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Review Article

Information Systems Planning: Towards the Sustainability of Competitiveness

This paper will consider the processes involved in Information Systems (IS) strategy. A significant outcome of this analysis is to produce a framework which may enable organisations to assess the implications, development and potential changes to their chosen IS applications. A detailed literature review is undertaken where various approaches for IS planning are noted. A model is derived which illustrates the factors required for a sustainable competitive advantage from implementing IS. Further observation is then made for a research paradigm in the field which would support an empirical assessment of the factors proposed. The research is believed to be of benefit to managers engaged in investment decisions for their organisations IS infrastructure.

Keywords: information systems, planning, sustainability, competitiveness.

1. Introduction

Extensive research has been conducted into the role of IS and competitive advantage and a number of frameworks have been proposed to identify potentially strategic applications (see Ives and Learmonth, 1984; Porter and Millar, 1985; King and Sabherwal, 1991; Ward et al, 1990). More recent findings have contradicted earlier reports on the ease at which IS can lead to improved business performance and particularly the potential for a sustained advantage (Clemons and Row, 1991; Cragg and Finlay, 1991; Senn 1992, Galliers 1993, Finlay and Griffiths 1995). However less emphasis has been placed upon the process of modification and monitoring of IS strategic planning despite evidence to show that it is one of the top 5 critical management issues facing UK business in the 1990s and expected to remain so to the year 2000 (Galliers, et al 1994).

The impact of information has been explored and Porter and Millar's (1985) Information Intensity Matrix attempts to classify the importance of information on a particular organisation and hence the amount of consideration IS needs to give to the subject. This in turn will impact the nature of IS utilised. IS can achieve these organisational gains (even if only for an ephemeral advantage) which reinforces IS position as a strategic resource, requiring attention at the highest level. Contrary

organisations that fail to act, understand or to address areas where IS can have a substantial impact on the industry or rivals can be placed in a position of competitive disadvantage. Beside IS enabling organisations to perform business 'better' e.g. at lower cost, the work of Ward et al. (1990), who built upon other commentators' research, including Porter's, studied 150 systems that 'claimed' strategic success and arrived at a number of classifications. The factors support Porter's conditions for an IS strategy which may be added to through a consideration of an additional type of system that aids strategic planning, as follows:

- those systems which allow an organisation to redesign its structure and practices leading to substantially increased flexibility and/or capability, resulting in an edge over traditional organisations.
- those systems that allow synergy between functions in the organisation e.g. gains that can be derived from IS in manufacturing and distribution (computerised delivery notes bar-coded in manufacture or software manufacturers updating software versions on customers machines remotely via satellite). These gains could not occur if the responsibility for these functions were in the hands of third parties.

By specifically addressing the above classification, an organisation stands the best chance of developing systems which could significantly enhance their IS strategy. The consequence of this approach is that any IS application would provide a new competitive edge which would be maintained until either the market, industry or an organisation's circumstances changed or the competitive edge is eroded as rivals 'catch up'. Most of these approaches, however, do not consider in any detail the difficult consideration of sustaining such an advantage.

Much of the above work concentrates on purely competitive forces whilst ignoring the collaborationist school of thought ((Kanter (1994), Dowling et al (1994), Peters (1993)), which emphasises the role of cooperative arrangements, strategic networks and business alliances between industry participants. Burton (1995) highlights the need for a composite strategy recommending a blending of competitive and collaborative strategies so that they are mutually consistent and reinforcing to optimise the firm's overall position. Burton (1995) offers the 'Five Sources' model of collaborative strategy as a complementary model to Porter's (1980) work.

2. Ephemeral strategies

There has been much debate as to what distinguishes sustainability from ephemeral or temporary IS derived advantage. Clemons and Kimbrough (1987) differentiate between strategic necessity and sustained competitive advantage. IS that is a strategic necessity must be present for an organisation to operate effectively (e.g. UK supermarket chains), but IS can lead to damaging effects on the industry. IS purchased by all firms in an industry in order to lower production costs may well result in higher profits for all providing prices can be maintained and all firms purchase similar technology. On the other hand, when it is necessary for all competitors to

purchase technology equal savings can be obtained by all which may lead to a price war. Smaller margins occur, with the benefits being passed to the customers but the industry might well wish that IS had never being introduced (Cragg and Finlay 1991). This was indeed the situation encountered by Sager (1988) who found that no Australian retail bank had detected any advantage after massive IS spending - all gains were passed to the consumers.

Much field work has focused upon the use of IS as a competitive weapon. Cronin, et al (1988) provide a mainly UK study which ranged from Agriculture and Banking through to Distribution and the Manufacturing industry. Their study, like many others, indicates that an IS competitive advantage is probably only sustainable in the short term. Very often organisations try to gain a competitive edge simply by adopting new technology more quickly than competitors. Clearly this advantage can rarely be maintained for long, unless the cost of acquiring similar technology is prohibitive. Although competitors will shortly 'catch-up' with the IS, the gain that has been derived might well have caused the organisation to 'jump' ahead in terms of market share, profitability, reducing costs etc. which could have much more long term benefits. Keen (1988) investigated the factors affecting sustainability and suggested that internally focused and developed IS that are aimed at 'soft' areas (e.g. involving aspects of company culture) will usually prove to be the most sustainable, simply because it is much more difficult for competitors to gain knowledge about the system. However the key to successful searches for IS is the organisation's ability to produce innovative developments, and this is most likely to be the route to any really sustainable advantages i.e. by out-thinking the competitors. To maintain an IS based competitive edge, organisations must continually look to improve and redesign their portfolio of IS applications. Lee & Adams (1990) investigated ways in which changes may be sustained for longer periods through 'mobility barriers' but their work added little to previous research in the area. Cecil and Goldstein (1990) describe three basic reasons why IS in itself is increasingly less likely to deliver sustainable advantage, i.e. market competitors; the differences in application knowledge; large scale developments rarely translate into cost advantage. Clemons and Row (1991) also discuss how IS innovators can defend the economic value of their development. They claim that one of the best ways to achieve sustainable competitive advantage is when IS leverages differences in an organisation's strategic resources and that this underlies all of the above factors to a greater or lesser extent. As these resources are unique to that firm then IS will be difficult and expensive for another organisation to copy and obtain similar benefits from the IS innovation. IS can change the value of key resources by reducing the cost of integrating and coordinating economic activities. This increases the potential production economies (e.g. scale, scope and specialisation) that can be exploited.

The way IS aids unstructured activities may also lead to a more sustainable advantage as these situations are unique, and organisation specific which makes them difficult to copy (Cragg and Finlay 1991). It is the use of the information that is clearly important here and not just the technology itself. Computerising the routine structured tasks of order processing and stock control will never lead to a sustained gain as rivals

have access to similar technology and skills. It is worth reiterating that the unique, company specific synergy situations will be difficult for rivals to duplicate as they will not have access to the same diverse resources. Stata (1989), in this respect, makes an interesting point :"the ability to learn faster than competitors may be the only truly sustainable competitive advantage". The types of organisations that can benefit from IS depends upon the impact that information has on its industry and the way it conducts its business. Apart from the early models presented which are useful tools, Broadbent (1991) suggests 8 features present in companies which had already achieved some information-based advantage over their competitors. Atkinson (1990) states there are fundamental questions that must be asked. The first is that 'Do the nature and needs of the organisation make IS critical to its future?' If the answer to this is 'Yes', then IS planning must be part of the overall strategy planning. Planning, like any other project will not be successful without clear objectives, scope and exclusions being established at the onset. The organisation must be sure which of the Information Life Cycle stages IS is addressing. IS must be sure whether it is looking to develop systems to consolidate its current business or gain leverage through IS.

Murray (1990) suggests a diagnosis that considers 2 dimensions - demand and supply side characteristics. There are again a number of tools and techniques designed to aid the IS strategy process. Some have been adopted by commercial companies and built into fully fledged methodologies. Some supported by software that allow findings to be stored in a repository and include diagrammatic modeling tools and matrix processing. Many are based on business techniques which have been adapted to address the inclusion of IS.

3. The need for IS alignment

IS must be appropriately positioned within the context of general business planning. Ward et al (1990) suggest a 'waterfall' approach with demand coming from the business through corporate and business planning, through IS management to strategic business analysis and finally into the Development Clearing House. The clearing house vets all requests and allocates the appropriate development approach, either Systems Development, Information Centre or End User. This model has IS planning is essentially a reactive process, triggered off by successive business planning rounds i.e. given a business strategy how is IS best deployed to meet those goals?

Atkinson and Montgomery (1990) propose a different view of IS planning which involves three levels:- Organisation, Information Systems, Information Technology Each level is divided into the current situation, the target situation and the transition mechanism in order to get current -> target. The three levels all impact upon each other and must be kept in alignment (there is an Impact/Alignment loop). The model acknowledges that business planning will affect and be affected by IS but IS still has a bit-part role rather than being fully involved. This is still likely to result in greatly reduced potential for information-based leverage. Lovell and Olson (1991) proposed a similar model of Information Technology, Business Practices and Organisation. They

claim that in order to take advantage of a development in one part, there must be changes in the other two to provide a smooth, seamless interface.

Figure 1 illustrates the IS driven sustainability model which highlights some of the factors noted that needs to be tested through an empirical study.

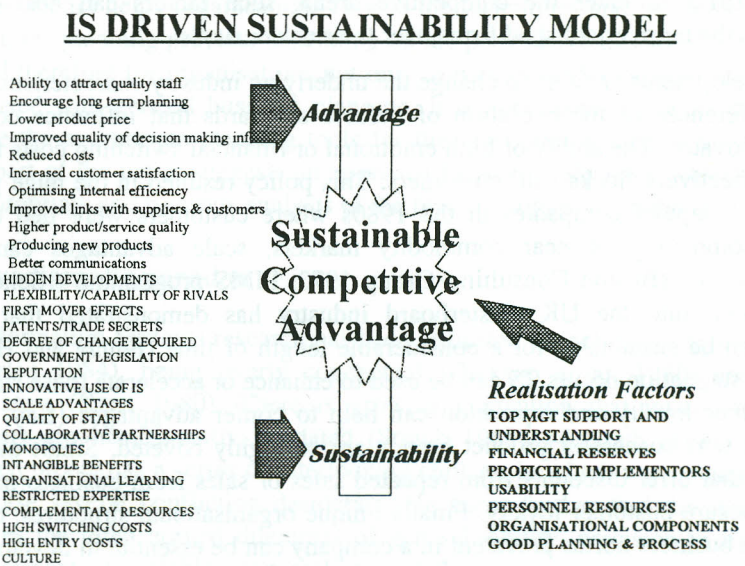

Figure 1. *EMBED PowerPoint*

The model suggests that traditional tools used to effect change will not be adequate in the 1990's. Henderson and Venkatraman (1991) provide another framework on business and IS alignment in terms of: strategic fit - choices about external business strategy and the infrastructure necessary to support IS and functional integration - choices about internal functional strategy and how this positions the organisation in the technological market (Hackney, 1996).

The model proposes that the factors leading to an ephemeral advantage when coupled with the sustainability elements will enable an IS derived sustainable competitive advantage. If innovators are able to hide their developments from rivals or their rivals are inflexible then the probability of extending the advantage will be increased. The difficulty in switching between IS systems has been well documented. This is helped by being a 'first-mover' - classic cases include American Hospital Supply and AA's Sabre Reservation System (Vitale 1986). Clearly if patents or trade secrets can be maintained (as for example in the pharmaceutical industry) then the innovation can be protected. There have been cases of patents for manufacturing systems but IS that is used to support decision making is by its very nature extremely difficult to classify and differentiate and this makes patents unlikely. The use of trade

secrets has also allowed software to be utilised between a small number of business partners but IS implementation has been sporadic. Legislation has guarded business practices on a number of occasions e.g. restricting imports on Japanese cars, Government policies towards ICL in the UK in the 1980s (Lea and Kenny, 1982) and towards Bull and Siemens in France and Germany in the 1990s. Companies who are fortunate to operate in a monopoly can dictate terms to suppliers and customers. Age can confer advantages. Porter (1985) refers to factors independent of size that make it difficult for firms to enter the competitive arena: such factors can also confer advantages on the more established firms over their newer rivals.

Some developments are able to change the underlying industry characteristics, e.g. customer preferences or the evolution of defacto standards that influence costs to favour the innovator. The ability of high emotional or financial switching costs is well known and effectively 'locks - in' customers. This policy resulted in the huge profits for the large computer companies in the 1980s where customers were tied to one vendor. In commodity or near commodity markets, scale advantages can reap substantial rewards (Boston Consulting Group 1973, PIMS programme - Schoeffler 1980). Research into the UK plasterboard industry has demonstrated that scale advantages can be sustainable for a considerable length of time (Finlay and Hannah 1988), unless stagnation occurs. IS can be used to enhance or accelerate these strategic assets. Customer loyalty and reputation can help to confer advantages (Kay 1993). This explains why successful product brands are so highly coveted. Smart cards or loyalty cards that offer discounts from repeated sales or sales from business partners will help to ensure customer loyalty. Finally unique organisational structures, quality personnel and business norms prevalent in a company can be essential in developing a culture that is encouraging of and sensitive to innovation (see Pinchot's (1985) work with 3M).

With the increasing trend of open systems and the move towards PC based software there are unlikely to be situations where monopolies in expertise occur. Consultancies and Software Houses will sell their services to your rivals and besides most have comparable knowledge and skills to develop particular applications. This makes a skill based IS advantage unlikely but still possible. EDI links can help to ensure access to low cost suppliers but also cement business partnerships enabling cooperation. If an innovation leverages differences in an organisation's strategic resources or is aimed at 'soft' areas (e.g. involving aspects of company culture) then there is a high probability that IS will be sustained. As these resources are unique to that firm then IS will be difficult and expensive for another to copy and obtain similar benefits from the IS innovation. IS can change the value of key resources by reducing the cost of integrating and coordinating economic activities or coordinating activities with business partners (synergy). This increases the potential production economies e.g. scale, scope and specialisation that can be exploited.

The model identifies a number of 'realisation factors' without which the IS derived sustainability would be difficult as it is widely acknowledged that the presence of top management support or a system champion for example is important in ensuring

successful development and implementation (Earl 1989) The key to successful searches for SIS is the organisation's ability to think of innovative uses for IS, and this is most likely to be the route to any really sustainable advantages i.e. by out-thinking the competitors. To maintain an IS based competitive edge, organisations must continually look to improve and redesign their SIS applications, or to ensure that there is a constant stream of new SIS's following on behind the existing ones.

The model helps organisations choose the techniques and methods which will be used in the planning process, depending on the perspective that IS wishes to take. It is critical therefore for organisations not only to plan their IS developments but that it is integrated with general business planning. It is also essential for an organisation to choose the appropriate planning tools for the objectives it intends to set for IS. The final part of the paper suggests an approach for such field work which would enable an appropriate and rigorous analysis of the features suggested in the framework.

4. Paradigmatic paradox

Information Systems research has been criticized as lacking in rigor (Turner 1980; McFarlan 1984), being overly conceptual (Dickson et al. 1980) and being non-cumulative (Keen 1980). There is growing contention that instruments in the IS literature are insufficiently validated (Straub 1989). McGrath (1982) describes the research process as a series of interlocking choices, in which we try simultaneously to maximise several conflicting desiderata. He states further that the research process involves the three horned dilemmas of generalisability, precision in the control and measurement of variables and realism and that there is no strategy that adequately copes with all three. Approaches must be made at the strategy, design and method level to "live with" two or in some cases all three of the conflicting desiderata. This agrees with the beliefs of Morgan (1980) and Polkinghorne (1983) who discuss the need for methodological pluralism (Hirschheim 1985) - the assertion that there is no one correct method of science but many methods. Hirschheim (1985) further argues for a shift in the research paradigm of Information Systems towards a 'post-positivist' stance.

Hamilton and Ives (1982) condemn the lack of empirical (scientific) research in IS work. They cite the majority (70.1%) of research published in journals during the ten year period (1970-79) has been non-empirical and typically focused on a single variable. As a remedy they suggest that use of empirical research strategies should be rewarded by greater recognition. In addition, interpretive approaches argue that the scientific ethos is misplaced in social scientific enquiry. Archer (1988) claims that the management research literature is divided into 3 distinct positions; using qualitative interpretist techniques; those that maintain that quantitative research is the rigorous, hard approach; those that maintain that qualitative research is the only true approach.

Abdel-Khalik and Ajinkya (1979) support a similar approach yielding a view of science where knowledge which is expressed in terms of measurements is superior to knowledge which cannot. Douglas (1971), quoted by Knorr-Cetina (1982), has the

view that 'the only valid and meaningful phenomena we can possibly have is that based ultimately on systematic observations of everyday life'. Pepper (1942) states that quantitatively based studies display a concern for multiplicative collaboration of research hypotheses at the expense of structural corroboration and cognitive refinement. The researcher is interested in multiplying the number of observations that are consistent with the hypothesis, rather than in developing a richer hypothesis that has a greater explanatory power, but also a greater chance of being refuted, and whose collaboration would therefore be more significant.

Mintzberg (1979) claims that the field of organisation theory has 'paid dearly for the obsession with rigor in the choice of methodology'. Abdel-Khalik and Ajinkya (1979) amongst others maintain that rigorous research involves the testing of hypothesis against multiple observations using statistical tools and that this, according to Archer (1988) can be identified with a combination of positivism and external realism. The reality under investigation is regarded as existing independently of the research community that studies IS (external realism), and the observations made by researchers ('facts') are considered as being independent of the beliefs and values to which the researchers adhere (positivism), and that rigour depends on maintaining such independence. There is a great deal of emphasis on the generalisability of research findings, which tends to be seen in terms of statistical generalisation rather than analytical generalisation (the extension of theory). Those that promote the superiority of 'qualitative' approaches tend to see rigour as requiring the intimate observation that can only be given to a small number of examples at any one time. This close observation does not readily permit the independence between researcher and researched, or between fact and value, to which positivistic external realists attach great importance. Miles (1979) taking a less inductive stance than Mintzberg, describes qualitative data having some attributes of an 'attractive nuisance' which can lead to 'injury', and who emphasises the need for 'well-formulated methods of analysis', 'guidelines for protection against self-delusion' and 'explicit preliminary frameworks'.

The differing views of both Mintzberg and Miles affects their discordant views of knowledge and reality. Miles (1979) acknowledges that inquiry is impelled by certain working hypotheses and background assumptions which are better made explicit, and that knowledge claims face the problem of validation, 'of analysis and how IS can be carried out in ways that deserve the name of science'. Mintzberg (1979) takes a contrary view and holds that his strategy of 'direct research' involves something close to pure description (unladen with theoretical presuppositions) from which conclusions are then drawn by means of inductive inferences in the form of 'creative leaps'. Critics (e.g. see Lakatos 1970a,b) warn of the dangers of ad hoc theorising that excessive inductivism inevitably leads and claims that 'serendipitous' discoveries do not lead to coherent theoretical development. In addition, Mintzberg and colleagues have apparently little or no concern for the issues of validation.

For the objectivist researcher (typically pursuing a quantitative research design), social facts exist independently of the research community that studies them, and they

can be observed in the form of empirical relationships which can be captured by suitable research design and statistical inference that are considered to be value-free. This approach tends to focus, at the organisational level, on states rather than social processes, the latter being less easy to accommodate within an objectivist perspective (e.g. differing accounts of them typically exist). For the interpretive researcher, social facts are to be considered in the intentional contexts intersubjectively constructed by the social actors whose interactions constitute such facts. This approach is more sensitive to the dynamics of social processes, as it is able to accommodate more than the account of a process.

Objectivism is an appealing aim and lies in its assumed affinity with the approaches made in the natural sciences. Tomkins and Groves (1983) however claim that this predominantly objectivist character of management research is largely responsible for the 'schism' between academics and practitioners. It certainly seems plausible that approaches which ignore the subjective rationalisation of managers and impose an alien theoretical framework can produce a 'schism' preventing the sharing of ideas. Objectivist approaches tend to ignore a whole raft of potential explanatory variables (beliefs, desires, and other intentional states) and make a number of assumptions in order to operationalise standard concepts. Scientific models can be highly simplified abstractions dependent upon restricted assumptions and idealised conditions and reflecting only a very partial understanding of the phenomena.

A number of analysts have argued for eclectic approaches stating that the field of Information Systems can only be understood and analysed with the help of pluralistic models (Banville and Landry 1989). Chua (1986) suggests a need for epistemological and methodological pluralism reflecting a range of philosophical viewpoints particularly in immature fields like accounting and presumably Information Systems. McGrath (1982) enforces the importance of seeking convergence among measures that differ in their methodological weakness. In particular he stresses the need for multiple operations.

Obviously, care must be taken to avoid bias of those responding to questionnaires (as they can be self selecting), in the researcher and in the time that the research is undertaken. Also there can be limitations as to insights into the causes or processes behind the phenomena under study. However as Galliers (1991) states the survey approach has a wide applicability in Information Systems research and that as a method it offers the opportunity to assess an organisation's approach to IS and can contribute to theory building (induction) as well as theory testing (deduction) with possibilities for theory extension (Galliers and Land 1987).

In view of the above and the proposed model the following research design considerations will be made.

Pre-test interviews - the draft research instrument should be subjected to qualitative testing of reliability and content, construct, internal and discriminant validity. The phase is designed to facilitate revision, leading to an instrument that can be formally validated. Personal Interviews should be conducted with participants in

order to locate and correct weaknesses in the questionnaire aimed at IS Managers and Business Professionals. Interviewees should be selected to derive maximum feedback from a range of organisational roles including the sample frames of Retailing, Manufacturing and Financial Services. Each version of the instrument should reflect changes suggested by participants up to that point. The interviews should move progressively from an open-ended general discussion format to a semi structured format and finally to a highly structured item by item examination of the draft instrument. Concepts independently introduced by more than two respondents will be noted as well as the precise language in which these constructs were perceived by the participants (content validity and reliability). Clarification of constructs and the means of operationalising selected constructs should also be undertaken (construct validity and reliability).

Participants should have the opportunity to evaluate the questionnaire in order to help remove ambiguities and further test validities. Content validity may be emphasised by participants highlighting pointless questions and suggesting new areas for inquiry. Interviewees may then pursue the questionnaire line by line - misunderstandings and discrepancies or variations in answers may be noted (reliability). The questionnaires should obviously make use of triangulation in order to improve validity of responses. Following the pre-test interviews, data related to all variables will have been collected and detailed analysis of this data will contribute to reliability.

Pilot Interviews with the questionnaire - these will aid validity (eg. possibly test the discriminant validity by statistical analysis) and offer the final 'dry run' for the questionnaires. Questions producing bunching around the middle (low discrimination) or generally a lack of variance should also be addressed (variance analysis). The pilots should be conducted by the analyst with IS and Business Professionals. Half should be given the questionnaire without an interview and half 'walked through' the questionnaire in an interview situation. It should be expected that each questionnaire will take respondents around 20 minutes to complete and that each interview will be of 1 hour duration.

Validated research instrument - the finalised questionnaire should be sent to as many individuals as is economically possible. Initially the questionnaire should be given to the IS Managers who will complete it naming a Business Professional who is familiar with the benefits of the particular system identified. The Business Professional will then be sent the business focused questionnaire.

Interviews - these should be conducted with a sample of the organisations contacted in order to assist with the investigation.

5. Conclusion

It is not always the correct decision to simply implement IS just as it is not always practical for business growth to be the main goal. Over-trading is possible if companies relentlessly seek IS opportunities through an infrastructure which can not

support them. This paper has proposed various techniques to help organisations carry out the first step in an appraisal of their current situation. Clearly an organisation must know where it is starting from, so that when it establishes where it wants to end up, a route can be constructed. McFarlan's Application Portfolio Matrix offers a useful approach through a consideration of the current development backlog, the types and numbers of systems in this list. This will give some indication of the operational needs of the organisation. Sullivan (1985) suggests an Infusion/Diffusion Model which can be used to see the extent to which the organisation's operational activities are supported by IS and the degree to which technology has extended out into the user community. Here the assessment of levels of user satisfaction may help in identifying the organisation's current IS position. If the only satisfied users are supervisors/line managers then it is likely that all systems have a control or recording orientation. In this way user involvement in managing system development projects is a good indication of the diffusion of IS into the business as a whole. Finally, the mapping of systems coverage of the organisation's value-adding activities onto details of overall business expenditure on those activities can aid the appraisal.

The paper has demonstrated the range of techniques which support an IS strategy and identified factors which may enable such an approach to be sustainable. The challenge for managers and analysts is then to implement the framework proposed and subsequently test its relevance in a field setting, adopting the principles outlined for a valued assessment.

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Griffiths G., Hackney R. Planiranje informacijskih sustava: prema podržavanju konkurentnosti

Sažetak

Ovaj rad razmatra procese koji su uključeni u strategiju informacijskih sustava. Značajni rezultat ove analize je da se proizvede okvir koji može omogućiti organizacijama ocjenu implikacije, razvoj i moguće promjene na aplikacijama izabranih informacijskih sustava. Dat je i detaljan pregled literature tamo gdje su zabilježeni različiti pristupi za planiranje informacijskih sustava. Izveden je model koji ilustrira čimbenike koji su potrebni za podržavanu konkurentnu prednost implementiranja informacijskih sustava. Dalje promatranje vrši se radi stvaranja obrasca istraživanja u području koje bi podržavalo

empirijsko ocjenjivanje predloženih čimbenika. Vjeruje se da je to istraživanje od koristi za menedžere koji su zaduženi za donošenje odluka o investiranju u informacijsku infrastrukturu svojih organizacija.

Ključne riječi: informacijski sustavi, planiranje, mogućnost podržavanja, konkurentnost.