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Editorial

IT and Socio-Economic Development?

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With this first SACJ special issue on IT and development, it may be meaningful, for a moment, to reflect on the very notion of development and its relationship (or not) with information technology. What do we mean by this concept of development? Can information technology play a role in it? And, what should this role be (if at all)? These are very fundamental questions that need to be addressed. I am of the opinion that if we were to neglect these questions developing societies may fall prey to a whole set of reductionist notions and mechanisms that may eventually have more 'costs' than 'benefits'. The questions raised above are complex and could surely not be resolved within the limits of an editorial, or even a single paper for that matter. However, I do believe it necessary to make some comments in order to highlight the issues and maybe propose outlines of possible answers.

The traditional (and commonly accepted) idea of development has a very Enlightenment twist to it. One may articulate it in the following manner. The fundamental idea of this type of development is the notion of progress that is one of the cornerstone values and assumptions of the Modernity movement [6]. In this paradigm the institutions of modern society must create the intellectual and physical artifacts for humankind to conquer Nature and in so doing control its own destiny. Development, according to the modernity view, is progress in degrees and levels of control. The modern, developed, person must be delivered from a contingent and haphazard existence into progressive modes of freedom, through progressive control. They, and society at large, must be the masters of their own destinies. Science and technology must provide the tools (material or conceptual artifacts) for control. Progress, and development as such, is defined by the variety of tools and tool application skills that an individual or a society has at its disposal to shape its own future. In this view then, information technology (and the associated skills to apply it) is seen as tools of development, as a way of increasing the variety to tools at the disposal of the less developed, tool impoverished society, in need of development. Development is for the modern developer synonymous with tool or technology consumption.

Information technology with its characteristics of relative low cost (due to large scale integration and economies of scale), flexibility (through software engineering methods) and ease of use (through sophisticated graphical user interfaces) is clearly an ideal host for the delivery of a wide variety of tools and technologies to a underdeveloped, tool impoverished, society. With the aid of IT a whole host of technological capabilities could be made available, for rapid socio-economic development, at a fraction of the cost of traditional means of delivery. Without too much thought one can provide many examples. For example, through computer assisted training, reading and writing skills can be taught reducing the demand for expensive human teachers. An expert system could be used for clinical diagnosis in the rural hospital reducing the need for expensive human medical experts. From this brief exposition it is clear why there are many who believe that IT, of all technologies, has an enormous potential to leapfrog the underdeveloped societies into the twenty first century.

What is the problem with this paradigm of development? I will briefly discuss three issues that come to mind. Firstly, technologically based progress will lead to the proliferation of instrumental reason [11–13]. Instrumental action is concerned with effect and is success-oriented. Its basis of validity is efficiency and effectiveness which are morally justified aims in modern society. In an instrumental society all things become objects to be manipulated in pursuit of effect. Instrumentality is at the heart of technology (technique) as seen in the definition of technology by Jacques Elull[4]:

Technique is the totality of methods rationally arrived at and having absolute efficiency (for a given stage of development) in every field of human activity.

Instrumental action through technology is clearly by definition reductionist since the pursuit of efficiency and effectiveness are always specific, not general. The forces shaping the modern technological society assume that if technique is applied to every problem or domain then eventually the whole of society will become efficient. This is an illusion. It is well known from systems theory that the optimization of the parts does not necessarily lead to the optimization of the whole. What is efficient for the local (individual) is not necessarily efficient for the whole (society). The effects of sub optimization, such as environmental damage, pollution, poverty, crime, suicide, etc., that is so prevalent in modern society, bear testimony to this illusion.

Also, with technique it has become possible to achieve

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For those who want to use technology for development this must surely be a reductionistic and instrumental approach to technology. The context of creation is substituted with the context of application. This is the advantage of technique. Even if the context is not understood, the technique will still produce something. Technique is designed to create ends if applied. It does not require the applicator to understand 'why', it only requires him or her to know 'how'. This is a very powerful incentive in a society where results have become the norm. Thus, the developer must move with the utmost prudence and not merely mindlessly populate a developing community with technology, and the subsequent proliferation of instrumental reason. Especially when it is evident from modern societies of excess technology what ecological damage (and I am using this term in a very general sense) technology could bring in the long run.

Some may argue that the proliferation of instrumental reason (embodied in technology) may not be desirable but it is inevitable. However, they would argue, there is the benefit that the technology does increase the choices available to the individual (or society) and as such the freedom of the individual or society. Hence the benefit of increased freedom outweighs the cost of instrumentality. This may be true, but the whole notion of increased freedom is based on a very doubtful syllogism which may be stated as follows:

- Technology increases choices
- Increased choices leads to more freedom
- Therefore increased technology implies more freedom

It is true that access to technology can increase the choices available to me. For example there are many more places that I could choose to visit if I have a car as opposed to being on foot. Thus the access to a car increases my freedom of movement. But, this is only true in that one dimension of analysis. In another dimension, to have the access to a car, I may have to forfeit my leisure time to work so that I can pay for the purchase and maintenance of the car and in so doing reduce my choice (and freedom) in how I want to spend my time. Similarly, a mobile phone provides me freedom to make a call where and when I choose but, it may also reduce my choices in another dimension as people may expect me to be contactable whenever or wherever I may be. Thus, the syllogism is only true in a one dimensional space of analysis.

Technology always has a price attached to it. This is why modern, technology saturated, societies are often the most existentially 'repressive' type of societies. More often than not one hears the modern plea to "get out" of the rat race, to get "away" for a break, to "escape" to some holiday destination. What is it that we must "get out" from, get "away" from or "escape" from? Heidegger correctly argued that technology will always 'enframe' [7]. Unfortunately the cost of technology is not exposed with the same vigour as the benefits. Mostly this price is ignored by a reductionistic and instrumental approach to technology. For those who want to use (information) technology for development this must surely be a major concern. What will the cost of the technology be for the society in which it will be introduced? Is the cost known or knowable? Do the recipient society agree with this cost and are they willing to pay it? Who will benefit and who will pay? These are ethical and moral issues that are mostly ignored by the Enlightenment paradigm of development.

Finally, there is the issue of technology transfer. I will agree that I may be overstating the case but, it seems to me that many technology based development projects are less about development and more about mere technology 'dumping'. Technology dumping does not lead to development it leads, in fact, to an increase in ignorance as argued by Hobart [9]. The law of requisite variety states that a system can only control another if it has, for every state or condition that the system to be controlled can produce, a counter state or condition [3]. Thus, if one dumps technology on individuals or societies without providing the individual or society with the necessary knowledge, skills and infra-structure to deal with all the conditions that the technology can produce (such as breakdowns, error messages, menu options, buttons, input data, configurations, etc.), then the technology will control them and not the reverse. In such a situation the individual or societies will be placed in a situation of increased ignorance. In this manner developing societies, through reductionistic development, are increasingly been pushed into a world of increased ignorance and higher levels of dependence[2]. It seems, without sounding too dramatic, that 'primitive' societies are pushed by development through mass education systems into factories and innercity slums, into economic systems where they have the disadvantage and, in general, into a world they are wholly unprepared for. In such conditions they merely become objects of control since they do not have the required variety. This form of development alienates them from their traditional world that they know and understand. I am not suggesting that this is the conscious objective of many of those in the development field. I am merely suggesting that good intentions on a local level can, in fact, lead to big injustices in a more global sense. Also, it is clear that technology can not be haphazardly transferred. If it is transferred it must happen as a coherent whole and not as a part. This is what Amin refers to as delinking [1].

If one accepts that technology must be transferred in a holistic manner then the next issue comes into play, namely, the fact that technology is not value free. If we transfer a technology, particularly in this manner, then we also transfer a whole set of values with it (this is very clear in some globally integrated societies where there is a homogeneous "coke" and "hollywood" culture). These imported values may displace some of the local values. Are the recipient culture prepared to pay the price of this cultural imperialism? Are they aware of it? Or, is it only discovered after it is lost?

It is clear from the above discussion that the Enlightenment paradigm of development may create a whole lot of very difficult moral and ethical dilemmas for those involved. It also seems clear that a technology based de-
Development intervention may have more 'costs' than the 'benefit' attached to it. It also seems to me that there is a need for a more holistic paradigm of development that is multi-dimensional in its efforts to develop [8]. A paradigm that is more than a mere converting of 'primitive' societies into modern societies. We in the field of information systems must not make the mistake to reductionistically 'drop' technology on individuals and societies. Due to the nature of our technology the urge may be big. We must, however, move with much caution and in a very transparent manner if we are to be seen as legitimate agents of development.

In this volume you will find a set of papers that, hopefully, is a move towards this type of holistic development? Decide for yourself.

References

A Pluralistic Approach to Systems Development*

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Abstract

It is believed that revolutionary developments in information technology may allow developing countries to leapfrog obstacles to development if they can successfully apply the new technology. However, many organizations in third world nations experience great hopes but many disappointments from their introduction of computer-based information systems. Project failures are very often caused by a complex interlinking of technical, social and political factors. This paper describes an in-depth study, undertaken over eighteen months, into the development of an information system for a procurement office in the Philippines. Based on the findings from the investigation, the author suggests a pluralistic approach under which systems enquiry[6] and data analysis[18] complement each other to enable information systems development for developing countries to become more effective.

Keywords: Pluralistic Approach, Systems Development, Soft Systems Methodology, Strategic Data Planning Methodologies, Developing Countries

Computing Review Categories: H.1.1, H.2.1, K.6.1

1 Introduction

This paper describes an in-depth study, undertaken over eighteen months, into the development of an information system for a U.K. owned procurement office in the Philippines. The research effort, using Checkland's[3] term, is primarily concerned with the application of systems enquiry and data analysis (Intellectual Framework, F) through an action research (Methodology, M) in the area of information systems development (Application Area, A) as shown in Figure 1 [6].

Carrying out the above process allows possibilities of amendments to F, M and improvements to A. The learning and reflection from changes are organized as a contribution to knowledge, which is, in this case, how systems enquiry and data analysis complement each other to enable the development of information systems become more effective in developing countries.

Systems enquiry and data analysis

The intellectual framework (F) for this research is developed from two disciplines:

1. systems enquiry through the use of Soft Systems Methodology[2, 28, 6]; and
2. data analysis through the use of Strategic Data Planning Methodologies[16, 18].

The former makes use of systems models to generate an appreciation and expression of different perspectives of the people involved in the organization about the information requirements to support decision making. Such information requirements, once identified, can be translated into a specification that is appropriate for the logical design to proceed. The latter tries to 'engineer' information systems development. By applying a series of systematic analyses, analysts aim to understand the nature and structure of the organization data. The end product is a 'Strategic Data Model', upon which an information system is built. Both methodologies are believed to be complementary to each other when practical works of information systems development are involved. And it is such a belief in methodology complementarity that started the research programme.

Systems development in developing countries

Information systems development (ISD) in developing countries is problematic and worthy of investigation (Application Area, A). Factors such as the current state of knowledge, availability, suitable equipment and infrastructure, lack of financial resources, shortages of technically competent personnel and constraints imposed by the social and political context make the environment of ISD in developing countries more complicated than those of the developed world. Developing countries, while striving to adopt and apply information technology to enhance socio-economic development, many have experienced great hopes but many disappointments, technical
success but organizational failure from the implementation of computer-based information systems. A pluralistic approach (such as the one developed from systems enquiry and data analysis) which aims to tackle historical, technical, organizational, social and political issues may achieve greater effectiveness in implementing information technology in developing countries.

An action research

The methodological vehicle (Methodology, M) of studying the applicability of a pluralistic approach to information systems development has been an action research. Action research is a self-constructing closed system whereby the activity of creating a methodology is followed by using the methodology. Using the methodology generates learning and from this learning, it is possible to modify the methodology itself. Action research has to be judged by the even application of two criteria which relate, respectively, to the 'action' and to the 'research'. For the case studied, the former is an information system architecture delivered to the concerned organization. The latter is a wider framework which encompasses systems enquiry and data analysis for information systems development.

2 A case in the Philippines

The applied framework is not another new methodology. Its elements are constructed and organized in such a way so as to facilitate practical information systems development from a broader perspective. The nine stages of the intervention framework, as described pictorially by Figure 2, follows two interacting streams of analysis: 1) a logic-based stream of analysis, and 2) a stream of culture analysis adopted from [6] and [18]. The two streams inform each other, and together, they lead to the implementation of information technology projects.

Stream of culture analysis

On the left-hand side of Figure 2 is the stream of culture analysis. This is done by treating information systems development as a social and political process. It is believed an understanding of myths, meanings, values, norms, people's interests and the exercise of power are of crucial importance to the successful implementation of new systems and should be exercised throughout the cycle of project development.

The cultural dimension of systems development has been addressed from the very beginning of the project with the appointment of a Hong Kong Chinese (the author) as a member of a U.K. study team. The author is involved not only because she is interested in the application of Soft Systems Methodology and Strategic Data Planning Methodologies in information systems development, but also because Hong Kong has a cultural context which is relatively close to that of the Philippines [12, 11]. A Hong Kong Chinese is expected to be able to understand better the attitude and feeling of her oriental colleagues towards changes brought about by the introduction of new systems.

The problem situation

The concerned organization - Alphaoice is a procurement office of a U.K. timber trading company in the Philippines. Its management is of a typical small enterprise style where the owner (executive director) performs most of the functions with the assistance of a small number of close employees. Operation data are recorded on paper and processed manually by responsible personnel into information when it is required. Such an information system worked very well in the 1970's when Alphaoice was at its initial stage. However, as the scope and volume of business increase, the task of information management is beyond the capability of a human being's memory. Quite often, information such as shipment details, supplies availability, trade tariff and government regulations are missed, misunderstood and misinterpreted. Such human errors cause severe damage to the company. By the late 1980's, it had become clear that the existing manual systems were inadequate and the management board decided to introduce a computer-based information system to the office for more efficient and effective operation. The final decision, which was made in January 1989, marked the entry point of an investigation into the problem situation.
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Alphaoffice as a social and political system

The cultural context of Alphaoffice is characterized by conservatism. Most members there have been working together for at least 10 years. They regard themselves (and are also treated informally) as key figures of the organization because of their seniority. Paternalism and stability are regarded by the staff members as the norms of good management. The staff, in general, resist the spread of automation. They feel that having so much information available on the computer, when it was previously accessible only to themselves, would reduce their importance in the organization. Computerization would probably bring overcontrol from the head office.

The situation is complicated by a fear of job losses resulting from the Philippine government's gradual ban on timber export in the late 1980's due to increased environment protection. Rumors have been circulated in Alphaoffice that the holding company has planned to shift most of its purchasing activities from the Philippines to Indonesia where there is still no restriction on timber trading and automation is a management action to reduce manpower of the office. Such a social and political atmosphere makes the introduction of a technologically based project very difficult. As pointed out by [27], 'the development of computer-based technologies hinges on many human judgments and actions, often influenced by political interests, structural constraints, and participants' definition of their situations'.

The messy and problematic situation of Alphaoffice at the start of the project is compiled and summarized on a 'rich picture'[3] as shown on Figure 3. This rich picture has been proved to be a useful tool for assessing the organization context of the undertaken systems development project. It defines concerned people's different interpretations of the introduction of the new technology. It enables members of the office to visualize and discusses their roles in relation to the computerization. Worries of individuals, differences of opinions and potential conflicts are expressed and resolved by pointing at the picture and trying to get them changed. It also helps the executive director (who commissioned the research study) to sort out his own thoughts and explain the fundamental issues to the project team.

Cultural change

The enquiry process of Soft Systems Methodology, however, has provided a learning system which guides the staff members of Alphaoffice to look at the problem situation from different perspectives. Information technology can be seen as an opportunity rather than a threat. The chance of optimum utilization of computing technology by the Philippine procurement office is extremely high because most staff members there are literate, trainable and conversant in English, the language of computer programming. The prospect of financial gain from administrative effectiveness and the notion of high status attached to high technology are also attractive to everyone in general.

Such a fresh look at the problem situation also alters all members of Alphaoffice that the present stability may not last forever. The technology is changing, the competition is changing, the business environment is changing and sooner or later, Alphaoffice has to undergo necessary changes for survival. The time to plan any change is when there is both the finance and time to do it, which is, in Alphaoffice's case: now. Every member of the staff eventually regards change as an inevitable phenomenon.

Discernible changes in perceptions at an individual level have led to cultural change at an organization level. The social atmosphere at Alphaoffice has gradually moved from conservatism to relatively liberal. It is under such a new and liberal cultural context that technologically based innovations are perceived as a meaningful and feasible solution to the problem of deficient information provision.

Stream of logic-based analysis

The implementation of changes, argued by [2], 'must meet two criteria simultaneously - cultural feasibility and systemic desirability'. Cultural feasibility asks whether a particular change is feasible for the characteristics of the situation and the shared experience of the people in it. This is done by examining the cultural, social and political dimensions of systems development as discussed before. Systemic desirability means that any change to be implemented must not violate, contradict or run counter to the logic that has gone into the systems analysis. The stream of logic-driven analysis of the applied framework is shown on the right-hand side of Figure 2. It comprises the phases of systems modelling, comparison and data analysis.

Systems modelling

Systems modelling makes use of a particular kind of systems model, 'human activity system' [2], to represent a particular view of the problem situation. Each human activity system is defined by a 'root definition' [2]. A root definition is constructed by consciously considering the six elements of mnemonic CATWOE as explained in Figure 4.

These six elements, in plain English, explain 'who is doing what for whom, and to whom are they answerable, what assumptions are being made, and in what environment is it happening?' [1]

| C Customer | Who would be victims and/or beneficiaries? Whom are of the purposeful activity? |
| A Actor | Who would do the activity? Who |
| T Transformation | What is the purposeful activity ex-pressed as: Input - T - Output? |
| W Weltanschauung | What world view makes this definition meaningful? |
| O Owner | Who could stop this activity? Answerable |
| E Environmental | What constraints does this system take as given |

Figure 4. Six essential elements of a root definition

Each root definition is then expanded into conceptual models [2] which exhibit the 'minimum and necessary activities that the system must do in order to be the system...
so defined' [2]. Conceptual models consist of verbs describing the activities which have to be there in the system named in the root definition. Since a problem situation can be interpreted in many different ways, there are always different sets of root definitions and conceptual models. Staff members of Alphaoffice were invited to participate in a brainstorming session during which every one was asked to talk about the problem situation and provide a statement of the purpose which he/she perceived for the running of the organization. After several debates and discussions, the project team was able to come up with a consensus root definition and ‘primary tasks model’ [28], which are illustrated by Figures 5 and 6 respectively.

The consensus primary task model, once constructed, ‘forms a cogent basis for an information model upon which the information system design process itself can be related’ [28]. The conceptual information requirement of Alphaoffice is derived by analyzing each activity in the consensus primary task model and examining what information categories should be available to enable someone to take that action [6]. This activity model is thus converted into an information flow model.

Comparison
The information flow deemed necessary to support Alphaoffice’s operation is then ‘brought in the real world’ [2] and compared with the existing data provision. A revised version of ‘Maltese Cross’ [28] is used as a device for comparison. The Alphaoffice Maltese Cross (Figure 7) consists of two segments:

1. a north-western segment, which represents the necessary information inputs to support Alphaoffice’s operation;
2. a south-eastern segment, which exhibits the data generated from Alphaoffice’s current information processing procedures.

By relating the south-eastern segment to the north-western segment, the project team is able to compare what is pro-

A Timber Acquisition system
An Alphaoffice owned system for the acquisition of timber through the placement of orders with selected suppliers so that timber supplies can be maintained at standard quality and quantity, within the constraints of company policy, timber availability and government intervention.

CATWOE
CUSTOMER: Alphaoffice’s holding company, timber suppliers
ACTOR: Staff members of Alphaoffice
TRANSFORMATION: Timber owned by suppliers ⇒ Timber owned by Alphaoffice’s holding company
WELTAN: Maintaining timber supplies at standard quality & quantity is essential for the company’s operation
OWNER: Alphaoffice’s holding company
ENVIRONMENT: Company’s policy on expenditure & inventory, timber availability, government’s intervention in timber trading

Figure 5. Consensus Root Definition of Alphaoffice
The south-eastern sector of Alphaoffice's Maltese Cross is very different from the north-western sector, and according to [28], 'where there are differences, there are possible reasons for a problem to exist.'

The operation of Alphaoffice, as understood from the analysis, requires a massive amount of information inputs, such as owner's expectation, resource availability, procurement policies, product knowledge, supplier position, the environmental constraints, etc. All this information, amazingly, does exist in Alphaoffice, not through a formal provision channel, but through the executive director's experience, knowledge of the environmental situation and utilization of external data. We can thus say that the strategic information exists in Alphaoffice, but not a proper system to provide it.

The provision of operation data, in contrast to that of strategic information, is very comprehensive. Alphaoffice has a regular set of reporting procedures that produce over 20 varieties of internal reports such as balance sheet, profit & loss statement, inflow/outflow cash, statutory overheads, wages reconciliation, inventory breakdown, timber on water, timber on quay, etc. on a daily, weekly or monthly bases. Technically, Alphaoffice is very strong in performance reporting - there is a record of nearly every activity. The internal reports are all sent to the executive director for review and distribution to concerned executives for necessary actions. However, being overloaded with an abundance of 'irrelevant' information (irrelevant to the executive director's management level), the executive director only looks briefly at the balance sheet and monthly profit & loss statement and defers scrutiny of the remaining reports.

Alphaoffice, like many other small enterprises, is organized around the business genius of a few men. Nevertheless, there will be a time when the genius must be passed on, and the executive director, who is responsible for nearly every managerial decision and planning is by no means immortal. Alphaoffice must generate a mechanism whereby it can continue its effectiveness & efficiency in spite of personnel changes and transferring information from human brains to systems. This mechanism, logically, is a formal set of information processing procedures.

**Entity Analysis**

What seems to be logically desirable and culturally feasible for Alphaoffice is to derive a technologically based system that will yield the information flow required by the structured set of activities relevant to its operation. However, the information categories, as shown on the north-western sector of Figure 7, are not precise enough to guide systems design. As stated in [6], 'the detailed linking of SSM to detailed design of computerized data manipulation system has not yet been accomplished'. What has to be done is to identify 'the data structures that could embody the information categories which characterize these information flows' [6]. Entity analysis adopted from [16] is a step in the applied framework to move from information categories to data structures.

An entity is something 'about which we store data' [16]. Based on the algorithms provided by Strategic Data Planning Methodologies and the project team members' human adjustments, entities which express the information categories required by Alphaoffice's operation are identified and their relationships are established. An entity chart showing the organization's underlying data structure is constructed. These entities are furthered clustered into eight supergroups according to the frequency of the associated paths used between them. The entity supergroup is a collection of entities which should be implemented in one subject data base. As an illustration, Figure 8 shows some of the data structures that could embody the information categories required by Alphaoffice.

The entity chart represents 'a reconciliation' [19] of real world 'data manipulation' and conceptual 'meaning attribution', the two halves of an information system [6]. At this point, 'actions' [2] are taken to implement the appropriate information system.

**Systems implementation**

What the pluralistic approach (see Figure 2) provided for the Alphaoffice project was an argument for changes which because it is convincingly obvious, actually helped significant changes to take places. Actions to implement the computer-based information system are generated logically from the proper application of the first three phases of the wider framework. There is an interconnection amongst 'finding out', 'systems modelling', 'comparison' and 'action' phases.

'Finding out' phase provides categorizations whereby people in the problem situation learn to see how the culture is affecting them. Once the subject of culture has been addressed, considerations of culturally feasible change can be made explicit. Formation of root definition, building up of conceptual models, derivation of information categories and data structure of 'systems modelling' phase are a series of logical analysis. Systems models are logical constructs used to generate ideas for changes which are systematically desirable. Change is a direct consequence of comparing
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Figure 7. Maltese Cross analysis of Alphaoice

Figure 8. Part of the Entity Chart of Alphaoice

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realities (what is) with systems models (what should be). At this stage of the project, emphasis is expected to shift from conceptual analysis to practical actions.

Once desirable, feasible and practical actions are identified, the cycle of the pluralistic approach is completed by taking these actions to implement the new information systems. However, each informatics project will yield many other elements for further consideration. The end point of the Alphaoffice systems development may only be marked (arbitrarily) by the complete transfer of computing technology to the organization. This arbitrary ending at the mean time starts a review and evaluation of the undertaken research effort which are explained in the following sections.

3 Learning – Implication for Developing Countries

'Practice is the best source of theory' and the essence of action research is 'Learning from its use' [6]. The eighteen months' systems development project in Alphaoffice has thus been assessed carefully in order to generate some feedback to 'recreate' the applied intellectual framework. The lesson distilled from the research is that systems enquiry and data analysis complement each other in the context of information systems development. Information systems development in developing countries, as pointed out in [27] concerns 'an interplay of human, organization and technical factors which cannot be easily separated' This complex interlinking may best be addressed by adopting a pluralistic approach which brings together the competence, effectiveness and strength of different methodologies. Thus a wider framework is believed to be useful for implementing informatics projects in developing countries. The usefulness emerges from three paradigms: (1) a paradigm of pragmatism, (2) a grafting paradigm, and (3) a learning paradigm.

Towards a paradigm of pragmatism

'All roads lead to Rome'. Systems enquiry and data analysis can be compared to two different means of transport to the same destination. With data analysis, doing systems development is like travelling in a tram. The analyst feels comfortable that the journey is on the right track and is certain that she can produce a defensible 'entity chart' upon which systems design is based. With systems analysis, doing systems development is like travelling in a bus. The analyst is not expected to follow a prescribed set of procedures and can go anywhere with no constraint. As illustrated in the case of Alphaoffice, culture analysis, root definitions and conceptual models are all means to break down a systems developer's mental tramway which restricts her scope of analysis. If methodologies of information systems development are analogous to different roads to Rome, then data analysis is a straightforward and comfortable route, while systems enquiry is more uncertain, yet it not only guides you to Rome, but also makes you think why you have chosen to go to Rome. The choice is up to information systems developers.

For developing countries, the choice of information systems development methodology will probably be based on practical application rather than ideological identification. A quick and dirty way to attain technological capability is 'to start with the end and end with the beginning' (National Technology Transformation Policy of Indonesia). That means the focus is placed on how a technological innovation works rather than what it is. For practical reasons, third world nations may consider all development methodologies as one, whether soft or hard, systemic or systematic, subjective or objective, interpretive or functionalistic, positivist or phenomenalistic, the only difference being whether it is applicable or not. A multi-disciplinary approach based on a pragmatic paradigm can be taken by thinking that there is an invisible equipment bag containing independent and co-existing methodologies. With a creative flair and open-mind, an analyst can draw an appropriate constitutive trajectory to the problem situation and choose an appropriate methodology accordingly [8]. The crucial decision is how to select an appropriate approach by the determination of requirements, rather than the selection of a methodology itself. It is important to be situation-oriented, rather than methodology-oriented.

Towards a grafting paradigm

Information systems are believed to be not only technical systems which have behavioral and social consequences, but also 'social systems which rely to an increasing extent on information technology for their functions' [9]. Project failures very often result from adopting a narrow, uniquely technical approach which ignores the realities of the organization which an information system is designed to serve [22].

Third world nations may benefit from not being first to implement information technology and learn from the earlier mistakes made by more advanced countries. A methodology, to be effective, should address issues of technical skills as well as 'behavioral awareness, concern for human values, at a higher level, organization and political skill' [27]. Systems enquiry and data analysis, as discussed before, are equally effective for information systems development. The former is comprehensive in the scope of analysis while the latter is reliable in systems design. This finding highlights the desirability of combining the two methodologies so that analysts can kill various birds (multi-dimensions of systems development) with one stone (one application).

One possible way to combine both methodologies is by grafting [20]. Systems enquiry could be used at the early stage of systems development. It allows human, organization, social and political problems to be found at the front-end, where they are more easily addressed, rather than at the end of the development, where they are disastrous. Once a consensus view of the situation is reached, rigorous techniques from data analysis can be applied to construct a corporate data model as a blueprint for subsequent phases of design and programming. The marriage of systems enquiry and data analysis is based on a philosophy that the
best features of different methodologies can be tailored and re-arranged in a purpose-fashioned framework.

Towards a learning paradigm
Many organizations in developing countries use outside consultants to develop and implement technological innovations. This makes technological transfers quite depend upon transient 'ex-pats' who are sent to show them how to use the technology [22]. These expats are temporary staff of an organization and may not have much commitment to their host countries. It is not surprising that much expatriate-initiated work does not 'stick' in developing countries. The systems are very often unmaintainable once the expats have returned home [22]. Information systems development is an on-going process. Technological transfer must be a 'transfer of knowledge rather than physical devices' [22]. Technology knowledge should thus include some guiding principles with which users can learn their own ways to continuous systems development.

Systems enquiry, because of its interpretive nature, can embody reflection in actions performed via other more structured methods. With a broader setting, systems enquiry and data analysis can be applied simultaneously. Data analysis is used to plan and develop a system for an organization. Systems enquiry is employed to make sense of the experience. It helps the project team members become more alert to what they are looking for, to assess what to do, to evaluate the consequences of surrounding environments and to unfold choices of activities and the ways they are handled. Users can start mentally from what has been done with data analysis and map it on to systems enquiry. The latter provides a ready made structure for reflection to be extracted and organized.

This meta epistemology takes the stance of a learning paradigm. It allows users in developing countries to learn their own ways to develop and implement information technology. The usage will continue to be extended through time in response to social and economic changes. It lasts as long as the situation requires, with or without the assistance from developed countries.

4 Conclusion
The result of the research implies that complementarity occurs when different methodologies from different disciplines are employed in information systems development. Systems enquiry and data analysis are viewed not as separate, self-contained methodologies to information systems development, but as approaches which can work together, and by doing so produce more assistance for information systems designers. An informatics project in third world nations, because it consists of technological, social and political problems, is too complex to be tackled by a single methodology. Multi-disciplinary teamwork, drawing together the competence, effectiveness and strength of different epistemology is believed to have advantages over uni-disciplinary endeavor. Complementarities of various approaches should be utilized by developing countries to enhance the effectiveness of their technological transfer programmes.

References
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