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Guest Contribution

A Pragmatic Approach to Development Information to Provide Service on a Wide Scale

Stephen S Mncube, PhD
Divisional Manager: Development Information Services, Centre for Policy and Information, Development Bank of Southern Africa

1 Introduction

The rapid technological growth in our time has produced an explosion of information. This, in turn, has spawned information systems based on the use of computers and automated systems. These mechanised devices with their seemingly infinite capacity to store and retrieve knowledge on command have myriad applications. But the use of computer and automated information devices pose serious problems to individuals, groups and societies on an international scale in disseminating the available information. This is even more true in information flow between regions with high information capabilities than in those that have little or none. The information flow between these regions has been varied and frequently haphazard whenever it has existed.

In this context the philosophy for development information speaks to interdependence and humanitarian concern in information flow to various regions of the earth. Information must be perceived as a universal entity. The initial failure of one region and the ability of another to acquire information should not dictate a permanent global demarcation into 'developed and less developed' categories.

2 Objectives

The objective of development information is for it to function as an interlinking mechanism between a complex industry of information resources and the users of information. In addition, development information should be a catalytic agent that aims at providing objective clarification in information needs between regions with high information capabilities and those with little.

3 Mission

The mission is to strive for a move in all regional, national and international agencies and organisations concerned with information to give full co-operation and assistance in setting criteria and standards, formulating policy, and assessing the information needs of a given region of the world. Development information is capable of realistically assessing information related to socio-economic development in the light of the unique requirements of world regions in need of information and information technology.

4 The Dynamics of Information Processing

The proliferation of information technology production has resulted in the growth and development of an ever expanding information packaging industry. This area has become so large in size and scope that it is necessary to discuss some of the important developments that are taking place in the area.

The newest phrases now being used in information packaging range from electronic archives, compact discs (CDs), computer tapes, microfiche, teletexts, video discs, magnetic tapes and interactive imaging systems (optical systems) to word processing and the use of laser technology. Developing countries will not escape this new wave of information packaging. It soon will be bombarded with vendors of these products, to a point where some adaptation will be inevitable.

Assuring the quality of technical processes and the accuracy of packaging information is becoming an increasingly difficult task. Rapid increases in the volume of information, the sophistication of information uses, and the complexity of material flows and processes are characteristic of most modern technical environments. As complexity increases, the risk of introducing significant errors into material processes increases. The very complexity of such systems makes the detection of error itself a complex task. With increasing frequency, public and private organisations are seeking help from corporations with experience in quality control and information validation to ensure that technical process and information packaging meet performance and accuracy standards. The problems association with quality control and validation can be minimised by following these guidelines:

- Establishing ways of aiding in planning, organisation and control of software purchasing and development

through
  - creating a directory of software suppliers
  - evaluating the quality of software supplied
  - keeping abreast of the state-of-the-art in software production
- Providing leadership in the innovative use of software materials and the utilisation of extensive market research on software before making a major purchase
- Establishing cost-efficient ways of packaging and designing your own software by learning how to design and evaluate software for your own use

Preparation for these new technologies for packaging information ought to be made in institutions of higher learning. Perhaps it would be timely to introduce some of these concepts in technical institutes in order that future demands imposed by the new information technology may be met.

The successful growth of developing countries information technology will ultimately depend upon the commitment of substantial resources, especially financial resources. The successful application of this information technology will require more than the mere receiving and storing of it. In addition to the tasks of acquiring and organising informational materials, channels must be established to analyse incoming information. Too much of the information technology that does get transferred out of the industrialised nations is never utilised because it is unsuited for the consumption of users in developing countries. A great deal more effort must be made to analyse, package and disseminate materials on existing and forthcoming information in all vital areas of work and study so that these technologies will be accessible to the developing countries' information-user communities.

5 The Need to Establish a Consortium

Information technology specialists need to establish a consortium of regional, national and international information networks and associations. The consortium could be an open structure inviting any institutions, organisations and agencies existing for the purpose of forming a network or documentation clearinghouse and of providing information technology not as an end-product but as a means for human change.

The element common to all membership is an interest in and dedication to providing useful and accurate information that can bring about humanistic change. Equally important is a commitment to the development of relevant information resources to meet the needs of regions with low information capacity.

The philosophical outlook of the consortium would therefore be to crystalise and emphasise broad knowledge, deep understanding, and imaginative efforts, including a dedication to great ideas in providing accurate solutions to the information needs of various regions on an international scale.

6 The Organisation of Services for Members

The ideas constituting a conceptual framework for a service-oriented consortium are as multitudinous as the Kalahari sands but in this instance the consortium could function to:

- support creative change within its membership
- facilitate and support new educational enterprises and programs addressed to meet the needs of previously disenfranchised persons
- develop and implement co-operative programs and projects among it members
- provide a meeting ground for a diversity of persons, institutions, and agencies with common values and purposes
- provide a forum for the exchange of ideas among its member associates
- encourage methods of solving social problems
- influence public policy to be consistent with its mission and purpose.

7 An Appraisal of Internet

While casual observers have the leisure to observe unobtrusively the growth and development in Internet to be a world-wide phenomenon in information sharing, they do so at no cost. On the other hand, information specialists have to judge and weigh the work of an ongoing Internet program and estimate its usefulness as a network or networks to their daily operations. Information specialists are, therefore, still more sceptical about the scope and magnitude of the Internet. They alone are facing challenges of adding another performance task of being evaluation researchers of Internet in order to provide objective clarification of incorporating Internet as an integral component of their information system. This can be a tedious undertaking because it entails not only knowing how to navigate the Internet network but also cognisance of the following key factors:

- how appropriate the Internet is to your information environments
- to what extent the databanks provided through Internet are relevant to the mission and objective of your environment
- what the relationship is between costs and benefits of having Internet at your disposal

All these factors need to be addressed to determine the effectiveness of Internet in any given information environment, be it in a government setting or in other work environments.

8 Training in Information Networks

A seminar for the network should be designed to launch the co-operative exchange of knowledge and experience with

information accessibility and utility of the participant's respective information holdings. To succeed in this effort, the organisers will marshal appropriate interdisciplinary experts and technical resources from within the regions involved. The content of the seminar will consist of information related to formalising and establishing a plan for information networking. It is important that information ministries achieve a high level of knowledge and sensitivity to the information needs of their individual country, region, and ultimately the world, in order to assess, prescribe, design, manage and evaluate the most appropriate uses of information technology for enhancing the advancement of their world countries.

Although the organisers will determine who will be invited to participate in this seminar, special effort will be made to ensure that representatives come from a diversity of backgrounds, and have some knowledge or experience relating to information systems. Additionally, consideration will be given to the level of information technology which is currently utilised by the representative's country.

The content of the seminar will be tailored to meet the specific needs and issues designated by the participants through a pre-seminar survey and needs assessment, which will be administered by the organisers.

9 Summary

The above aims at presenting some possible scenario and does not pretend to be exhaustive. The issues, however vital to development information, are given cursory treatment here. It remains important for the luminaries in this area to expand on some of the thoughts contained above.

Bibliography

1. A D Burnett. *Technology for information in development: proceedings of the sixth conference of the International and Comparative Librarianship Group of the Library Association.* International and Comparative Librarianship Group of the Library Association, Brighton Polytechnic, Falmer, Sussex, August 21–23 1987.
2. M Cook. Guidelines on curriculum development in information technology for librarians, documentalists, and archivists. Paris Unesco, 1986.
3. O Fairfax, J Durham, and W W. Audio-visual materials: development of a national cataloguing and information service: Report of a joint feasability study for the british library and the council for educational technology. Distributed by Councils and Education Press, 1976.
4. M Fransman. *1948 – The market and beyond: Cooperation and competition in information technology development in the Japanese system.* Cambridge University Press, New York, 1990.
5. N K Hanna. The information technology revolution and economic development. World Bank Discussion Papers, World Bank Washington DC., 1991.
6. N Heaton and L W MacDonald. *Human factors in information technology product design and development.* Ellis Horwood, 1991.
7. T Koizumi and G E Lasker, eds. *Advances in education and human development: new trends in learning and teaching evolution of human systems and institutions, individual freedom and sociopolitical controls in the high technology environment of the advanced information society.* International Institute for Advanced Studies, Baden-Baden, West Germany, 1990.
8. V Sethi. The development of measures to assess the extent to which an information technology application provides competitive advantage. Ann Arbor: MI, University Microfilm International, University of Pittsburgh, 1988.

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The Homological Transfer Research Method Revisited

C Koornhof
Department of Accounting, University of Pretoria, Pretoria 0002

Abstract

The Homological transfer method is a very efficient research method which is based on similarities between manufacturing, financial, educational, informational and other productive processes. The existence of these similarities imply that corresponding disciplines should have similar models – i.e. laws, techniques. Therefore existing models in one discipline should be capable of being transferred to another discipline. This article suggests three improvements to the transfer research method proposed by Mende [15] and identifies the benefits that may be obtained by using the method.
Keywords: *Homologous transfers, Homological transfer research method, Research method, Systems Theory, Taxonomy.*
Computing Review Categories: *H.I.I. General Systems Theory*

1 Introduction

The use of homologies in research was originally suggested by Von Bertalanffy [4]. He showed that there are similarities between models in different disciplines and attached the names "homology" or "isomorphy" to such similarities. The existence of these similarities implies that related disciplines should contain similar models. Therefore an existing model in a donor discipline should be capable of being transferred to a recipient discipline where the model is not yet being used.

The literature provides many examples of successful transfers between donor disciplines and recipient disciplines using the idea of "homology". The following are some examples of taxonomic models that were transferred between Management Information Systems (MIS) and related disciplines.

1. Nolan and Wetherbe [16] developed a comprehensive taxonomy for classifying MIS research. The model consisted of two dimensions – the MIS transformation process, and the interaction between MIS and its organisational environment. The latter dimension of their model was derived from a model developed by Kast and Rosenzweig [10]. A successful homological transfer was thus made between Organisation Theory and MIS.
2. Du Plessis and Lay [7] subsequently adapted the Nolan and Wetherby model to develop a framework for classifying computer auditing research. This successful homologous transfer introduced a robust framework for the classification of research into a discipline lacking such a framework. It enabled the authors to identify several areas of Computer Auditing that required further research. They also indicated that further homologous transfers may be possible between MIS and Auditing.
3. Banville and Landry [2] derived a MIS taxonomy from the work of Whitley [19]. Their taxonomy classified intellectual fields in terms of three variables – functional dependence, strategic dependence and strategic uncertainty. Banville and Landry thus effected a successful homologous transfer between the Sociology of Science and MIS.
4. Ives, Hamilton and Davis [9] developed a comprehensive framework to categorise all previous MIS research, using concepts of System Theory. Their model consisted of three information system environments, three information systems processes, and the information sub-system itself, all surrounded by an organisation environment and an external environment. Their research resulted in a successful homologous transfer between Systems Theory and MIS.

Additional South African examples of research using homologous transfers were published by Mende [14] and O'Donovan [17].

2 The Homological Transfer Research Method

Previous authors made knowledge transfers intuitively, without being aware of the potential or pitfalls of their approach as formal research procedures were lacking.

In the June 1990 edition of this journal, Mende [15] developed Van Bertalanffy's idea of "homology" into a formal research method. He recognised that there are many similarities between productive processes such as manufacturing, investment, learning and systems development and that many homological transfers should therefore be possible between disciplines such as Economics, Finance, Education, Information Systems, etc. These disciplines have, inter alia, models in the form of (1) laws to describe cause – effect relationships between elements of productive processes, and (2) techniques that prescribe how people should manipulate productive processes.

The Mende research method consisted of five steps as illustrated in Figure 1

In step 1 the researcher recognises the similarity between two productive processes to determine whether a homologous transfer is possible. The existence of simi-

larities between productive processes implies that the corresponding disciplines could contain similar models. For example, an information system is similar to an education system, and the subject Information Systems contains an I-P-O model which is similar to the process model of an instructional system [15].

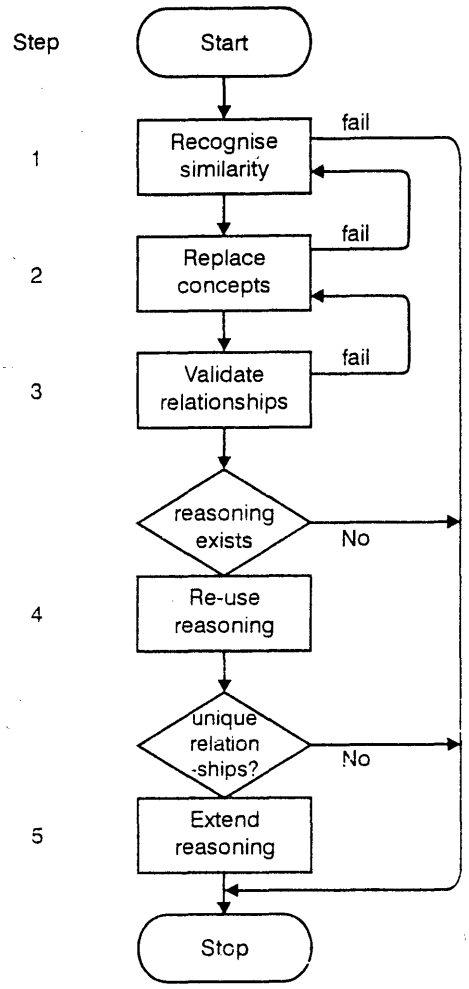

Figure 1. Homological transfer procedures

In step 2 the researcher takes a particular model from the donor discipline and replaces its concepts with the concepts of the recipient discipline. Although homologous models express similar relationships, the concepts of the two disciplines will usually differ. For example, in the I-P-O model of Information systems, concepts such as data input, data process and information output would have to be replaced by educational concepts such as resource input, instructional process and knowledge output [15].

In step 3 the researcher validates the relationships of the transferred model in the recipient discipline. For example, an information system has a set of programs which interact with a dynamic environment, whereas an instructional system has a set of lessons which interact with a dynamic environment [15].

In step 4 the researcher re-uses any reasoning that may be available in the donor discipline to derive new arguments in the recipient discipline. For example, the rationale behind the analysis-design-programming approach adopted in information systems development can also be used in instructional design [15].

In step 5 the researcher extends the reasoning by incorporating relationships which are unique to the recipient discipline. If the extended model reflects more features than the original model, it describes the process more accurately and is therefore more useful. For example, in instructional design the possible impact of environmental changes requires the inclusion of a monitoring phase before the analysis phase [15].

3 Improvements to the Homological Transfer Research Method

The author [11, 12] used the Mende research method to identify and transfer an appropriate taxonomy from MIS to Accounting. Previous taxonomies and frameworks in Accounting addressed only specific problem areas, and none covered the whole domain of the discipline of Accounting. As domain coverage taxonomies are well researched in MIS, the author studied several robust and well tested models in MIS [1, 2, 9, 16], and identified one of them [16] as suitable for transfer to Accounting.

Before effecting the transfer the author found three areas where Mende's method could be improved. As the method was adjusted before it was applied, the research [11] also served to validate the improved method. These three areas of improvement are now discussed briefly.

Updating the donor model

The first improvement is necessary in order to counteract two historical factors which were not considered by Mende. First, the model that is selected in step 1 may have been published many years ago, and the process which it describes may have changed. To illustrate, the Nolan- Wetherbe taxonomy [16] was published in 1980 when information technology was used in a purely support role, providing information almost exclusively to the host organisation [11]. Since the publication of the Nolan-Wetherbe model, information technology has progressed from a support role to a means of gaining competitive advantage by serving the host organisation business environment [18, 20].

Second, the published model may contain inadequacies that may have been revealed through subsequent research, application or validation. To illustrate, the Nolan-Wetherbe model identified only the "environment of the organisation" while Kast and Rosenzweig [10] had since then refined the environment into three different types; the host organisation, the task environment and the general environment.

Therefore, an additional step 1C "update donor model" is required between steps 1 and 2, as illustrated in Figure 2.

Validating the extended reasoning

The second improvement is necessary in order to reduce three risks that were not considered by Mende.

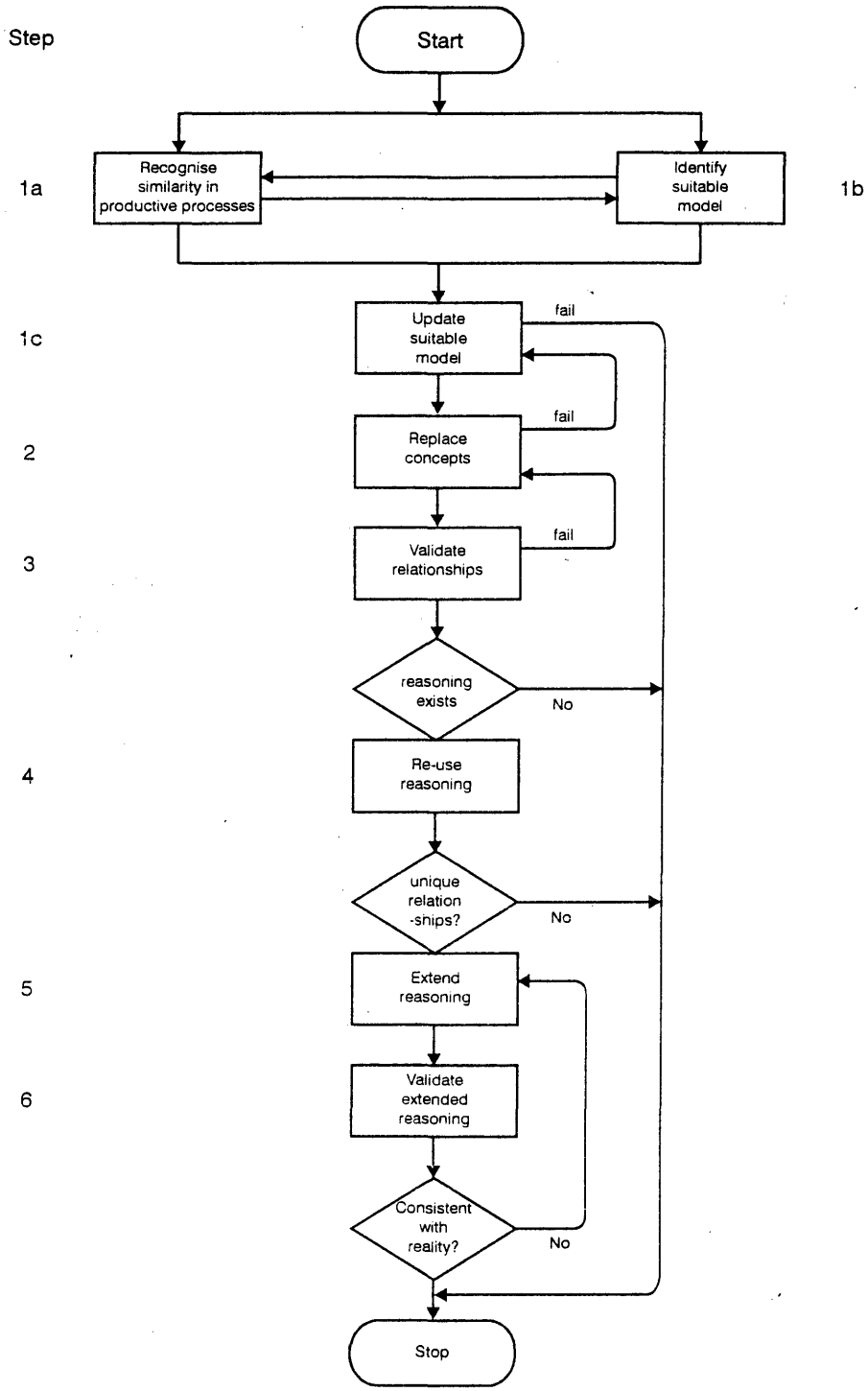

Figure 2. Improved homological transfer procedures

First, the model that was selected in step 1 may have been based on methodological premises which are incompatible with those used in extending the model. To illustrate, the model may be developed using a functionalist research method such as systems theory whereas the reasoning may be extended using an interpretive research method such as phenomenology [6].

Second, the model may be based on a paradigm [13] which conflicts with the paradigm used in the extension. For example, in a homologous transfer between branches of a discipline such as Accounting, the original model may be developed using the decision usefulness paradigm but may be extended using the information economics paradigm [3].

Third, the model may be based on specific assumptions and limitations which may conflict with those used in the extension. To illustrate, the model may be developed on the assumption that markets are efficient in the semistrong form, but may be extended on the assumption that the markets are not always efficient due to functional fixation [8].

The extended reasoning in step 5 may extend beyond the scope of the underlying premises and may result in a model that is inconsistent with reality. Therefore an additional "validate extended reasoning" (step 6) should be inserted after step 5 as shown in Figure 2. Step 6 should be connected to step 5 with feedback loop because inconsistencies discovered during validation should be eliminated by modifying the extended reasoning.

Structuring the research approach

The third improvement is necessary because step 1 in the Mende model can be approached in two different ways. One way is to start by identifying a donor process which is similar to the process being researched and then to survey a selected donor discipline to find a model suitable for transfer to the recipient discipline. The other approach is to start by surveying the literature of various productive processes to find a model suitable for transfer. Once a model is identified, the researcher would assess whether similarities exist between the two processes and whether a homologous transfer is therefore appropriate.

Step 1 should therefore be divided into two sub-steps:

Step 1a the recognition of similarities between productive processes and

Step 1b the identification of a suitable donor model.

These sub-steps can be carried out in two alternative sequences: a-b or b-a. For example, the author structured her research on taxonomies using the a-b alternative. Consequently a related donor discipline was selected (MIS), the existence of similarities in productive processes in the two disciplines was motivated and a literature survey was conducted within MIS to find a suitable model. Various models in MIS were considered, and assessed, prior to the selection of the Nolan-Wetherbe model [11]. The risk attached to this approach (a-b) is that although the donor discipline and the recipient discipline will have related processes, the most appropriate model may not be transferred as the search is restricted to one, or at best, a few selected disciplines. If the b-a alternative is selected, the emphasis of the research changes to finding a suitable model within a large variety of productive processes and disciplines. The assessment of the relationship between the donor and recipient disciplines would be deferred until a suitable model is found. The risk attached to the second approach (b-a) is that although a suitable model is found, it may be from a discipline so unlike the discipline under research, that a homologous transfer may be neither feasible nor valid.

The alternative chosen in step 1 affects the whole approach to the research, the literature surveyed, the choice of model, the structure of the final report and even the conclusion.

The three proposed improvements to the Mende research method are incorporated in Figure 2.

4 Benefits of the improved Homological transfer research method

A number of benefits can be derived from the use of the improved homological transfer research method. First, the method saves unnecessary research effort because it eliminates the need to reinvent models that are already available in other disciplines. For example, the taxonomy of Nolan-Wetherbe in MIS was transferred and amended for use in Computer Auditing instead of inventing a new model [7].

Second, the method will encourage the updating of donor models prior to transfer. Thus the donor discipline will reap the benefits of improvements to the model. For example, the Nolan and Wetherbe model was updated and improved prior to its transfer Accounting [11]. Any extended reasoning included in the model in the recipient discipline also has the potential to feed back improvements to the original model in the donor discipline. For example, if the analysis-design- programming approach is extended in the instructional system by introducing a specification phase, the additional phase may also be useful in informational systems [12].

Third, the method may stimulate the search for similar models in different disciplines. The identification of similarities between disciplines will, in turn, facilitate and encourage further homologous transfers. For example, the fact that the Nolan-Wetherbe model in MIS was successfully transferred to both Accounting and Computer Auditing suggests that further homologous transfers could be made between these three information based disciplines.

Fourth, research into underresearched areas of the recipient discipline may be stimulated as ideas for research and hypotheses are gleaned from related disciplines. For example, the extensive and successful domain coverage taxonomies in MIS have served as precedents for other disciplines such as Accounting and Computer Auditing [11, 7].

Finally, the Homological transfer research method encourages interdisciplinary research by emphasising parallel ideas between related disciplines. Inter-disciplinary research in turn encourages researchers to rediscover the importance of adopting a holistic approach to research. A

holistic approach ensures that potential new areas for research are not overlooked. Boulding [5] for example, warns against a too monistic view of science:

> "The more science breaks into sub-groups, the less communication is possible among disciplines, so the greater the chance of the total growth of knowledge being retarded by the loss of relevant communications."

5 Summary

Homologous transfer is a very powerful research tool. It can be used by researchers to avoid "reinventing the wheel", by transferring models – discoveries, rules and methods – from donor disciplines to disciplines where such models are lacking. Mende proposed a formal structure for homologous transfers, called the Homological transfer research method. Although this method has identified the necessary procedures for transferring knowledge between disciplines, a number of shortcomings became apparent when it was used to transfer a taxonomy in MIS to Accounting [11]. This article proposes three new improvements – the updating of the donor model, the validation of extended reasoning and the planned structuring of the research approach. The article also demonstrates that several benefits may be derived from the use of the new improved research method, such as the establishment of logically consistent models in disciplines that lack them, the unification of knowledge by establishing similar models in different disciplines, and the promotion of interdisciplinary research.

References

1. E Auramëki, M Leppanen, and V Savolainen. 'Universal framework for information activities'. *Data Base*, pp. 11–20, (Fall/Winter 1987/1988).
2. C Banville and M Landry. 'Can the field of MIS be disciplined?'. *Communications of the ACM*, **32**(1):48–60, (1989).
3. A Belkaoui. *Accounting Theory*. Harcourt Brace Javanovich Inc., New York, first edition, 1981.
4. L V Bertalanffy. 'The history and status of general systems theory'. In J D Couger and R W Knapp, eds., *Systems Analysis Techniques*. John Wiley, New York, (1974).
5. K E Boulding. 'General systems theory – the skeleton of science'. *General Systems Year Book 1*, **2**(1):197–208, (1956).
6. G Burrel and G Morgan. *Sociological Paradigms and organisational analysis*. Heinemann, London, 1979.
7. R du Plessis and P M Q Lay. 'A framework for computer auditing research'. *De Ratione*, **3**(1):8–14, (Winter 1989).
8. E S Hendriksen and M F van Breda. *Accounting Theory*. Irwin, Boston, fifth edition, 1992.
9. B Ives, S Hamilton, and G B Davis. 'A framework for research in computer-based management information systems'. *Management Science*, **26**(9):910–934, (1980).
10. F E Kast and J E Rosenzweig. *Organisation and Management – A Systems Approach*. McGraw-Hill Book Company, second edition, 1974.
11. C Koornhof. Towards a taxonomy of accounting. Mcom dissertation, University of the Witwatersrand, Johannesburg, 1992.
12. C Koornhof. 'Towards a taxonomy of accounting'. *Meditari*, pp. 143–164, (1993).
13. T S Kuhn. *The Structure of Scientific Revolution*. University of Chicago Press, Chicago, second edition, 1970.
14. J Mende. 'Educational implications of similarities between productive processes'. *South African Journal of Higher Education*, **4**(2):30–37, (1990).
15. J Mende. 'Homological transfer – an information systems research method'. *South African Computer Journal*, **2**:6–11, (1990).
16. R L Nolan and J C Wetherbe. 'Towards a comprehensive framework for MIS research'. *MIS Quarterly*, **4**(3):1–9, (1980).
17. B C O'Donovan. 'Using information systems methodology to design an instructional system'. *South African Computer Journal*, **7**:126–130, (1992).
18. M M Parker, H E Trainor, and R J Benson. *Information strategy and Economics*. Prentice Hall Inc, New Jersey, 1989.
19. R Whitley. *The intellectual and social organization of the Sciences*. Clarendon Press, Oxford, 1984.
20. C Wiseman. *Strategic Information system*. Irwin Publishers, Illinois, 1988.

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Manuscripts for *review* should be prepared according to the following guidelines.

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  - author's initials and surname;
  - author's affiliation and address;
  - an abstract of less than 200 words;
  - an appropriate keyword list;
  - a list of relevant Computing Review Categories.
- Tables and figures should be numbered and titled.
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Manuscripts accepted for publication should comply with the above guidelines (except for the spacing requirements), and may be provided in one of the following formats (listed in order of preference):

1. As (a) LaTeX file(s), either on a diskette, or via e-mail/ftp – a LaTeX style file is available from the production editor;
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References

1. E Ashcroft and Z Manna. 'The translation of 'goto' programs to 'while' programs'. In *Proceedings of IFIP Congress 71*, pp. 250–255, Amsterdam, (1972). North-Holland.
2. C Bohm and G Jacopini. 'Flow diagrams, turing machines and languages with only two formation rules'. *Communications of the ACM*, **9**:366–371, (1966).
3. S Ginsburg. *Mathematical theory of context free languages*. McGraw Hill, New York, 1966.

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