

A Soft Systems Methodology Based Analysis of the ATM System in Egypt

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Abstract— The study at hand reports a partial use of Soft Systems Methodology SSM in an analysis of the Automated Teller Machine (ATM) system in the Egyptian banking industry. It was suggested that the central stages of SSM – formulation of root definitions and conceptual models - can be usefully deployed as an analytic toolset in a broader investigation, without going through the preliminary immersive phase, and without necessarily offering the conceptual models as a base for an organizational change project.

The study developed root definitions and conceptual models, not from immersion but from imagining how different stakeholders might see the ATM system, and by working from general knowledge, a review of the literature, and rational analysis. Conceptual models developed in this way were then used pragmatically as the research proceeded: they could be modified, merged or discarded, or new ones might emerge. One of the main outcomes of the research was a consolidated combined conceptual model, which brought together different perspectives on the ATM system from different stakeholders, and brought to light some of the tensions and contradictions in the development of a national ATM network.

The research reported here suggests that the central stages of SSM can be used independently of the other stages in the investigation of sociotechnical change. Such use may be appropriate where the full use of SSM is for one reason or another not feasible, or where the researcher's interest is primarily analytic and not tied to particular organisational change projects or consultancy work.

Keywords--- Soft Systems Methodology; Conceptual Models; Root Definition; ATM Usage; Stakeholder analysis; Egypt.

I. INTRODUCTION

In recent years, the banking sector in Egypt has been experiencing some remarkable changes. ATM is one of the most innovative techniques that has been introduced into the banking system. The increasing numbers of bank customers preferring this technique do so not only because of its self-service delivery attribute, increased autonomy in executing transactions but also diversified financial services it offers [1]. Moreover, the spread of ATM technology is accompanied by changes in the banking industry, changes in customer

behavior, and changing relations between banks and their customers [2,3]. New patterns of activity emerge from the technologically-mediated interactions between the various parties involved. The research reported here was concerned with understanding ATMs as *socio-technical*, rather than simply as technical systems. In order to engage with the social aspects of such systems, it was necessary to consider the perspectives of a range of stakeholders. A stakeholder analysis was used to understand how various ATM stakeholders viewed and ranked different ATM characteristics in terms of actual and ideal provision.

As a theoretical framework for extending knowledge about the usage of ATM technology, socio-technical theory provides a suitable base from which to consider social and technical issues. Within the socio-technical perspective, different stakeholders can be identified, such as users and decision makers. A good way to explore different stakeholders' views is to formulate conceptual models of the problem at hand.

A suitable tool for doing this is Soft Systems Methodology (SSM), which is mainly used to tackle complex problems in organisations [3], and which puts its primary emphasis on problem formulation rather than problem solution [4,5,6,7,8,9]. Reference [10] stated that real world problems were typically ill-defined or messy and could not be answered satisfactorily by 'hard' systems approaches focusing on machines and structures, but rather required a 'soft' systems approach, which put central emphasis on human values and purposes [10,11, 12,13,14]. SSM theory uses conceptual models in a distinctive way to create learning and insight, which makes it an appealing vehicle for studies that are broad or not well defined [15] such as the one at hand. The next section explores the stages of SSM in a little more detail, after which the study will proceed to show how we made what we think was a useful partial use of SSM in our ATM research.

II. SOFT SYSTEMS METHODOLOGY

Soft Systems Methodology (SSM) is an approach to tackling complex and messy problems in organisations [9, 16, 7, 8, and 17]. Unlike most other systems methodologies, it puts its primary emphasis on problem formulation rather than problem solution.

Soft Systems Methodology has been proposed by Checkland as an approach to understanding organisational problems. His approach is close to sociotechnical systems theory, and provides a good set of concepts with which to explore complex sociotechnical problem situations. But whereas sociotechnical systems theory tends to be realist, Checkland's position is idealist in that he is not concerned with how real social or technical systems are, but how we can use them to interpret the world [13, 18].

Soft Systems Methodology in its classic formulation consists of the following seven stages:

1. Explore the problem situation within the real-world frame of thinking.
2. Express the problem situation.
3. Produce root definitions of relevant systems in the problem situation.
4. Construct one or more conceptual models.
5. Compare (with relevant organizational actors) the conceptual model(s) with the real world problem situation.
6. (Actors) determine desirable and feasible changes.
7. (Actors) make changes to improve the situation.

SSM practitioners have found it useful to identify, as they try to produce root definition out of expressions of the problem situation (as represented, for instance, in "rich pictures" [19], the following important elements, gathered together under the acronym 'CATWOE': Customers, Actors, Transformation, Weltanschauung (world view), Owner(s), and Environment. Customers are the beneficiaries (or victims) of the system. Actors are those who carry out the activities in the system. Transformation is the primary conversion of input to output that the system is designed to achieve. The transformation (T) is at the heart of any root definition. In the production of conceptual models in SSM, monitoring of the transformation is often represented in developed diagrams in the form of two control loops, one for the efficiency of the transformation, and the other for the effectiveness of the transformation (how well the system's real purposes are being met Weltanschauung refers to the set of values that makes the transformation meaningful or desirable. Owner(s) could be anyone who has the power to start up or shut down the system. Environment refers to external resources and rules that the system takes as given [9].

III. BACKGROUND TO THE ATM USAGE

Egypt is one of the major countries in the Middle East and has a great potential to expand in retail banking activities because, it has the highest population among the Arab countries, reaching over 90 million [20]. Moreover, the rapid development of IT networks and telecommunications in the last decade [21] enabled better electronic payment systems [22, 23]. The Egyptian banking sector is considered one of the largest in the region [24, 25].

Banks in Egypt can be classified as either public private sector banks. Lotayef's survey showed that, in Egypt, the public sector banks are considered the largest operating banks in Egypt; as their balance sheet size forms more than half of the total bank assets [26]. They have considerable market shares in retail and corporate banking services; due to their large branch networks and their relationship with companies that are owned by the state [27]. At the end of 2009, there were 39 banks operating in Egypt; three of which are large public banks: National Bank of Egypt (NBE), Banque Misr (BM), Banque du Caire (BDC) that dominate the Egyptian banking industry. These public sector banks are considered the largest operating banks in Egypt; as they control 40% of the sector's total assets and 50-55% of deposits. The National Bank of Egypt (NBE) is the largest commercial bank in Egypt and one of the top three largest in the Middle East. The bank was established in 1898, with 405 branches across the country. NBE currently has US\$ 21 billion (bn) in assets. Then, Banque Misr was established in 1920, it reported total assets of US\$ 29.7 bn followed by Banque Du Caire, which was established in 1952 [28].

During the last two decades, the financial sector has developed rapidly in terms of size, industry structure and the variety of consumer products and services [29]. This prompted most banking sectors to reduce pressure within the banking hall [27]. ATMs are the most acknowledged as compared to than any other e-channels [30]. Egypt has approximately 7,290 ATMs. They are banking terminals in public places, connected to data system and related equipment. ATMs play an important role in enhancing the firm's competitive position; as they were first introduced in an attempt to lower bank cost [31]. ATM industry has seen explosive growth in recent times. Also, banks have been positioning ATMs to increase their reach. As clients value their time, they would appreciate a reliable ATM that would help them save their time in conducting routine banking activities [32]. ATMs have been substantially increasing in number; where according to the Daily Star Egypt staff results, number of Visa ATMs in Egypt has increased by 15% to exceed 1700 ATMs, placing Egypt second in the region following Saudi Arabia [33]. Most of the banks in Egypt are connected to ATM networks and the Egyptian government is making several attempts to apply electronic banking. One of these attempts is to convert salaries and pensions into accounts at banks, which will in turn increase the ATM usage in Egypt [34].

The degree of customer satisfaction and customer loyalty to a specific bank has been a major concern for many Egyptian banks. Clients face queues when they go to banks, and may have to spend too much of their working time waiting for their turn. Often, banks in Egypt are not open in the afternoons or in vacations. Installing ATMs extends the bank's working hours by making cash and some other banking services available at all times; and customers may well be willing to pay reasonable fees for using ATMs in return for the

convenience. As a result, the use of ATMs has been growing substantially over the past decade in Egypt, as all over the world.

As ATMs involve several interests, ATM usage cannot be adequately understood, nor designed, in terms of technology alone. Technology always exists within a social context. In this sense, in order to understand ATM usage from the technical perspective, it is necessary to understand services ATMs offer, where they are located, what users find satisfactory and what they do not, and how are they changing people’s behaviour and the way that people use banks.

IV. UNDERSTANDING THE PROBLEM DOMAIN

The Egyptian banking industry should realise that there are a variety of social and technical challenges to achieving socio-economic development objectives. ATMs face the same social challenges; as customers seem to lack awareness regarding where the current ATMs are, what are the charges and fees related to using ATMs, and what services are delivered via ATMs [34, 35]. Other important social aspects could include things like the spread of ATMs, people’s attitudes, behaviours, and preferences. Technical challenges on the other hand, include infrastructure and poor resources with respect to the telecommunications infrastructure and lack of network [36]. Low telephone line density, is also a major technical problem, when for every 100 people, there are only seven telephone lines [33, 24].

The main research question derived from the various angles mentioned above combined with a socio-technical perspective was framed as “How do different perceptions of ATM systems affect their provision and use in the Egyptian context?”

In order to answer the above question and extend the understanding of the problem, a mixture of methods was chosen to collect and analyse both quantitative and qualitative data. A suitable method for addressing the research questions was to use part of the front end of SSM (conceptual modelling) as a vehicle for exploring multiple perspectives on ATMs.

Accordingly, SSM was used to define root definitions and develop a conceptual model, through which questions for interviews and questionnaires could then be assembled. Using SSM to create root definitions and develop conceptual models thus helped in designing the subsequent investigation.

Two primary perspectives from which to view ‘the ATM system’ as a transformation in the SSM sense straightforwardly present themselves: the bank’s and the customer’s perspectives. It also seemed worthwhile to differentiate the bank’s view (as a management position) from the view of the bank employees (as a staff position). Other perspectives could be relevant. For instance, the thief’s

perspective could have also been modelled since thieves may be interested in ATMs as a source of cash. But taking a socio-technical perspective on security, one can see that fraud is not constant in different cultural contexts, but depends on the level of education of thieves and the general attitude towards theft. In this situation, users in the Egyptian culture are not mainly concerned with security but rather with reliability and availability. Thieves in Egypt are usually poor and not well educated; and would be more likely to steal cash after withdrawal from the machine than to install a device in the machine to access card data.

Accordingly, three root definitions were developed to approach the ATM system from three different angles; customer perspective, bank perspective, and staff perspective.

A. Conceptual models for ATM Usage in Egypt

Customer Perspective

The initial understanding of the customer viewpoint was that customers regard ATMs as a way of accessing routine bank services from any place and at any time; customers no longer have to wait in queues to be served, or waste their time by physically going to the bank’s premises.

An initial customer root definition (RD) might be: ‘ATMs are banking terminals that make it easier for customers to manage their accounts, by providing a more convenient and satisfactory banking service’.

CATWOE for Customer

C: customers.

A: customers, staff.

T: could be one or more of these:

TABLE I. ATMS FOR CUSTOMERS

From	less satisfied customers	To	More satisfied customers
	Customers without cash		Customers with cash
	customers who do not know their balance		Customers who know their balance
	customers who want to deposit cash		customers able to deposit cash
	customers who want to transfer funds		Customers able to transfer funds

W: Customers want and will benefit from more flexible and accessible account services.

O: banks, managers.

E: ATM technology, literacy, banking system.

A customer conceptual model derived from this root definition is shown in Fig 1.

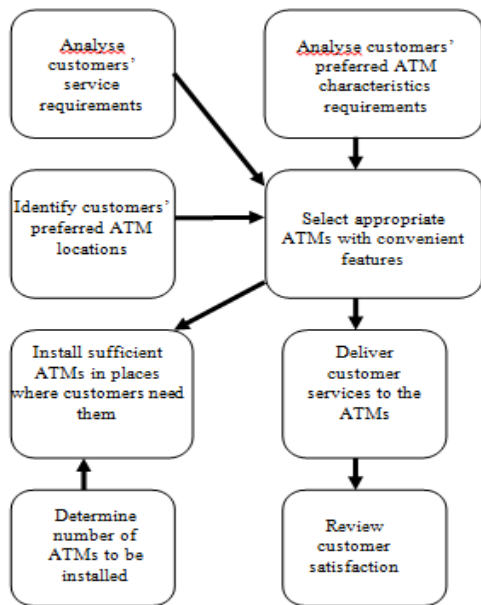


Figure 1: Conceptual Model for Customer

A bank conceptual model derived from this root definition is shown in Fig 2.

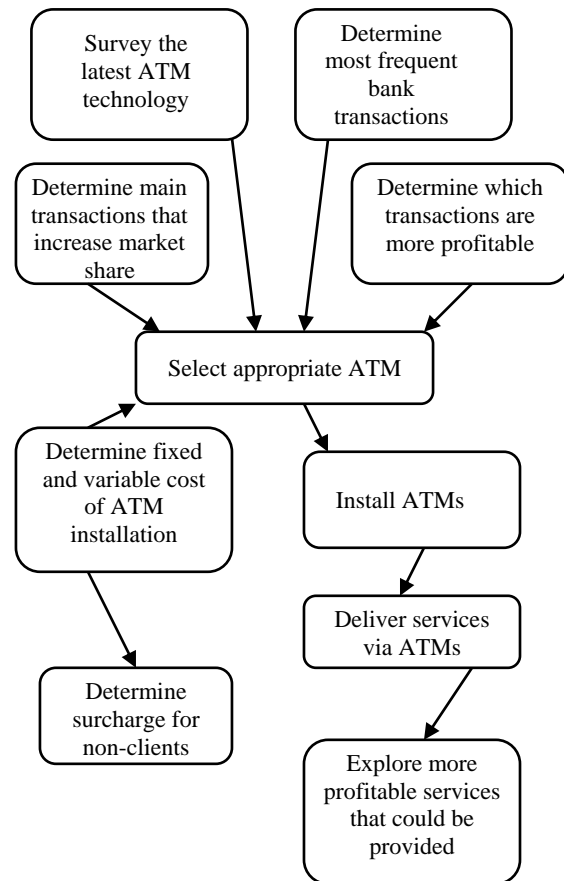


Figure 2: Conceptual Model for Banks

Bank Perspective

Banks are financial institutions that use ATMs in order to reach more customers and satisfy current customers by making bank services available out of bank working hours. This in turn will increase the number of transactions and the number of clients leading to an increase both in profits and market share.

An initial bank root definition might be: ‘ATMs are a profitable information technology banking service that increases banks’ market share and daily transactions’.

CATWOE for Bank

C: customers, shareholders, bank staff.

A: managers, staff, customers.

T: could be one or more of these:

TABLE II. ATMS FOR BANKS

From	banks with lower number of transactions	To	banks with higher number of transactions
	Banks with lower market share		Banks with higher market share
	banks with lower profits		banks with higher profits

W: Banks can increase the number of their transactions, their profits and market share by investing in customer-oriented technology.

O: Head Office, shareholders, government.

E: technology, infrastructure, location of ATMs, legal issues and policies, transaction volumes.

Staff Perspective

The introduction of ATMs brings changes the role of bank staff. Some tasks once discharged by staff over the counter are now routed through the machines. From a more positive point of view, ATMs can liberate staff from routine duties and enable to engage in tasks requiring a wider range of skills, such as making decisions regarding granting loans.

An initial staff root definition might be: ‘ATMs are a way of freeing bank employees from routine tasks and enabling them offer services that need decision making and judgment’.

CATWOE for Staff

C: staff, customers.

A: staff, managers, customers.

T: could be one or more of these

TABLE III. ATMS FOR STAFF

From	Staff busy doing routine tasks	To	Staff doing more responsible tasks that need human judgment
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W: Staff should have interesting work; organizations will work better if staff is given more responsibility.
O: managers, shareholders, professional bodies.
E: technical support; staff knowledge, skills and training; customer attitudes; management attitude.

A staff conceptual model derived from this root definition is shown in Fig 3.

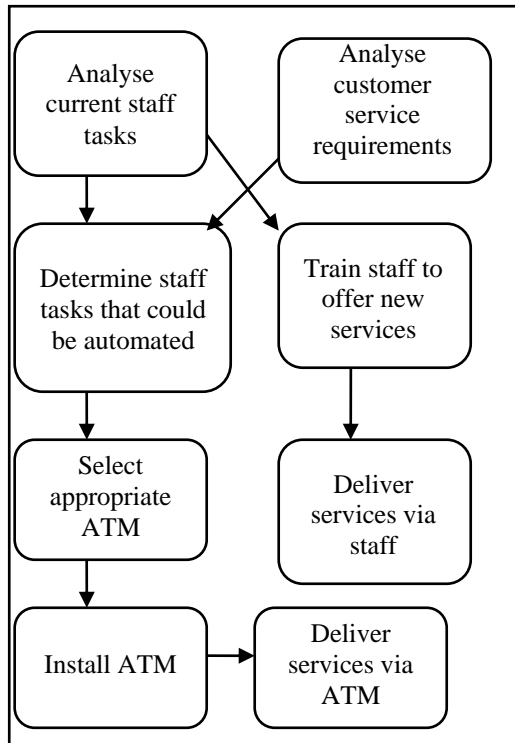


Figure 3: Conceptual Model for Staff

A consolidated conceptual model

One can imagine a situation in which discussions about the development and implementation of ATM systems included all three of the perspectives modelled above. Therefore, the three perspectives modeled separately, are now brought together to produce a consolidated root definition and conceptual model which includes aspects of the views and priorities of the different stakeholders.

At this stage, the perspectives represent the researchers’ understandings of the different viewpoints, based on general knowledge and literature review. It might be argued against that the different viewpoints here might well not be reconcilable. However, researchers believe that this is a matter to discover in practical cases. This is inline with the generally positive position framed in SSM that in the broad swathe of problem situations considered ‘pluralist’, different viewpoints are negotiable.

An initial consolidated root definition for ATM location and usage might thus be as follows: ATMs are banking

terminals that make it easier for customers to manage their accounts, by providing a more convenient and satisfactory banking service. For the banks, they are a profitable information technology banking service that increases banks’ market share and daily transactions. They are also a way of freeing bank employees from routine tasks and enabling them to offer services that need decision making and judgment’.

CATWOE elements for this definition would be an amalgamation of those listed previously for the three separate root definitions. Figure 4 represents, in outline, a consolidated conceptual model drawn from this definition. Controls for efficiency and effectiveness have been included.

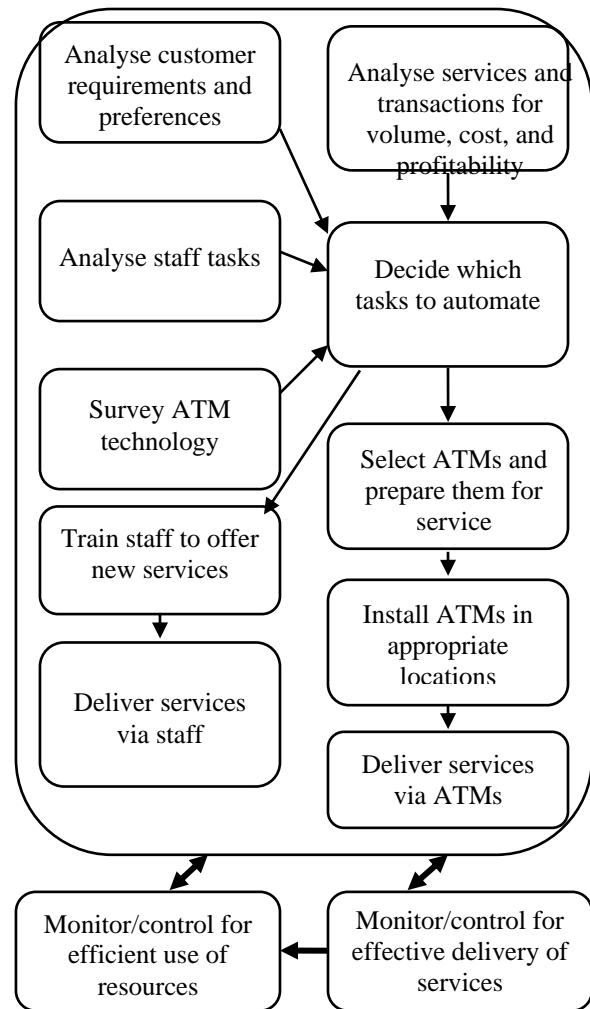


Figure 4: Consolidated Conceptual Model for ATM Usage in Egypt

V. THE USE OF SSM IN THE PROBLEM CONTEXT

The development of a conceptual model in SSM served the purpose of broadening and deepening understanding of the ATM system in Egypt. The use of the SSM framework facilitated consideration of multiple perspectives that might be

inconsistent with one another, rather than discussing the model with any of the stakeholders nor using it as basis for change.

From initial understanding of the problem areas it seemed worthwhile to draw three different conceptual models representing the ATM system from customer, staff, and bank perspectives. The three perspectives were subsequently combined to produce a consolidated conceptual model, which makes one perspective (the bank perspective) centred, to reflect the actual balance of the situation. The consolidated conceptual model was the basis upon which both the questionnaire and the interview were designed.

Although it was not in the original plan, integration of findings including derivation of two new versions of the conceptual model, one showing more closely the structure of the real situation, and the other giving a broader view that could serve as the basis for recommendations on improving practice.

A stakeholder originally considered minor, namely supplier, emerged as more significant during interviews with bank staff, and led to the conduct of an additional interview. The supplier interview tied up several loose ends and revealed a broader picture of the ATM system that confirmed the gap between the two main ATM stakeholders.

Data analysis of the interviews clearly affected the conceptual model leading to a revised conceptual model in order to reflect the real current ATM situation, where inside banks, there is little serious consideration of either the Staff or the Customer perspective and suppliers seem to be a very important stakeholder of ATMs as they represent the link between the ATM users and decision makers.

The revised model removes the stream of staff retraining for new services, introduces the contractual relationship with the supplier, and moves the bank’s relationship with the customer from a pre-installation to a post-installation position.

After a full ATM stakeholder analysis, an extended proposed model was designed keeping bank decision makers as the main actor, but taking account of other stakeholders and allowing more interaction between bank branch and the other stakeholders in order to reduce the gap between ATM interested parties. Having reached this point after a long process of data collection and analysis and remodelling, there are some suggestions on improving decision making about ATM usage and provision.

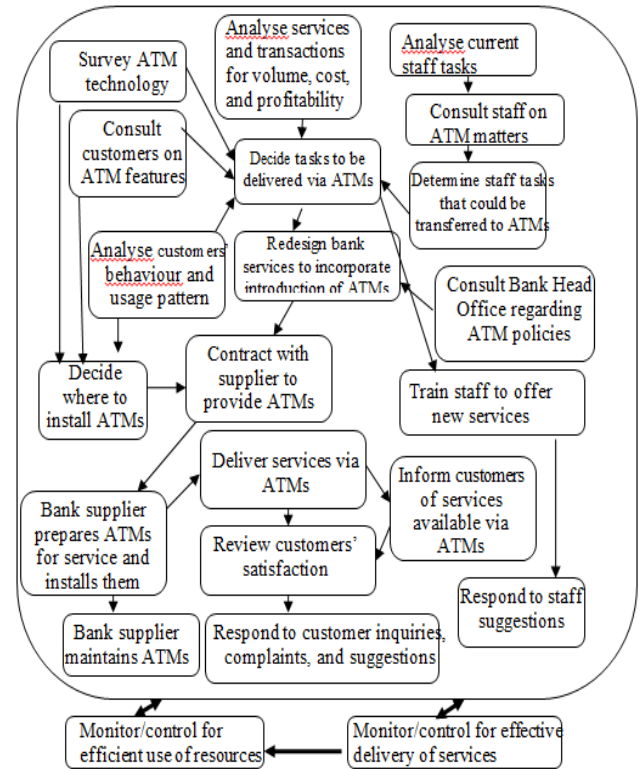


Figure 5: Revised Conceptual Model for the desirable ATM situation in Egypt

VI. USING SSM PARTIALLY AND ANALYTICALLY

In the reported study, the application of SSM was novel in the sense that the problem situation addressed stretches beyond any organisational boundary. Although this does not have much effect on the central stages of the methodology (root definition and conceptual model), it does affect the stages either side. ‘Immersion’ in a problem situation which is not organisationally bounded, but which is in effect national, or even global, is not feasible, so that SSM’s hope that the analyst can apprehend the problem from the inside, as it were, cannot be met. The post-modelling stages (comparison to implementation) suffer from a similar lack of closure, in that there is no single organisation to report back to, or to take action.

SSM was thus used in a manner different from that intended by its inventors. The normal ‘project’ or consultative focus of SSM, in which the methodology is used to surface and structure an organisational problem as a prelude to moving towards action to tackle it, is replaced by a more diffuse investigative focus, in which the immersion and reporting phases are displaced away from a specific case organisation and towards a more general research community. This partial, analytical use of SSM has sought to separate the

problem modeling from the organisational action; it has sought to derive root definitions and conceptual models without immersion, and with the purpose of deepening analysis rather than facilitating action.

Although conceptual models formed this way may less surely distil the essence of an organisation, they can be more flexible in analytical use. In the ATM study, it made sense to merge, modify and consolidate conceptual models (CMs), once derived, rather than keeping them tied to their respective root definition (RDs). These modified CMs have lost some purity in not being straight elaborations of original RDs, but on the other hand carry forward the attractive diversity of reference of rich pictures. The final CM coming out of this kind of use of SSM is not intended as an alternative model against which the reality of an organisation can be compared, but rather as an analytical outcome of the research, in the form of a model of, not an organisation, but the topic under study (in this case, “the ATM system”).

Whether such a use of SSM is legitimate or strays too far from its core purposes is a matter for debate, but there may be analytical and methodological benefits to be obtained using SSM’s central modelling method in a research investigation of the kind reported here. It may also be thought appropriate that, as information systems themselves become increasingly trans-organisational and globalised, SSM, as means of studying them, can be generalised in the same direction.

The use made of Soft Systems Methodology in this research did not include discussing the model (as such) with any of the stakeholders, and did not subsequently use the model directly as a basis for a change programme. SSM was instead used to get a multi-perspectival view of the research area and to derive the design of the questionnaire and interview. So the thinking behind the conceptual models influenced the design of the main data collection instruments in the research study, which were a questionnaire (to gather customer opinion), and interviews (to gather information and views from selected decision makers and staff in banks and other organisations). The results from those investigations were then used to review and revise the model, after which the revised model was used as a basis for recommendations.

In this way, after a full ATM stakeholder analysis, and combination of ATM stakeholders’ perspectives into a consolidated model, a point was reached at which it was possible to suggest and recommend changes to current practices in the Egyptian industry, in an attempt to reduce the gap between ATM interested parties, and accordingly enable a more effective ATM system in Egypt.

VII. CONCLUSION

The research focus of this paper has been mainly methodological. ATM usage in the Egyptian context is used as a case to provide examples of how SSM can be usefully

deployed as an analytic tool in a broader investigation. Normal SSM assumes prolonged ‘immersion’ in an organisation, which enables the analyst to understand it from the inside, and to use this understanding to develop ‘root definitions’ that capture the essence of the problem situation and elaborate them into conceptual models. In the study, by contrast, conceptual models were developed from imagining how different stakeholders might see the ATM system, working from general knowledge, the literature, and rational analysis, rather than proceeding from immersion and internal knowledge.

In this approach, root definitions are built directly from CATWOE elements, without immersion. Conceptual models are derived from root definitions, but treated them as approximate and adjustable, so were ready to merge, modify, discard or reinvent them where it seemed beneficial to the analysis, especially if data coming in from other parts of the investigation pointed in that direction.

In this ATM study, the normal ‘project’ or consultative focus of SSM, in which the methodology is used to surface and structure an organisational problem as a prelude to moving towards action to tackle it, was replaced by a more diffuse investigative focus, in which the immersion and reporting phases were displaced away from a specific case organisation and towards more general business and research communities.

An analyst taking this kind of approach starts with findings in the research literature as the point of departure, and reports back into that literature. The movement towards action becomes a more diffuse and protracted process beyond the analyst’s original inquiry. Whether such a use of SSM is legitimate or strays too far from its core purposes is a matter for debate, but there may be analytical and methodological benefits to be obtained using SSM’s central modelling method in a research investigation of the kind reported here. It may also be thought appropriate that, as information systems themselves become increasingly trans-organisational and globalised, SSM, as means of studying them, can be generalised in the same direction.

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