demand which exceeds the existing capacity to supply. It also suggests that the technology can supply the market with a product of acceptable quality at an acceptable price. In spite of all the difficulties remarked upon in this

study there is no reason to suppose that the situation will change unexpectedly. Mr. Kwaako is one of three manufacturers established by the TCC with a steel bolt making capability. All produced under sub-contract to the TCC during the period under review. The other two manufacturers also produced additional quantities of bolts and nuts for other customers which are not recorded in Table 5. Thus the total production achieved exceeded the figures given but there was no indication of market-saturation. The total demand for steel bolts and nuts of all types in the whole of Ghana has been estimated from the import data of earlier and more affluent years to be as high as 1,000,000 per annum. This being the case it would seem that the project has not yet reached 10% of this requirement.

The TCC's Steel Bolt Production Unit operated over the 8 year period of its existence roughly at break-even point. In the years 76/7 and 77/8 it earned a substantial surplus. Within a year of commencing operations Josbarko Enterprise had equalled the TCC's rate of production. It had done so with a smaller staff, fewer machines and lower overheads. There are several reasons to suppose that it should continue to operate profitably. Mr. Kwaako has demonstrated his entrepreneurial and managerial ability and has exhibited a sense of resolve and stability of character which augurs well for the future. He has overcome his technical weaknesses and even introduced technical innovations to improve efficiency. Compared to the TCC's operation he seems to have more advantages than disadvantages and he can be expected to continue to build on the TCC's experience to forge further ahead in the years to come.

Mr. Kwaako sees his greatest problem as that of ensuring an adequate supply of raw material. After a long period of rehabilitation during which there was no production Tema Steelworks were about to resume production. The TCC supplied Mr. Kwaako with letters of introduction to the Steelworks and to the Ministry of Industries, Science and Technology in the hope of securing a regular allocation of steel rods. If this were possible it would provide a great boost for his business.

The TCC has purchased a workshop in the heart of Suame Magazine which it is operating as an Intermediate Technology Transfer Unit (ITTU). The Steel Bolt Production Unit has been transferred to Suame as part of that project. However as soon as there is a positive indication that the market need for steel bolts and nuts is being adequately supplied the TCC will withdraw and leave the field to Mr. Kwaako and those who seek to emulate him.

CONCLUSION

The economic environment in Ghana does not favour small industry development. It is difficult to say to what extent the prevailing trading mentality is the product of the environment and to what extent it played a part in creating it. The relationship is a complex one. What is certain is that small-scale industrial development is hindered by the following factors.

1. Shortage of raw materials of all kinds whether locally produced or imported.
2. Shortages of machines and equipment of all types due to the absence of local production and a shortage of foreign exchange to finance importation.
3. Shortage of capital available to new and small enterprises lacking security.
4. A strong tendency for all skilled labour to be drawn away to neighbouring countries where wages are higher.
5. A lack of motivation in the labour force due to the low value of the currency and poor economic conditions generally.

The experience of the TCC has shown that to attempt to promote small-scale industrial developments in the face of these difficulties requires the combination of an integrated technology transfer mechanism and an individual of outstanding entrepreneurial qualities. This report has shown how these two elements can interact successfully to overcome most, if not all, of the problems. Above all it has shown that some progress is possible even in this difficult environment. From this can be drawn hope for greater progress in the future.

APPENDIX A

SCHEDULE OF MACHINE TOOLS OFFERED FOR SALE 24/8/79

We have pleasure in offering you for sale the following machine tools and equipment.

	¢
2 off Used Ward 2A Capstan Lathes complete with coolant system and bar feed	10,000.00
1 off Used Denbigh Milling Machine complete with coolant system	8,000.00
1 off Used Pedestal Drilling Machine	4,600.00
1 off New Gate Milford Lathe Tool Grinding Machine	3,000.00
1 off New Rapidor Powered Hack Sewing Machine	3,815.00
1 off New Marlco Indexing Head for Milling Machine	3,350.00
1 off New Tapping Head for Drilling Machine (No. 3)	980.00
1 off New Roller Box for Capstan Lathe	650.00
2 off Sets of spare rollers for above	30.00
2 off New Jones & Shipman Parting Tool Holders	276.00
12 off Parting Blades to suit	360.00
1 off Coventry Die Box for Capstan Lathe	1,530.00
15 off Sets of dies to suit (BSW $\frac{3}{8}$"(3), $\frac{7}{16}$"(1), $\frac{1}{2}$"(2) $\frac{9}{16}$"(1), $\frac{3}{4}$"(1), Metric M10(3), M12(2), M14(1), M16(1) @ ¢72.00 each	1.080.00

10 off $\frac{1}{2}$" × $\frac{1}{2}$" × 6" Cobalt Steel Tool Bits @ ¢38.00 each	380.00
10 off $\frac{3}{8}$" × $\frac{3}{8}$" × 4" Cobalt Steel Tool Bits @ ¢22.00 each	220.00
1 off 0-$\frac{1}{2}$" Drill Chuck with 1" parallel shank	92.00
10 off Collets to suit Capstan Lathe $\frac{3}{8}$", $\frac{1}{2}$"(2), $\frac{5}{8}$", $\frac{3}{4}$"(2), $\frac{7}{8}$", 1"(2) and 1$\frac{1}{4}$", @ ¢100.00	1,000.00
41 off Machine Taps BSW $\frac{3}{8}$"(8), $\frac{7}{16}$"(3), $\frac{1}{2}$"(5), $\frac{9}{16}$"(3), $\frac{3}{4}$"(3), Metric M10(8); M12(5), M14(3), M16(3) @ ¢25.00 each	1,025.00
4 Side and face cutters for Milling Machine	1,200.00
	41,588.00

DR. J. W. POWELL

APPENDIX B

REVISED SCHEDULE OF INITIAL EQUIPMENT OFFERED FOR SALE 7/9/79

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2 off Ward 2A Capstan lathes	10,000.00
1 off Lathe Tool grinding machine	4,600.00
1 off Lathe Tool grinding machine	3,000.00
1 off Tapping head for drilling M/C	980.00
1 off Roller box for Capstan lathe	650.00
2 off Parting tool holders	276.00
6 off blades to suit	180.00
1 off Coventry Die box	1,530.00
4 off die sets M10 & M12 @ ¢72.00	288.00
5 off cobalt steel tool bits $\frac{1}{2}$" × $\frac{1}{2}$" × 6" @ ¢38.00	190.00
5 off cobalt steel tool bits $\frac{3}{8}$" × $\frac{3}{8}$" × 4" @ ¢22.00	110.00
1 off 0-$\frac{1}{2}$" drill chuck with 1" parallel shank	92.00
4 collets to suit capstan lathe $\frac{1}{2}$", $\frac{5}{8}$", $\frac{3}{4}$", 1" @ ¢100.00	400.00
8 off machine taps M10 & M20 @ ¢25.00 each	200.00
	¢22,496.00

APPENDIX C

HIRE PURCHASE AGREEMENT

This Agreement is between the Technology Consultancy Centre, hereafter T.C.C., and Mr. Barimah Kwaako of Josbarko Enterprises, Kumasi.

The T.C.C. offers to Mr. Barimah Kwaako machine tools and equipment as detailed on the attached Schedule for HIRE PURCHASE on the following conditions:

1. *DEPOSIT* An initial deposit of ₵5,000.00 is payable to the T.C.C. upon signing of this agreement.
2. *MONTHLY RENTAL* 21 Monthly payments of ₵1,000.00 commencing three months after the signing of the Agreement.
3. *OWNERSHIP* The machine tools and equipments listed on the attached Schedule remain the property of the T.C.C. throughout the duration of the period of repayments. Ownership changes only upon payment of the final monthly rental payments.
4. *INSTALLATION* Mechanical installation of the machine tools and equipment will be undertaken by the T.C.C. but Mr. Barimah Kwaako shall be responsible for the cost involved.
5. *INSURANCE* The machine tools and equipment shall be insured by Mr. Barimah Kwaako against fire and theft for a total value of ₵25,000.00. It is also recommended that the machines be insured against injury to operators as the T.C.C. can accept no responsibility in this respect.
6. *MAINTENANCE* Mr. Barimah Kwaako shall be responsible for the cost of all repairs and maintenance of the machine tools. The T.C.C. will, however, offer its technical services in support of these activities.
7. *DEFAULT* In the event of default of 2 consecutive or 3 separate payments the T.C.C. may recover the machine tools and equipment and Mr. Barimah Kwaako shall be responsible for removal costs.
8. *TERMINATION* The agreement may be terminated after 6 months by either party giving 2 months notice in writing. The terminating party shall be responsible for the cost of removal. This clause is not effective after payments have been completed.
9. *MONITORING* The T.C.C. requires that during the Period of this Agreement it shall be provided with all details of the progress of the business which it may require for research purposes. Full cooperation in the monitoring exercise is a condition of this Agreement. In the case of failure to meet its requests the T.C.C. reserves the right to withhold further assistance.

Signed

.....	.....
Mr. Barimah Kwaako for and on behalf of Josbarko Enterprise	Dr. J. W. Powell for and on behalf of Technology Consultancy Centre

Witnessed by

..... Date .....

Name.....

Occupation .....

APPENDIX D

TCC/JE 11th September, 81

Mr. Barimah Kwaako,
Josbarko Enterprise,
P.O. Box 4560,
Kumasi.

Dear Mr. Kwaako,

COMPLETION OF HIRE PURCHASE AGREEMENT

It is with much pleasure that I hereby confirm that you have now completed payment under the terms of your Hire Purchase Agreement signed on the 12th September 1979. The TCC now relinquishes all interest in the machines purchased under that Agreement and they are now your exclusive property. You are also released from all terms and conditions attached to the Agreement but it is hoped that you will continue to allow the TCC to collect data for the Case Study that we are preparing.

We congratulate you on having completed the purchase of your machines on schedule and having fulfilled in an exemplary manner all of the terms and conditions of the Agreement.

Yours sincerely,

(Sgd.) DR. J. W. POWELL
DIRECTOR

cc: TCC Accounts
Mr. J. D. Russell