Open Research Online

The Open University's repository of research publications
and other research outputs

Worker Information Systems & the Development of Large Co-operatives

Other

oro.open.ac.uk

by Mike Robinson   and   Rob Paton
     SYN   Co-operatives Research Unit
     61 Kings Road   Systems Group
     Kingston-upon-Thames   Open University
     Surrey, KT2 5JA   Walton Hall
     England   Milton Keynes MK7 6AA.   UK

Abstract

Over the past few years, the number of co-operatives in the U.K. has
grown rapidly. Much of this growth has been in the small co-ops sec-
tor. Further significant growth may involve federations of small co-
operatives or the appearance of more large co-operatives. Both
federation and sheer size create problems of reconciling democratic
practice with commercially sound management. If the potential of the
movement is to be realised, these are important problems to overcome.
This paper summarises recent accounts of difficulties facing co-
operatives, and discusses the role that computer-based Worker
Information Systems may play in resolving them.

Preface

This paper was originally produced as an internal document intended
to give an overview of our plans for a research programme on worker
information systems. It has been hastily prepared for a wider cir-
culation in response to the interest that has been expressed among
those who have heard of the proposals. Hence it is worth emphasising
that in important respects our thinking has now gone beyond the ideas
set out in this document. However we will be glad to receive comments
on it, or requests to receive subsequent documents.

Mike Robinson and Rob Paton July 1983

Introduction

There are now more than 500 worker co-operatives in the U.K.(1)
Recent growth - against the trend of the recession - has been spec-
tacular. A network of support agencies now exists at local and
national levels, involving significant amounts of public funds. It is
extremely likely that the co-operative sector will continue to grow
rapidly. Most co-ops are small, but a number are medium sized
enterprises, employing from 20 to several hundred people(36). The
latter can arise from the success and growth of small co-ops, but most
arise from conversion or "rescue" attempts where the alternative is
large-scale redundancy.(2) Small co-operatives can operate with
collective decision-making and fully participative structures. In many
ways these two ideas define what a co-operative is - at least as far
as most people that want to work in co-operatives think about it.

Members of large co-operatives do not have - and cannot have - control
over the enterprise in the same way as members of small co-ops.
Direct individual influence diminishes. More and more limitations
appear on "how much say" any worker can have. The large co-op may be
a co-operative in the constitutional and legal sense: much of the
personal "meaning" of being in a co-operative evaporates. As Paton
put it in a previous paper(3):

> ".... the meaning of "co-operation" is tied most closely to
> its use in describing arrangements or activities volun-
> tarily undertaken by a limited number of individuals or
> small groups. In such cases, there is little doubt about
> the appropriate use of the term. But when used in
> reference to larger, more differentiated, organisations
> where the voluntary nature of the joint undertaking is
> reduced by the participant's need to earn a livelihood,
> then, although it carries connotations from its
> established context, there are no clear rules for its use."
> (p10)

Robinson(4) drew a similar distinction in a rather black and white
way:

> "Members of strong co-operatives have an on-going say in
> the direction, policies, products, and conditions. Strong
> co-operatives tend to be small or community based. Weak
> co-operatives, on the other hand, are similar to tradi-
> tional commercial organisations but with a little profit-
> sharing and a periodic "right to vote" on some matters.
> Weak co-operatives use standard management techniques, and
> tend to be large, urban, and distributed over several
> sites. The very success of a strong co-operative leads to
> growth. The system of informal communication becomes too
> rich to be workable. Role differentation, formal com-
> munications, and the centralisation of information (as
> opposed to its diffusion) evolve as solutions - and the
> co-operative becomes weak. Instead of involving them-
> selves at all levels, the workers become "employees".

Paton(3) catches the same idea when he says of commercially successful
Common Ownership enterprises:

> .... despite their commercial strength, such companies
> have had the greatest difficulty in developing forms of
> organisation that involve more than just profit-sharing, a
> weak supervisory board, and a participative management
> style."
> (p4)

It can be pointed out that the dichotomy between active involvement
and near-passivity is too stark. The distinction is usually of degree
not of kind. Many people do not want to be highly involved - espe-
cially when things are going well in a fairly routine way. See
Robinson(11) for evidence of this in Trades Unions and larger volun-
tary groups. Nevertheless, most evidence of non-involvement comes
from larger co-ops (12, 14, amongst others), while most evidence of
involvement comes from smaller co-ops (6, 13). We are therefore
justified in looking for structural as well as psychological explana-
tions. Also, at the psychological level, many members of larger co-
ops feel that they ought to have more influence and more say - but are
unclear on how this could be achieved (3, 12).

In view of this, and the commercial collapse of some of the larger
"rescue" co-operatives, there is a temptation to see large co-ops as
"bad" and small co-ops as "good". (5). ICOM and the national network
of Co-operative Development Agencies are now concentrating almost
exclusively (and with a great deal of success) on the creation of small
co-ops. Another way in which the problem has been recognised is that
some co-ops, quite deliberately, put a limit on their size.
Landsmans, Trylon, Suma, CERIA in France, and Mondragon group in
Spain, all have size limits (6).

On the other hand, the "small is beautiful" ethic has severe limita-
tions. There is a danger that small co-ops will be "ghettoised" in the
low capital, labour intensive sector, and will be excluded from high
technology, high capital, and mass production areas of the economy.
Both small and large co-ops have advantages and disadvantages, and we
will look at these later. After that we will look at the differences
in structure between large and small co-ops. We will see that the
main difference is that large co-ops develop a <u>Dual Control Structure</u>.
On the one side, there is a conventional management hierarchy: on the
other there is a set of representative procedures. The scope of these
two control systems, and the relationship between them, can throw up a
whole range of problems. Many of these can be summed up in the
question "Who has how much say in what sorts of decisions?" It is
usually agreed that "management must manage" and "everyone cannot
decide everything". What is to be included in "managing" is a fuzzy
area from which conflict can readily erupt. For example, how are com-
mercial decisions that directly concern members to be handled?

The dilemma of Dual Control Structures is that the number and
complexity of problems and decisions in larger co-ops appear to make
it necessary. If everyone were involved in all decisions, there

wouldn't be any time left to do any work. On the other hand - using cybernetic language - The Dual Control Structure is probably the essential mechanism that makes non-involvement into a self-reproducing system. Again we are looking at a structural basis for the "evaporation" of democracy in larger co-opratives. The workers - in theory - determine policy, while a management stratum determines how that policy will be implemented. This division tends to push workers into an "oppositional" role. They object to, or modify decisions, but have little influence over the framework within which the decision is posed.

Acceptance of the Dual Control Structure leads directly to a primary distinction between policy and implementation. Paton (3) has analysed some of the ways in which co-operatives restrict the area of policy. "Community decisions" may be taken communally, while "commercial decisions" may be managerial. Decisions involving technical expertise may be managerial, while broader issues may be communal. A collective bargaining style may be adopted, where "employees" can raise any issue that they feel affects them - making the distinction one of number rather than kind. Even where these areas of responsibility are agreed, it is easy to see in theory how - and easy to observe in practice that - they break down.

To date, most of the effort that has gone into designing democratic structures for large co-ops has concentrated on the best way of enabling workers to make policy (7). This paper proposes an alternative, but complementary approach. Instead of concentrating on "policy" and "implementation", we will look at the idea of a plan. A plan for any co-operative will include decisions about policy and about implementation. Until recently, planning has been a "prerogative of management" because of the amount of technical and specialist information involved. Recent advances in computing - especially in techniques for building models of organisations - mean that (with the proper design) models can be created that allow workers in large co-operatives to take part in the planning process. One key idea of a Worker Information System that will be used in this paper is a working model of the organisation that enables the workers to try out and create alternative plans for the organisation. This is too large a project to attempt in one go, so it will be broken down into stages. Many questions will immediately arise in the reader's mind about such a system. Who controls what information goes into the model? Who makes the assumptions on which the model is based? Will the whole thing be too technical for the ordinary worker to use? And so on. Many of these will be raised and discussed in ther description of the stages of development of the WIS. But, because much of the discussion that follows will be structural or technical, it is worth emphasising two points.

Techniques that enable workers to take part in the planning process are seen as a compliment to, and as an extension of policy making. They are not a substitute for it. Policy making and political differences may be clarified, but cannot be resolved by model building. Similarly, there are parts of the process of implementation - specific production skills, and tacit knowledge - that are too detailed for a plan to "reach down" and include. Like policy and political dif-

ference, these cannot be included in a plan. Getting policy and imple-
mentation "right" are crucial for making a co-operative work - but
these two areas are not the subject of this paper.

| policy | | | | |

plan

implementation

←——————— political process/conflict

←——————— technique/model-building

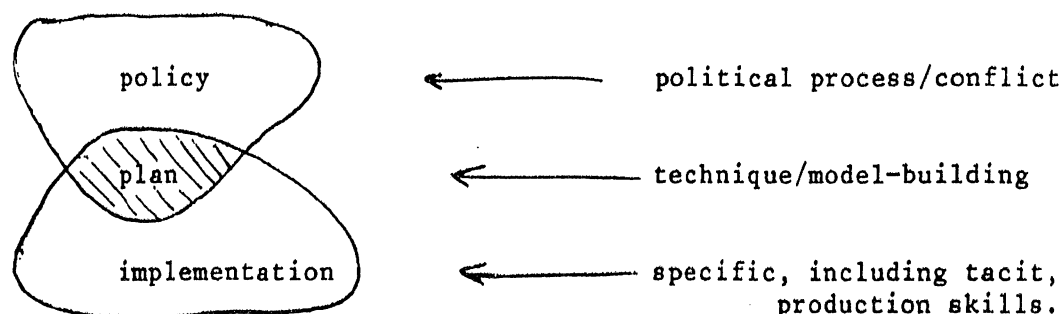←——————— specific, including tacit,
production skills.

FIGURE 1: Overlapping Areas of Decision Making

"Plan", as pictured here, enables us to avoid the simple dualism of
policy/implementation. If accepted, this dualism leads to a
traditional management/worker division of responsibility - and a role
structure that supports this division. Hopefully a successful WIS
would open roads to novel role structures and more convivial forms of
participation.

But it should be mentioned that the policy/plan/implementation scheme
has a more profound methodological significance. A general account
can be found in Robinson 1983 (11). Methodological implications for
co-operative research using these categories will be the subject of a
further paper.

In the next section, we will look at the Large/Small co-operative
distinction in more detail, bearing in mind the control problems we
have just outlined.

The last section of this paper will sketch a series of Worker
Information Systems (called WIS-0, WIS-1, WIS-2, to WIS-N) as they
might be developed for use in large co-operatives.

The Distinction between Large and Small Co-operatives

There is no need to get tied up here in a numbers game about "how
large is large"? The real distinction is whether any member of a co-
op can know enough about what is going on to have a real say in deci-
sions. This knowledge always comes more from informal than formal
conversations, networks of friends, and so on. In a small co-op, the
members are usually co-extensive with the conversations and
friendships. In a large co-op, they are not. Most members are excluded
from the crucial conversations. This may not be deliberate. In a
large co-op, it would take a huge effort to get all the information
round all the members. Mandel has argued that real workers control
would mean halving the working week - because all the other time
would be needed for discussion. Although the conclusion is not very
practical the argument correctly estimates the scale of the problem.
So the problem is really about information and understanding, and
size is only a convenient indication of it. There are at least five
obvious barriers to communication and discussion. "Size" is a shorthand
way of referring to them (or any combination of them) in this paper.

i) <u>Size</u>. Communication becomes increasingly difficult with increasing size. An absolute number cannot be put on the point where informal or richly structured communication gives way to formal or "thin" communication. It may be as low as six or seven people. We have heard it claimed that as many as 40 people can maintain good communications - but that was a case where the next four barriers were absent.

ii) <u>Community Roots</u>. Richly structured, informal communication is much more likely when the co-op is part of a community. People meet outside as well as inside work. Agreements can be reached and viewpoints exchanged in a way that is not possible in a purely formal meeting. Oakeshott (8) has described a fishing co-operative in Scalpay in the Hebrides that appears to work well in terms of understanding and participation, and is highly integrated into the community.

iii) <u>Multiple Site Working</u>. It is obvious that there is less chance of rich, informal communication when the workforce is distributed over several sites. Problems can arise directly from this in large co-ops (9). Martin Lockett's account of Fakenham Enterprises(10) shows that similar conflicts and problems can arise when the workforce is relatively small - if it is divided into groups in separate rooms.

iv) <u>Role Specialisation</u>. Communication becomes more difficult when members have different, specialist skills, and there is little overlap between the different work experiences. Empirically, small co-ops tend to have a high degree of role-flexibility and job-rotation. Large co-ops, on the other hand, tend to develop fixed, specialist roles.

v) <u>Membership turnover</u>. Shared understandings and patterns of informal communication take time to establish. They have to be re-established - and may be disrupted - when new members, or groups of new members join the co-operative. This was seen at Fakenham (10) when a group of new workers joined without any commitment to the idea of a co-operative. Robinson has shown how membership changes in voluntary groups can cause severe disruption (11).

<u>Advantages and Disadvantages of Small and Large Co-operatives</u>

The main problems for co-operatives can be sketched as a two-dimensional paradox. Small co-ops tend to have a strong democratic ideology and practice; they also tend to be economically weak in structure and practice. At the moment they are marginal to the economy (which is bad). The margin could turn into a ghetto, as mentioned earlier, (which would be worse). Large co-ops can develop a much stronger economic position - but often at the expense of personal involvement. A point is reached where members question whether the co-op is <u>really</u> a co-op (12).

Briefly listed, the main advantages and disadvantages seem to be:

i) <u>Small Co-ops: Advantages</u>
Informality * Friendliness * Rich communication structure and collective

decision making * high commitment of members * role flexibility and job rotation * shared information and experience * ability to innovate and respond rapidly to external pressures * in tune with the intuitive idea of what a co-op should be. (It should be said that small co-ops share many of these things with other small organisations.)

ii) Small Co-ops: Disadvantages
Undercapitalisation and inability to access capital * frequent examples of low pay, sometimes inaccurately called "self-exploitation". This can lead to a "shabby" image, that is unattractive to future potential co-operators, and to bad relations with the Trades Union movement. * overdependence on single, unstable, or marginal markets * economic inexperience – elementary and "silly" mistakes * unpleasant psychological pressures that are found in any intensive friendship group, but made worse by commercial pressures.

iii) Large Co-ops: Advantages
Easier access to capital * potential to control market and have a diverse product and service range * ability to enter high technology, high capital, mass production areas of the economy * fewer psychological pressures.

iv) Large Co-ops: Disadvantages
Failure to develop a differentiated management structure; decision-making paralysis; poor commercial prospects and sometimes failure. This set of characteristics is often found in failed co-operatives(14) * success in developing a differentiated management structure; importation of traditional hierarchical management techniques; loss of ability to make collective decisions; loss of personal involvement; co-op begins to look like a conventional business. This set of characteristics is found in what might be termed "successful non-co-operatives".

Some Solutions on Offer

*Wait for Socialism. Co-operatives are utopian (and so will fail) in a market economy. Even if we could wait, the Yugoslavian, Eastern European, and Chinese experiences show that similar problems are experienced by co-operatives in socialist countries (15).

*Keep co-operatives small. Democracy is not possible, and conflict inevitable in large organisations. We have already seen that this is a solution some co-operatives have adopted. Nor is it the purpose of this paper to argue against small co-operatives. They are attractive and there should always be a place for them. However, this solution excludes co-ops from many, if not all, the key areas of the economy. It also forgets that success or survival or the product itself may demand large scale organisation. It is not a general solution.

*Federation. It is argued that federations of small co-operatives – possibly with their own bank (16) – solve both sets of problems. The problem here is that federations, even in their early stages, raise similar difficulties to those we find with large co-ops (17).

*Design proper representative structures for large co-operatives. Many interesting and innovative experiments have been tried and are

being tried in this area (18). One problem here is the relative iso-
lation of large co-ops from each other. An important aid to this pro-
cess would be the development of a Large Co-ops Network so that
experiences and ideas could be exchanged (19). Although this effort
may improve policy making - which is very important in its own right -
representation moves away from direct personal involvement by members.
It can also forget the relationship between power and the centralisa-
tion of information/development of expertise by managers.

As Paton put it in a private communication to a group of co-operators
(20)

> "To be blunt about it: even if everyone below managerial
> level was given ten votes, the managers and directors would
> still be the most powerful group. Why? Because they have
> lots of other resources at their disposal to ensure that
> their proposals are accepted, and their ideas of what is
> best for the company will be acted upon. Votes and consti-
> tutions deal with formal power and that is only half the
> story. The other half is influence, or informal power.
> The most important sources of influence are information and
> expertise; a person who could persuade people that "If we
> do that, this will happen" would be powerful, even if he
> had no votes at all!"

When "expert power" appears, the individual influence of most members
decreases rapidly, while the influence of a few members increases out
of all proportion. This is not (necesarily) a psychological problem
of managers being "power mad" or "lacking any feel for democracy". In
general, expert power does not depend on easy access to "the books" or
other commercial and production information. It depends on knowledge
of the relationships between all the factors and problems of the co-
operative. This knowledge is often in the form of an intuitive, non-
verbal model. The manager finds it easy to use, but almost impossible
to explain. Others come to depend on the judgements, but is a matter
of trust, not of understanding and participation.

Dual Control Structures

This, as was said earlier, is a system (no matter how sophisticated)
in which the workers collectively determine policy while the managers
control how the policy is implemented. Dual control structures are
rare in small co-operatives, which often do without a managerial stra-
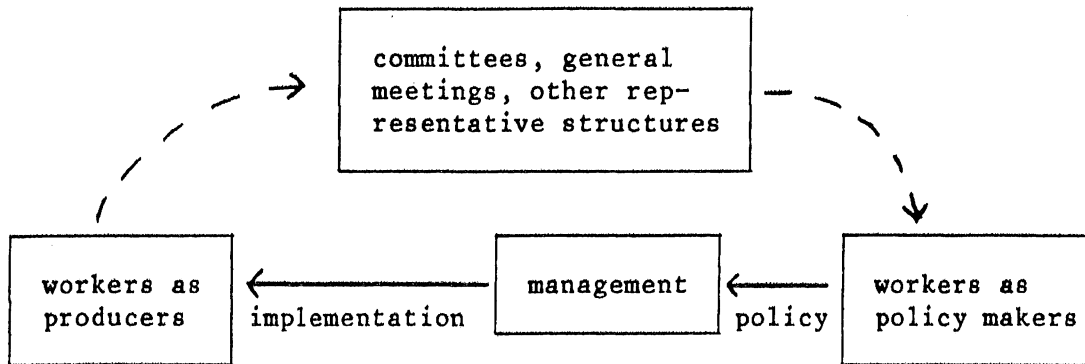tum, but very common in large co-ops.

FIGURE 2: A Dual Control Structure (vastly simplified)

A Dual Control Structure leaves business and other plans largely in
the hands of management. Plans and the expertise involved in drawing
them up can have a significant effect on, or even determine policy
(21). Loss of direct involvement and control can result in apathy, in
"trust", or in opposition, depending on circumstances.

Dual Control Structures exclude the majority of co-operators from the
planning process, and the models on which the plans are based.

A Few Words about Models

Most people think of models as toys (e.g. a model railway) or as
super-sophisticated scientific devices (e.g. the Treasury "model" of
the Economy). It is often not appreciated that most human activity
involves modelling. Our personal relationships, attitudes towards
others, expectations for the future and understandings of the past, all
involve models - "pictures" of what matters and what does not matter,
and of what is likely to happen. People are very good indeed at
creating models, but often not very good at describing them or manipu-
lating them (more of this later).

As the founder of cybernetics, Ross Ashby, once said, it is a mistake
to imagine that models contain some "deeper truth". We use models
because the reality is too complicated to deal with directly.   Models
are simplificztions and if they were not they would not be useful. To
be useful, they have to be understandable. Even more, a good model
should catch the imagination - so it is often true that the presen-
tation is as important as the content of a model. "Catch 22" is a
good example of an imaginative verbal model. The London Transport map
of the undergound train system is an excellent example of a model that
simplifies the "reality", is extremely useful in planning journeys,
and uses skillful colour presentation to increase its usefulness and
usability. On the other hand, the LT map would be a useless and very
misleading model if we were trying to plan repair and maintenance of
the tracks (22). We should not judge models by how "true" they are,
but by how useful they are to a particular group with a specific
purpose.

An Alternative Approach to the Problems of Large Co-ops

As a complement to the work that is going on in designing and trying
out representative, policy making structures, the Worker Information
System concentrates on democratising the planning process. The objec-
tive is two-fold. A good WIS should counter and prevent some of the
alienation and disaffection that can set in if members do not
understand or agree with managerial decision - and yet can do
nothing about it. Much more positively, the WIS should enable all
members of the workforce to contribute their intelligence as well as
their labour power to the enterprise. This comes much closer to
restoring the intuitive meaning of "co-operative" from which we
started.

It was said earlier that members of large co-ops cannot have direct
control over the enterprise in the same way as members of small
co-ops. The understanding, knowledge, information, and influence
necessary depend on direct informal communications as well as on
structured meetings. The necessary friendship networks, time for con-
versation and discussion, and the complexity/technicality of some of
the problems all mean that it is unrealistic to hope for direct
control in large co-ops in the same way as in small co-ops. But these
three elements define what would have to be done in large co-ops to
establish or re-establish direct member control. It is a major part
of this argument that these three elements cannot be re-established in
large co-operatives without a material infrastructure to support them.
That is a high-sounding phrase, and best explained by analogy. There
is usually no problem in people talking to ech other. But if one is
in Scotland, the other in London - no matter how loudly they shout -
they will not be able to hear each other unless there is a material
infrastructure (e.g. a telephone system). The WIS is the beginning of
an attempt to provide a material infrastructure via which large numbers
of people can communicate in a rich and near-informal way, and through
which they can generate mutually understood plans.

The WIS, then, is an attempt to assist information, understanding, and
planning between large groups of co-operators. It may have implica-
tions for collective policy making, but the immediate target is
collective planning and increased participation. Paton (23) has aptly
summarised the nest of problems on which the WIS might be brought to
bear.

> "Both the managers and the members of co-operatives com-
> monly express the view that information is, in one way or
> another, a "problem". For example, managers may express
> concern about the cost (in time and effort) of preparing
> reports to the members - they may complain that their
> reports or presentations are poorly understood or ignored
> and that members raise issues (and "ripples") without
> checking the "facts" (of company policy, procedure, etc);
> managers may mount straightforward instructional classes in
> an attempt to increase the representatives' appreciation of
> company data. By contrast, members complain about insuf-
> ficient information, or about reports being too complicated;
> they may wonder if information is being withheld; members

may be reluctant to ask for additional explanations; and
even when co-operatives officially adopt an "open books"
policy, members may be inhibited from asking a busy manager
for information not directly relevant to their jobs.
In fact, the provision of an appropriate amount of infor-
mation in a clear form with any necessary explanations,
is bound to be costly - especially since what is
appropriate varies with the issue in question, and what is
a 'necesary explanation' varies with the previous
experience and job of the individual member concerned.
Moreover, in the context of a particular issue of conflict,
the provision of information may itself become part of the
dispute, unless access to information has been institutiona-
lised in a way that prevents it being purely a mangerial
prerogative.

....

It is worth emphasising that although co-operatives face
these problems in a particularly stark form, they do not
have a monopoly. The same difficulties face conventional
firms introducing participation schemes, or pursuing
progressive industrial relations policies.........."

Generalisation to Non-Co-operative Organisations and Enterprises

In passing, it can be noted that information systems of this sort have
a potential beyond co-operatives. They could have an important role
under other forms of social ownership where participation by employees
was desired or desirable - for example, community organisations and
charities. In other systems, such as local government, where accoun-
tability is sought, and where "policies" can be so broad as to be
meaningless without specific "plans", a modified WIS could also be
of great value. The area of progressive commercial organisations is
more problematic. In situations where there was goodwill on the part
of the management, and tolerance by the unions, a WIS might be
possible. But, and it is a big "but", a successful WIS depends, in
the last analysis, on a communality of interest. It is a consensual,
or consensus generating system. While there is both a need and a
basis for such a system in co-operatives, the possibility of main-
taining consensus, especially under conditions of recession, is far
more fragile when the interests of owners/management and workers can
conflict. Under these circumstances, an "oppositional WIS" of the
sort discussed by Lockett (33) or implicit in the Lucas Plan (37) may
be more appropriate.

The point is that co-operatives have the motivation for developing such
systems, and provide far and away the most suitable sites for develop-
ment. For institutional reasons, other organisations are far less
likely to take the risks - although they may be in a better position
to bear the financial costs - though they may consider adapting the
WIS once it has been developed.

The Introduction of a WIS

Although the general form and purpose of a WIS is clear, the specific
design and programming problems involved are much less clear.
Ian Stobie (24), the Computercraft team, and the Co-operatives
Research Unit of the Open University have put a great deal of thought
into the design and introduction (they are deeply related problems) of
a WIS into a large co-operative. What follows is a very short - and
necessarily inadequate - summary of their views.

Stobie makes a central point when he says:

> "At the stage of designing the first version of the system
> the main aim should be to avoid ruling out any particular
> evolution. The computer-based WIS may be most valuable as
> a general co-operative resource, as an educational tool,
> as a communication channel from management to staff or as a
> link between co-op members, a means of broadening decision-
> making or something else. Ideally the decision should be
> left to the evaluation stage of this project rather than be
> pre-empted by the design."

On the other hand there is a serious problem about involving co-ops in
a deep way in the design of the initial system. As Stobie puts it:

> "If the employees choices have not been registered in the
> design and development stage then it can't be assumed that
> their interests are reflected in the final result.
>
> I think we are justified (in an initial CRU/Computercraft
> design) as we are confronted with the problem that nobody
> else really knows what we are going on about down at
> the initial test sites and won't until something turns up
> in their coffee room. Only then will the computer-based
> worker information system seem real. I favour going ahead with
> this course, as the alternative is to try and convey by verbal
> means what are very abstract ideas. Only some people are
> experienced in interpreting messages sent in this way, but most
> people respond to being hit over the head with a fact.
>
> I derive from this a very clear set of imperatives for deve-
> loping the project. That we proceed step by step, that we
> leave everything as changeable as possible, that the first
> thing we put in (to a co-operative) should be a delibera-
> tely and clearly incomplete system, and that priority goes
> on developing a range of uses and capabilities in the
> system. In short, an incomplete demonstration system
> should go in before any of our own ideas become too
> solidified."

In other words, the first system - let us call it WIS-0 - should be a
dispensible prototype. Co-operators can "play" with it, and their
activity should generate a clearer picture of desirable ways of deve-
loping the system. This approach should avoid the usual computing
disaster area of becoming committed to a complex system (by spending
large amounts of time and money on it) that nobody needs or does not

work. It also avoids the other fetish of assuming an inexperienced
user can have a clear idea of what they want, and all that is
necessary is for the systems analyst to "dig it out". Learning (and
the space for it) is necessary on both sides. An introductory stra-
tegy should allow for this.

Stobie then goes on to discuss an initial _form_ for the prototype WIS-0
that meets these conditions. We will come to this in the next section
After that we will outline the general form of WIS development. To
pretend that we did not have preconceptions already would be disho-
nest.

Stages in the Development of Worker Information Systems

WIS-0

The purpose of WIS-0 is to see whether the sorts of development the
authors have in mind are favoured _in practice_ by the users. The con-
tents should be appropriate to this purpose: varied; indicative but
incomplete; light and easy-to-build but stimulating and easy-to-use.
WIS-0 should also allow the co-operators to become familiar with the
technology - without breeding contempt for it.

Stobie suggests a division into **background** and **foreground** uses:

> "In the foreground we have programs that are completely
> self-explanatory and easy to use. These are the normal
> day-to-day programs that are available as soon as the
> machine is switched on in the morning, and which live on
> the discs that are normally left in the machine.
>
> Lurking in the background are other programs which don't
> come up to these standards for various reasons, and which
> you don't need to know about to use the system".

or again:

> "We need to avoid demoralising people with complexity, so
> we are in effect making the promise to them: "you will
> never get into trouble if you stay in the foreground, but
> if you go into the background you may have to puzzle things
> out a bit.""

Programs placed on the background may involve more difficult proce-
dures (e.g. Visicalc, the author mode of Pilot); may not be working
fully; may be too large to "fit" in the foreground; or may not be of
general interest (e.g. usage reports, data loading programs).

Programs placed on the foreground will be very easy to access, using
a "joystick" rather than a keyboard - it is felt the former is less
intimidating, and will not be seen to require computing or typing
skills. Movement between programs and between frames of information
within programs will be achieved by simple up/down (more abstract/less
abstract) or left/right (repeat the last frame/go on to the next

frame) movements. For instance, if we were considering information on
sales – as opposed to wages, production, or budget – a user path
through the information frames might look like Figure 3.

```
CHOICE
  │
  ▼
┌─────────┐
│ SALES   │      WAGES      PRODUCTION              BUDGET
└─────────┘

                    ┌─────────┐
ANNUAL SALES        │ OUTLETS │    WEEKLY FIGURES        COMPARISON
                    └─────────┘

              ┌─────────┐
  SHOP 1      │ SHOP 2  │      MAIL ORDER          MARKET
              └─────────┘

┌──────────────┐
│ OVERALL SALES│      PRODUCT RANGE        WEEKLY SALES
└──────────────┘
```
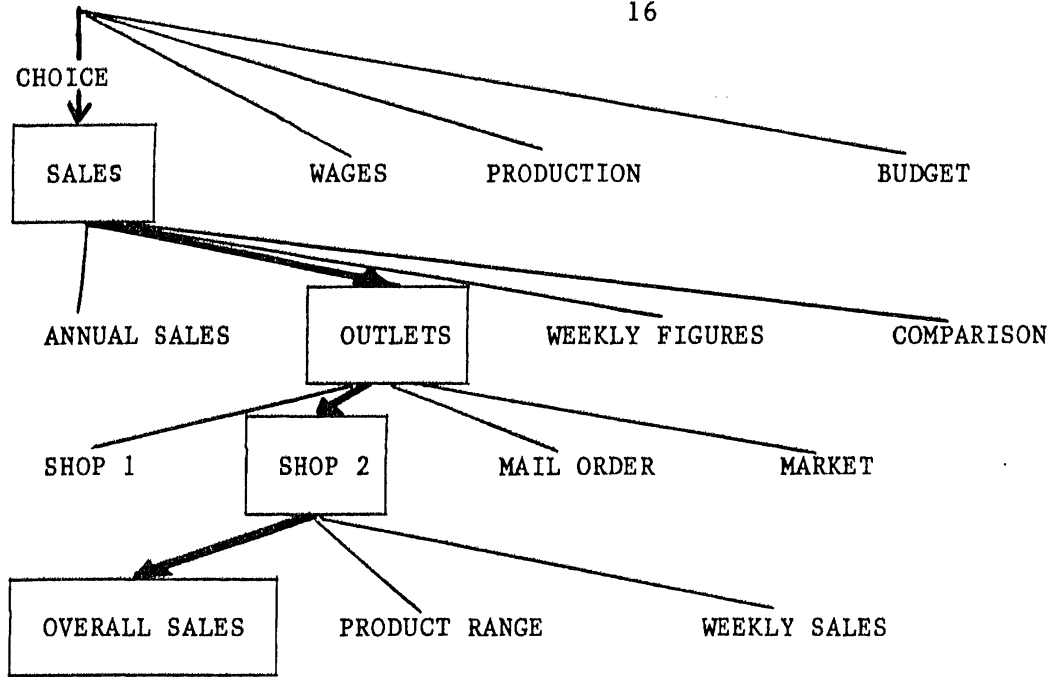
Figure 3.   One Path Through an Information Tree

A Prestel-like (hierarchical tree) presentation form was chosen after much deliberation (see again Stobie, 24) so that a consistent style of interaction could be adopted thoughout. This is clearly very helpful to the inexperienced user. The disadvantage is that animated graphics and interactive "frames" are ruled out (or placed in the background with foreground "pointers" to them).

Projected Foreground Contents of WIS-0

i)   Specific information about the co-operative in which the system is installed. (Sales/wages/production levels/authority/ and com-munication structure). Where possible graphics/iconic representation will be used rather than figures. The best ways of ordering and pre-senting information - experience to be gained under WIS-0 - will be valuable for the construction of WIS-1 and 2. It will also be of interest to develop a standard "easy to understand" format for pre-senting election/authority structures.
ii) Educational programs: there should be at least one educational program available in the foreground. An explanation of the concepts underlying the construction and use of a balance sheet is a good can-didate for this.

iii) Forecasting: this aspect of WIS-0 is spelled out at greater length as it is a less "standard" use.

A program should be available that enables the co-operators to make short-term forecasts from their own "data-series" (e.g. data on pro-duction or on sales). A variant of the Harrison and Stevens techniques (25) seems a good candidate for this. The technique itself is con-venient as it allows predictions to be made from relatively small

amounts of data (thus not burdening the user); and the type of predic-
tion being made is relatively clear, as illustrated in figure 4 below.

No change

Transient
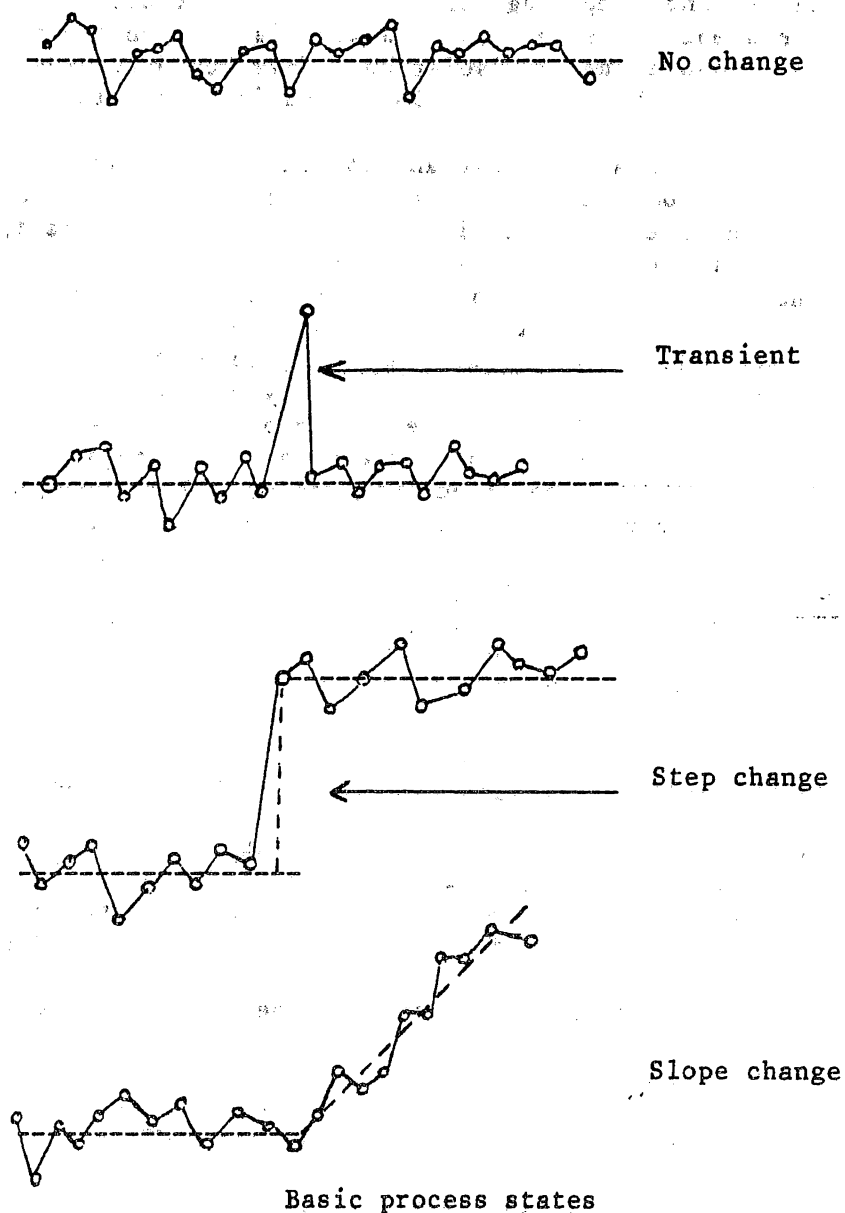
Step change

Slope change

Basic process states

Figure 4:   Basic Process States (from Harrison & Stevens, 25)

The advantages of including such a forecasting system are numerous.
It could induce an interest in a deeper examination of the infor-
mation frames than might otherwise be the case - since it is possible
to do something with the "information" apart from look at it or talk
about it.   It could induce a critical consciousness about the power of
computers - not all the forecasts will be correct!   It could develop
into a competitive game - co-operators versus machine to see who could
come up with the best "prediction".   Such a development could have
beneficial spin-off effects for the co-operative - members would be

keeping a much closer eye on critical variables. A "game" of this sort would also be of theoretical interest for later WIS stages. Evaluating and comparing human and machine predictions could open the way for a mode of symbiosis or synthesis between the two that would be "better" than either in isolation. This could provide significant insights into the design of WIS-2, and its potential "accuracy".

A further advantage is that an "abstract" forecasting system such as this avoids some of the dangers of creating a co-op specific model for testing the use of predictive systems. On the one hand, a co-op specific model could be complex, and require too much programming effort for the WIS-0 stage. On the other hand, if it were simple, it might be regarded a simplistic, and not used, or it might be rather dangerous. If it were simple **and** plausible, the danger would be that it would be wrong - yet taken seriously by the co-operators. Decisions might be influenced by, or even based on it. If the information were wrong, those decisions could have very bad consequences. This is one problem that has to be taken into account in all stages of WIS design. We have to steer a narrow course between providing a boring (but correct) system, and a more interesting and adventurous system with attendant risks of encouraging over-credulity and creating mystification. Providing a forecasting system that only works on single series chosen by the co-operators, and is obviously wrong when it is wrong, goes some way in the right direction.

iv) Wage Structure Models
These will be simple, general models of the consequences of adopting any particular wage structure. The models will serve several purposes. They will be (implicitly) an introduction to models for the co-operators, allowing them to see the sorts of ways "What if....?" questions can be answered. They will also illustrate the capacity of the machine to present dynamic - and apparently qualitative - processes. From the research point of view, they will allow an evaluation of how models are used: whether they are treated as games, or whether they stimulate serious debate; how critically the users regard the assumptions and consequences; how to gauge the right level of complexity (in content and presentation) for models in co-operatives - which will be useful in the design of later WIS stages. Wage structure models have two other advantages. They can be general, and will thus be "portable". They are not tied to any specific co-op, and can be tried out in several. They are immediately of interest to co-operators as they deal with a problem in a general way that many have experienced in detail.

Co-operatives are free to, and do decide on their own wage structures. Often these structures generate problems that had not been forseen. An initial choice of wage structures will often reflect ideological preference as well as practical concerns. We have seen some very heated discussions between those that practiced an "equal wage" policy and others that were trying an "each according to their need" policy (31). Wage structures are of great interest to members of co-operatives.

An interesting and non-obvious aspect of wage structures can be
brought out by the use of dynamic models. A policy where those with
dependents get a greater rate of return than those without ("each
according to their need") results in its own negation (often). The
co-op ends up composed of those people with dependents; the differen-
tial fails; and the rate of return falls. Similar contradictions
follow from an equal pay policy. Elster (32) termed this process
"counterfinality", and illustrated the general principle with an
example taken from Satre:

> "Each individual peasant seeks to obtain more land by cutting
> down trees, but a general deforestation induces erosion
> with <u>less</u> land available to each peasant than at the outset."

v)   Social Audit
It is relatively easy to make commercial profit and loss calculations
for co-operatives using micro-computers. The information frames
discussed earlier will begin this function, and it will be an essential
part of the projected WIS-2 model for planning and control. However,
profit and loss is far from the whole story, and it would be very
desirable to embed these calculations in a wider framework, often
called "social audit". Social as well as commercial costs and bene-
fits need to be looked at. (This point applies to a wider organisa-
tional spectrum than co-ops alone.) Although an integrated
social/commercial system would be over-ambitious for WIS-0, it would
be desirable to include a social audit component. A version of the
methods developed by Freer Spreckley of Beechwood College (34) seem a
good candidate for a WIS-0 "social audit program".

vi)   Bulletin Board
The bulletin board facility is just that. It allows users to leave
messages for each other (or for the researchers). Specifically, the
"board" displays messages typed in by foreground users. There will be
an (optional) explanation of how to enter a message, with appropriate
prompts. On the display side, when this is selected from the "hook",
the system shows the messages currently held in order of recency.
Since storage space within the system will be limited, so will be the
number of messages that can be held. When the memory is "full", new
messages will push older messages out of the foreground, and they will
become inaccessible to the users. They will not however be lost - see
Stobie (24) for details.

vii) Games (e.g. Biorhythms; Space Invaders)
Games can be effective as ice-breakers, in overcoming peoples' initial
reluctance to touch the keys. The trouble is that addicted users can
hog the machine. Hopefully the other WIS-0 programs will be written
in a sufficiently exciting way to make ordinary gaming unattractive.
Initially games will be used as a last resort in the event that the
system is not being used. They will not (at first) appear on the
"hook" - although we may be being unduly prudish in making this
decision.

WIS-1

This would build heavily on the experience gained from, and the reactions and interests of co-operators in WIS-0. WIS-1 would be a specific model of a specific co-operative as a computer program. A great deal of attention should be paid to making it user-friendly and robust. It should have the colourful graphics and interest of a pub-game (pinball machine/Space Invaders). Instead of "winning", the results would be consequences of particular courses of action to the co-operative. For example, we might choose an economic model. Wage levels, production levels, costs, sales levels, etc could all be manipulated to give BONUS or BUST (an outcome that predicts bonus levels - or a nastier option).

It is almost inevitable that workers in large co-ops will use the "results" of such a model to argue for particular courses of economic action. This is very desirable, and a step towards the full objective of increased participation. There are also dangers. The model may be too simple. Its results may be misleading or wrong. A less vital model (there are many alternatives) might decrease such risks - but would probably be less interesting and productive. The whole process of introduction and use would have to be very carefully monitored.

A second stage of WIS-1 might be to introduce several models of this colourful and game-like nature into several co-operatives. There might well be a difference in use between co-ops that grow up with such a system, and co-ops in which it is super-imposed on existing decision-making methods. Raul Espejo has, for example, suggested that such new systems only really come into their own under crisis conditions (35).

Like WIS-0, WIS-1 should be conceived as an incomplete demonstration system. It should be designed to be changeable in response to the needs and uses of co-operators. It might develop as a participative management tool if it included the possibility of making serious short-term forecasts (25). It might develop as an educational system, using Computer Aided Learning techniques to explain, say, key accounting concepts. It might be a dynamic and up-to-date information archive open to all membners. It might be used to sound out opinion, or as a "bulletin board". All of these uses would be consistent with a core program structure of an organisational model, which could then be developed in any of these directions.

As WIS-1 should be readily changeable, it is important that not too much effort (and hence commitment) is sunk into any one version. Options might be to use program-generators, existing model-building tools, or to develop a very flexible core model.

WIS-2 This would build on the experience of the previous stages. It would incorporate many aspects of WIS-1, but would go well beyond it. The objective would be to enable the workforce to take day-to-day control of the co-operative. (This is entirely distinct from the policy making role of the members as a collective.) It is direct rather than indirect workers' control. It implies a system that allows worker-members to re-appropriate certain important management functions - or to discharge them more effectively.

In this context, two functions are particularly important.

First, WIS-2 should be able to identify and interpret emerging trends in important variables. For instance, cash flow and sales. This depends on the ability (derived from experience) to distinguish probably normal from probably abnormal fluctuations. This is important since much decision-making is concerned with fast reactions to actual changes. The changes themselves may come from outside - indicating changes in the "market place" - or they may be a result of policy changes in the co-op. Either way, the ability to respond quickly increases the meaningfulness of participation - and should make the co-op more likely to thrive and survive.

Second, WIS-2 should enable worker-members to consider alternative plans. An important point here is that competence in evaluating alternatives does not spring from simple access to the "books" - the raw statistics of sales and production, etc. Knowledge of the relationship between the variables is much more important. Currently such knowlege usually takes the form of an intuitive, informal, and often non-verbal model. This allows appreciation of the effects of changing one variable on all the others. Such models are usually "private" - meaning it is difficult for the individual holding them to explain them, or allow others to participate in getting "consequences" out of them. A major function of WIS-2 is to make this model (or models) available to the workforce. "Externalisation" (26) of the organisational model also opens it to examination and challenge by the worker members. Externalisation, in practice, means embedding the variables (with their static and dynamic relationships) in a computer program. The effects and consequences of changing any variable (or set of variables) can be automatically generated. The model becomes usable by the workforce to generate alternative plans. It ceases to be the private property of a managerial individual or group.

Drawing on the seminal work of Stafford Beer and the Project Cybersyn team in Chile under the Allende Government (27), extra general specifications for WIS-2 can be made.

*It should be a real-time system, or a close approximation.
(Time-lagged data can often be very misleading.)
*It should generate automatic information on incipient change through a statistical filter (probably using some variant of the Cusum technique).
*It should present information in iconic form (this ties in with the importance of user-friendly presentation).

A minimum WIS-2 configuration is presented in Figure 5.

It should now be clear that WIS-2 is a very different sort of animal to WIS-1. WIS-1 is essentially experimental, and an information system.
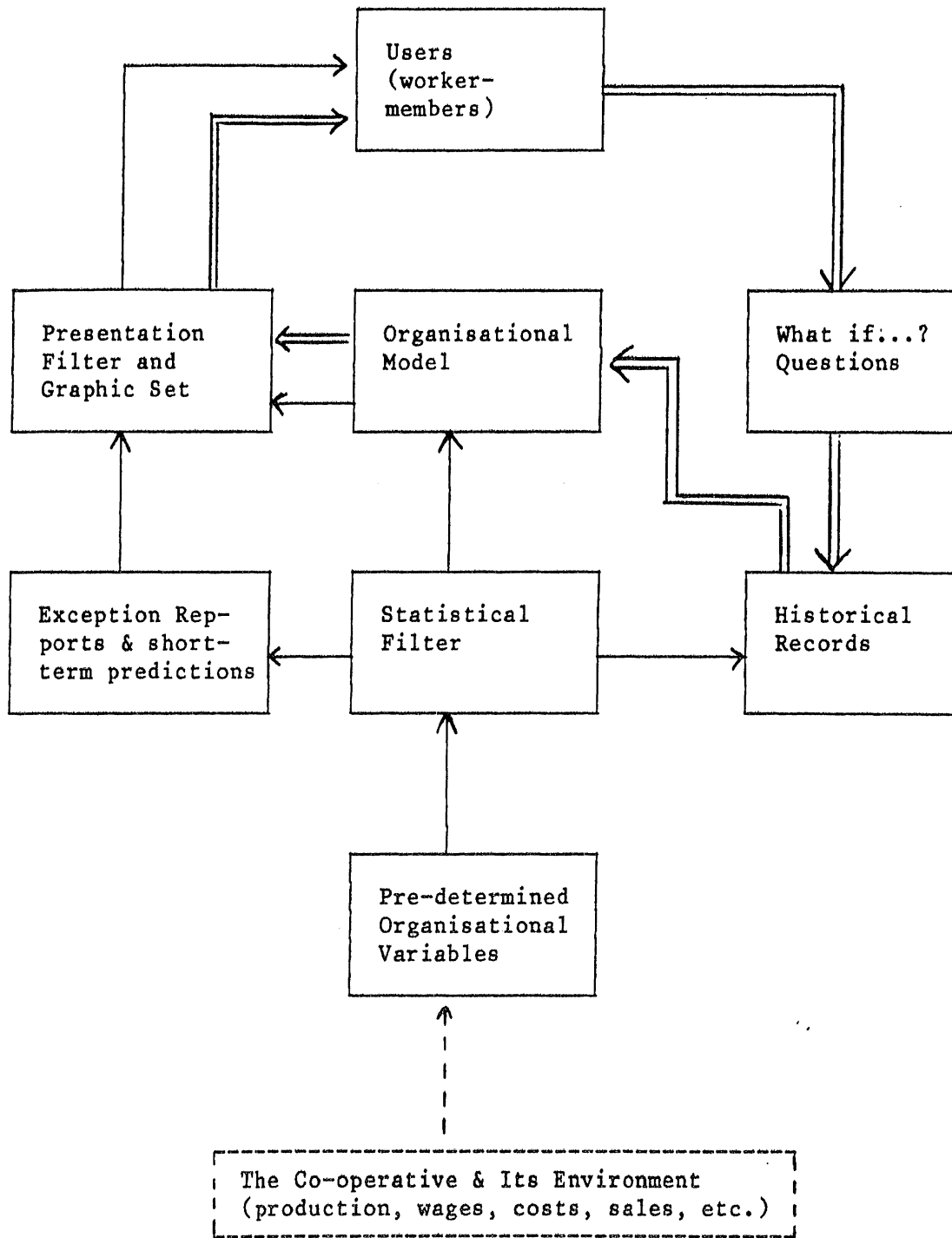
Figure 5: Minimum Configuration for WIS-2

WIS-2 is essentially a control system - although it may have informational, educational, or other uses. Its function is to allow as much control as possible over organisational variables by the workforce, not to pursue the Taylorist project of trying to control the workforce (28). As Paton put it, control in the sense of power to rather than power over. Policy making sets the parameters of control. WIS-2 enables the worker members to extend the process, and start to gain control over the variables within the parameters.

WIS-3 The critical reader will have noticed that in WIS-0 to WIS-2 the design and programming of the models is done by "experts" who will not be members of the co-operative using the models. The intention is to use the experience, comments, and ideas of the co-operators - but nevertheless it is clear that the outsiders will determine the assumptions on which the model is based, which in turn largely determines the sort of information that goes into (and out of) the model.

The first stage of WIS-3 will be to build in processes that allow the co-operators to challenge and change the assumptions of the model. The second stage of WIS-3 will be to provide a model building kit that enables the co-operators to build their own models.

Although in "purist" terms, the WIS is not truly "democratic" until WIS-3 is reached, in practical terms it would be very difficult to start here. There is a lack of knowledge about techniques and uses of such a system. The experiences of WIS-0 to WIS-2 is needed to fill the gap. Even if the knowledge were there, the full WIS-3 system would simply be too much to lay on any group of co-operators until they had developed familiarity with a much simpler system. On top of this, the programming effort required to develop WIS-3 will be quite massive. Even if money were avaialable for this, it would push the practical start of the project - co-operators having something they can use - too far into the future.

In terms of programming schedule, the development of WIS-3 should start as soon as possible, in parallel with the installation of the other phases. WIS-3 should be informed and aided by the experience of the other phases. Conversely the aim of producing WIS-3 will influence the way in which the other stages are designed. But in installation terms, WIS-3 is some way in the future.

WIS-3 is thus a terminal point for the project of developing Worker Information Systems. Up to this point a relatively continuous and logical process of development can be foreseen. Beyond this point we can expect discontinuous - and hence unforeseeable - change in the national and local organisation of co-operatives, and in the way in which computing tools are seen and used.

In an earlier section we named three elements that would have to be re-established in large co-ops (using a material infrastructure) if direct control of production were to be exercised by the co-operators as in small co-ops. These were:
        *friendship and communication networks that were co-extensive
        with the membership of the co-operative.
        *time for conversation and discussion.

*"externalisation" and access to complex or technical models of organisational process and "commercial reality".

The succession WIS-0 to WIS-3 starts to tackle these problems. There is a concentration on the third (modelling) element, but all stages should increase the scope and depth of the living debate, and the model-building facility of WIS-3 should amplify communication in interesting and unexpected ways.

Beyond WIS-3, the model building kit, is an imaginary point we might call "WIS-N". This would be a system in which models were exchanged and negotiated - in much the way we exchange and negotiate simple concepts in everyday conversation. We would be justified in seeing "WIS-N" as a conversational medium rather than a computing system in the usual sense (29). Reading back from this idea has several advantages. A "system" has connotations of objectivity and determinancy. A "medium" on the other hand is essentially malleable. It is responsive to, and can embody the intentions and subjectivity of its users. It can amplify their abilities, and the possibilities open to them. This is the way in which the WIS stages should be seen. They are in the tradition of Illich's "convivial systems" and Cooley's "human-centred technology"(30)....

Summary and Conclusions

We have argued that both large and small co-ops have advantages and disadvantages. The differences between the two are indicated by size, but are mainly structural and psychological, and result in different types of power distribution. The main 'emergent' factor in large co-ops is a Dual Control Structure, where the workers (in theory) determine policy, while management (in theory) determines implementation. In practice, this duality is hard to support, and control passes increasingly into the hands of management. This applies especially to day-to-day decision making, where workers, because of their nearness to the process of production, might be expected to make a large contribution.

We argued that workers could become involved in "planning" as well as "policy making". This would avoid many of the problems connected with the policy/implementation dualism. Planning involves much more than "access to information". It involves access to the models that make the information into a coherent whole on which decision-making can be based. Collective planning in large co-ops involves even more. It depends on friendship and influence networks, on time for conversation and discussion, and on a reduction of the complexity and technicality of problems that give rise to mystifying specialisms. It is part of this thesis that these four problem-aspects cannot be resolved by goodwill alone. A material infrastructure is needed to make collective planning possible. This infrastructure would be a computer-based Worker Information System. This would make information and models available to all members - it would be "open-access".

Clearly, this means that the WIS is more than 'just' a computer system. That is one thing. How it is used is quite another. Characteristically, systems developments precipitate organisational change. It is to be expected that a WIS would change, amongst other things, the nature and form of meetings - and such changes might in due course generate additional demands of the system. Substantial attention would have to be devoted to monitoring and facilitating such changes, or the whole project could easily become stunted. Social factors will be more important in WIS development than computing considerations.

Social dynamics and considerations of systems and program design make it essential that WIS is developed in stages. Insofar as we can anticipate a plausible sequence, these stages are:

WIS-0: A "sweetshop" of prototypes and possible uses, that we have already discussed at some length.

WIS-1: An integrated prototype information, education, and communication system developed from the experience of WIS-0. At this stage WIS is still experimental, and will need to be "tried" in, and "tailored" for several different co-ops.

WIS-2: Built on the experience of the previous stages, WIS-2 will go well beyond them. Its objective is to enable the workforce to take day-to-day control of the co-operative - to participate in "planning" as well as in "policy-making". Modelling (both the "externalisation" of existing models, and the creation of new ones) will be the major aspect of WIS-2. This will integrate other uses carried over and evolved from earlier stages into a novel "distributed planning" process.

WIS-3: This is the most ambitious system, in which the co-operators are provided with a model-building kit through which they can construct their own models, and are freed from dependence on outside experts - just as WIS-2 should largely free them from dependence on the "expertise of management".

The succession of WIS stages thus corresponds to a succession of steps by which co-operative members increase their collective autonomy and independence.

WIS-0 should be the first step on a very exciting road. There are many aspects that have not been covered in this introductory paper. The methodologies of action research and design-participation by co-ops; the problems of formal and informal project evaluation; and a review and critique of existing speculative and technical work that has prepared the ground for the WIS concepts will be the subject of further papers - along with progress reports on WIS development.

Finally, the authors would like to thank the Co-operatives Research Unit of the Open University for supporting this initial theoretical work.

NOTES

1. Directory of Co-operatives, CDA, 1982.

2. For instance, Scottish Daily News, Meriden, KME in the "rescue" category: Scott-Bader and Airflow Dynamics in the "conversion" category.

3. Paton, R. "Some Problems of Co-operative Organisation" CRU Monograph No. 3 (OU) 1978

4. Robinson, M. "CRU Discussion Paper" based on PAS REVIEW, Social Synthesis Unit, 1980.

5. This is part of an overall trend of attitudes against large organisations, Two other disparate examples would be the Thatcher Government's (supposed) emphasis on small business, and R. G. Barker and P. V. Gump's classic study "Big School, Small School" (Stanford, 1964).

6. from Jenny Thornley, Workers Co-operatives – Jobs and Dreams Heinemann, 1981.

7. See for instance the Scott-Bader "Authority Diagram" reproduced from Paul Bernstein's "Workplace Democratization" Transaction Books, (New Jersey) 1980.

FLOWS OF AUTHORITY AND COMMUNICATION IN THE SCOTT-BADER COMMONWEALTH
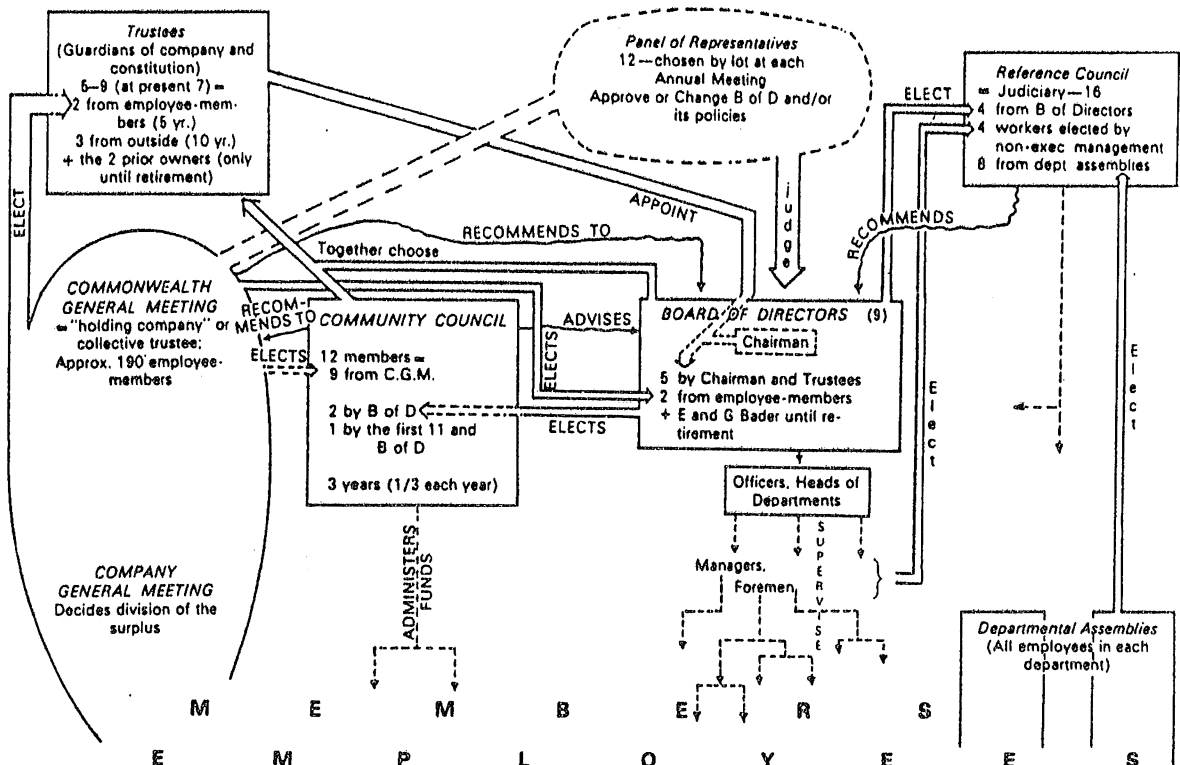
8.   Oakeshott, R.   Financial Times Article, 1979.

9.   Robinson, M.   PAS REVIEW, Social Synthesis Unit, 1980.

10. Lockett, M.   "Fakenham Enterprises",
     CRU Monograph No. 1 (OU) 1978

11. Robinson, M.   "The Identity of Human Social Groups"
     in Behavioural Science, Vol. 28, 1981.
     and "Groups", John Wiley, (forthcoming)

12. Paton, R. & Lockett, M.   "Fairblow Dynamics"
     CRU Monograph No. 2 (OU) 1978.

13. Tynan, E.   "Little Women"
     CRU Case Study No. 2 (OU) 1980.

14. Tynan, E.   "Sunderlandia"
     Case Study No. 3 (OU) 1978.
     Eccles, T.   "Under New Management" Pan, 1981.

15. Hinton, W.   "Fanshen" Merlin Press, 1968.
     Articles on Yugoslavia in "Work and Power" eds. Burns, T.,
     Karlsson, L. and Rus, V. Sage Books, 1979.

16. Thornley, op.cit.
     Campbell, A. et al, "Worker-Owners: The Mondragon Achievement"
     Anglo German Foundation, 1977.

17. See for instance the extract from Co-op Development News
     (Oct. '82) in the box below. The complaints about CDA's by
     co-operators look very like complaints usually made about manage-
     ment by workers - including an element of contradictory demands.

CO-OPERATIVE DEVELOPMENT WORKERS - WHY CO-OPS DON'T LIKE US

This is a typescript of notes taken during workshop discussions bet-
ween CDA workers and co-op members at the 1982 Co-ops Fair in
Beechwood. It is the record of one person rather than an agreed sum-
mary of the discussion.

1   CDA WORKERS AS PARASITES

CDA workers tend to enjoy better terms and conditions of employment
than co-op members and benefit from the status of professional advi-
sors without carrying the risks of trading or giving the commitment of
a co-op member.

Co-op members argue that CDA workers often lack knowledge/experience
of particular industries/services, and call upon the advice and
assistance of co-op members in those sectors in carrying out develop-
ment work with groups. 'Not only are you paid more than us, you
cannot even do the job you are paid to do without asking us to give up
work time and money to help you do your job.'

Many CDA workers have no direct experience of membership of a worker co-operative. Co-op members therefore question the quality of CDA advice to groups on working collectively - its problems and how to tackle them. This side of the work, some argue, should be carried out exclusively by established co-op members - the business skills/funding side could be dealt with by CDA workers. Time spent by co-op members on development work at the behest of CDA workers should be paid for in the same way that professional consultants are paid for their time.

More effort should be made by CDA's to recruit ex-co-op members to CDA work. Positive discrimination in favour of experienced co-operators should be operated. CDA workers generally supported these ideas and felt a strong comitment to training up to increase their competence.

2 WHO SPEAKS FOR WHOM?

There was general agreement that CDAs should be controlled by worker co-operatives. CDA workers should exert moral pressure on non-worker co-op controlled CDAs to come into line. Alan Taylor's definition of co-op controlled CDAs (having legal structures designed for co-op control) allows for the development of co-op control in those areas where there are not yet enough co-ops to counterbalance other classes of CDA member, but will be in the future.

CDAs should not attempt to speak for worker co-ops. This was generally agreed although some CDA representatives felt that they had to speak for 'their co-ops' because the co-ops were too busy earning a living to speak for themselves. There was a strong feeling of resentment from co-op members that they were being asked to take control of CDAs when in many cases they had barely been consulted about setting them up and did not particularly want them. Other co-op members recognised that CDAs represented a resource and a means of incresing the number of co-ops, which co-op members had little time to do.

3 SETTING UP CO-OPS - PLAYING THE NUMBERS GAME

Co-ops made it clear that they did not see co-ops as the answer to unemployment. They felt that they were being used as the latest toy of government (in this case local government) - and CDA workers might take a similar attitude, attempting to co-operatise everything that moved without regard to quality.

CDA workers argued that co-op members were being elitist. By calling for 'organic growth' without CDAs rather than forced growth with CDAs they were condemning areas of UK without a co-op network to continued absence of co-ops and retaining the co-operative option within a particular social group rather than spreading the word throughout. It was felt particularly that co-ops growing out of mass redundancy receiverships would stand little chance without local CDA support.

One area of suspicion - co-op members thought that only new co-ops would get access to resources/grants/aid and assistance from CDAs. This was generally felt to be wrong - established co-ops with growth problems needed help and were just as important as new co-ops.

18. See Note 7 above. Also the Pregnancy Advisory Service has been through no less than 3 radically different forms of representative structure since becoming a co-operative in 1980 – each of which is (in my view) an improvement on the last.

19. Information on the current stage of development of the Large Co-ops Network can be obtained from Kingston CDA or from ICOM (London).

20. Paton, R. Private Communication, CRU.

21 See Note 3. Also, the GLC Technology Policy Group reports. A good example of implementation determining policy was reported by Mike Cooley. The choice of underground switching system for communication lines determined the choice of copper over fibre-optic cable. This in turn determined a "metered use" rate of charge for the system (rather than any other). Political choice was pre-empted.

22. Glanville, R. "Mapping Realities" Architectural Association Quarterly, Vol. 12, No. 4, 1980.

23. Paton, R. "Draft WIS Propsal" 1982. CRU, unpublished.

24. Stobie, I. "A Computer Based WIS" Computercraft, 1980.

25. Paton, R. As note 23.
    P. J. Harrison and C. R. Stevens "A Bayesian Approach to Short Term Forecasting" Op. Res. Q'ly, V. 2, No. 4, and subsequent work by Harrison. Also
    Robinson, M. PAS MONITORING SYSTEMS. Social Synthesis Unit, 1980. and
    Hogarth, R. & Makridakis, S. "Forecasting and Planning: An Evaluation"
    in Management Science, Vol. 27, No. 2, Feb. 1981.

26. See especially the work of Pask, G. et al. on the exteriorisation of concepts and models with the CASTE and THOUGHSTICKER systems. System Research Ltd. 1965-1980.

27. The work of Beer and his colleagues on this system of "cybernetic praxis" has had a deep influence on this current work, and remains an inspiration. Reports in:
    Beer, S. Platform for Change, Wiley, 1975
              Brain of the Firm (2nd. Ed) Wiley, 1981.
    Espejo, R. Ref. note 35
    Schwember, H. "Cybernetics in Government" in
    Computer Assisted Policy Analysis, (ed. Bossel) Birkhauser Verlag, Basel, 1977.

28. Cooley, M. "Architect or Bee" Hand and Brain, 1980.
    Robinson, M. "Management and Self-Management – the Objective/Subjective Dimensions" in Int. J. Man-Machine Studies, 14, 1981.

29. The idea of "WIS-N" as a conversational medium, based on the exchange and negotiation of models held by people and groups of people, where the models are held by, and transmitted through computers, is captured by Pask in the following passages. "Stable conceptual system" is a restricted version of our use of "model".

> ....stable conceptual systems not uncommonly exist in several, maybe many, brains over which they are distributed (cultures, schools of thought, traditions, social institutions). Hence cultures A and B may "converse" or people may converse with cultures, and so on."

and

> "Methods of conversation through a mechanical interface, most fitted to one or two subjects, have been extended to small group operation in the learning/teaching environment, and are currently used in team operations for decision/design environments (including such activities as planning and theory building). In other words, there is no difficulty in going from two person to several person interaction, using computers as distributive media, and no other-than-technical limitation in contemplating nation-wide or industry-wide systems".

both from Pask, G. "A Conversation Theoretic Approach to Social Systems"
in Sociocybernetics (eds. Geyer, F. and Zouwen, J van der)
Amsterdam, Martinus Nijhof, 1978.

30 See Cooley, M. above cits. and
Illich, I. "Deschooling Society" Calder and Boyers, Open Forum, London 1971, and other works.

31. "Concrete Economics" (Conference), University of Lund, Sweden, Feb. 4-7, 1982.

32. Elster, J. "Logic and Society", Wiley, 1978.

33. Martin Lockett, "Worker Information Systems: Towards an Analysis" CRU Working Paper, (OU) 1978.

34. Spreckley, F. "Social Audit for Co-operatives" Beechwood College, Leeds, 1983.

35. Espejo, R. "Cybernetic Praxis in Government: The Management of Industry in Chile 1970-1973" University of Aston Management Centre, 1980.

36. The following table gives the number of co-ops in the UK at different size levels.

Number of paid, full-time workers	Number of Industrial & Service Co-operatives
Fewer than 7	278
7 - 12	113
13 - 19	25
20 - 49	25
50 - 199	13
More than 200	4

37. Wainwright, H. & Elliott, D. The Lucas Plan, Allison & Busby, London, 1982.