A Systems Approach: Evolving IT into a Centre for Business Innovation and Technology Solutions (C-Bits)

Dr. Raj Siriram

University of Witwatersrand, Johannesburg, South Africa

ABSTRACT

Given the rapid pace of technological evolution, firms are faced with a multitude of technologies. Typically the ownership for technologies is seen to fall within the ambit of information technology (IT) divisions. However IT divisions are often seen as not being sufficiently innovative and creative to support firms in their journey towards achieving competitive advantages. In addition IT divisions are seen more as technology providers failing to make the transition to innovation, driving systems adoption and integrating technologies into critical business processes i.e. commercialization success. In this paper a systems engineering approach is used to transform a traditional IT division into a centre for business innovation and technology solutions (C-Bits). The paper describes a four year transformation within a global organization. The approach provides important lessons on how systems engineering techniques may be applied to transform an IT division into a strategic functional unit within a global organization.

INTRODUCTION

Information technology divisions are continually being criticized for not being sufficiently innovative and creative to support firms in their journey towards achieving competitive advantages. IT divisions are seen as being too slow in order to adapt to the latest technology trends and in addition they are not seen as “masters” in being able to commercialize these technologies to obtain better competitive advantages. Furthermore when newer technologies have been adopted firms fail to integrate these technologies into a holistic approach. No sooner have firms mustered the use of latest technologies they are forced to change into yet newer technologies. Many researchers have proposed improvements in how IT divisions can add more value, however little work has been done into fundamentally transforming IT divisions into strategic business assets. In this paper we explore how systems engineering techniques may be used to transform an IT division into a strategic business asset. The paper describes a piece-meal approach over a four year period transforming an IT division from a functional unit into a centre of competence and strategic business asset eventually gaining the reputation for being a centre for business innovation and technology solutions (C-Bits).

From (Figure 1), we see a shift in thinking from a results now thinking to new paradigm thinking. Many researchers have made a contribution to knowledge in terms of improving IT however gaps exist in terms of developing a systematic approach to selecting those technologies and or processes which yield best gains. Little work has been done in terms of systemic thinking and a new paradigm in terms of IT. Traditional firms have looked at models like ITIL, COBIT, Zackmann, etc to manage IT divisions. These approaches are more service centric and do not help move IT divisions into making a strategic shift. IT divisions are part of the larger organization and exist within sections of the firm.

LITERATURE SURVEY

The shifting paradigm facing IT divisions is to become more strategic. Being able to use technology to gain efficiencies and make firms more competitive is becoming paramount, Siriram (2011a). Over the last 20 years firms are continually trying to improve, customers are demanding better products and services, Hammer (1990), Brem and Voight (2009), Botha and Van Rensburg (2010) and Siriram (2011a). New technologies like the internet and more recently technologies like cloud computing are rapidly bringing new capabilities to firms, thereby raising the competitive bar. The influence of new technology has resulted in more focus on radical out of the box thinking in terms of the latest state of the art technologies. The focus should be on how one uses technology to drive competitive advantages. Firms are expected to become learning organizations where people continually expand their capacity to create the results they desire, where new patterns of thinking are natured, (Senge, 1990). Adopting this approach to IT requires a paradigm shift, (Figure 1), Siriram (2007), Siriram (2011b).

Therefore IT divisions should be viewed as being able to the link sections of the firm and other firms. IT divisions are therefore part of a larger system.
A SYSTEMS APPROACH: EVOLVING IT INTO A CENTRE FOR BUSINESS INNOVATION AND TECHNOLOGY SOLUTIONS (C-BITS)

Dr. Raj Siriram

Figure 1. A paradigm shift results now thinking vs new paradigm thinking

(Bertalanffy, 1968) explains that, viewing an organization from a systems perspective, shows organizations are a group of inter-connected entities, that interact together to supply products and services. This interconnection leads to complexities, which when not managed appropriately may lead to diminished returns, Siriram (2001b). Others like Checkland (1999) have developed a more ‘soft’ systems approach to solving problems of this complexity.

These views have been taken further by people like Senge and Sterman (1992), Van Ackere (1993), Pourdehnand and Robinson (2001) and Pourdehnand and Herb (2002), where a more systematic thinking has been applied to organizational learning activities and more specifically in terms of this paper IT.

In further support Stephen and Singer (2008) say system thinking is a holistic yet elegantly simplistic way of thinking; it gives a complete view of complex relationships. Looking at IT from a systems perspective requires an understanding of systems theory. In general systems may be classified in two extremes, ‘soft’ systems and ‘hard’ systems. Soft systems are fuzzy unstructured with purposeful behavior to such that the system is capable of setting its own objectives. The ‘soft’ system makes use of feedback to facilitate its goal seeking behavior, Blanchard and Fabrycky (2006).

More importantly it brings the human intervention early on in the analysis. Hard systems on the other hand are inter alia based on certain underlying assumptions, a) the problem is well defined, Simon (1962), b) the problem can be represented using a quantitative model, c) the system containing the problem may be regarded as purposeful and d) the system containing the problem is nearly-decomposable, Simon (1977). IT divisions are surrounded with complexity and unclear boundaries and therefore exist in often vague and unstructured situations where the hard systems approach may be inappropriate.

The holistic perspective brought about by systems thinking helps identify real causes in IT. Siriram (2011b) quotes various researchers in terms of taking a holistic organizational view using systems concepts viz. Ackoff (1971), O’Connor (1977), Checkland (1981), Senge (1992) and Sterman (2001). Systems thinking offer’s a powerful perspective to see events and patterns though a holistic lens. The soft systems methodology (SSM) ensures the human dimension is incorporated at an early stage in the process, hence it is qualitative. The main aim is the emphasis on “what” as well as “How”. The SSM emphasizes the use of rich pictures which give a holistic perspective and contextualization of the problem situation, this together with more qualitative tools like root definitions helps bring together a better understanding and hence better problem resolution.

In this paper we link soft and hard system methodology to transform an IT division in a large global IT organization. Hard quantitative techniques involve use of value engineering methodologies like numerical evaluation and functional analysis. These techniques when used in a holistic manner may lead to better benefits in terms of transforming IT divisions. The research methodology is next discussed.

METHODOLOGICAL FRAMEWORK

From a SSM we build on the approaches followed by Checkland (1999), Yeo (2002), Crawford and Pollack (2004), and Salhieh (2007). There has also been a wide use of systems techniques by at least the following researchers Carmen et al (2009), Bergvall-Kareborn et al (2004), Neal (1995), Hookins (2005), Snowden and Boone (2007), Brown (2008) and Siriram (2011b). Therefore in view of the large amount of research gone into systems approaches a ‘soft’ and ‘hard’ systems methodology has been used in this transformation process, Figure 2.

The first phase; strategic planning: opening up the problem involves setting up the problem framework i.e. identifying the problem owners, obtaining the unstructured problematique, selecting the correct people both at executive management, senior management, the problem owners and involving all the necessary stakeholders at the outset. Siriram (2007, 2011b). Once the project framework is established the next step involved opening up the problem. Using the model we first constructed a naïve picture of the situation, obtaining all symptoms and all views, collecting all hard data and performing the necessary data
A SYSTEMS APPROACH: EVOLVING IT INTO A CENTRE FOR BUSINESS INNOVATION AND TECHNOLOGY SOLUTIONS (C-BITS)

Dr. Raj Siriram

analysis giving way to a more realistic rich picture of the problematique. The rich picture allowed members of the team to become involved in obtaining a better understanding of the problem situation, the human element is hence included early in the analysis. Since the IT department is a service function it is imperative that key internal customers, selected suppliers and selected external customers are also involved in this process.

The second phase, structuring the problematique was next analysed. Thereafter root definitions (CAPE.apache.org, C-Customers, A-Actors, P-Performance, E-Environment, T-Transformation, O-Owners, W-Weltschauung (Attitude within the system), N-Nature) adapted from CATWOE models developed by Checkland) were constructed to work towards a more structured problematique. The CAPETOWN models are a structured approach to understanding the systems dynamics. This resulted in identifying a realistic rich picture of the IT problematique, which had to be evaluated and selected in order to obtain a more structured problematique.

The CAPETOWN models were used to look at the problematique in a systemic manner. Hard systems techniques involve value engineering techniques like numerical evaluation aligning key strategic initiatives to the firm’s economic objectives and are only used once an elaborate analysis of the naïve and rich pictures are completed. In this way a better holistic picture of the problematique may be considered.

The third phase; evaluation involved evaluating the critical success factors from the numerical evaluation against the organizations strategies and goals and then obtaining a more realistic problematique. The output being a list of areas targeted for improvement either incremental or radical, which would yield the best gains. These areas were then reviewed to make sure they aligned to the firm’s strategies and goals.

CASE STUDY

In this section, the application of the author’s proposal to a South African firm operating in the information technology service industry is analyzed. A similar model has been used previously by the author in five other case studies, Siriram (2007, 2011b); in this paper the author describes how the methodology is utilized in transforming an IT division into a strategic business asset. The author has over 20 years’ experience in implementing Systems in the areas of manufacturing, project management, supply chain management, services and IT.

He has run various systems engineering workshops and used many systems engineering techniques. Through his experience he has gained many valuable lessons which have been intuitively applied in this paper. The model has been used to drive the transformation of IT within the South African region of this global organization. The case study is based on a four year journey gradually transforming the IT support function into a strategic centre of competence proving valuable thought leadership into the main stream business.

The work covers a four year period and included many strategic sessions both a regional and a global executive level. On a more operational level this included extensive analysis and evaluation of data gathered through structured workshops involving cross functional teams (involving marketing, sales, logistics, IT, other business units). Review meetings between management and the project team were held on an annual basis to identify areas for ongoing improvement. Regular feedback and performance monitoring over the four year period also allowed the development of other strategic tools and methodologies e.g. project portfolio analysis, balanced score card performance measurement, etc. both at an operational and strategic level.

Background.

Given the rapid pace of technological change, the IT industry is flooded with the latest state of art technologies; compounded with this is persistent innovation and rapid technological change these are attributes of the IT industry. Many e.g. Carr (2003) regard IT as commodity, however it is how one uses technology that leads to competitive advantages, Siriram (2011a), therefore it is important for IT firms to continually differentiate themselves from other firms. Firms operating in the IT industry may differentiate themselves from other firms by using technology as an enabler to business needs, it is more about using technology to create competitive advantages rather than merely implementing the latest technologies. In this case study transformation of IT from a support function into strategic business asset is seen as one of the attributes that could assist firms in gaining competitive advantages. Firms have however failed to strategically integrate IT functions within main stream business responsibilities. Brem and Voight (2009) argue firms operating in the IT industry have to integrate functionality and support which is the only outcome of customer’s needs, and is independent of emerging technologies. Transforming the IT function into strategic business asset is a complex transformation solving many problems some of which include portfolio of services, skills levels, strategic visioning, make or buy decisions, etc.

General Company Information.

The researched company was founded in South Africa in the 1980s. Customers are dominant in the financial, public, FMCG, health care and retail industry sectors. The company is the biggest IT service provider in South Africa. The product portfolio includes IT applications (e.g. for ERP systems), services (e.g. IT-Support) offered over five geographic regions (Middle East Africa, North America, Australia, Europe, Asia). In 2010 the company employed more than 11,000 people, with annual sales of US $ 60 billion, with the South African contingent employing 5374 people and a revenue of R10 billion, i.e. approximately 60% staff compliment and 33% revenue. The company is technology driven mainly because of its origins in networking and infrastructure solutions. Owing to its rapid growth the company grew from a multitude of mergers and acquisitions and as a result the company had become reliant on systems and technologies in order to gain competitive advantages. In the last few years the awareness has grown to make changes within the formal internal organization and see IT systems as strategic business assets. The view of executive management was that IT is critical to the evolution of the firm and therefore should be transformed into a more strategic business asset.

Findings Case Study Specific.

In general the company had recognized that IT had to play a more strategic role in business, however executive management was unsure about how this would integrate into the rest of the business functions. The IT transformation project was however not initiated as a LSTK (lump sum turnkey) transformation project; the initiatives were more a piece-meal approach on how IT could be turned into more of a strategic
business asset meeting short, medium and long term sustainability.

Through regular interactions at both an executive and operational level the IT function was positioned into taking a more strategic focus. The critical success factors were to appoint an executive to head up the IT function (CIO). The individual should be able to apply strategic innovation management as well as operations management capabilities into transforming IT into a strategic focus area. The critical skill being a business leader rather than a technology specialist.

**Case Analysis**

The transformation initiative consisted of a piece meal approach which included a portfolio of strategic projects, which were aligned to achieving a long term objective. (Figure 3) shows a snapshot of a project portfolio analysis. The approach taken here is different to the approach used by Siriram (2007) and Siriram (2011b), an overall transformation initiative for IT was not tabled a more pragmatic approach of smaller shorter projects aligned towards a common objective was used. In addition an overall CIO council was used to gain alignment at a global level and an IT steering committee was used to gain alignment at a regional level, (Figure 4).

**Figure 3. Project Portfolio Analysis**

Furthermore to ensure there was alignment between the project teams and executive management, it was necessary to establish executive steering groups, which consisted of a cross-functional group of executives from the managing director, CFO, financial director, services executive and CIO. Participants from several departments are chosen; seven in total. The executive steering group also assisted in driving some of the initiatives through the organization.

The roles of the individuals in the steering group are important and critical parts of the systems methodology, these roles have also been used by Siriram (2007), (2011b), and the roles are next discussed. The project champion initiates the project, he is the person who recognizes, proposes, motivates and demonstrates the new idea or approach for management approval (CIO in this case), the project sponsor is the person responsible for guiding and developing the team, he provides behind the scenes support, protection, advocacy and sometimes “bootlegging” of funds (CFO in this case). Thereafter the project sponsor and project champion should be responsible to appointing the steering committee. The steering committee is commissioned as a group responsible for ensuring the project is aligned towards the project objectives in terms of specifications, cost and time requirements. Thereafter the project champion and project sponsor should consider the appointment of a cross functional team, whom are responsible for the project development and execution.

The review group is a peer group used to verify the solutions generated by the cross functional team are realistic and achievable, they act as a feedback loop to the project team. The steering group structure was a useful way to obtain a holistic view of the problematics. Over and above the steering group further stakeholder workshops were also used.

**Figure 4. CIO council and IT steering committee**

The stakeholder workshops have the objective of bringing internal and external experts together, special focus lies on the balanced mix of know-how from the different fields, Brem and Voight, (2009). The overall governance of the project however had to aligned to the objectives of the CIO Council and IT steering committees. The CIO council was responsible for IT strategy, development and identification of key strategic projects. The CIO council met twice per annum.

The IT steering committee for was responsible for IT governance, execution and control of operational projects. The IT steering committee met four times per annum. The interfaces to the CIO council and IT steering committee was important especially in elevating the importance of the transformation project and this helped in overcoming any barriers and resistance to change. The IT transformation touched some 5000 employees and their corresponding departments; it was a challenge to co-ordinate activities given the vast diversity of the audience.

The stakeholder workshops allowed the IT team to bring experts from other areas such as industry associates, other internal interested parties included people from quality, corporate planning, etc., other external parties included suppliers. The most important part of the stakeholder works was obtaining the necessary buy-in in terms of focusing IT driven initiatives, e.g. which process where considered the most important in which areas was the company experiencing the most pain? etc.

The stakeholder workshops were structured and interactive. During the stakeholder workshops the techniques from soft & hard systems were utilized. Additional input was gathered through attending conferences and workshops and presenting at external conferences, also assisted in testing ideas and obtaining useful input. This resulted in valuable inputs, which could be utilized later on in the hard systems analyzes
which included amongst others numerical evaluation and functional analysis techniques. The results from the stakeholder workshops and executive groups were appropriately recorded and transferred into project specific plans. All trends and ideas were extensively documented for further presentation and discussions with other employees and stakeholders. The success of this approach was largely due the integration of the ‘right’ people at the ‘right’ time.

As a result of interactive, structured workshops one of the primary outputs was the systems hierarchy or ecosystem followed by a rich picture of the problematique. (Figure 5 and 6) gives a graphical representation, of the systems hierarchy and rich picture respectively; this facilitated getting the necessary stakeholders agreeing to an IT evolution i.e. the transformation from an IT support function to C-Bits (Centre for business innovation and technology solutions). This approach also allowed the stakeholders to visualize links to other systems and subsystems.

After a three year transformation, the IT department decided to take stock before redefining their journey. To this end a three day workshop was conducted. The focus of the workshop was on the strategic intent of IT, firstly where do we wish to take IT i.e. a strategic business asset and secondly what should we do today to achieve that objective. In transforming the IT division the first step involved creating a naive picture of the situation this involved a SWOT analysis, Table 1. The SWOT analysis is a simple technique which allows a realistic evaluation of the current system. Once the SWOT analysis was completed an objective matrix of the TO-BE situation was completed, Table 2. CAPETOWN models were used to conduct an analysis of the TO-BE situation (Figure 7).

Table 1. SWOT analysis

<table>
<thead>
<tr>
<th>SWOT ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose – “To be an integrated value adding business partner”.</td>
</tr>
<tr>
<td>Objective – Strategy – “To be an innovative provider of integrated business solutions”.</td>
</tr>
<tr>
<td>Strengths</td>
</tr>
<tr>
<td>Good Skills</td>
</tr>
<tr>
<td>Reliable/dedicated resources</td>
</tr>
<tr>
<td>Business financial support</td>
</tr>
<tr>
<td>Good track record/Sound base/foundations</td>
</tr>
<tr>
<td>Opportunities</td>
</tr>
<tr>
<td>Expanding C-Bits offering internally</td>
</tr>
<tr>
<td>Expanding C-Bits offering externally</td>
</tr>
<tr>
<td>Advisory service – BI</td>
</tr>
<tr>
<td>Establish monitoring offering</td>
</tr>
</tbody>
</table>

Once the CAPETOWN models were completed a brain storming exercise was held to obtain a list of the improvement areas. To complete the CAPETOWN model the cross functional team was used, the group consisted of the senior management of the C-Bits division together with a selected group of outside stake holders from other business related areas. In this way different perspectives were obtained in terms of C-Bits position within the company. The CAPETOWN model formed the basis for input into identifying opportunities for evolution.

The next step involved identifying areas for future innovation and growth to this end the focus was broken down into strategic (Table 3) and operational focus areas (Table 4). Breaking the opportunity analysis into two areas allowed the team to focus on strategic and operational areas separately, in this way clear boundaries between the two areas could be identified. Once the opportunities for innovation and growth were listed, numerical evaluation was used to select those areas which would give the most gains i.e. separating cause and effect.
Once the numerical evaluation was completed the key strategic and operational focus were extracted. These areas were then evaluated against a 7 point Likert scale. In addition the strategic and operational areas were linked to the service delivery of the key systems delivered by C-Bits. These key systems were also evaluated in terms of service delivery on a 7 point Likert scale. A summary of the results are shown in (Table 5). In terms of strategic focus a 67% achievement, operational focus 71% and application adoption (service delivery) a 63% improvement was noted.

Having completed the evaluation of C-Bits, the team next produced a value chain offering for C-Bits. The value stream was developed showing the development path of the IT division. This is shown in (Figure 8). The road map shows growth from IT support, business systems and managed services, system adoption and optimization, business intelligence, business process optimization, TQM and finally innovation and evolution into a strategic business advisor.

The next step then resulted in developing a measurement model to ensure that C-Bits was delivering to a specific value stream, this consisted of a value management model viz::

\[
\text{Value} = \frac{\text{Function}}{\text{Cost}} = \{\text{Dependability, Economics of scope, Effectiveness (smarter), Efficiency, Flexibility, Marketing & packaging, Quality, Reliability and Speed}\}
\]

\[
= \{\text{Reduce complexity, Standardise, Better procurement, Economies of scale/ repeatability}\}
\]

The value function was a mechanism, which provided each member a paradigm upon which they could conceptualize the concept of value this gave each member a better indication of what it meant to add value. The value function gave a clear expression in terms of showing that increasing any of the terms in the numerator and/or decreasing any of the terms in the denominator would result in increased value and hence by varying these factors value could be added.

Therefore using the value function each member could see whether the activities they were performing was adding value or not. For example if a team member was looking at a new process they could ascertain whether the new processes was adding value by simply looking at the value function and comparing the variables to the existing process. If the variables in the value function ‘improved’ compared to the existing process, the team member could ascertain they were adding value. This simple yardstick measurement allowed the team to move to a new way of thinking and hence a paradigm shift.

**DISCUSSION AND IMPLICATIONS**

By using structured interactive workshops, it is argued that all stakeholders participating have achieved a greater understanding for the
need for IT transformation and therefore a more holistic approach towards IT could be obtained. The initial application of the methodology revealed a significant number of instances where an understanding of the relationship between tacit and explicit knowledge helped move towards a holistic approach in terms of the IT transformation. Furthermore the forums enhanced the participant’s ability to make sense of how IT functions.

The debates and discussions in the stake-holder workshops were fruitful in resolving issues which impacted IT transformation. These included paradigm shifts in results now thinking versus new paradigm thinking. Initially the firm was largely technology centered and was actively investing in the latest available technologies by making the transformation to C-Bits the new IT division became more focused towards using technology as an enabler to business needs. Consequently as a result of the ‘soft’ and ‘hard’ systems methodology in transforming IT the importance of the transformation was realized, this gave rise to a more holistic view of IT and assisted in transforming IT into a strategic business asset gaining the reputation as a centre for business innovation and technology solutions (C-Bits).

The application of the interactive approach i.e. using cross functional teams from different areas of the firm allowed a framework supporting knowledge sharing and the building of knowledge networks which assisted IT in their transformation. In many respects, the knowledge of the participants was enhanced in terms of understanding different viewpoints about IT and its relationship with broader contextual factors. Ultimately the participant’s ongoing support and participation illustrate the usefulness of this approach. Such support and participation will only be achieved if its application is meaningful, interesting, continuously creating debates, tangible and value adding.

LIMITATIONS AND FURTHER RESEARCH

The research methodology has been followed previously in five other cases studies, (Siriram, 2007) and Siriram (2011b). Siriram (2011b) gives a more holistic view surrounding the workings of the methodology. In this paper it is apparent there are certain pre-requisites to adopting a systems approach, these include a) firstly setting the platform on what is a systems approach, b) secondly selection of the participants and c) education of the participants in terms of what is included in a ‘soft’ and ‘hard’ systems approach.

These three pre-requisites are critical and are necessary ingredients which will determine the success of the systems approach. Even though the methodology has been used in five cases a repository of knowledge comparing soft and hard systems approaches and the integration thereof will go a long way in enhancing the benefits of SSM.

The integrated soft and hard systems approach used in this case study is rather sophisticated and even though more cases evidence is required to better understand the workings of a ‘soft’ and ‘hard’ systems approach, the evidence presented in this paper supports the integrated approach. Since the research is based on limited cases, conclusions must be seen against this background, Siggelkow, (2007) and Siriram (2011b).

By conducting multiple-case-research, more similarities could be identified for further generalization. On a workshop level, further research is needed to get a deeper insight into the right mix of internal and external experts in the stakeholder workshops and the right level of pre-alignment in terms of exposing stakeholders and team members to systems methodologies Finally the results are limited to the IT industry, further research in other industries are also encouraged.

CONCLUSION

This paper proposes an integrated ‘soft’ and ‘hard’ systems approach to IT transformation. The hybrid application of ‘soft’ and ‘hard’ systems provided a structured methodology for problem contextualization, creating opportunities for stake holders to influence the system dynamics and thereby enabling better analysis and more focus. The framework proposed recognizes the complexity involved in transformations of this nature it also proposes a combined ‘soft’ and ‘hard’ systems approach to organizations.

The approach allowed early human intervention the proposed goal seeking behavior allowed the transformation of IT into a strategy business asset. In this way the team could focus on those objectives which were critical to the firm and aligned to the firm’s strategies and goals. In terms of the central question posed: are we able to develop a systemic methodology that will assist managers in transforming IT into a strategic business asset. Evidence from this paper and others like (Siriram, (2007), (2011b)) indicate using a hybrid ‘soft’ and ‘hard’ systems approach leads to better benefits and therefore it may be concluded using a systemic methodology may assist managers in IT transformation.

Figure 8. Value stream road map
A SYSTEMS APPROACH: EVOLVING IT INTO A CENTRE FOR BUSINESS INNOVATION AND TECHNOLOGY SOLUTIONS (C-BITS)
Dr. Raj Siriram

Table 5. Summary of strategic and operational focus areas

<table>
<thead>
<tr>
<th>Management Area</th>
<th>Department Area</th>
<th>Total (Table Area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing and sales</td>
<td>Sales Management</td>
<td>7</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>Customer Support</td>
<td>4</td>
</tr>
<tr>
<td>Human Resources and Information Systems</td>
<td>Information Technology</td>
<td>7</td>
</tr>
<tr>
<td>Information Systems</td>
<td>Information Systems</td>
<td>2</td>
</tr>
<tr>
<td>Applications Adoption</td>
<td>Applications Adoption</td>
<td>10</td>
</tr>
<tr>
<td>System Management</td>
<td>System Management</td>
<td>8</td>
</tr>
<tr>
<td>System Design and Improvement</td>
<td>Systems Design and Improvement</td>
<td>5</td>
</tr>
<tr>
<td>Integration Tools</td>
<td>Integration Tools</td>
<td>1</td>
</tr>
<tr>
<td>Support Tools</td>
<td>Support Tools</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>Total</td>
<td>Total</td>
</tr>
</tbody>
</table>

REFERENCES

Ackoff RL. 1971. Towards a system of system concepts, Management science, 17, 661-671.

Banuls VA. Salmeron JL. 2008. Foresighting key areas in the information technology industry, Technovation, 28, 103-111.


Checkland, P. 1999. Systems thinking, systems practice, John Wiley & Sons Ltd.


Pourdehnand J. Hebb A. 2002. Redesigning the academy of vocal arts (AVA), Systems Research and Behavioral science, 19, 331-338


A SYSTEMS APPROACH: EVOLVING IT INTO A CENTRE FOR BUSINESS INNOVATION AND TECHNOLOGY SOLUTIONS (C-BITS)

Dr. Raj Siriram


