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**SWP 36/88 INFORMATION SYSTEMS & TECHNOLOGY
APPLICATION PORTFOLIO MANAGEMENT
- AN ASSESSMENT OF MATRIX-BASED
ANALYSES**

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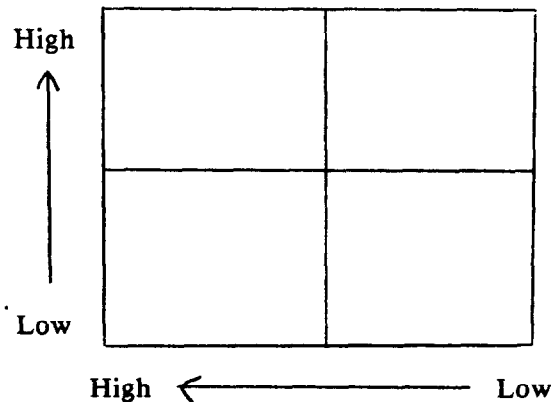
INTRODUCTION

As the role of information systems and technology (*IS/IT*) has expanded during the 1970s and 1980s a number of two-by-two matrices have been proposed which help assess how to approach the management of *IS/IT* in its extended role.

A number of these matrices are reviewed and analysed below with the following objectives:

- to consider the usefulness of each matrix in helping management make informed judgements about how *IS/IT* should be developed in the organisation;
- to identify key issues and ideas raised by each;
- to consider the common ground or areas of conflict amongst the various ideas expressed in the matrices;
- to identify how far it is possible to produce a composite matrix which will help management formulate *IS/IT* strategies and policies.

The matrices considered are a representative sample, inevitably including the most well known, not a comprehensive analysis. In each one the axes have, where necessary, been altered to a common structure to aid the comparison process.



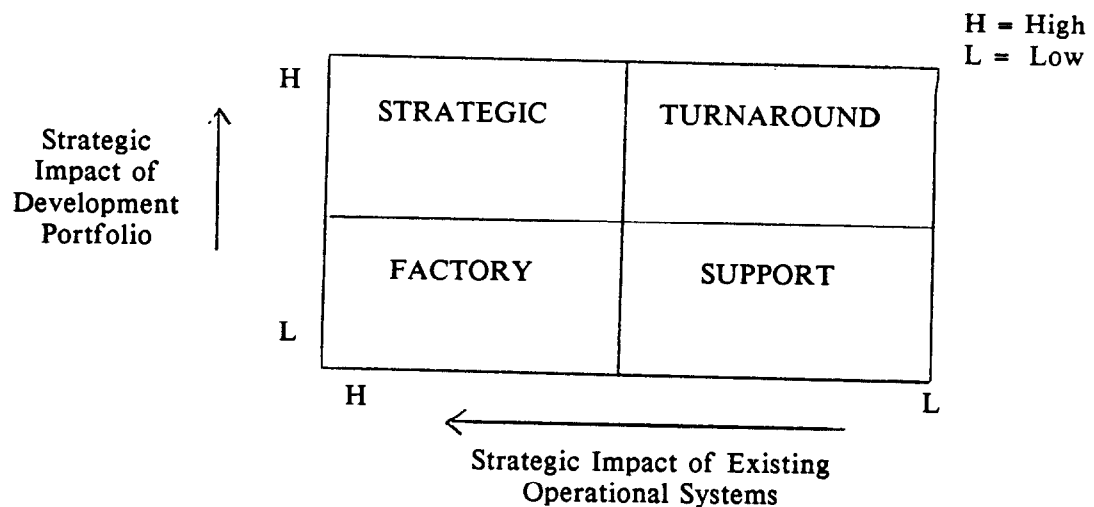
Matrix analysis approaches are attractive because they reduce an apparently infinite continuum of alternatives to a manageable, pertinent number of discrete options from which high level directions can be determined. They demonstrate relationships which evolve over time, but which will normally have to be managed to success simultaneously in the organisation.

Management education could not be carried out without two-by-two matrices in the 1980s! They are used in many fields of management and business analysis. Perhaps the most famous is the Boston Consulting Group matrix (Boston Square) devised to show how a portfolio of businesses or products can be managed most effectively in a competitive environment, given a life cycle evolution of the product, market or business. Like all such models, including those below, it is over-simplistic and many

derivative models have been developed to overcome its limitations. As complexity is added, however, clarity of perception often dims.

The assessment below attempts to see what benefits can be gained - in terms of management understanding - by the use of simple two-by-two matrices in examining *IS/IT* in organisations. Six basic matrices, with some derived variations, are considered and then discussed with respect to the objectives set out above.

1. THE 'McFARLAN' MATRIX (REF 1)



The matrix was developed for use in assessing an organisation's or business unit's total *IS/IT* application portfolio, in order to determine the importance, and therefore management approach required, of *IS/IT* in the business.

Where *IS/IT* was not and could not be seen to become critical to the business the role was support. If the business depended on *IS/IT* today but could see little benefit from further investment then a factory role is appropriate. Strategic implies existing and future systems are critical to business success and turnaround that future systems investment will be more important than existing systems.

The analysis relates two aspects of *IS/IT* as it affects the organisation:

- How *IS/IT* is being used in the industry in which the business competes, ie. the market forces affecting *IS/IT*, and
- How much *IS/IT* currently contributes to business operations.

An organisation (A) with a limited perception of *IS/IT*'s role may only see it as a support function. If competitors have already used *IS/IT* in a critical role (factory) and can see the potential benefits of further investment (strategic), then organisation (A) has to respond through essentially a turnaround philosophy - which implies it has much to learn and much to do if it is not to become less competitive.

Vitale (ref 2) explores the implications of this matrix on a set of example firms. He changes to nomenclature of the vertical axis slightly - 'Future Competitive Importance of *IS* to the Industry' - opening up an external dimension - the organisation's future is not of its own making, a point made less explicitly by McFarlan et al. He explains how the turnaround 'box' poses major dangers for a firm in the support box due to likely lack of management knowledge and technical competence to make the necessary risky investments in *IS/IT*. It may do better to consider non-*IS/IT* based strategies to reduce the impact of competitors' strategies rather than try to achieve parity via *IS/IT*.

Parsons (refs 3 & 4) explores the use of the same basic matrix in a number of ways. First, he shows that certain business competitive forces in different industries at different stages of development or decline will be more or less susceptible to strategic use of *IS/IT*. Therefore, some applications will be more strategic, based on their use to produce leverage or reduce threats, whilst other application focus in the same organisation will be merely factory or support if competitive forces cannot easily be influenced by *IS/IT*. He uses the Porter (ref 5) model of competitive strategic analysis

- a) Industry level
- b) Competitive forces: substitutes, new entrants, buyers, suppliers and existing rivals
- c) Generic business strategy: low cost, differentiation, focus

to show that the portfolio is not a whole entity that can be 'plotted' into one quadrant. Different uses of *IS/IT* will fall into different quadrants based on the state of the industry, its determining forces and the chosen strategy of the business. For instance, supplier 'management' may be more strategic than using *IS/IT* to influence customers.

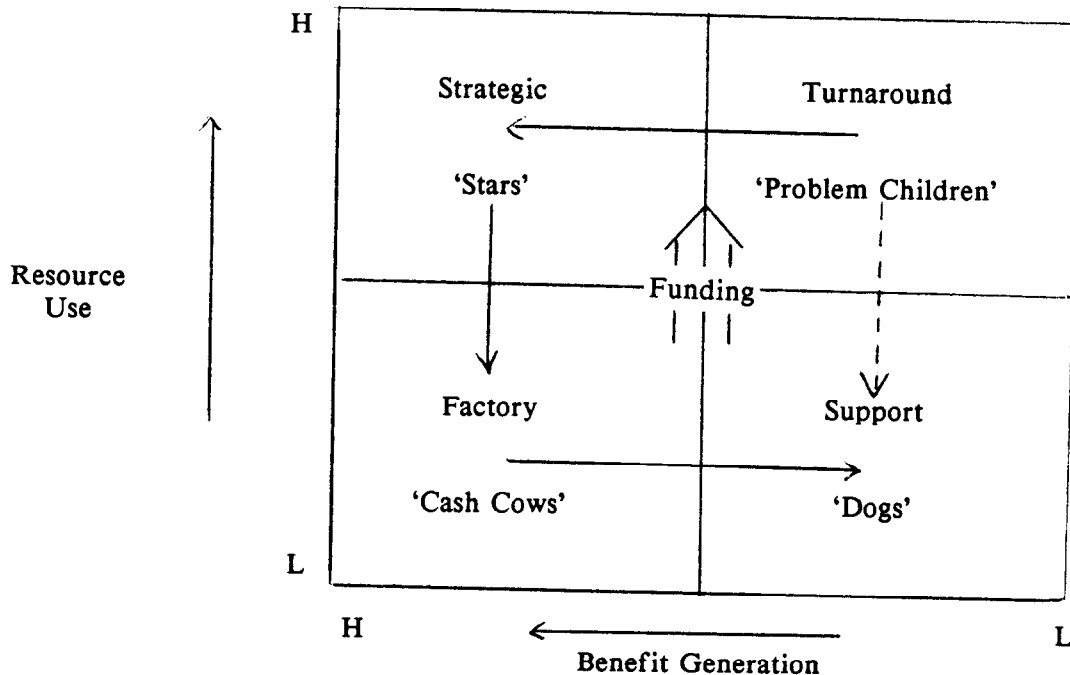
Second, he relates his 'Linking Strategies' - patterns of successful management philosophy and behaviour with respect to *IS/IT* - with the quadrants of the matrix. This produces a logical correlation with the most appropriate strategies to adopt, based on the placement of the overall portfolio at any one time.

Strategic	Centrally planned - <i>IS/IT</i> planning is fully integrated with business planning.
Turnaround	Leading Edge - technology will produce advantages if exploited effectively, or Free Market - users can best determine their own needs.
Factory	Monopoly - a central utility or service is the best way of satisfying business needs.
Support	Scarce Resource - choices of <i>IS/IT</i> investment should be made on financial considerations primarily.

He also identifies the need to consider a balanced mix of strategies to cope with a mixed portfolio for the business - because not all *IS/IT* applications will have a similar value in terms of competitive impact.

The author, in previous articles (refs 6 & 7) considered the same matrix in relation to the portfolio management concepts derived from the Boston Square and concluded that the matrix can be used as an analysis tool with regard to systems portfolios as well as product portfolios, although in a more qualitative way.

The correlations of 'cash cows' to Factory systems - the current 'profit earners', the importance for the future of 'stars' and Strategic systems, the uncertainties involved in managing 'problem children' and Turnaround applications are easy to draw. 'Dogs' and Support applications are less obviously related perhaps.



Two particular aspects of the analysis are worth comparing directly.

IS applications like products have life cycles - and contribute more or less to the business and drain more or less resources from the business during the evolving phases of their lives. Hence, they move around the matrix during that life cycle - hopefully in the right direction - 'problem children' overcome their adolescent problems to become 'stars' and sustain that potential to be mature 'cash cows' and only after a long and healthy life are they declared 'dogs' to be looked after as cheaply as possible, or ...

Cash cows and Factory systems generate the funds - benefits of money and corporate experience that can be used to undertake more risky ventures.

In the *IS* matrix the importance of experience in developing and sustaining complex and critical systems is as important as generating investable benefits - or the organisation will be incapable of tackling the more problematic, more advanced systems effectively.

Benefit generation equates to cash generation, resource use equates to cash use in the Boston sense. The Strategic and Turnaround applications will demand both substantial and high quality resources to make them successful - these must not therefore be being

drained in sustaining Factory and Support applications, the latter in particular should be resourced only when absolutely necessary.

As can be deduced from the above discussion, management styles required for each segment are quite different - this means that the processes of systems management, the systems tools, techniques and technologies to be used are different; different skills, abilities and organisations of people are required in each sector and for each strategy.

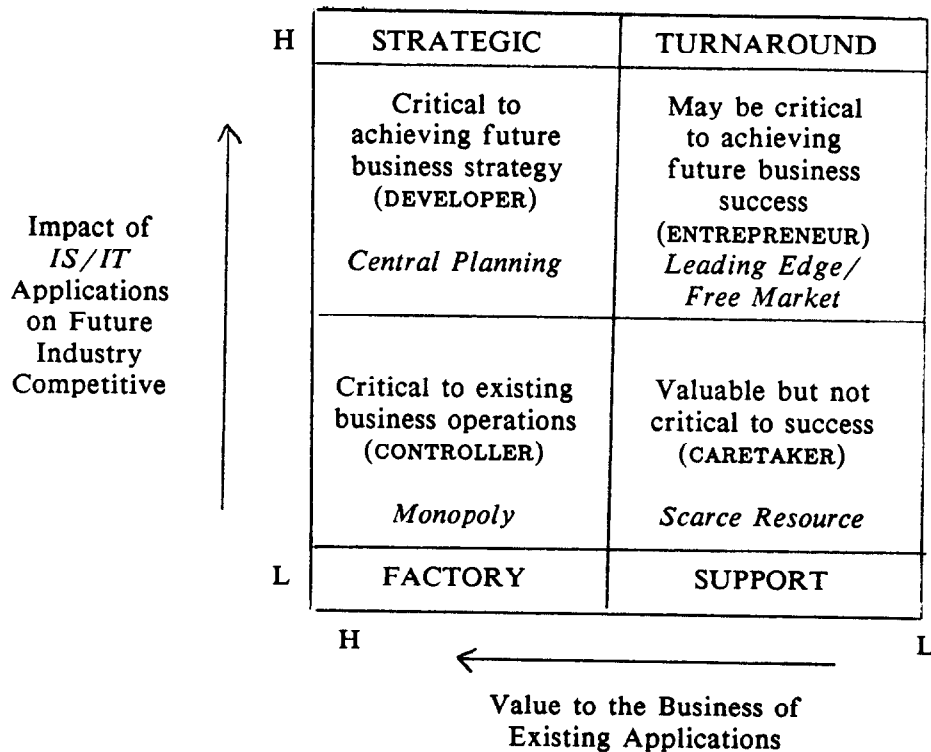
This is the same for a product portfolio - different management styles and expertise are required to manage a product at different points on the life cycle. Information systems need similar sensitive handling since the objectives, risk and practices to be managed will be different as the application evolves through its life.

- The early uncertainties need entrepreneurial management to champion the application through the phases of doubt or decide to stop when benefits cannot be realised.
- Strategic systems need more nurturing: adept team and resource development, flexible approaches to problems and opportunities.
- Factory systems needs tight control of quality and change to avoid disruption to the business but an awareness of how the system needs to develop to sustain the business benefit.
- Support systems should only be touched when absolutely necessary and should not be an issue. Consolidation and replacement by less resource demanding alternatives should be the prime objective in managing them.

Thus, the managerial characteristics of an entrepreneur, a developer, a controller and a caretaker will be needed in the different sectors and for an application as it evolves. The wrong style of management will place inappropriate importance, too much or too little, on a system and converting systems across sector boundaries in order to manage the portfolio effectively will be inhibited unless management approaches can be changed.

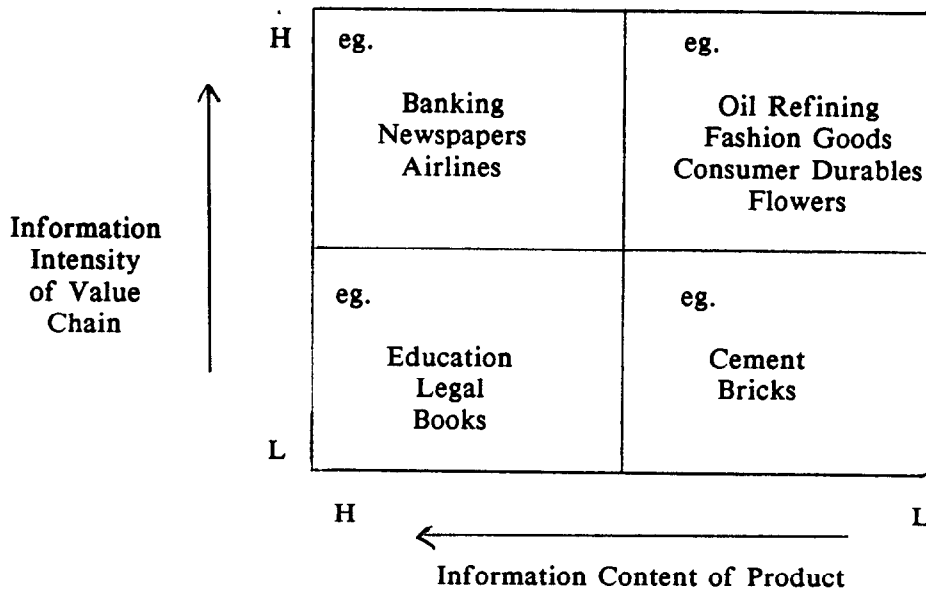
In Ref 7 these ideas are explored in more depth with respect to particular *IS/IT* methods and approaches to each segment of the matrix.

Combining these various approaches to the same basic matrix produces a composite of consistent emphasis.



Thus, any application can be classified according to the contribution it makes (or may make) to the business within the actual and expected competitive environment of the firm, and an appropriate strategy can then be adopted to its management. As times change, the portfolio will evolve and strategies for each application adapted according to its changing contribution.

2. THE PORTER/MILLAR MATRIX (REF 8)



The Porter/Millar model, like the original McFarlan matrix, takes a high level view of industries within which *IS/IT* impact will vary according to the 'information intensity' of the industry. Information intensity is a composite of the information content of the product (eg. total in news broadcasting, very little in a brick), and the amount and cost of information exchange which must occur in a given time to complete a transaction (high in fashion goods or with perishables, low in legal documents such as wills). Some industries combine both, others have one dominant aspect and a few have little of either.

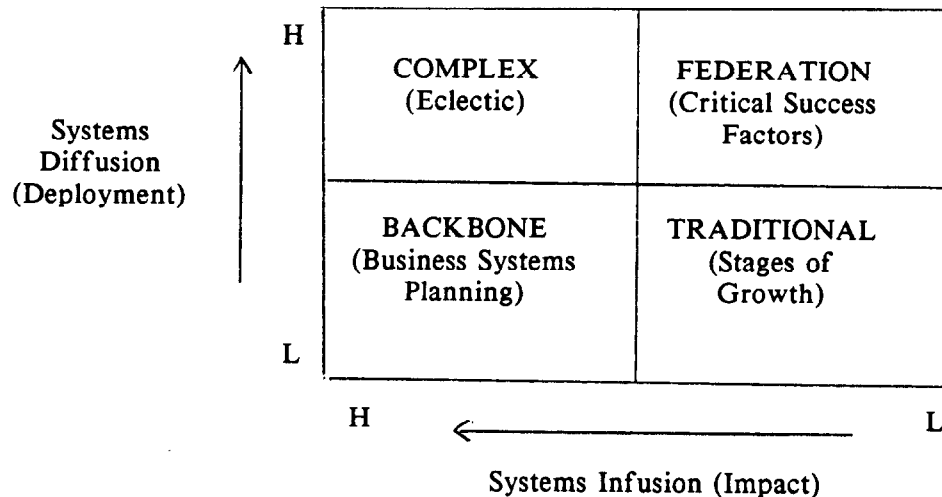
Again, the whole business is plotted, not now from the point of view of the firm and what it chooses to do, but from how the industry can utilise *IS/IT* in the product and its relationships with suppliers and customers.

Whilst the correlation with the McFarlan square is not entirely congruent, organisations in the 'LOW-LOW' intensity quadrant are less likely to find *IS/IT* being used as a major competitive weapon than in the 'HIGH-HIGH' quadrant, and less integral planning of *IS/IT* with the business is essential.

Businesses in the 'HIGH-LOW' squares are likely to have a more mixed portfolio, depending on how *IS/IT* affects the economics of the product, its production and delivery (a 'Factory' approach - the end product of the process being information in whatever final form) or affects the way a firm competes for business by rapid and effective exchange of information about its (non-information) product or service (a 'Turnaround' or initiative based approach). Firms in the 'Factory' box will suffer from business diseconomies if they do not adopt the correct technology for their product - a competitive disadvantage. Firms in the 'Turnaround' box may be able to exploit *IS/IT* to change business relationships to their advantage, but it will depend upon the co-operation of other parties (suppliers or customers, etc.), to achieve more effective value/cost relationships in the information intensive value chain.

Therefore, whilst the correlation with the 'McFarlan Box' is not concise, the Porter/Millar matrix implies a similar range of *IS/IT* management approaches to the *IS/IT* portfolio suggested by the other writers who have produced the various interpretations from the original matrix. If, for instance, an organisation can add information to a basic product in order to provide a new service, they will become dependent on *IS/IT* for delivery of that information service, and hence, move from 'Support' to 'Factory' in terms of criticality of *IS/IT* in its existing business systems.

3. THE SULLIVAN MATRIX (REF 9)



This matrix plots the '*infusion*' of *IS/IT* in the organisation

- 'the degree to which *IT* has penetrated a company in terms of importance, impact or significance'

against the '*diffusion*'

- 'the degree to which *IT* has been disseminated or scattered throughout the company'.

Based on this assessment an appropriate approach to planning *IS/IT* development can be adopted. Given the axes defined the assessment of approaches is based on the situation which prevails in an organisation and does not consider the external environment of the organisation.

Where infusion and diffusion are low, the use is 'Traditional' - ie. a centralised DP shop acting as a utility service and efficient, cost justified development of the resource is the objective. Applications are developed in isolation based on local needs as *IS/IT* evolution offers favourable investment opportunities. The 'stages of growth' evolutionary philosophy put forward by Nolan and Gibson (ref 15) seems to apply - benefitting from the experience gained as and when the use of *IS/IT* is economically justified.

High infusion, low diffusion implies an *IS/IT* 'backbone' - the company has become dependent on at least some of its systems and needs to ensure they are reliable and correctly integrated both in data and processing. The discipline of formal 'Business (or Information) Systems Planning' is required to ensure new developments fit effectively in the known pattern of business requirements. Information is viewed as an asset and Data Management has a strong role in the development process. Preventing systems failure predominates over exploiting *IS/IT* opportunities. The *IS* department has a dominant role. Sullivan mentions this as very like a 'factory' for *IS*.

In this part of Sullivan's analysis it is easy to see a close correlation between 'Traditional' and 'Support' systems, and 'Backbone' and 'Factory' systems as developed in overall concept above. The other two quadrants are less obviously related.

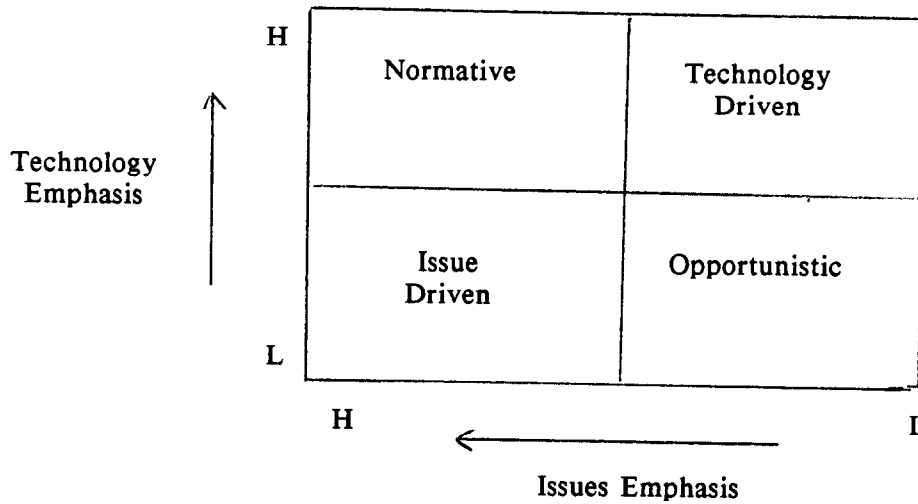
Where deployment (Diffusion) is high and impact (Infusion) is low, the control of the central *IS* group is lax and technology and its control is scattered. Users generally determine their own destiny but some co-operation, co-ordination amongst users and with any existing *IS* department is usually developed to enable data to be communicated, even if it is not properly shared. This arrangement 'Federation' is somewhat similar to the Parsons (ref 4) Free Market strategy - use of *IS/IT* is likely to be responsive to local business needs and may be innovative if somewhat wasteful due to duplication and possibly low levels of expertise. It describes a similar environment to 'Turnaround' - searching out the best way forward but in a non-integrated fashion. Sullivan suggests a 'Critical Success Factor' planning approach - local response or reaction driven to ensure *IS/IT* is used to address the most pressing business issues, based on prevailing senior management perception.

In the fourth quadrant both infusion and diffusion are high - the environment is 'Complex' - and *IS/IT* has become a critical in terms of the dependence of the organisation as a whole. This means it is of 'Strategic' importance and must be managed accordingly. 'Packaged' planning methodologies do not work well in this area, and hence, Sullivan terms the required approach as 'Eclectic' - any mixture of ways which relate *IS/IT* to the organisation's products and external relationships - using *IS/IT* to add value to its position in the market place, rather than focus on internal improvements. In this quadrant the organisation adapts the way it operates to the opportunities offered by *IS/IT*, rather than use *IS/IT* where it improves existing organisational relationships. Technology is generally centrally controlled and application demands are centrally co-ordinated and planned as part of the similarly eclectic (mixed) approach to the development of business strategy which pursues the organisation's uniqueness not its common ground with competitors. Information Systems Planning and Stages of Growth approaches emphasise the similarity of the organisation with a 'standard' business in the industry. Critical Success Factors focus on short term perhaps local competitive issues - but reactively - assuming the given objective. Eclecticism suggests that *IS/IT* is considered in establishing the objective as part of the business formulation process.

Thus, the four quadrants of Sullivan are very similar to the composite quadrants derived above, although the approaches to planning the less well established areas have a slightly different emphasis - this may reflect the internal view the matrix takes of the organisation's systems state of development rather than the external view of the business and the *IS/IT* relationship developed elsewhere.

4. THE HUFF & MUNRO (ITAA) MATRIX (REF 10)

The ITAA matrix (Information Technology Assessment and Adoption Matrix) was derived in the above reference from previous work by Rockart et al (ref 11).



The previous work of Rockart et al produced a matrix based on observed examples of how organisations have used *IS/IT* for competitive advantages. This identified four categories of *IS/IT* usage - based on the degree of change implied and the degree of external focus:

	Internal Operations	Competitive Market Place
Traditional Products	eg: more efficient invoice handling	eg: terminals in customers' premises
Significant Structural Change	eg: electronic payment systems	eg: managing customers' inventories

Based on a survey of ten large Canadian organisations Huff & Munro identified two main driving forces for *IS/IT* development - technology and business issues from which the matrix is derived - the ITAA matrix. They describe the extremes of 'technology driven' as solutions looking for solutions!

Where neither emphasis is high - the situation is described as opportunistic - not highly organised, merely evolutionary. If the technology emphasis is high and issues low, the *IS/IT* approach is 'technology driven, looking for ways of deploying new technology to advantage'. 'Issue driven' where technology emphasis is low tend to application planning first within the known possibilities of (existing) technology - very similar to the Business Systems Planning approach.

Where technology and issues drives are high, the approach described is Normative/Ideal (a situation not observed in the survey). Business issues and technology opportunities are fused in an integrated approach to the use of *IS/IT* in seeking strategic value from investments. Few organisations, they argue, can sustain this totally integrated approach.

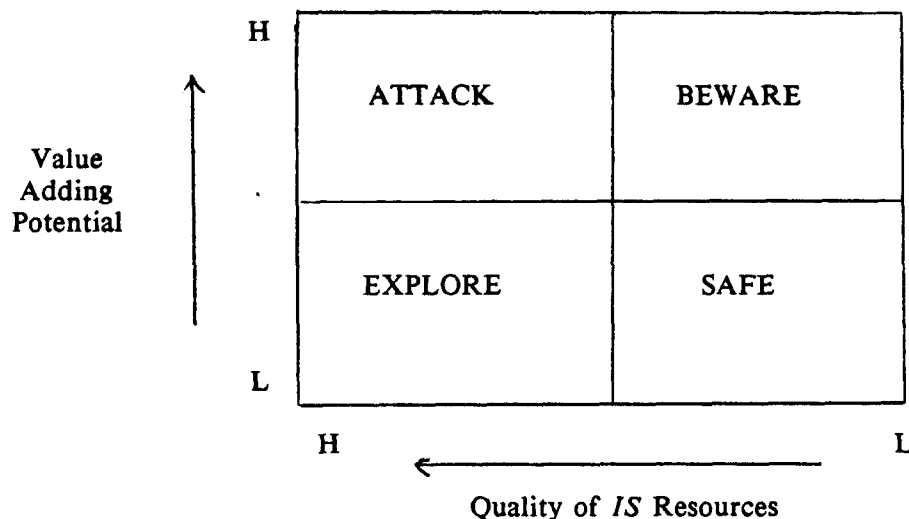
From their survey it appears that 'issue driven' organisations are more likely to develop both strategic systems and top down approaches to *IS/IT*. Opportunistic and Technology driven organisations are less exploitive of *IS/IT* in a business context and less co-ordinated in planning the gamut of potential applications and technologies from a corporate perspective.

These conclusions make sense in the context of the consolidated 'McFarlan' matrix - organisations with strong 'Factory' systems and a centralist approach find it easier to match the technology to the issues to produce strategic systems (the Normative/Ideal Match) than organisations with a previous emphasis on 'Support' - low on issues and technology - which requires a step function change in appreciation of *IS/IT* - and also those that are technology driven (Turnaround equivalent) since this probably means the general management of the organisation, as yet, perceives little proven benefit from technology.

In practice, the ITAA matrix covers similar territory to the extended 'McFarlan' matrix, but, rather like the Sullivan Square, has a more internal analytical rather than market driven *IS/IT* emphasis.

5. THE IVES & LEARMONTH/GALLIERS MATRIX (REFS 12 & 13)

This matrix, referenced from the above articles, is in both cases derived from work by McLaughlin et al (ref 14). It was expressed as a set of trends but can be easily partitioned into a matrix.



This matrix plots for an organisation/business the 'value adding potential', including the reduction in cost of doing business as well as enhancing market access or product differentiation, etc., against the competence of its systems resources.

The vertical axis is very similar to the Porter and McFarlan vertical axes - how can *IS/IT* impact the products, markets of the industry and the competitiveness of the firm

in that market? The 'value adding potential' and the 'information intensity' of the industry are related in considering *IS/IT* impact.

The horizontal axis plots the 'ability to deliver' of the *IS* resources within the organisation. Given high potential and strong resources the organisation should be seeking all possible opportunities to 'attack' the competition by exploiting *IS/IT*. If opportunities are high but ability low, the organisation is vulnerable to competitors via *IS/IT*. With low potential and low competence, the firm can assume it is 'safe' from attack, at least for the present. But where it is strong in *IS/IT*, even if opportunities at present are limited, it should consolidate its assets by 'exploring' any avenues which may produce more effective systems than competitors, by ensuring that wherever possible, *IS/IT* solutions are matched to evolving business needs. This will enable it to 'attack' quickly from a strong base should *IS/IT* impact change over time.

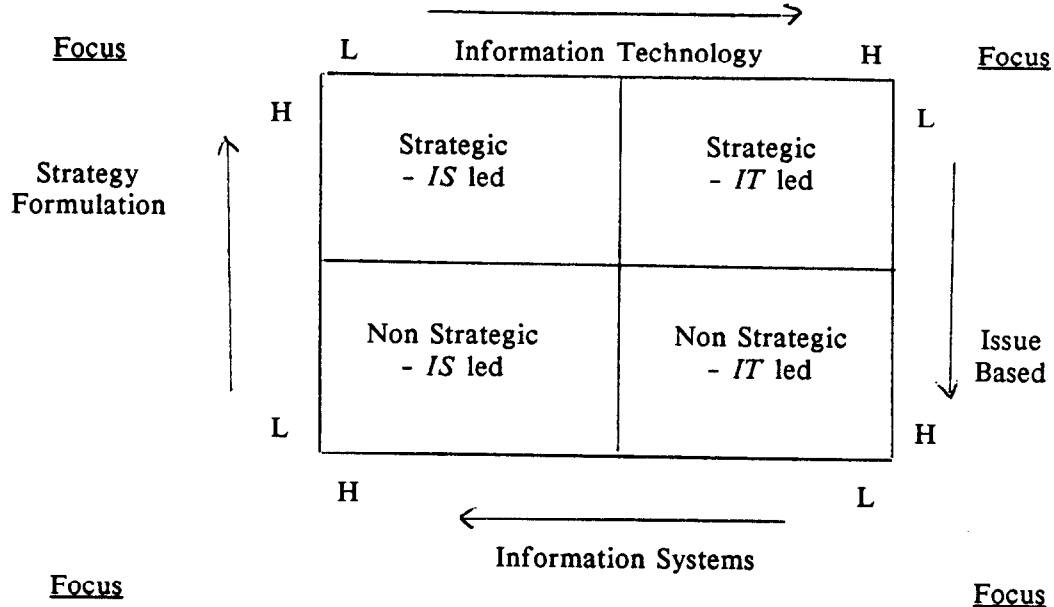
In essence, the 'safe' position equates to a 'stages of growth' philosophy discussed above, producing only support applications. Equally, 'exploring' from a sound base is similar to an 'issues driven', business systems planning approach which is orchestrated, not just allowed to proceed. The 'quality' of *IS/IT* resources in an organisation will reflect senior management's attitudes to the role of *IS* in the organisation, and thereby the degree of business direction given to their deployment.

As *IS/IT* provides more competitive potential or threat, depending on existing strength or weakness, it is obviously more feasible for an organisation which has been 'exploring' the business for *IS/IT* use to move up a gear into strategic or attacking mode. An organisation that has been idling safely will become vulnerable, and will have a choice of either first improving the quality of its resources, or buying into the riskier technology driven, turnaround mode to repulse the attacks as and where they in practice emerge as business threats. Defending itself will absorb considerable resources which will force management's attitude to change.

In summary, therefore, this matrix too addresses many of the same issues from a marginally different perspective.

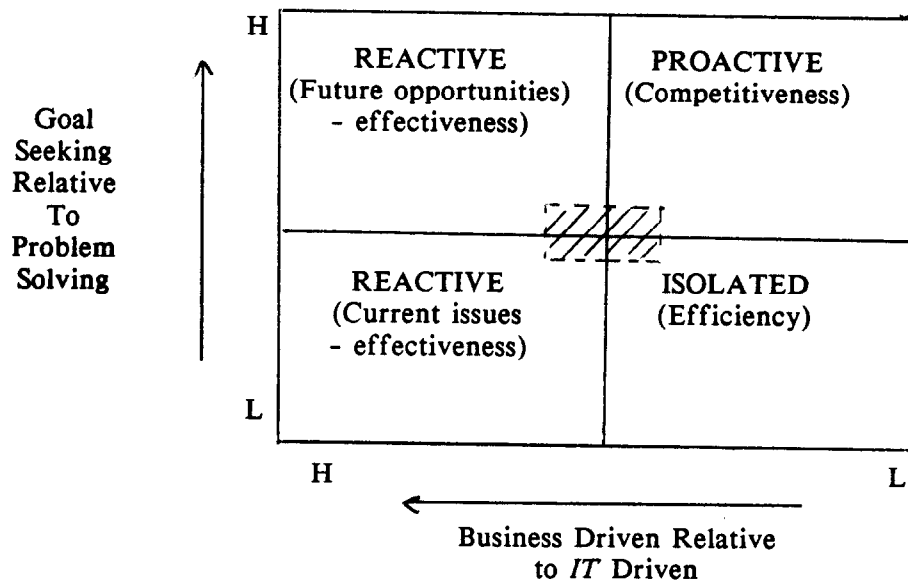
6. THE GALLIERS/HIRSCHHEIM MATRICES (REF 16 & 17)

The matrices below were adapted by Galliers from original analyses of *IS/IT* planning approaches produced by Hirschheim. Like the Sullivan approach earlier, they focus on planning approaches adopted by organisations as the role of *IS/IT* expands in an organisation, and as such reflect a similar evolution of planning maturity as that expressed by Earl (ref 17).



Once more the various segments closely reflect the Strategic (*IS* led) - Turnaround (*IT* led) - Factory (*IS* led) - Support (*IT* led) divisions of McFarlan, etc. where Strategy Formulation is the focus in Strategic and Turnaround; and Issues are the focus in Factory and Support.

They then develop the implications of the matrix on approaches to be adopted in *IS/IT* planning in the organisation.

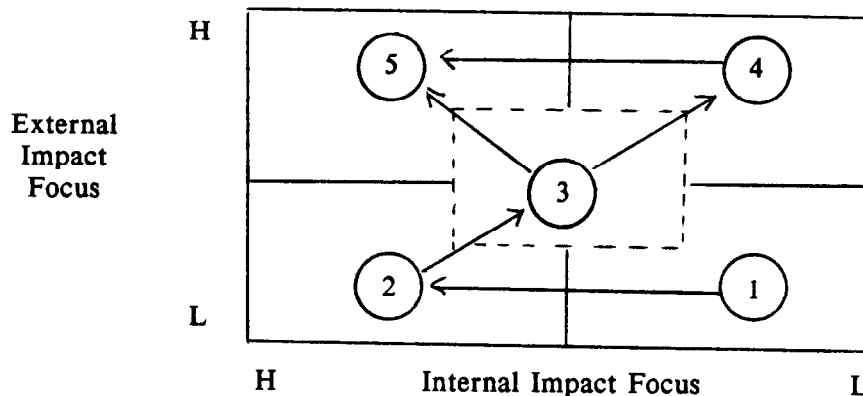


Galliers places an additional box around the central intersect called **INSIDE-OUT** planning - opportunity seeking (Competitiveness).

This compromise is derived from consideration of Earl's (ref 18) *IS* planning evolutionary/maturity model, which addresses five stages:

<u>Task</u> (& objective)	<u>Approach/</u> <u>Emphasis</u>	<u>Sullivan</u> <u>Equivalent</u>	<u>Led by</u>
1. <i>IS/IT</i> mapping (management understanding)	'Bottom Up'	'Stages of Growth'	<i>IS/DP</i>
2. Business Direction (agreeing priorities)	'Top Down'	'BSP'	Senior Mgmt Initiative
3. Detailed Planning (balancing the portfolio)	'Bottom Up + Top Down'	?	<i>IS</i> + users
4. Strategic Advantage (pursuing opportunities)	'Inside-Out'	'CSFs'	Users + Senior Mgmt
5. Strategy Linkage (integrating <i>IS/</i> business strategies)	Multiple methods	'Eclectic'	<u>Coalition</u> <i>IS</i> + users + senior mgmt

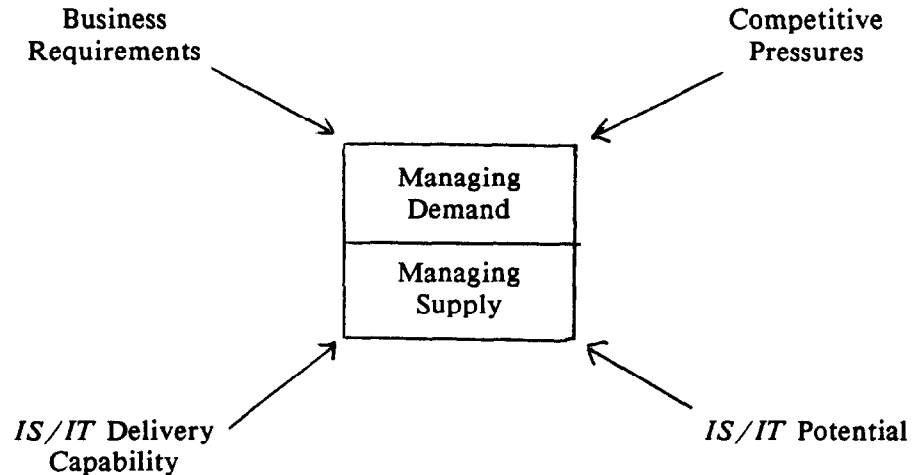
This evolution in the maturity of *IS/IT* planning can be seen in many organisations. If superimposed onto a basic matrix it appears to show a Z-shaped evolution.



Stage 3 appears to fill the middle area defined by Galliers, as a time of reassessment of the role of *IS/IT* in the business, enabling the external role to be recognised and re-focussing the attention of the organisation on the contribution of its information systems. A 'transition' or realignment as proposed by Nolan (ref 19) when *IS/IT* is seen as requiring the combined, if not yet fully co-ordinated, attention of *IS* professional users, if it is to realise its full potential in the organisation. Unless this happens the 'opening up' of *IS/IT* opportunities in the essentially user driven stage 4 will be without an overall business context, within which the potential can be effectively harnessed.

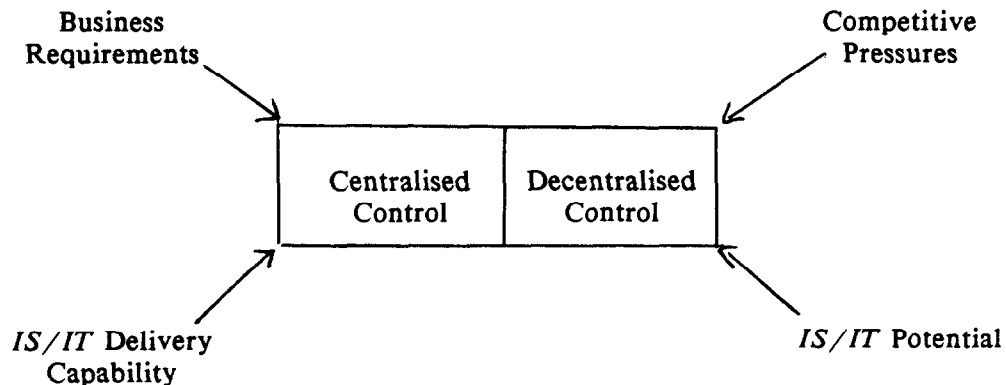
DISCUSSION

All the models seem to address the relationship between at least two of four variables or forces determining the role of *IS/IT* in the organisation.



In various ways they seem to address the need to manage *IS/IT* supply (which traditionally predominates) in harmony with *IS/IT* demand (which is not entirely under the control of the organisation in a competitive environment).

Also, they seem to address the need to accommodate centralised and decentralised management approaches which will depend on the degree of integration both desirable and feasible required in the applications of *IS/IT*, or at least how those application requirements are likely to manifest themselves.



Particular competitive opportunities and uses of new *IS/IT* will address singular or few applications and, initially at least, be exploited most advantageously close to the business opportunity. Applications which produce benefits by business integration or sharing of assets require centralised co-ordination which will only be achieved by effective planning within the business planning framework and will need competent *IS/IT* management to achieve long term goals. In overall terms therefore, an organisation

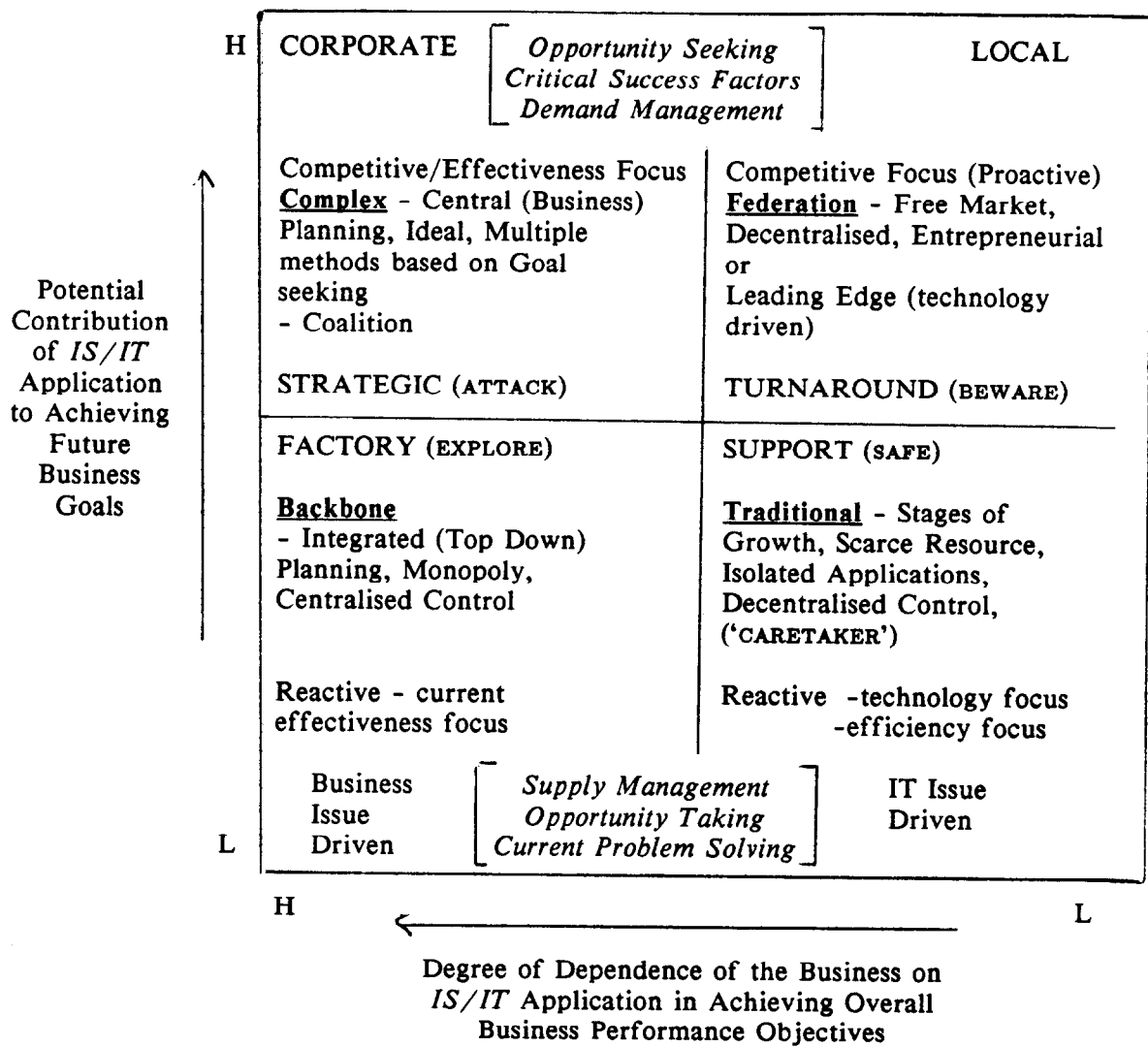
with an extensive *IS/IT* portfolio will need to balance at least four management approaches.

Centralised Demand Management	Decentralised Demand Management
Centralised Supply Management	Decentralised Supply Management

All of the matrices generally suggest this overall pattern.

The discussion during the examination of each of the matrices points out many of the similar or common aspects of each. There are many particular ideas expressed and very little direct conflict amongst them. To demonstrate this point it should be possible to draw a composite matrix which incorporates all the key ideas in appropriate, consistent segments. That is attempted below. Key words and phrases have been used wherever possible to show how the approaches in each of the matrix segments vary, although some ideas clearly cross matrix segments.

The axes chosen are derived primarily from the McFarlan matrix. The horizontal axis attempts to reflect the ability of an organisation to control its destiny where business parameters (and therefore applications) are well known or stable. The vertical axis reflects the uncertainty due to market forces of future *IS/IT* impact, and therefore *IS/IT* applications with potentially major structural/competitive implications in the industry. In practice, defining the composite axes is more difficult than mapping similar attributes into the segments. The axes finally chosen may not be the best expression of the contents.



SUMMARY AND CONCLUSIONS

This article set out to explore and examine the use of simple 2 x 2 matrices as a method of classifying *IS/IT* applications, opportunities, etc. to enable management to make more pertinent judgements with respect to *IS/IT*. Against this first objective, most of the matrices offer useful classifications - at least reducing the potentially infinite options available to a reasonable, relevant number of alternatives. As such they can offer management a degree of business guidance similar to that provided by other business analysis matrices - perhaps less quantified analysis, but a 'first-cut' high level assessment of *IS/IT* implications for the business.

Some key issues and ideas raised by the matrices are:

- the need for different 'generic' strategies in each segment leading to different management styles and degrees of devolvement of responsibility;
- applications have business life cycles and need to be managed in different ways as their contribution waxes and wanes - a cycle subject to market forces;
- approaches and planning have to become more flexible, creative and sophisticated as the *IS/IT* use is linked more closely to the business objectives. Traditional *IS/IT* planning 'methodologies' are inadequate for the task;
- the competence of the organisation in *IS/IT* is a key factor in determining the options available and in itself will influence the ability of the organisation to plan effectively;
- effective *IS/IT* strategic management requires the management of demand for and supply of *IS/IT*. Historically most effort has been expended managing the supply.

The matrices show significant degrees of commonality and little conflict. They are essentially complementary. This is re-assuring - that each set of ideas is probably part of a logical pattern.

Finally, a composite matrix can be produced to provide more comprehensive advice to management than using each idea separately - although defining suitably all-embracing axes is difficult. The resulting matrix provides a balanced set of management parameters - but could be over simplistic as with all matrices. It is important to use this composite matrix with a full appreciation of the component ideas.

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