On Systems Science:
An Interview with Professor Frank Stowell

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IJITSA is pleased to include in this issue an interview with Professor Frank Stowell. Frank Stowell is Professor of Systems and Information Systems in the School of Computing at the University of Portsmouth in the United Kingdom. He was formerly the Director of Campus at De Montfort University Milton Keynes and moved to back to Portsmouth in 2003 to undertake a leading role in Information Systems research. Professor Stowell is also visiting Professor of Systems and Information Systems to University of Northumbria. His PhD is in Organisational Change and his research centers on participative design of Information Systems. He is the coordinator of the Information Systems research group and the Centre for Innovation and Inclusion through Information Systems (CIIIS).

Professor Stowell is co-chair of a number of funded research projects, notably the Systems Practice for Managing Complexity project, (http://www.spmc.org.uk/) which was awarded an EPSRC grant for 3 years. This work currently continues as a self sustaining network for managers from industry and academia. He is also past President of the UK Academy of Information Systems and the UK Systems Society, and the current Vice President of that society. He is the current chair of the Council of Information Systems Professors (CISP). He has also held academic managerial responsibilities as Head of the Department of Computing at two universities in the United Kingdom. Professor Stowell also has experience defining and developing IT supported management information systems. Prior to his academic career, he was a consultant in a central government sponsored Management Systems Development Group.

IJITSA: What do the terms “systems approach,” “systems thinking,” or “systems paradigm” mean to you? When did you first begin to believe these concepts were particularly important to understanding information systems?

Professor Stowell: My first encounter with systems thinking was many years ago when I was working within in a central government consultancy group. I had the opportunity to listen to Peter Checkland at a seminar given to Senior Civil Servants. I wasn’t one of those at that time, but his seminar was so popular that it was repeated and I managed to get a seat. What he had to say made sense to me and answered many of the questions that had arisen in the years I had spent as a consultant. I was so impressed with what I heard that soon after I resigned my post and went to Lancaster University, where Peter lectured, to read for a Masters degree. I have never regretted my decision although looking back it was a very risky thing to do but my wife supported me throughout. I was also lucky enough to have Peter as my PhD supervisor.
Interestingly, my youngest daughter completed her Master’s Degree at Lancaster in 2006 and is now researching for her PhD there, too – so I guess Peter has a lot to answer for!

Systems practice cannot exist without systems thinking and vice versa. Systems practice informs and renews systems thinking which in turn, renews systems practice. Systems practice also informs and renews systems theory, which stimulates new systems skills by stimulating systems thinking and thus systems practice (see Systemist 2001).

The Systems approach is a particular way of trying to make sense of the world. It is a particular epistemology and I suppose the simplest way to describe it is through the notion of holism. It is a holistic approach that emphasizes the connections between issues and components and simplifies the complexity by thinking at a greater level of abstraction or generality. Systems thinkers attempt to understand a situation as a whole rather than break it into small components. Of course, that begs the question what is the whole? In its simplest form the notion of boundary and environment are important ideas in Systems which help to address that question. These are simple yet powerful intellectual tools which characterise thinking systemically and help us decide what makes up the system of interest.

Systems thinking fosters a multiple perspective approach to complexity and I am in favour of one of the original tenets of the Systems movement, that of an isomorphy of concepts. I see advantage of incorporating ideas from other areas where they may be of value in aiding understanding. After all, the way we divide our intellectual domains is arbitrary and many ideas that are attributed to a particular domain are relevant across domains when considered at a meta-level.

There are also many examples of Systems ideas that have developed from experience. I suppose one of the most important is that of Sir Geoffrey Vickers, whose texts provide insights into the way systems thinking might be applied to the complex issues that we face. Of course, it is Vickers ideas that were an inspiration to Peter Checkland and the development of Soft Systems Methodology. Over the years I have had several research students who have revisited Vickers’s work and it has provided the inspiration for their research. I can certainly confirm that my own interests are inspired by Vickers, Churchman, and Checkland, who have provided me with valuable insights into inquiry and the problems of action research.

I confess that despite being involved in this area for more than a quarter of a century, my interest in Systems Thinking and Information Systems has not diminished. I feel that with the advent of modern communication technologies, which are cheap and easy to use, the IS and the Systems communities have a golden opportunity to explore new ideas about information and systems of information.

**IJITSA:** Do you see the “systems approach” as a scientific methodology? If so, how does it guide scientific inquiry, in your opinion? If not, how would you describe the relationship between a “systems approach” and scientific inquiry?

**Professor Stowell:** Not in the generally accepted interpretation of science. Systems thinkers and practitioners share the same desire to find out about the world but we do it in a different way. The scientific approach is characterised by designed experiments in which observations are made and recorded. The experiments are set up to produce an unambiguous expression of the behaviour of the subject. The generally accepted way of carrying out scientific research is by reducing the complexity of the subject by making it into a manageable size. The outcome of this kind of research is validated by its repeatability and by subsequent failures to refute, what becomes, the resultant “law.” In order to set up such an experiment the scientist must have complete control over the experiment. But we learnt in the twentieth century that our knowledge is only a description of that thing at a given moment in time. As our knowledge increases, so too our descriptions of things will change and/or become more refined. The classic example of this, of course, is Einstein’s general
theory of relativity which provided a model of space and time which was better than Newton’s in describing planetary motion.

We have learnt that the outcome of an experiment is valid for that experiment only. A recent and graphic example of the disparity between laboratory experimentation and “real world” application is the TGN1412 case where immunomodulatory drugs were tested in a laboratory and then tested on human guinea pigs. In its first human clinical trials, in March 2006, the volunteers became extremely ill with near disastrous effects. Some suffered catastrophic systemic organ failure resulting in the hospitalization of six volunteers. At least four of these suffered multiple organ dysfunction, and one trial volunteer is said to be showing signs of developing cancer. A company spokesperson described the incident as “unfortunate and unusual,” and said “it had followed guidelines and such cases were extremely rare” (see http://www.i-sis.org.uk/LDTC.php -Institute of Science and Society & http://www.mhra.gov.uk/NewsCentre/Pressreleases/CON2023822 for full accounts).

We cannot dispute the power of the scientific approach as many nations have prospered because of it and its citizens enjoyed its benefits. But as we seek to learn more about our world and its inhabitants we recognise there are some deficiencies in the approach to cope with complexity. The Systems approach is likely to be most useful in contexts where reductionist, single perspective processes have failed to provide adequate management of the complexity involved.

One example is in the complexity of designing, developing and implementing Information Systems. On one side we have technology which is exploiting ideas from Physics whereby the behaviour of molecules stimulated by a small electrical charge is being used to convert and manipulate meaningful bits into bytes and then data into a form which is usable by a human being. Then on the other side we have human actors with different reasons for using the data and each with a different way of converting its representation into something meaningful to them. The design and development of this complex arrangement requires knowledge of a different kind to that of the engineer building a machine in a laboratory capable to manipulating data. Understanding the complexities of human grouping and of each person’s relationship to information is outside that of scientific enquiry alone.

Of course, it is possible to identify some patterns of human behaviour but a scientific explanation alone will be restricted to specific responses to specific events rather than encompassing the richness which such a situation portrays. This is not to say that systems thinking and practice are superior to the scientific paradigm, but that they are better able to address some aspects of complexity. In many instances combining ideas from Systems and ideas borrowed from reductionism makes a powerful intellectual and practical tool. Of course, this thinking has become more commonplace with everyday examples from medicine and environmental concerns in which wider aspects are taken into account rather than treating a condition or situation in isolation. Systems thinking and practice should not be thought of as “instead of” but “as well as;” it is complementary, not contradictory.

**IJITSA:** How would you describe your philosophical approach to information systems research, given that a “systems approach” may require the use or integration of research paradigms from multiple disciplines reflecting multiple philosophical bases (positivist, interpretative, social critical and critical realism)?

**Professor Stowell:** I suppose that my natural way of thinking corresponds to what we call “systems thinking.” I worked for several years within a government consultancy called Management Systems Development, which was set up in the early days of computing to assist managers with their responsibilities. The seven years that I spent with them provided me with experience of analysing activities and translating some of them into a form that could be transformed into computer based systems. But when I look back, we were not always successful...
in what we set out to achieve. Often what we provided was not what the end user or client wanted. Of course, it was the presence of the technology which enabled the end user to realise what they really wanted, so I suppose taken from that perspective we made some progress. However, I felt that we were often replacing one inefficient processing system with a faster but still inefficient IT-based processing system. From a philosophical perspective I suppose I would now describe my thinking at that time and subsequently in terms of phenomenology/interpretivism in a philosophical sense and hermeneutics in a sociological sense.

What I had instinctively felt as a consultant is that we were trying to define the information needs of an individual or group which was, in fact, impossible. What we did then, and to a large extent what we do now, is to explain through some form of technological framework what we observe a client does. We take the problem as given. Often the analytical tools we use are derived from the early days of data processing and I feel that this is because Information Systems has too close a relationship to computing. A computer is a device which can aid decision making and support some aspects of an information system but the kind of tools and analytical skills we need for IS development are different to those used by a computer or software engineer. Consequently, we also need a different kind of education programme to support the kind of skills and knowledge that the modern IS consultant/practitioner requires. One reason I am happy to be associated with IJITSA is because we are attempting to encourage discussion and research in IS which will feed into the education programmes in some way.

In an article that Ison et al. (2001) wrote they drew attention to the distinction about the nature of a ‘system,’ which they said was not trivial, although at first it may appear so. They said that distinctions are both epistemological (concerned with how we know, or what we accept as knowledge) and ontological (the nature of reality). In terms of systems practice, and I think it equally applies to IS, the two positions are different. The realist interpretation sets out to discover, or describe THE system – which they call systematic practice. The alternative to this is practice which recognises the uniqueness of each person’s experience (perspective) and an awareness that we only have communication (in its many guises) as a basis for collaborative action - what is called systemic practice. When looked at from this perspective, Systems practice can be seen as designing a learning process in which systemic insights are gained. It is this latter perspective that underpins my own work.

It is from this philosophical basis that I have been trying to develop ways of enabling end users or clients to express their information needs and, importantly, for them to be able to identify and control how technologies (or a variety of kinds) are used in support. We have made some interesting progress over the past decade or so and unearthed a number of areas which require more research and understanding. We have found the interpretivist systems ideas and tools to be particularly useful in IS development but there are areas which require more work. For example, we are working on ways of navigating from an expression of needs into ideas for action. That is to say, to find suitable vehicles to move from a natural language expression of needs into a description and then a specification that is meaningful to a technical expert. What we mean by description is a description of information system as a whole and the specification to relate to the technical support required.

**IJITSA:** As a former President of the prestigious UK Systems Society, which is an interdisciplinary scientific society, what are the main implications of this society for the Information Systems, Software Engineering and Systems Engineering disciplines and how does education in a “systems approach” help prepare these different students?

**Professor Stowell:** I was fortunate enough to be President of the UK Systems Society and the UK Academy of Information systems at the same time. The term of office of each overlapped, which provided me with some useful
insights into the way in which each community perceived their domain. I found that there are more similarities than differences between the two societies. Most Information Systems colleagues are more concerned with the way in which IT can be used and its effect upon an enterprise than they are concerned about the intricacies of hardware and software. In the Systems community colleagues are interested in the way that perceived systems operate and how they interrelate. Many colleagues in Information Systems use Systems ideas to help them in their research and practice.

From my perspective, I feel that Computer and Software engineers are concerned with the design and development of computing devices whereas an Information Systems professional is concerned with understanding the system of interest, the information system that serves it and then identifying what kind of technological support that the information system might require and how it might be used (see Checkland 1981, Winter et al. 1995).

Interestingly, when I began in IS/IT there were three groups involved in management systems design and development. The first group was the Systems Analysts whose task was to define the IT/IS requirements and who had overall responsibility for the management of the project itself. Then there were the staff responsible for hardware and the third group for the software. I suppose in that respect this is how I still see the relationship between Information Systems, computer science, and software engineering.

I think that there is a deficit in the education programmes that support the discipline of Information Systems. Often the educational programmes are made up with modules from computing and software engineering rather than being a set of modules dedicated to an IS programme. There seem to be two practical reasons for this anomaly within the UK at least. The first is the Research Assessment Exercise (RAE, see http://www.rae.ac.uk/) which measures the research performance of each participating University. Submission to this exercise is made against predetermined units of assessments and Information Systems is not one of them (most IS academics submit under management). The second problem for IS education is the move to modularisation in most UK universities. What this meant initially was a proliferation of modules which naturally was followed by a rationalisation of modules which was then followed by strict control over the introduction of new modules. The result of these activities has been that many IS programmes have to incorporate modules which are vaguely in the right area and modules which are more technical than an IS professional might need.

Academics have found that trying to introduce new modules and/or new programmes is problematic, especially as many IS programmes reside in departments of computing, an historical legacy from the early 1980’s. The result of this situation is that there are few IS programmes that really reflect the requirements of an IS professional. I am presently the chair of the Council of Information Systems Professors (CISP) and we are conducting an exercise to try to establish how many IS programmes there are within the UK Higher Education sector and how many IS modules exist that may form part of other programmes. We hope that this exercise may help us to gain insight into the way Information Systems as a distinct subject is taught in the UK.

IJITSA: The top European journals publish more papers that reflect a systems approach (e.g., papers that build from SSM) than the United States journals publish. Thus, it seems the Systems Approach has been received more widely in European research than in the research that originates in the United States. How do you feel about this assessment? If you agree, can you offer any reasons for this discrepancy?

Professor Stowell: I think that there is a tradition in European journals which has been more open to accepting papers which deal with the philosophical and sociological dimensions of any subject matter than in some other countries. Within the UK and especially Scandinavian countries there has been recognition for decades that there is a difference between data
processing and information systems. To this end many researchers have explored ideas which do not belong to the technological traditions of computing.

Many colleagues find it difficult to publish papers which deal with the complexities of understanding information and its consequences upon the design information systems in US journals. There is a view held by many senior IS researchers within the UK that the only way to get published in US journals is to fill a paper with a statistical analysis of samples (often taken from captive groups such as Masters students). This has resulted in a growing scepticism within the UK IS community about what are considered to be “top IS journals.” I believe that any journal that can offer an opportunity for IS researchers to publish ideas which explore the nature of IS and appropriate design methods would be welcomed in the UK. I think that IJITSA can fill that gap and provide an opportunity for IS researchers to publish ideas which will move the subject on and provide healthy competition to the present market.

**IJITSA:** You are the coordinator of the Centre for Innovation and Inclusion through Information Systems, which is an interdisciplinary organization. One of the Center’s goals is to integrate research through collaboration amongst researchers from a variety of specialist areas. How is a systems approach used in this center?

**Professor Stowell:** The CIIS was set up in response to European research programme which had one area of funding which was dedicated to research into the ways IS could be used to help European integration. We generated a research programme which involved 105 IS/Systems/IT researchers coordinating around nodes located at universities in 11 different countries. It was an exciting collaboration. Unfortunately, we did not get funding and so were limited in what we could achieve. The UK group has evolved into a System and IS group and its members meet several times a year to discuss ideas and collaborate on writing papers. We also react to calls for conference papers and research applications.

**IJITSA:** You are also co-chair of a number of research funded projects, notably the Systems Practice for Managing Complexity project, which was originally funded through the Engineering & Physical Sciences Research Council (EPSRC). How does this group study complexity?

**Professor Stowell:** The original concept for the above European research submission was modeled on a UK-based network called Systems Practice for Management Complexity (http://www.first-pages.com/ukss/spmc) which has been operating since 2001. The espoused purpose of the projects within the Network was (i) ‘to develop a potential agenda for future research into systems theory’ and (ii) ‘to explore [if it is] timely to encourage fundamental research on the nature of systems and the limits to what can be made systematic’. The funding council recognised that ‘the research would be speculative, difficult and of high risk’ Our design for the network included drawing into conversation our existing research collaborators (especially our business, public sector, NGO and systems education associates) and the extremely large network of users of systems thinking and practice via taught postgraduate project and research work and the membership of the Open University Systems Society Alumni and the UK Systems Society. It is interesting to note that prior to the workshop reported here there had not been any systematic interaction between these stakeholder groups. The network is co-chaired by me and Ray Ison from the Open University. It was originally funded by a UK research council for three years but has continued to operate on a self-funding basis to the present day. The aim of the network is to:

- harness the energies of current stakeholders to develop and share expertise within the network
- initiate new ‘networks of conversation’ between systems practitioners and “joined-
up” thinkers in business, public sector, NGO and industrial contexts
• bring together those involved in the interfaces between human and technological systems
• gain an appreciation of the need for Systems Practice and how this might be met by new research and educational initiatives.

The workshops were created with the aim of identifying the needs and enthusiasms of the invited participants, to discuss current trends in systems practice and how these ideas may be put to good use in helping to address those needs. On average, the network offers two workshops per year. Participants nominate an area of interest to which they then apply analytical and thinking tools as a means of gaining insight into the problems. The group makes suggestions about how these problems might be addressed and an expert in the field comments upon the practicality of their suggestions. In this way they learn about the area of interest and about a useful tool for addressing complex issues. The two most recent SPMC workshops were hosted by the University of Northumbria in July 2008 the first dealt with urban regeneration and the second social services and care. The group were then given the opportunity to gain experience of a systems-based tool to help them think about the complex issues surrounding these situations. The facilitators are able to learn about the way the participants have used the ideas and how useful the guest expert found their suggestions. In this way we all gain some insights and from an academic point of view we learn how the ideas might be developed further. We attach particular importance in surfacing process for challenging new practices. Our expectations are that out of the whole will emerge fresh insights into organisational practice rather more powerful than the sum activity of the parts.

**IITJSA:** You are involved in a number of activities and projects that involve industry people. In what ways would you recommend that information systems professionals apply a “systems approach” in their work?

**Professor Stowell:** Systems ideas make a valuable contribution to the process of design and development of IS. Thinking in terms of the relationship between information, which is based around (or enables) purposeful human activities to take place, and the technologies that might be used within it, is important. One difficulty that has persisted since computers began to be used within an enterprise is the way in which the human activities are altered to fit the needs of the computer. Initially these difficulties were accepted, as it was seen as a welcome way of transferring the repetitious chores of processing data onto a machine. But the ubiquitousness of computers and their ease of use have created different social and working environments. It seems that the focus is very much in the way that human groups exchange data and the way in which that data is used. The exchange of data is varied and might range from sharing interests in popular music through to data used for complex procedures such as those carried out in an operating theatre. It is not possible to anticipate the variety of requirements that may arise between different groups nor the effect upon them that the processing technologies might have.

Despite attempts by software engineers to take into account the needs of the end user, success still ends up being determined by the technology. For example, the best known of the lightweight methodologies XP (extreme programming) focuses on building a person-to-person mutual understanding of the problem environment through what they describe as minimal formal documentation and maximum on-site interaction (see Highsmith, 2000). But it is not clear from many of the methods used who the customers are, how they are selected and how the suitability of the resultant software is assessed (see Bustard and Keenan, 2005). It is also not clear from the methods used if the design process is requirements or product driven.

As far as the IS practitioner is concerned, simple systems ideas such as the notion of boundary and environment can help in the definition of the “system” itself. There are also many systems tools that can be used to help both the
user and the developer gain understanding of the situation. Even in the early days of computer systems provision I found that end users did not really know what they wanted and it was often only after the technology had been installed that they began to realise what could be achieved. It is, of course, much different now and much harder. In those days we used a paper-based set of forms to record what people did and converted these into an automated version, but now a group of individuals have a variety of interests which are impossible to predefine. Even when we are thinking purely in terms of a business, the business activities will vary. Ideas such as Vickers’s notion of relationship maintenance, for example between the enterprise and its environment, enables the developer to think in terms of the dynamisms of the relationship of the enterprise to its environment and the actions that those who work within have to take to enable it to maintain that relationship. IT provision is an enabler and not an end in itself; it is part of tool-box. A craftsman has the knowledge to carry out the task and will select an appropriate tool according to the situation that he or she confronts. Similarly a manager will select the tool to enable him to do his job. That tool might be computer-based but it might not. The way we continue to develop computer systems is akin to thinking that we can design one tool which will fit all situations. I feel that the lessons about failure are not being learnt and research into design methods not taken up, a situation which one commentator described as being “like a computer virus, endlessly replicate the mistakes of the past” (Caulkin, 2004).

For many years now my research has centered on participatory methods. A key problem which has exercised me and my researchers is how to enable the end user or client to drive the whole IS process, including the technical definition. There have been useful contributions such as the notion of a system and a serving system (Checkland 1991, Winter et al. 1995) and ideas from soft systems which we use as a means of providing the clients with tools which they can use to control outcomes. Recent ideas from the work of West (1991, 2005), Champion & Stowell (2002, 2004) and Cooray (2006) and Cooray & Stowell (2006) brings us a step closer to navigating from the clients description of their “information system” needs through to a specification of their IT needs.

**IJITSA:** Do you think a “systems approach” perspective would benefit society, if more people understood systems concepts?

**Professor Stowell:** It is ironic that just as many Systems undergraduate degree programmes within the UK have declined so the interest in Systems within the general population has increased. The SPMC network is an example of this interest. The network continues to attract participants seven years since it held its first meeting; similarly, the UKSS continues to attract members and is able to hold Systems conferences 33 years after it was formed.

Systems thinking is of benefit to society, especially nowadays. I think most would agree that that we are indeed a global village (Lewis 1948) and are aware of the need to consider the wider implications of individual and national actions. But the problem is that many Systems ideas, although at first sight are simple, demand considerable skill in using them. Even ideas which appear to be Systemic often end up in practice being the very opposite. For example, the “joined up thinking” era of the present UK Government has produced “silo” thinking in many government departments which is the very opposite of what was intended. This feature is because of the narrow way in which they define their system of interest, usually excused by arguments about budgetary constraints. This deficiency in thinking systemically underlines a need for systems-based programmes of education.

One important role that the learned societies can play is to provide opportunities for people to find out more about Systems Thinking and Practice. Within the UKSS and SPMC we have been attempting to communicate Systems ideas and how we can reach a wider audience than the membership. The result of a series of workshops aimed at addressing the challenges facing IS and Systems was the comment that

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academics do not communicate ideas very well. It would seem that even when we try we express them they are difficult to comprehend. I think both the IS and Systems community should take that comment seriously if we are to ensure our future.

My own experience, gained through the SPMC network, has shown me that there is a growing interest in holistic ideas and in ways of using them. So I think one important lesson for academics to learn is to make our ideas more accessible to those outside academe. I hope that we can provide opportunities for the IS/Systems community to pass on their experiences and ideas of the practice. Their experiences are invaluable to others and especially to students studying IS and Systems.

Perhaps through IJITSA we can encourage more practitioners to share their knowledge and encourage them to submit papers that are written in a way that non-academics can appreciate. I suppose what I have in mind are papers along the lines of a business review type of paper. Of course, the backbone of the IJITSA will continue to publish academic papers, but I think there is room for papers based on experience as well as those based on research.

**IJITSA:** What areas of your own research give you the most satisfaction?

**Professor Stowell:** Since I was a practitioner many years ago I have been interested in participative information system design. I think you understand what I mean by this now. So my research over the past twenty-five years has been devoted to using systems ideas as a means of enabling this. With the help of several researchers over that time we have developed what we called Client Led Design which evolved into Client Led Information System Creation (CLIC). This is a framework for thinking rather than a method with the key idea that the process is client led rather than client centered. In the latter case the client is usually a passive participant being led by a technical designer. What we are trying to achieve is the reverse of this where the client is in the driving seat and is in a position to make decisions about the information system as a whole.

Our research has produced some novel ways of first developing then translating the end-user (clients) descriptions of their needs into a form that a technical expert can use. We have achieved this whilst keeping faithful to underpinning ideas of interpretivism. What we are trying to achieve are ways of enabling the clients to express their information needs and then “navigate” the gap between their description and the kind of specification needed for the technical support. For example, we may use the Appreciative Inquiry Method (AIM) combined with Object Modeling to produce both a description of the information system (the serving system) and the technology that contributes to it (e.g., Champion et al. 2005, Guo et al. 1999).

AIM itself is also a result of research which was developed by Duane West and me in the early 1990s (Stowell and West 1991). It started out as a sort of short-hand version of Soft Systems Methodology but we have refined it considerably over the years and it has developed into quite a sophisticated method. We have incorporated some more of Vickers’s ideas and ideas on organisational power which I believe have provided a flexible approach to information systems development. So I suppose in answer to your original question, I have received some satisfaction in seeing the work of several years and several PhD projects being combined in this way.

**IJITSA:** Thanks very much for sharing your knowledge and wisdom with us and the IJITSA readers (researchers, academicians, PhD students and practitioners)!

Clearly, Professor Frank Stowell has given much thought to systems concepts. As an internationally recognized leader in the systems field, we are grateful to have him working with IJITSA to develop this journal. We look forward to following the progress of his work.

Professor Stowell’s responses cited a number of his publications. They are included in the references below.
REFERENCES


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David B. Paradice is professor and chairman of the MIS department at Florida State University. He received his doctor of philosophy in business administration (management information systems) from Texas Tech University. He has worked as a programmer analyst and consultant. Paradice has published numerous articles focusing on the use of computer-based systems in support of managerial problem formulation and on the influence of computer-based systems on ethical decision-making processes. His publications appear in *Journal of MIS*, *IEEE Transactions on Systems, Man & Cybernetics*, *Decision Sciences*, *Communications of the ACM*, *Decision Support Systems*, *Annals of Operations Research*, *Journal of Business Ethics*, and other journals.

Manuel Mora is an associate professor of information systems in the Autonomous University of Aguascalientes (UAA), Mexico, since 1994. Dr. Mora holds a BS in computer systems engineering (1984) and a MSc in artificial intelligence (1989) from Monterrey Tech (ITESM), and an EngD in systems engineering (2003) from the National Autonomous University of Mexico (UNAM). He has published around 30 research papers in international top conferences, books and/or journals. Dr. Mora has co-edited two books on DMSS and i-DMSS, and serves in editorial review boards for several international journals. His main research interest is the development of a common management and engineering body of knowledge for software engineering, systems engineering and information systems underpinned in the systems approach.