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From Day-to-Day Coping to Strategic Management: Developing Technological Capability Among Small-Scale Enterprises in Zimbabwe

by
Gordon Wilson

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Abstract

The ability to move from coping with the day-to-day technological function to managing its strategic function is crucial for the technological capability of an enterprise. Interventions aimed at small-scale enterprise development in Third World countries can assist in this move, but it is important that they neither reduce technology aid to provision of hardware nor provide training for enterprise workers in isolation from their hardware. A systemic approach is required which also recognises the impact of the environments in which enterprises operate on their ability to make strategic technological choices.

1 Introduction

A central question of industrialisation concerns the processes by which societies develop technological capability. Equated with the ability to manage the technological function of an enterprise, such capability includes selecting technologies, absorbing them, and developing them via local innovations (Trindade in Bhalla, 1991, pp. ix/x). The arguments for acknowledging its importance in underpinning economic development have been reviewed previously in this working paper series (Wilson, 1993).

There has also been increasing interest in the role of small- and medium-scale enterprises in development in recent years, and one perspective emphasises the capacities of such enterprises for innovations (Bhalla, 1991, p. 4). Riskin has specifically claimed that the establishment of small-scale workshops in China during the 'Great Leap Forward' (1958-60) provided an 'initial experience with industrial methods' which 'proved invaluable later when industrialisation was again pushed vigorously.' (Riskin, quoted in Kaplinsky, 1990).

This interest has coincided with a number of policy interventions in Third World countries to promote small- and medium-scale enterprises (for an appraisal relating to Africa, see Hëlmsing & Kolstee, 1993). Such interventions frequently have an equity objective in that they seek to provide waged employment in poor areas. This is especially likely to be the case where the promoting agency is a value-driven organisation, such as an international, northern NGO (Wilson, 1995), which, for similar reasons, will also often support co-operative forms of work organisation.

These interventions rarely focus on technological capability, however, and even when its importance is acknowledged by agencies, positive intervention is hampered by lack of understanding of the process involved in its acquisition and

development. This process is fairly well understood in broad terms as involving imitation, modification, redesign and major innovation (Hewitt & Wield, 1992), but in the fine detail of a small enterprise, often working in an adverse economic environment, little is known empirically.

One point of entry, and the point of entry of this paper, is to go back to a generalised definition of technological capability, such as equating it with the management of the technological function of an enterprise. If technology is viewed as the organised interaction between people and machines or other hardware, technological capability, therefore, equates with the management of this interaction.

'Management' needs unpacking in this context, however. It can mean 'coping' with the day-to-day, routine technological function of the enterprise, or it can mean strategic intervention in the function, with the latter implying a greater level of capability than if just the former is practised. The question then arises:

What condition(s) have to be fulfilled before an enterprise can exhibit a strategic technological capability?

This is the key question of this paper. It parallels a similar discussion of a model for the 'secondary innovation process', where the authors suggest a process of moving from learning by mastering acquired technology to understanding by engaging in its adaptation (Quingrui and Xiaobo, 1991). This model can be generalised to cover technological capability (of which the ability to innovate is part), where the process requires a crucial shift from day-to-day managing the technological function (i.e. 'mastering' it or 'coping' with it) to understanding it by making strategic choices concerning its development.

The above question is applied in this paper to two small-scale enterprises which have received some form of aid and a subsequent question becomes, therefore:

What are the intervention implications for aid agencies that arise from the answer to the initial question?

The discussion focuses on empirical, qualitative findings at two small-scale enterprises in Zimbabwe, which are affiliated to the Organisation of Collective Co-operatives of Zimbabwe (OCCZIM), an organisation that receives international, northern NGO support.

2 Methodology

A qualitative research methodology was used, principally involving five days of detailed observational study at each of two OCCZIM-affiliated enterprises in Masvingo province. These were:

Cheziya bakery: an all-male, worker co-operative in Masvingo town with 15 members and one non-member employee. It was formed as a worker buy-out from its private owner in 1983.

Garabwe tailoring co-operative: a 12-member, all-woman worker co-operative situated in a rural area about 25km from Masvingo town. Its main work is producing school uniforms, but it also does some sewing to individual customer orders, machine-knitting, hand-crochet, basket-making and clay pots production. It has a small vegetable garden next to its building which the women erected themselves. It started life as a social and savings club after independence in 1980. Before they had a building, the women did their sewing under a tree.

Cheziya bakery was visited over the period 17th-23rd August 1995 and the Garabwe tailoring co-operative over the period 26th August-1st September 1995.

The two co-operatives were chosen from a larger sample of 11 enterprises, which were visited in a pilot study of technological capabilities in 1992 (Wilson, 1994, 1995). They were selected on the basis of similarities:

i) they are both co-operatives affiliated to the same umbrella organisation;

ii) they have a similar number of workers;

and differences:

iii) one is all-male and the other all-woman;

iv) one is based in Masvingo town, the other in a rural area of the province;

v) the previous study indicated that one (Cheziya bakery) has a higher technological capability potential than the other.

Following Silverman, the observational study at each was guided by a set of general questions (Silverman, 1993, pp. 29-31, 36-37):

What is going on here? What do people at Cheziya bakery and Garabwe tailoring co-operative have to know and do (individually and collectively) in order to manage (routinely) their technological function?

Specifically, the study recorded the production process at each enterprise: the interaction of the co-operative workers with each other (including the technical and social divisions of labour) and with the machinery and tools used.

The observational study was as unobtrusive as possible, but it was supplemented by lunch time interviews with the production manager at Cheziya bakery and the co-operative chairwoman at Garabwe tailoring co-operative. The interviews included both specific and open-ended questions.

Specific questions were asked to clarify puzzling aspects of the production processes that had been observed and to obtain basic information about each co-operative. Open-ended questions were asked to ascertain perceptions of the economic environment in which each of the enterprises operates, major policy issues and the way strategic decisions are reached. At Cheziya bakery, where the production manager spoke good English, these latter questions tended to be in the form of a participatory discussion. This was less possible at Garabwe tailoring co-operative where a translator had to be used.

3 Making Bread at Cheziya Bakery

The basic process should be instantly recognisable to anyone who has made bread domestically:

1 Flour, water, yeast, sugar, oil and salt are mixed together to form a bulk, 'raw' dough, which is placed in a trough and left to rise.

2 Pieces of 'raw' dough are cut off to a pre-determined weight and each piece is hand-kneaded slightly.

3 The pieces of dough are hand-moulded and placed in oiled bread tins which have been welded together in fours, each four being enclosed in an outer casing which forms a 'tray'.

4 Lids are put on the trays which are stacked near the oven and the dough allowed to rise again.

5 Once the dough has risen, the lids are removed and the bread is baked. The coal-fired oven has an upper and lower chamber, each with its own temperature gauge and each with a capacity of 15 dozen loaves.

6 When baked (visual checking), the bread is removed from the oven and emptied from the tins.

The only mechanised part of this operation at the time of the field operation was the initial mixing, which consisted of a large, enamel vessel with a single, electrically operated mixer-blade. A machine had been bought for moulding the dough and putting it in the bread tins, but this was not being used.

Despite this lack of mechanisation, however, the scale of the operation requires production to be organised on an industrial basis. At the time of the field trip, two shifts operated, one in the morning (8.00-12.00/12.30) and the other in the afternoon (11.30/12.00-17.00/19.00 depending on bread demand), each shift having a minimum production target of four batches of 15 dozen loaves per batch (i.e. 720 loaves per shift). As one batch takes four hours (i.e. the greater part of a shift) from initial mixing to removing from the oven, clearly the four must be made in parallel. The situation is further complicated because it is possible to have only two batches -- one in each chamber -- baking in the oven at any one time.

The system, therefore, is to have staggered starts for each bread batch, which takes advantage of the periods when the dough is rising for the previous batch(es) or they are baking in the oven. The timing of these starts, however, has to be carefully calculated. This is because the bread should rise by just the right amount within a narrow time range. Thus, the rising time has to be fairly finely tuned, yet it is very susceptible to temperature fluctuations. It usually takes longer in the morning, for example, when the bakery is not so warm because the oven has only been lit a few hours, and for this reason the first (empty) tins are placed in the oven to warm before being filled. Also, there will be quality problems if the dough is left for too long in the tins because the oven is not available, either because it already contains one batch of bread or because it is not at the correct temperature. Fluctuations in baking time arise because of variations in temperature which is not easy to control in a coal-fired oven. Also, the lower chamber generally operates at a higher temperature than the upper chamber, so bread in the latter always takes longer.

Clearly, an operation of this nature has to be highly organised, which is a feature of industrial production. More specifically, however, industrial production is also

characterised by, among other things, a complex division of labour by task and a diverse range of skills among the workforce (Hewitt, Johnson & Wield, 1992, p.6). At Cheziya, the organisation of labour is even more complex than is implied by these characteristics, in that the workers also engage in a continuous feedback process to ensure an abundance of labour is available to overcome production bottlenecks, such as moulding the bread dough and placing it in tins (see section below on 'Division of Labour').

The operation also relies on a good deal of experiential knowledge, especially as there is no thermometer to test the temperature of the dough when it is first produced. Water from the hot tap is mixed with that from the cold and finger-tested to provide an initial correct mixing temperature. Later, the rising dough in the tins is continually checked visually until it has risen enough to go in the oven and the baked bread is also checked to see if it is done before it is removed from the oven. It is important to note here that the loading of a 15-dozen batch of bread takes around seven minutes and it sometimes happens that the bread that went in first, which is at the back of the oven, is done before the bread that went in last, which is at the front. In such circumstances, the front bread has to be removed and then returned to the oven for further baking once the (done) back bread has been removed.

The bakery does possess an electric oven, where it would be much easier to control oven temperature, but this was not being used at the time of the field trip. It was considered to be too small (capacity 12 dozen loaves, compared to 30 dozen for the coal oven) and electricity is expensive compared to coal. It would be used in addition to the coal oven if there was a demand for greater output, in which case the machine for moulding the pieces of dough and putting them into bread tins would also have to be brought into operation to increase the throughput. This demand did not exist at the time of the field trip, however.

Figure 1 is a plan of the bakery shop floor at the start of observation (8.40am) of the morning shift, Thursday 18th August, 1994, which also shows the 'flow' from initial mixing to placing the dough in the oven. Figure 2 shows the subsequent bread-making operation. Four workers operated this shift, two less than normal because of holidays. They were: Joshua (age 57), Lloyd (33, who was also the shift supervisor), Peter (69) and Stephen (42)[1]. Of these, Joshua and Peter had worked for the previous, privately-owned bakery and had been part of the worker

[1] These and all subsequent names in this working paper are pseudonym first-names.

buy-out. The other two, who were considerably younger, had joined the co-operative and trained at the bakery.

Figure 1: Plan of Cheziya Bakery Shop Floor (16 X 16 metres), 8.40am, Thursday 18th August 1984

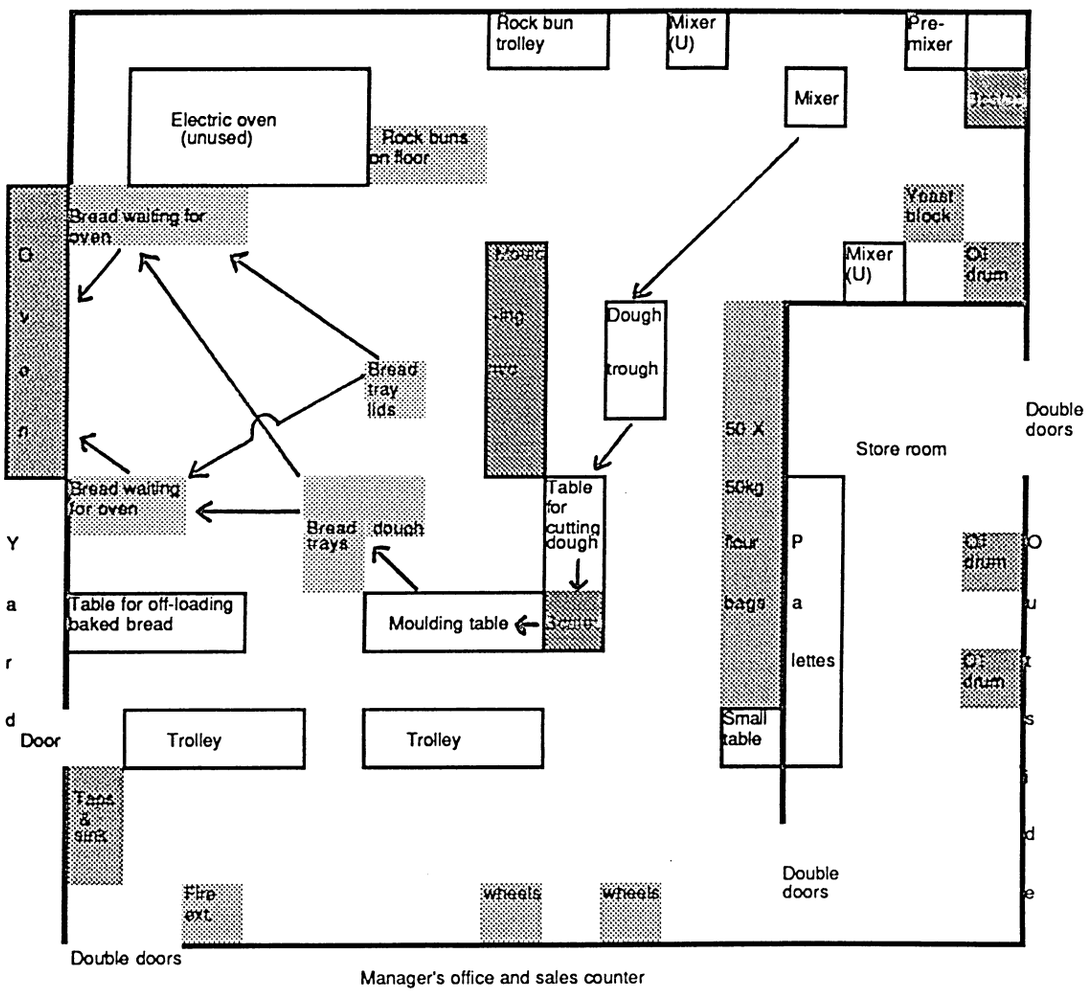

Figure 2: Bread-Making Operation, Cheziya Bakery, Thursday 18th August 1994 (morning shift)

Time	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5 (1)	Other
8.40	Dough already in tins & trays (4 tins per tray) stacked by oven (RHS).	Dough already in tins & trays (6 tins per tray) stacked by oven (LHS).	Cutting & weighing raw dough, plus kneading.			
8.50				Loading trough with raw dough from mixer.		Icing rock buns & placing on trolley.
9.00			Moulding dough & placing in bread tins.			Kettle placed in oven to boil water.
9.10			Stacking bread tin trays by oven (LHS).	Cutting & weighing raw dough.		Kettle removed from oven.
9.20	Loading trays into top oven.			Kneading, followed by moulding & placing in bread tins.	Mixing the raw dough.	
9.30				Stacking bread tin trays by oven (RHS).		Inspecting rock buns on trolley.
9.40		Loading trays into bottom oven.			Loading trough with raw dough from mixer.	
9.50 10.00 10.10						Break.
10.20	Removing baked bread from top oven(2).		Loading trays into top oven(2.		Cutting & weighing raw dough, followed by kneading.	
10.30	Removing bread from tins onto table.	Removing baked bread from bottom oven.				
10.40	Bread from table onto trolley. Empty trays stacked & oiled ready to receive new batch.			Loading trays into bottom oven.		More coal added to oven fire.
10.50					Moulding dough & placing in bread tins.	
11.00		Removing bread from tins onto table, then onto trolley. Empty trays stacked.			Stacking bread tin trays by oven (RHS)	Record made of bread baked.
11.10 11.20 11.30						Break.
11.40			Removing baked bread from top oven, followed by removing bread from tins onto table.			PM shift arrives, starts mixing raw dough.
11.50			Empty trays stacked.	Removing baked bread from bottom oven.		
12.00		Empty trays oiled ready for new batches (PM shift).				

Notes:
RHS and LHS refer to the right-hand and left-hand sides of the oven (when facing it) respectively.
(1) Batch 5 is prepared by the morning shift to be baked by the afternoon shift.
(2) Batch 3 is loaded into the top oven as soon as Batch 1 has been removed.

Apart from the process already described, other aspects of the operation can be gleaned from figure 2:

* five lots of bread are started during the shift, four of them finished. Two were rising next to the oven when observations began (the shift started 40 minutes earlier at 8.00am), two more were made during the morning, and the bread dough for a fifth was also made, to be baked by the afternoon shift;

* there is considerable overlap between the morning and afternoon shifts. The latter has done one lot of mixing and oiled a set of bread tins by the time the morning shift has finished;

* the morning shift also bakes 70-80 dozen rock buns. This usually takes place at the start of the shift to take advantage of the oven warming up (they require a lower temperature than bread). They had just been removed from the oven when observations began.

* the oven has 'peripheral' functions in addition to that of baking. A nearby firm brought in a large kettle to place in the oven on this particular day. On other days, chicken pieces and other food for lunch were placed in the oven.

* During the shift, one of the workers (Stephen) goes outside to the back of the oven and loads more coal. The oven is actually lit each day around 6.00am, with the morning shift workers taking it in turns to come early and light it.

* Lloyd, as foreman, keeps a record of the bread baked.

Figure 2, however, does not properly convey the degree of co-ordination between the four shift workers, all of whom know exactly what they are doing at any one point and, apart from an occasional request to help with a particular operation, such as bread-moulding, are never given any orders.

3.1 Division of Labour

Figure 3 shows who did what on this particular shift and reveals that some of the bakery operations are performed together, others in pairs, and some singly.

Figure 3: Cheziya Bakery Division of Labour, Morning Shift 18th August 1994

1	Inspecting & 'painting' the rock buns -- *Joshua.*
2	Helping Mike load large flour (50kg) bag into mixer -- *Joshua.*
3	Making a pre-mix of sugar, salt and oil -- *Lloyd.*
4	Mixing -- *Lloyd.*
5	Loading trough with raw dough -- *Lloyd.*
6	Cutting and weighing raw dough -- *Joshua.*
7	Moulding bread dough -- *Joshua, Lloyd, Peter, Stephen.*
8	Moving stacked bread trays to oven and putting on lids --*Joshua, Peter, Stephen.*
9	Checking rising dough --*Lloyd, Stephen.*
10	Checking oven temperature -- *Lloyd.*
11	Loading bread into oven -- *Peter, Stephen.*
12	Checking bread in oven -- *Lloyd, Stephen.*
13	Removing bread from oven -- *Peter, Stephen.*
14	Emptying bread onto off-loading table -- *Joshua, Lloyd.*
15	Oiling empty bread tins -- *Joshua, Peter.*
16	Putting coal on the oven fire -- *Stephen.*
17	Keeping records -- *Lloyd.*

As can be seen from Figure 3, the only activity that engages all four workers is the moulding of the bread dough and placing it in the tins. This involves them standing either side of the moulding table and is the operation for which they have idle machinery. It is crucial that the operation is done quickly so that all the bread dough starts to rise at the same time.

In general, Lloyd and Joshua are concerned with the earlier operations of mixing the initial dough and cutting and weighing the pieces. The cutting of the raw dough into pieces of equal weight is performed especially swiftly: Joshua cuts a piece from the raw dough using a blade set into a piece of wood, throws it onto a weighing scales and invariably gets the weight exactly right. If, occasionally, the

dough is too heavy he removes a bit, or if it is too light he adds a bit more before tossing the dough onto the moulding table ready for the next operation.

Peter and Stephen are more concerned with the oven operations, although Lloyd (along with Stephen) will check the rising dough, the oven temperature and the bread inside the oven. Lloyd also does the main initial job of mixing, with its requirement for precise quantities of ingredients and a correct temperature. To do this, he makes up a bulk pre-mix of sugar, salt and oil and weighs the correct quantity of pre-mix to be blended with 50kg of flour, water and yeast. A small quantity of acetic acid is added to the water (which he has brought to the mixer in a bucket, filled from the cold and hot taps at the opposite corner of the bakery) to act as a preservative. He also checks the consistency of the dough by hand before finishing the mixing operation. If it is not correct he throws in a handful of flour or more water as appropriate.

Taken as a whole, Lloyd has the greatest responsibility for those aspects of the process requiring mental skills, measurements and decisions. Without giving any formal orders to the others, he and Stephen seem also to have a qualitative, influential role in that they work efficiently and flexibly, making themselves available to help where necessary, which sets standards and encourages the other workers.

3.2 Hardware

The main hardware is the coal-fired, double-chambered oven and the electrically operated mixing machine. Mention has also been made of the unused moulding machine and electric oven. Peripheral hardware already referred to are the scales for weighing the individual pieces of dough and the blade for cutting the raw dough (the same blade is also used for scraping the sides of the mixer at the end of that operation).

A metal rod, bent at one end to form a hook, is used for pulling the bread trays into position across the bakery floor. Each tray possesses a hole in the rim of its outer casing and the rod hook is inserted into this in the bottom tray of a stack. Other peripherals are concerned with the loading and unloading of the oven. For the former operation, Peter removes the lid from each tray of four bread tins and loads by hand the tray onto a 'pell' (a steel shovel with a handle about 4metres long) which Stephen holds at the oven entrance. The bread is then pushed into the oven and off-loaded from the pell.

As the trays fill the oven they are placed closer to the front and using the pell with its 4 metre handle and 5kg mass becomes awkward. The last trays are, therefore, pushed directly in the oven by hand. Also, at the end of baking, removal by the pell of the closer, front trays is difficult. Three different lengths, depending on the distance they have to be inserted into the oven chamber, of hooked rods are used instead to hook into the aforementioned hole in the tray outer casings and pull them out, with only those at the far back of the oven being removed by the pell. According to the manager, a production worker just turned up with these rods one day and they have been used ever since.

A torch is used for checking that the oven chamber is empty. This has again been made in-house, consisting of a light bulb, connected by a cable to the mains, inside a wire frame covered with sacking. Sacking is also used to make rudimentary oven 'gloves' for handling the hot trays once they leave the oven.

3.3 Variations

The process described in detail is for a single shift on a single day. Variations were observed on other days as follows:

Wednesday 17th August

The cutting and weighing of the raw dough was done mainly by Stephen, with Joshua only doing the task for the last batch. Stephen and Peter, rather than Joshua, also helped Lloyd load the flour into the mixer.

Variations such as this took place on every day, pointing to the flexibility of the workforce in terms of its ability and willingness to identify and undertake a variety of tasks without any orders.

Friday 19th August

Stephen was replaced by Robert on the morning shift. Robert is the normal member of this team but had gone on holiday, and negotiated directly with Stephen to cover for him. Stephen had been doing both morning and afternoon shifts this week.

At the start of the morning shift on this day only a small quantity of dough was moulded and loaded into the bottom oven due to a shortage of flour. A flour delivery was eventually made at 9.10am. In an attempt to recoup at least some of the lost time the subsequent kneading and moulding operations were not separated. Also on this shift, Joshua operated the mixer late in the morning and

broke the raw dough he produced directly onto trays to rise and be baked (by the afternoon shift) as rock buns.

The shortage of flour was because the cash flow position of the bakery is such that it cannot afford to hold stocks of inputs, especially as it is not allowed credit. Yet the bakery, in turn, is not in a powerful enough position vis a vis the other two bakeries in the town to be able to refuse credit to its outlets. This is one recorded example of the difficult economic environment having a direct impact on the production process.

Monday 21st and Tuesday 22nd August

The morning and afternoon shifts had now changed round, except Stephen was still absent as he was now on holiday. On both these days the new morning shift was less well organised than the previous week. In general, there was more watching each other work, rather than helping each other out. Production was unsynchronised to the extent that only part of a batch was ready for the oven at any one time, with the result that the full batch would be split between both the upper and lower chambers. In addition, a second batch would be added halfway through the baking of the first. The knock-on effect was that removal then became a problem with only half the bread in a chamber being done at any particular time. Mistakes were made and on the Tuesday three trays of one batch were left in the oven by mistake, and eventually removed burnt and thrown away. Another effect was that unloading and re-loading the oven -- reasonably staggered the previous week -- took place at almost the same time on occasion. This resulted in short-cutting practices during loading such as literally throwing the trays to the back of the oven by hand rather than first placing them onto the pell.

Apart from this, workers were now slower in performing their activities. This was most apparent in the cutting and weighing of dough, with rarely the exact weight being cut, again in contrast to the previous week. As a result, it was now common to combine the kneading and moulding operations.

On the Tuesday the morning shift arrived early because the weekly cleaning operation needed to take place. Again, only a high degree of flexibility among the work force enables this.

3.4 Quality

Quality checks take place continually during production by the shop floor workers (especially by those responsible for the oven operation and the supervisor), and on

each day of observation bread considered to be under-baked was returned to the oven.

The production manager said he goes to the shop floor to ask how things are going generally and checks on quality specifically whenever he has time. His quality checks were observed on two occasions.

The first was shortly after mid-day on Thursday 18th August, during the shift change-over period. He noticed that some of the bread on the trolleys was 'cracked', a symptom of baking at too low an oven temperature. The problem, it transpired, was that ashes had not been removed from the oven for several days and it could not reach its optimum temperature. Removing the ashes is the sales clerk's job normally, but he had not had time to do it. This job was eventually done by the sales clerk the following morning.

The second was on Tuesday 23rd August at 8.40am. Because of the early start on this day, one bread batch had already been baked and was on the trolley. The manager noted that the bread had a crust that was too thick. This was because the person operating the mixing machine on this shift had arrived late and to speed the rising process up had added excess hot water to the mixture. This in turn had made the dough 'sour' which had resulted in the thick crust.

3.5 Social Aspects of Production at Cheziya

The morning and afternoon shifts overlap by up to one hour and during this period it was observed that the two sets of shift workers would help each other out -- the morning shift to finish its work and the afternoon shift to start preparing dough.

There is a propensity for everyone at the bakery to 'muck in' when necessary, with the manager and sales clerk helping to load bread onto trolleys and even enlisting members of the public who have called in (including a policeman on one occasion) to help. The sales clerk also helps to mould bread dough when required.

On Monday 22nd August, one of the afternoon shift (Peter) arrived at 10.30am, one hour early. Generally, all the workers (including the manager) engage in a good deal of social interaction during slacker periods and even the discussions concerning quality problems are friendly. The workers are also able to arrange holiday cover among themselves.

3.6 Distribution

Bread is a perishable commodity which makes distribution decisions problematic. The bakery distributes to both the main residential 'township' of Masvingo (Mucheke) about 3km away in the early hours each morning and to the rural areas during the day, travelling many kilometres along dirt roads to the latter.

On Wednesday 17th August there was a miscalculation. The truck arrived back from the rural areas having sold less than 100 dozen of the 119 dozen it took out. The manager said that the shortfall was due to the teachers in the rural areas being on holiday and away from their schools. The following Tuesday, however, (23rd August), the truck arrived back empty having covered only three quarters of its customers.

The bakery has two delivery trucks but one was out of service during the period of observation. The truck that was being used was giving problems too, and had to be serviced late at night on two occasions. In order to cut down on servicing costs, the manager and sales clerk have been on a motor maintenance course. The drivers can also do rudimentary repairs from their experience.

3.7 Strategic Decision-Making

Up until 1988/89 the bakery was run by a management committee elected from among the workforce. This, at the time of the field trip, had evolved into a 'Political Unity' which is responsible for the welfare of the members, making sure the co-operative's constitution is followed and understood, and for calling general meetings. Most importantly, however, the Political Unity had spawned a sub-committee -- the 'Production Unity', described by the manager as a technical unit for making strategic investment, production and distribution decisions.

The chairperson of the Political Unity appoints the chairperson of the Production Unity, who becomes the general manager of the enterprise. The composition of the Production Unity is then completed by the sales clerk (who, at the time of the field trip was also the elected chair of the Political Unity) and the shift supervisors (appointed by the manager).

The Production Unity has to take (or, strictly, recommend to the Political Unity, although in practice it enjoys considerable autonomy) strategic decisions concerning new products, capital investment and personnel. Although no direct observation of the Political Unity in action was possible, inter-related issues concerning each of these areas were noted during the field trip, as follows:

Sweets versus a delivery truck

The Production Unity relies heavily on informal feedback from its delivery drivers on what modifications/new products are needed. The manager and sales clerk also occasionally accompany the drivers on their rounds to ascertain needs.

For some time, diversification into confectionery has been a consideration and the Production Unity has made an assessment of profitability and reported back to the Political Unity. The proposal has floundered, however, because the co-operative only has so much money to invest and there are competing, survival needs. In particular, rather than invest money in the necessary machinery for making confectionery, the bakery has felt obliged to buy a second truck to lower the risk of failing on deliveries. If it fails to deliver one morning to Mucheke township, for instance, the other bakeries in the town will almost certainly move in and take over the market. There is less intense competition in the rural areas but a breakdown there would be disastrous if there did not exist a second vehicle. The confectionery plans have, therefore, been shelved.

The bread moulding machine: to use or not to use?

The bread-moulding machine was bought three years prior to the field trip and has rarely been used. It mechanises an operation that involves all the workers on the shift and, indeed, when it was used, one or two of the workers would be sitting around doing nothing, according to the manager.

The Production Unity decided not to use it, therefore, so that everyone could be gainfully employed. The only exception to this decision would be when business is exceptionally brisk and its use becomes essential. Such conditions had been extremely rare since its purchase.

The important point here is that on purely economic grounds the bread-moulding machine would be used all the time with under-employed workers laid off as, not only does it increase the productivity of the enterprise, it represents capital investment not being utilised. In fact, in this instance, the Production Unity has made a welfare rather than a technical decision, based on the co-operative's aim of providing for its members. It would be used if demand for bread were to expand considerably (indeed, this was the original reason for its acquisition) but the prevailing economic environment in Zimbabwe makes this unlikely in any absolute sense for the foreseeable future. The bakery is also unlikely at present to expand production by increasing its market share. The other two bakeries in Masvingo

are both well-established and there are also limitations imposed by Cheziya's distribution capacity, referred to above.

Influential workers and an ageing workforce

The manager acknowledged during discussion that one set of shift workers had appeared much more efficient and competent than the other during the period of observation. He pointed to the need, confirmed by the observations, to have 'influential people' on each shift. Lloyd and Stephen had provided this function among the first set of shift workers observed, but there had been nobody among the second set of workers when it took over the morning shift who could fulfil the role (Stephen normally worked this latter shift but he was on holiday when it was observed). Moreover, Stephen appeared an obvious candidate for a supervisory role, but this was not possible because he cannot read or write. This basic literacy requirement generally limits the pool of people who can be trained as supervisors and also means that some of the best shop floor workers cannot take on the role.

The problem among the second set of shift workers was exacerbated as two of the four were, at 69 and 71, well over the official retirement age of 65 but had to keep working to earn money (a pension scheme had been introduced but was still in its infancy). The Production Unity, therefore, was working on a scheme which would encourage these people to retire by paying them an allowance to bring in their own nominated trainee (the manager suggested that this might be a son or other relative) to the bakery. The idea is that the allowance will last for a fixed period while the person is trained, after which retirement will take effect.

4 Making school Uniforms at Garabwe Tailoring Co-operative Society Ltd

The co-operative's core business is making school uniforms for which the workers are organised into teams of three, each team making a complete garment. Two teams, comprising half of the co-operative, normally work Mondays and Thursdays and a further two teams work Tuesdays and Fridays. On Wednesdays the whole co-operative is present.[2] Figure 4 shows the general plan of the shop floor.

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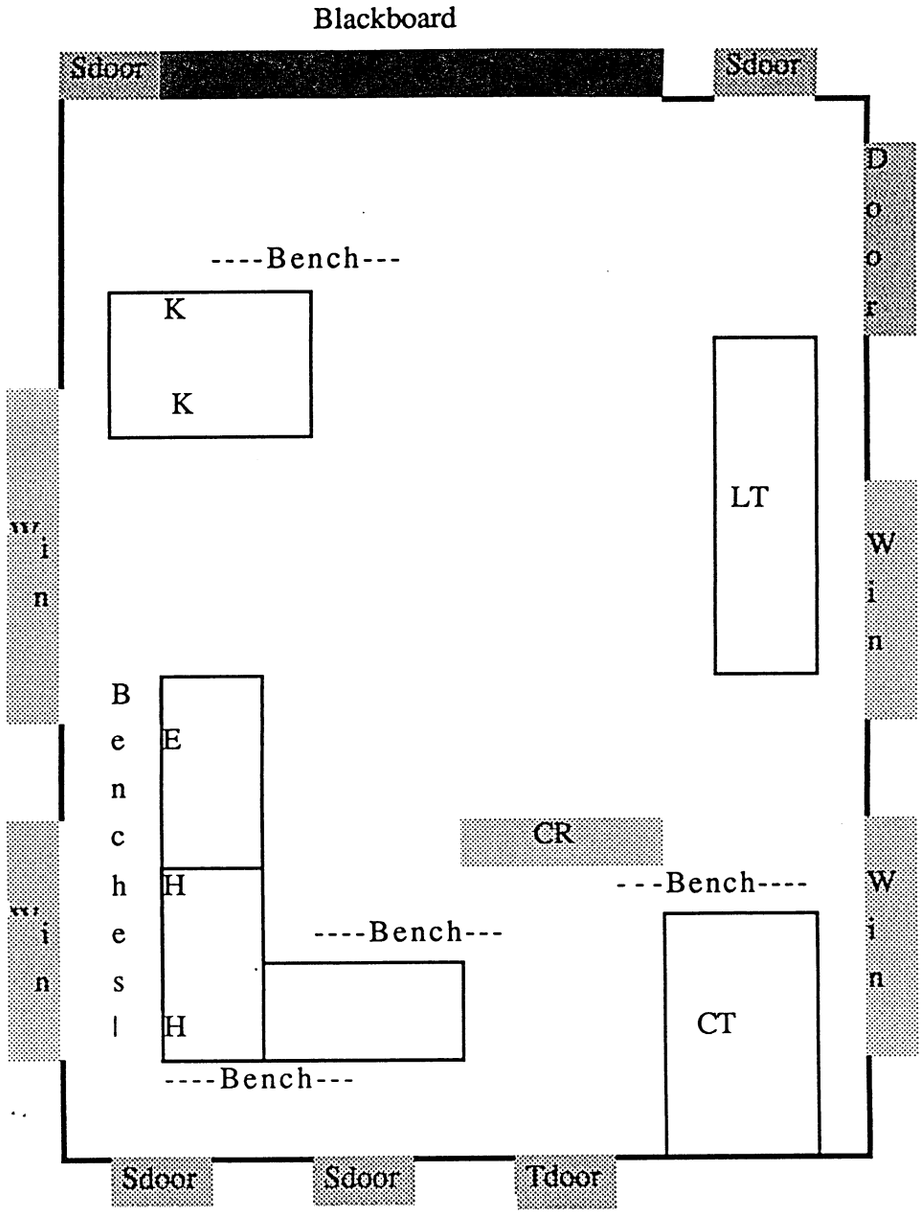
[2] During the five days of observation, half of the co-operative was being instructed in the use of knitting machines. Except for Wednesday, only one team of three was working each day, therefore.

Figure 4: Plan of Garabwe Tailoring Co-operative Shop Floor (11 X 8 metres)



Legend
Sdoor: door to small storeroom
Tdoor: door to toilet
Win: Window
K: knitting machine
E: electric sewing machine
H: hand sewing machine
CT: cutting table
LT: lunch table
CR: clothes' rack
Win: Window

Four uniforms were started, of which two were completed, during the five-day observation (the remaining two were close to completion). The basic process is as follows:

1 The pattern is cut. Pieces of shaped card are available as templates and on the first day of observation these were placed on the cloth and traced around in chalk. The card was then removed and the pattern cut. On subsequent days, however, the chalk had run out and the pattern was cut directly around the card shape. In one instance, card was not used and a piece of cut cloth for one uniform was used as the template for a similar piece (but different colour) of a second uniform.

2 Tacking together of pieces of cloth takes place before they are sewn. For the hem, tacking is replaced by pinning.

3 Sewing usually takes place on a hand sewing machine, occasionally on an electric machine. The hem is sewn by hand.

4 The uniform is finished by trimming the edges and ironing.

The co-operative possesses 13 general-purpose sewing machines, of which 12 are hand-operated and one electrically operated. It does not possess an overlocking machine for providing a professional finish, although a 'zig-zag' stitch equivalent to overlocking (but providing a rougher finish) can be produced on the multi-purpose machines.

The main features observed during this process were:

- Only one person in each team had been trained how to use the electric sewing machine. Thus, the dominant machinery was hand sewing machines.
- Only one worker in the first team of three was observed pattern cutting. In the second team, two workers were observed pattern cutting, although one predominated.
- Although all three workers in a team at various times both sew and tack, there is division of labour. For example, in one team, one worker was observed sewing the sleeves and a second doing the 'overlocking' (zig zag) on a garment, which would be thrown back and forth for these operations between the two workers across the table (and over the head of the third member of the team).

- The making of school uniforms could not keep all three members of a team fully occupied and other activities were observed during the course of a day, for example:

    * Mending and making other garments that local people had brought directly to the co-operative. A pair of boy's shorts and a pair of navy blue men's trousers (copied directly from an intact pair of khaki trousers which the customer had also supplied) were made during the period of observation;

    * sewing some patterned cloth to make 'uniforms' for the co-operative members to wear;

    * sewing scraps of cloth together to make a patchwork sheet which would then be used as an ironing surface;

    * going to the shop at the nearby growth point[3];

    * watering the vegetable garden to the side of the premises;

    * boiling the kettle for the morning tea break and cooking the food for lunch on the wood fire just by the entrance to the premises;

    * sitting and watching the others.

- Activities for all team members were continually disrupted because of the division of labour which meant a garment would be passed between workers and also because of the other jobs that required doing. They were also disrupted for reasons that had nothing to do with the formal organisation of production, such as:

    * some workers experienced obvious difficulty in threading the sewing machine needles and others would have to break off from what they were doing in order to help them;

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3 A growth point is a government-promoted rural centre which acts as a focal point for surrounding villages. It is 'a centre with an identifiable resource base capable of stimulating specific production and marketing activities and whose exploitation leads to rapid and sustained growth with development' (Wekwete, 1991, pp. 187-221). In practice, the term is often applied to any rural centre, whether or not it fulfils the requirements contained in this quotation.

* workers frequently asked for items of equipment from each other. Some of the 13 sewing machines were preferred to others and these would be pushed from one worker to another when required. At other times requested items (e.g. pin cushions or scissors) had to be searched for because they had been covered up by cloth off-cuts on the table or personal belongings;

* non-workers frequently turned up and stayed for a short while. Sometimes these were customers; at other times they were sons and daughters and friends. On one occasion two hawkers arrived and talked, disrupting production, for 15 minutes;

* a sewing machine would occasionally break down (observed once) and other workers would stop what they were doing, come over and attempt to fix it;

* some team members became obviously tired towards the end of a day. Falling asleep on the job was observed twice.

Figure 5 describes in simplified form the work of one team over one day and gives some idea of the dislocated nature of the process.

Figure 5: Production at Garabwe, Tuesday 30th August 1994

Time	Mrs. Wekwete	Mrs. Mutizwa	Mrs. Chaguma
10.00	Tacking followed by sewing	Pattern cutting	
10.15	Trimming followed by sewing	Sewing	Tacking *Threads needle for Mrs. Wekwete*
10.30	Trimming followed by sewing	Sewing on customer special order.	Tacking
10.45	*Goes outside to shops*	Unpicking followed by re-tacking.	
11.00		Sewing Pinning hem	Tacking
11.15	*Returns from shops*	Hand-sewing hem.	Sewing
11.30	Unpicking a fault	Sewing on customer special order.	Pinning & tacking

11.45	*Watches & talks to others*	Sewing	*Inactive*
12.00	*Tries & fails to thread needle, receives help.*	Sewing on customer special order.	Pinning & tacking
12.15	Sewing on customer special order.	Sewing. *Collects lunch money from others.*	*Inactive (watching Mrs Mutizwa).*
12.30	*Goes outside to collect lunch.*	Sewing on customer special order.	Sewing, followed by pinning.
12.45			
13.00	**Trimming, followed by sewing, followed by finishing garment.**		Tacking, followed by sewing, followed by pinning.
13.15	*Lunch*	*Lunch*	*Lunch*
14.15	*Goes outside.*	Electric sewing on customer special order.	Pinning & tacking.
14.30	Returns and sews scraps together.		Sewing.
14.45			Pinning/tacking/sewing
15.00		Trims hem.	*Inactive (talking to Mrs Mutizwa as she trims hem).*
15.15	*Sits & watches the others*	Sewing cloth to make member 'uniforms'.	Pulls pins from hem.
15.30	*Start to clear away for the day*		

This represents the uniform started by this team the previous Friday.

This represents the uniform started today.

This represents other sewing-related work.

This represents non-productive activity.

Below is a detailed account of the period before lunch that was observed for a member of the second team on a different day:

Prudence Zinyama's hour before lunch Thursday 1st September 1994

12.00pm *Prudence Zinyama checks a uniform that has been completed and ironed. Satisfied, she lays it on the table and pulls over a sewing machine, which she checks and then pushes away. She picks up the uniform again and takes it to the store room. When she returns she knocks one of the cardboard pattern templates which have been*

placed on the sewing machine table nearest the cutting table, to the floor. She does not notice and stands on it while watching the pattern cutter work. After a further two minutes she picks up two pieces of cut pattern from the cutting table and returns to the sewing machine table. She has a brief conversation with the third member of the team before starting to tack her pieces.

12.15pm *She interrupts her tacking to sort out some money for lunch. Then she returns to eight minutes of uninterrupted tacking.*

12.25pm *She stops tacking to help the pattern cutter put away some (but not all) of the pattern templates that are in a heap on the sewing machine table (plus the one on the floor by it).*

12.30pm *She returns to her cloth and does some sewing (moving to a different machine to the one she pushed away).*

12.35pm *She finishes sewing, gets up and goes to the store room. She returns with the patchwork sheet that is used as an ironing surface. It is wrapped in a blanket. She unrolls it on the sewing machine table on top of the remaining pattern templates and irons the cloth she has been working on. (The wood-fired iron is taken from the cutting table. It has been used for other jobs continually that morning)*

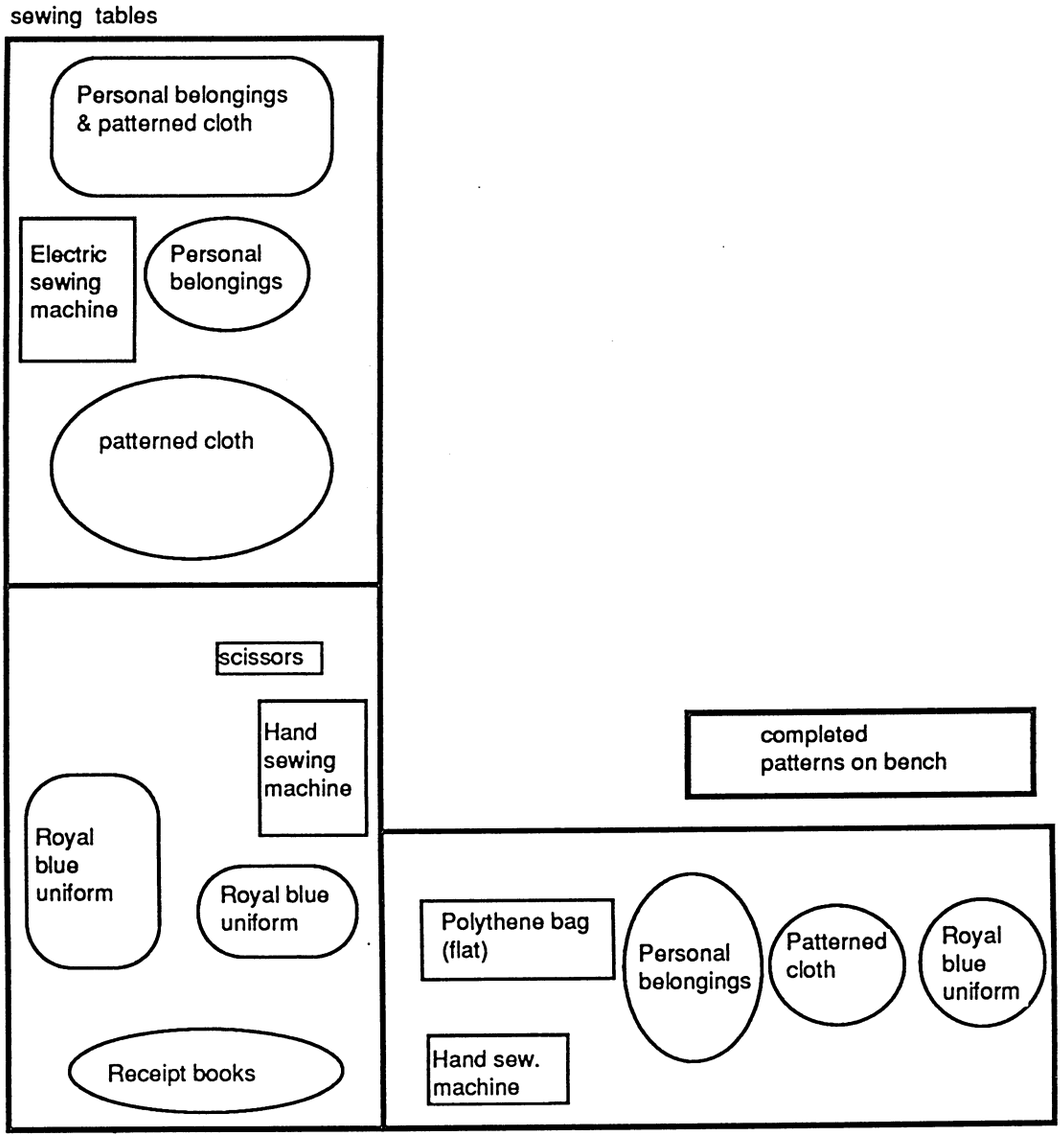
12.40pm Having finished ironing, she sits at the table in front of the *machine she pushed away. She now pushes it further away and pulls over another machine in its place. She begins to sew but soon has to stop as the thread breaks. She threads the needle and removes some of her tacking before re-commencing to sew.*

12..55pm *She breaks off from sewing to do some more tacking. Then she sews again.*

1.10pm *Lunch.*

This kind of routine was not unusual. One consequence of it was that the production process often bordered on the chaotic. Figure 6 is taken from the field notes for Thursday 1st September, 12 noon. It depicts the situation at that point on the sewing machine tables.

Figure 6: The Sewing Tables at Garabwe, 12 noon Thursday 1st September



4.1 Social Aspects of Production at Garabwe

The 12 workers are all original members of the co-operative and have therefore been together since 1980. Work is frequently punctuated by conversation and on each day of the observation there was at least one visit by a friend or relative of one of the workers(often a son or daughter).

The women sat at the same table each day to have their morning tea break and their lunch, both of which were usually preceded by Grace. On the Wednesday lunch this was quite an occasion as both halves of the co-operative work that day.

4.2 Informal Work Hierarchies

Whereas Cheziya bakery has formalised a hierarchy (there is a production manager and shift supervisors), this does not exist at Garabwe. Some members are obviously more technically competent than others, however, and the less competent are continually disrupted from the main work in hand to run errands, water the garden or look after the lunch pot on the fire. They also engage in less-skilled, often internal, sewing work, such as producing the patchwork sheet that acts as an ironing surface. One member spent approximately one third of her sewing-related time on this last activity over the period of observation.

Having said that, it would be wrong to suggest that a complete division along these lines exists. More productive members were also observed doing these things if not to the same extent over a working day.

4.3 Decision-Making at Garabwe

The seven-strong management committee is elected from among the 12 members each year. The chairwoman has been re-elected in that job since 1989.

The committee made the strategic decision to diversify, so that, as well as sewing, the co-operative does machine-knitting, hand-crochet, basketry, clay pots and tends a vegetable garden. This decision was made because the market for school uniforms is seasonal, with the busy period being January to April.

The committee's main work, however, is to plan the sewing and knitting, although it checks with all the members to obtain a consensus on its plans. As far as the school uniforms are concerned, the co-operative does not receive orders, at least not in bulk from schools. It has to make a reasonable estimate of what it will sell, then it makes the uniforms and local people come and buy.

The co-operative puts a small amount of its earnings into a savings bank. This is used to buy materials. Insufficient is put by to purchase equipment and there is an implicit assumption that, if this is to be obtained, it will be from donors. Any other money left over from sales is shared among the members every three months where it forms their only source of income.

5 Technological Capabilities in Cheziya and Garabwe Compared

Over the respective periods of observation it was clear that the technological function was being managed much more effectively at Cheziya than at Garabwe. In the former, there was an underlying rhythm to production, even when this was disrupted (e.g. when the flour inputs arrived late one morning). In the latter, production was characterised by its dislocated and 'stop-go' nature. At Cheziya the organisation of labour and tools was efficient, at Garabwe it was not.

There are several, possible, inter-related explanations for these observations:

5.1 Historical

Cheziya bakery has a tradition of industrial production. It existed as a private bakery which had been going some years before the worker buy-out that established the existing co-operative in 1983. Garabwe, on the other hand, started in 1980 when the women came together to form a social and savings club. Sewing originally took place under a tree and over the years the women have had to build by themselves the small building that currently houses their operations. Apart from one (out of 13) sewing machines, all equipment has been provided as aid, in direct contrast to Cheziya, where the equipment either existed in the old, private bakery or has been purchased using savings and commercial loans since.

The worker buy-out at Cheziya came about because the previous owner 'failed', according to the production manager. The buy-out cost Z$16 000, of which Z$10 000 was provided (part grant, part loan) by OCCZIM and the rest as share capital by the members. Some outsiders (including the production manager) bought in at this stage. Since the buy-out the bakery has operated on a substantial turnover, which was Z$1.5 million in 1993/94. In that year the net profit was around Z$280 000, of which 25% went into a reserve fund, 10% to members' share profit and the rest added to capital for potential re-investment. The workers are paid a weekly wage of around Z$200 (slightly more for supervisors or for those working close to the oven heat) and there are formal overtime, leave and sick pay arrangements, plus a pension scheme which has been recently introduced[4].

Cheziya has an evident understanding of wage labour and of capital accumulation, which was inherited from the original bakery. By contrast, at Garabwe, where the women who formed the co-operative, had little or no business experience, there is little such understanding, still less practice. The co-operative has some small

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4 Z$12 = £1 at the time of the field trip.

savings in a bank which, according to the chairwoman, is used to buy materials, not equipment. They don't make enough money to put to one side for equipment. Any money that is left over from sales is shared among the members every three months and this forms the 'wage' (which, nevertheless, forms their only source of cash income, according to the members).

These different histories lend support to the hypothesis that learning is cumulative, independently from learning by doing and that firms learn how to learn (Stiglitz, 1987). The amount learned from any experience is higher, the higher the past learning and this is a basic distinction to be drawn between the two enterprises. Thus, the over-riding impression was that Cheziya, because of its long history as an enterprise, is learning continually in terms of organising its production and investment decisions. Garabwe, with no such history, is struggling to learn beyond its basic survival requirements. In other words, and without wishing to over-state the case, there was some evidence of a virtuous learning circle at Cheziya, very little at Garabwe.

5.2 Gender

Cheziya is all-male, Garabwe all-woman. The workers at the latter have multiple work roles compared with the former. For the Garabwe women, the day starts at 5.00am preparing the children for school. When they leave the co-operative they have to cook the family tea and put the children to bed; thus they rarely end their day before 9.00pm. On top of this they have their own farm fields to work, which can take over at key seasonal periods (a letter from the co-operative to the author, received in November 1994 at the start of the rainy season, stated that the women were busy in their fields). It is little surprising that at the end of each day of observation at the co-operative some of the women were obviously tired (to the extent of literally falling asleep) and that concentration lapses were evident throughout their work.

5.3 Social and Welfare Issues

Each co-operative appears tó fulfil a social need. At Cheziya this was limited to the internal interaction of the worker-members whereas at Garabwe it was more diverse, as witnessed by the number of casual callers. Cheziya is in Masvingo town, Garabwe in a rural area (although close to a growth point). It is possible that the Garabwe building serves more as a focal point for local people than is required at Cheziya. This social function has an adverse impact on the

management of the technological function (in that it disrupts it) when judged by the yardstick of productive efficiency.

With respect to welfare, there is some similarity between the co-operatives. Elderly people form a significant proportion of the workforce in both enterprises, and, in both, their individual capabilities were clearly less than those of younger workers. This extended to both physical capabilities (e.g. inability to thread needles at Garabwe, slower bread dough preparation at Cheziya) and to mental capabilities (e.g. greater literacy among the younger workers). Also, at Cheziya, a deliberate decision was made not to use the bread moulding machinery for welfare reasons. Overall, the observation at both enterprises was that welfare issues, which generally take on a higher value in co-operatives, could hold back technological learning.

5.4 Entrepreneurial Presence

Entrepreneurs are normally associated with individual risk takers who invest time, money and skills in enterprises in order to make them successful. They are increasingly regarded as key agents of development in small-scale enterprises, including agents of technology adaptation to indigenous resources, human capital development and the development of innovative technologies (Miller & Clarke, 1990).

Entrepreneurial presence is, therefore, clearly related to technological capability. It certainly exists at Cheziya in the form of the production manager who displayed a variety of business skills (both technical skills -- such as those associated with financial control and cash flow -- and social skills when communicating with production workers), including an ability to think strategically, but is not so obvious among any individual at Garabwe. The question arises, however, given that these enterprises are co-operatives, whether a collective entrepreneurial presence is possible.

The work of the Production Unity at Cheziya suggests, albeit tentatively, that it is. This sub-committee of the overall governing body (the Political Unity) has made several, apparently informed and coherent, strategic decisions in recent years (the bread moulding machine issue, the sweets versus a delivery truck issue, the ageing workforce issue). Nor are these decisions always aimed at maximising the commercial success of the enterprise -- note the decision, for essentially welfare reasons, not to use the bread moulding machine. The point is that rational decisions, within the overall goals of the enterprise, have been reached and the

point holds even if the particular decision on the moulding machine is read as a response to a 'wrong' strategic decision to buy it in the first place. It is probable, however, that the Production Unity is itself heavily influenced by a particular individual -- namely, the manager.

At Garabwe there is only the overall governing body - the management committee. Apart from an initial decision to diversify, which appears to have been taken on the basis of what the members can do rather than on what they can sell, this has concerned itself with short- and medium-term operational planning of production. No income is set aside for investment in new machinery and the co-operative relies on donor support for its acquisition, which is hardly a stimulus to entrepreneurism. It could be, however, that entrepreneurial potential does exist within the management committee at Garabwe, but it is unable to be realised because of adverse demand factors (see below) and competing, gender-related demands (see above) on their time (Chell, 1990, pp. 183-194; Epstein, 1990, pp.254-265). Also, it is probable that the present resources of this enterprise, including cumulative knowledge, are not sufficient to enable it to practise and 'learn' entrepreneurism.

5.5 Demand Factors

Cheziya bakery has to make 720 loaves each morning shift, and at least that number in the afternoon, a quantity that requires a flexible, co-ordinated effort involving effective management of the technological function. Such a demand did not exist for the core product (school uniforms) at Garabwe at the time of the field trip. It would be useful to return to this co-operative when the demand is claimed to be seasonally high (January-April) to ascertain whether this has any influence on the management of the technological function.

Competition among the three bakeries in Masvingo town has a positive impact on demand for quality and this was certainly considered important at Cheziya bakery. The technological function was therefore carefully managed in an attempt to ensure it. Garabwe also faces competition -- from another rural production unit a few kilometres away and from the shops in Masvingo town 25km away, but this does not seem, as yet, to have induced a demand for quality as a means of customer discrimination between suppliers. Concern for quality is not built into the management of the technological function at Garabwe, therefore, and the uniforms are poorly finished, although the co-operative claimed that its products are of a better quality than those from the other nearby production unit. The co-operative acknowledged, however, that the quality of its uniforms is worse than those

available in the shops in Masvingo (at slightly lower price). Locality seems to edge out quality here as a principal factor in consumer choice, although recently local businesses at the growth point had started selling the same uniforms that are available in the Masvingo shops.

There is no apparent demand for diversification of the range of products at either co-operative, although Cheziya says it has identified one in terms of confectionery (which it is unable to meet at present). Garabwe certainly produces a diverse range of products but there is no evidence of any particular demand for them and only school uniforms appear to be made continuously. This is significant because having to meet demand for different types of bread or reasonable quantities of garments other than school uniforms would require more diverse, evolving skills.

5.6 Training Supply Factors

Cheziya bakery has invested strongly in technological training, especially management training for the manager. Z$10 000 was borrowed from the Government Small Enterprises Development Corporation (SEDCO) for this purpose. The manager has also been on Zimbank courses in pricing and costing and both he and the sales clerk have been on a motor maintenance course. The co-operative has also benefited from having management students from the University of Zimbabwe on placement.

Although technological training exists at Garabwe, it has not been on the same scale. Some members have been on a short, management training course and the secretary has been trained in book-keeping. Nobody, however, has been on a maintenance course.

These different training experiences link back to the observations regarding cumulative learning (present at Cheziya, largely absent at Garabwe) in section 5.1 above. Until an organisation learns how to learn, commitment to training will inevitably be weak and restricted to specific technical outcomes.

5.7 Institutional Support, Credit, Material Inputs and Distribution

These are factors either side of the production process itself and, in this sense, form part of the environment within which the technological function has to be managed.

Both co-operatives are members of OCCZIM, but the degree of direct support this organisation can offer is limited because it is itself poorly resourced. Garabwe

appears to have no other direct, institutional support (although it may benefit from a marketing organisation being planned by OCCZIM -- see below), but Cheziya has had additional support from SEDCO, referred to above.

There are major differences between the two co-operatives in terms of access to private credit in that Cheziya does have access, Garabwe does not (see below). Both, however, face constraints in terms of their material inputs. Cheziya is unable to hold stocks of flour because of its cash flow position and because it is not allowed credit by the supplier. This can, and does, result in lost production between deliveries. Garabwe cannot obtain its cloth wholesale because of the low volumes involved and members have to travel to Masvingo town, often by bus, to obtain supplies from the shops.

The absence of transport makes distribution for Garabwe impossible beyond its immediate area. Cheziya does have its own transport and serves a comparatively wide area, although this is restricted by the road infrastructure. Road surfaces in the rural areas are poor and often there are no inter-connecting routes between adjacent areas so that, having made one delivery, the van has to travel back to Masvingo town and out again to make another.

There is little that either co-operative can do about these environmental constraints, except 'cope' with them. They represent serious obstacles, however, to developing a strategic technological capability, an issue returned to in the next section.

6 Discussion and Policy Implications

Within the economic and social environment in which it has to work, and given its specific combination of labour and machinery, the observational studies suggest that Cheziya bakery manages its day-to-day technological function at close to an optimum level. This is not the case at the Garabwe tailoring co-operative although there is an important caveat to this conclusion.

The caveat concerns what is meant by 'optimum level'. If it means managing the technological function so that the enterprises' products are produced efficiently in an economic sense, there can be no argument that Cheziya is far more efficient than Garabwe. What, however, if we reject efficiency as an end in itself (Winner, 1977, p.229) or define it differently so that it does not equate with the quest for maximum product output per unit input, but with something that cannot be measured such as maximum worker fulfilment per unit input? Producing and selling products for a livelihood then becomes part of a much wider scenario where

production efficiency has to be balanced against other factors. The field work has thrown up one example of this balancing act at Cheziya (again, the decision not to use the bread-moulding machine) but there is tentative evidence which suggests that non-productive, social functions are of greater importance at Garabwe.

On the other hand, the co-operative is the only source of cash income for the women at Garabwe and, for this reason alone, productive efficiency is an issue of significant importance. The two teams observed at Garabwe did not quite complete four uniforms in just under a week, which constitutes low productivity by any yardstick. It is true that other productive activity was sometimes taking place but this did not actually remove labour from the uniforms, the work on which was more or less continuous.

Thus far, the discussion has centred on the ability to manage the technological functions of these two enterprises as they were observed over a brief period of time. The observations inevitably record the management of the routine, day-to-day function as it exists at a given moment. This is management in the sense of coping. The observations do not tell us about the dynamic capability nor, indeed, whether it has the potential to develop further, which brings us back to the paper's first question regarding the conditions that are necessary before an enterprise can engage in the strategic management technological function.

The limited evidence on decision-making derived from this study is that Cheziya understands its strategic technological function better than Garabwe, but that it is thwarted from making many positive choices because of the adverse environment in which it operates. This, together with the observed superiority of Cheziya in managing its day-to-day function (which, in reality is not so easily separated from the strategic function), leads to the following hypothesis:

An enterprise that manages its day-to-day technological function at, or near to, the optimum level, generally has the potential to manage it at a strategic level. For this potential to be realised, however, circumstances in the firm's economic environment have to be favourable to the making of strategic choices.

Based on brief, albeit detailed, studies at two enterprises, such a hypothesis can only be tentative. One possible objection is that it apparently only relates to management of the technological function for optimum productivity, whereas flexibility is just as important for a more generalised capability (Middleton, Ziderman & Adams, 1993, p. 1). However, one of the features at Cheziya is the flexibility of the workforce which adds to the effectiveness of the day-to-day

management of the function. The point here is that flexibility can be an integral part of a well-managed enterprise, no matter how specific its product, and can therefore be practised in-house.

Some of the issues connected with the economic environment have been discussed in relation to credit access, material inputs, distribution and markets. The difficulties described are, in part, a consequence of the small sizes of the two organisations. In that they adversely affect the capacity to manage the technological function in both enterprises (more so in Garabwe than in Cheziya), this raises the question as to whether they need to grow in size as a pre-requisite to developing any strategic capability. An alternative view, stemming again from the observation of labour flexibility at Cheziya, is that an enterprise may remain small and exhibit a growing strategic capability which will be characterised by gains in flexibility, product diversification and market diversification.

If shown to be generally valid, the hypothesis has implications for agencies -- governmental and non-governmental -- concerned with promoting small enterprise development (whether co-operative or not). Indeed, it suggests two areas where agencies can consider their impact. These are:

- in-house interventions to help the enterprise optimise its day-to-day technological capability;
- environment interventions to optimise the realisation of potential for strategic management of the technological function.

In-house interventions aimed at enhancing day-to-day capability

Technological capability is concerned with managing the organisation of people and machines (or other hardware) in an enterprise. Interventions aimed at small enterprise development should, therefore, ideally consider the machine/person interaction systemically, rather than treating each component as discrete entities, or, worse, considering one and not the other. Moreover, the precise, optimal interaction of people and machines is unique to any given enterprise which suggests that interventions have to be customised if they are to have a significant effect. This means that they should, wherever possible, take place 'in-house' at the site of work and not in any artificial setting. This notion that technological capabilities are firm-specific, which has implications for the type of interventions required to help develop them, has also been explored, from a quantitative economics perspective, by Navaretti (1994).

Abstracting the people typically involves providing technical and managerial training courses in colleges or other centres away from the place of work. This paper is not trying to argue that such vocational instruction has no value, but providing it without reference to how it is going to be applied and practised, or, indeed, whether it will be possible to apply and practise it, back at the enterprise (that is, if there is an enterprise to return to), raises serious questions about its efficacy. One study suggests that the record of vocational skills training in centres is very mixed and its success depends on whether or not there is a demand for such training as opposed to it being 'supplied' to stimulate local enterprise development (Middleton, Ziderman & Adams, 1993, pp. 37-71). The same study acknowledges that training for flexibility must to some extent take place outside of the confines of a specific workplace, but argues that a sound, basic general education is a more important requirement for creating a flexible workforce (ibid, pp. 202-205).

Abstracting the machinery, which, in intervention terms, usually means supplying it as aid without further reference to how it might be assimilated within an enterprise, has had its critics for some time. The OECD, for example, has criticised the strong tendency of aid to supply equipment on a highly subsidised basis while at the same time failing to ensure the human resource capacity and recurrent expenditure requirements are available, a propensity which has a negative impact on the capacity to manage technical change (OECD, 1991, p.16). Such aid often fails to maximise economy of operation, minimise maintenance costs or allow for costs of future expansion or renovation (ibid, p.67). This OECD critique seems particularly pertinent to Garabwe where 12 out of 13 sewing machines plus the two knitting machines have been supplied as aid, abstracted from the overall management of the technological function.

Again, this paper does not seek to argue that equipment should never be provided unless it forms part of a comprehensive technology management package. But if an intervention is to be the supply of equipment-only, steps should be taken to ensure that it will blend in with the existing technological function and there is an evolution, rather than dislocation, of the management of the function. In this context, there should be no problem in assimilating the mechanisation provided by the bread moulding machine at Cheziya bakery into production; it remains unused, however, because of economic, environmental factors.

Environment interventions to optimise the realisation of potential for strategic management of the technological function.

Government policies, of course, affect the macro-economic environments in which enterprises operate all the time, and the calls to make these environments more conducive for small enterprises are many (e.g. Helmsing & Kolstee, 1993). NGOs have a much more limited scope for individually affecting the environment, although specific interventions on supply of credit and in marketing are worthy of note in the context of this study.

Absence of access to formal credit on reasonable terms is generally acknowledged to be one of the biggest barriers to small enterprises in Third World countries, especially those operating in poor rural areas. Although the Cheziya bakery (but not Garabwe) does have access, the interest rate is extremely high (33 per cent at the time of the study) and this mitigates against the diversification into confectionery. NGOs have been instrumental in facilitating access to credit in various parts of the Third World, one example being that of the UK-based, positive ethical investment NGO, 'Shared Interest', whose promotional leaflet states that it makes 'loans available, on favourable terms, to enterprises which are geared towards providing benefits for people in need: real jobs, proper rewards, and the chance to take control over their own lives'. However, the efficacy of policies aimed solely at improving access to credit without taking into account other underlying social relations has also been challenged (Crow, 1992).

There are also examples of NGO-supported marketing organisations for widely dispersed small rural enterprises engaged in the same line of business. These organisations help firms sell beyond their local catchment areas and possibly stimulate improvements in quality plus some diversification as firms try to expand their sales through a marketing organisation and are able to see what other firms are producing. At the time of writing, a marketing organisation was being considered for the textile-related OCCZIM co-operatives in Masvingo province, of which, of course, Garabwe is one.

Nevertheless, it is important not to over-exaggerate the impact that NGOs can have on the economic environment of small-scale enterprises. Indeed, their limitation in this respect is one factor fuelling the current debate on 'scaling-up' for NGOs to enable them to have a greater impact through 'influencing' government policy reform and international advocacy (Clark, 1992).

7 Conclusion

Technological capability is a complex phenomenon which is both unique to each individual enterprise and comprises transferable, generic skills. These latter include the ability to analyse individual (unique) people-machine interactions and then make strategic decisions concerning them.

It is probable, however, that strategic capability is predicated on first having the ability to manage the individual enterprise on a day-to-day level, so that it does its routine work efficiently within the means available. In terms of intervention to aid the development of technological capability the implication is that, at this basic level, it should take place in-house and should ensure that it keeps the people-machines link intact.

This is targeting carried to its extreme, but the criticism of supplying machines without reference to how people in an enterprise will use or maintain them is well known. There is also evidence to suggest that measures such as providing vocational training in colleges (in the absence of a specific demand for such training) is not effective at this level. This is probably because the ability to learn in a college itself pre-supposes certain skills in conception and abstraction, in other words, in knowing how to learn.

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