Allied Academies International Conference

Las Vegas, Nevada
October 12-15, 1999

Academy of Information and Management Sciences

Proceedings

Proceedings of the Academy of Information and Management Sciences

October 12-15, 1999
Las Vegas, Nevada

Jo Ann and Jim Carland
Co-Editors
Western Carolina University

**The Proceedings of the
Academy of Information and Management Sciences
are published by the
Allied Academies, Inc., PO Box 2689, Cullowhee, NC, 28723.**

**The Academy of Information and Management Sciences is an affiliate of the
Allied Academies, an international, non-profit association of scholars whose
purpose is to support and encourage the exchange of knowledge around the
world.**

Proceedings of the Academy of Information and Management Sciences

Table of Contents

TESTING THE VALIDITY OF
MILES AND SNOW'S TYPOLOGY

Anne-Marie Croteau, Concordia University
croteau@alcor.concordia.ca
Louis Raymond, Université du Québec à Trois-Rivières
louis_raymond@uqtr.uquebec.ca
François Bergeron, Université Laval
francois.bergeron@fsa.ulaval.ca

ABSTRACT

Within the context of the strategic alignment of information technology, Miles and Snow's (1978) typology was used to measure the business strategy construct, as operationalized with an instrument developed by Segev (1987). A survey of 301 firms indicates that this typology, after some modifications to the original measure, is still appropriate to evaluate business strategy. A confirmatory factor analysis approach was adopted, using structural equation modeling. This paper addresses the aspects of this investigation..

INTRODUCTION

Since the early 1990s, improving the information system planning process has been one of the top ten concerns of senior information systems executives (e.g., Janz, Brancheau and Wetherbe, 1996). Gartner Group's 1999 annual survey reports that aligning information technology with business goals is still CIOs' critical technology management issues (Raphaelian and Broadbent, 1999). In order to carry out this planning process successfully, it is deemed important to align the information systems plan with the organization's business plan. A few recent studies have successfully observed the effect of the alignment of information technology with organizational variables on organizational performance. Specifically, information systems management and business strategy gain to be mutually planned to improve organizational growth and profitability (Bergeron and Raymond, 1995; Raymond, Paré and Bergeron, 1995; Chan, Huff, Barclay and Copeland, 1997).

From a methodological point of view, various instruments have been used to explore the relationship between business strategy and performance; for instance, Venkatraman's (1989) instrument on strategic orientation has been frequently used. However, the best known approach to characterize business strategy originates from Miles and Snow (1978), which has been quoted more than 650 times in the last years (Social Sciences Quotation Index, 1989-1998). The principal strength of this typology is the simultaneous consideration of the structure and processes necessary for the realization of a given type of business strategy. Miles and Snow's (1978) typology reflects a complex view of organizational and environmental processes, as well as the attributes of product, market, technology, organizational structure and management characteristics (Smith, Guthrie and Chen, 1989).

Within the context of strategic alignment of information technology, the purpose of this research is to validate Miles and Snow's typology as operationalized by Segev (1987).

MILES AND SNOW'S TYPOLOGY

Business strategy is the outcome of decisions made to guide an organization with respect to the environment, structure and processes that influence its organizational performance. Approaches to identifying a business strategy can be textual, multivariate or typological (Hambrick, 1980). The typological approach is recognized as creating a better understanding of the strategic reality of an organization, since all types of business strategy are viewed as having particular characteristics but a common strategic orientation. While several typologies have been proposed (see Ansoff and Stewart, 1967; Freeman, 1974; Porter, 1980; Miles and Snow, 1978), the most frequently used in empirical research is Miles and Snow's (Zahra and Pearce, 1990; Smith, Guthrie and Chen, 1989).

Miles and Snow's typology consists of four ideal types of business strategy defined as prospector, analyzer, defender, and reactor. Firms choose one type rather than another according to the perception they have of their environment. The first three types can be considered along a continuum, expected to enhance organizational performance. The prospector strategy is at one end of the continuum, and the defender one at the other. The analyzer strategy is a combination of the two. The reactor strategy is excluded from the continuum since it represents an organization having no specific strategy identified. This last type is expected to impede organizational performance.

Organizations opting for the prospector strategy wish to have access to the largest possible market. They are characterized by their repeated efforts to innovate and bring about changes in their industry. Organizations selecting the defender strategy have a restricted market and stress production efficiency. They emphasize the excellence of their products, the quality of their services, and their lower prices. Organizations choosing the analyzer strategy do all of the above, but in moderation. Finally, organizations having a reactor strategy ignore new opportunities, nor can they maintain markets already acquired or take true risks.

Several empirical studies have used Miles and Snow's typology (1978) (Snow and Hrebiniak, 1980; Hambrick, 1983; Conant, Moksa and Burnett, 1989; Namiki, 1989; Smith, Guthrie and Chen, 1989; Tavakolian, 1989; Shortell and Zajac, 1990; Thomas, Litschert and Ramaswamy, 1991; Parry and Parry, 1992; Abernethy and Guthrie, 1994; Julien *et al*., 1996; Karimi *et al.*, 1996). The presence of the four strategic types vary depending upon the industry, the sample size or the other constructs linked to business strategy. Among those studies, some have used an item-based approach (Segev, 1987; Conant *et al*., 1989; Namiki, 1989; Smith *et al*., 1989; Thomas *et al*., 1991), whereas others have used the self-typing approach (Snow and Hrebiniak, 1980; Tavakolian, 1989; Shortell and Zajac, 1990; Parry and Parry, 1992; Julien *et al.*, 1996; Karimi *et al*., 1996).

METHODOLOGY

The instrument used to measure Miles and Snow's typology in this study was taken from Segev (1987) which uses 25 items on a Likert-type scale varying from 1 to 7 (highly disagree to highly agree). This instrument was chosen among others because of its content validity, characterizing all four types of business strategy, and was the only one readily made available to researchers through

its publication. Following in-depth interviews used to pre-test the research instrument, questionnaires were sent to a sample 1,949 Canadian firms. These companies were listed in Dun & Bradstreet's directory. The selection criteria were to have more than 250 employees and to come from various branches of industry. A total of 301 companies returned the questionnaire addressed to the CEO for a final response rate of 15.4%.

RESULTS

Given the research objectives, a confirmatory factor analysis approach was adopted, using Wold's (1982) PLS ("partial least squares") implementation of structural equation modeling. Such an approach is based on *a priori* information about the structure of the business strategy construct. The structural model estimation and results provide assessments of unidimensionality and convergent validity, reliability, discriminant validity, and predictive validity of this construct.

The structural model to be solved for unidimensionality and convergent validity can be defined as $x = \Lambda\xi + \delta$ where x is a vector of the 25 observed variables (indicators or items), ξ is a vector of the 4 latent variables (traits or factors), δ is a vector of random (measurement) errors, and Λ is a 25 by 4 matrix of factor loadings (λ) relating the observed variables to the latent variables. The initial PLS estimates obtained for Λ are presented in Table 1. Six items (D4, D5, D7, AN2, AN3, PR5) were dropped because of their weak loadings on their hypothesized factors. A seventh one (AN1: "The firm adopts quickly promising innovations in the industry") was transferred from the analyzer to the prospector dimension as it loaded more strongly on the latter and could plausibly be attributed to it on a theoretical basis. The results obtained from estimating the modified model, based on the 19 remaining items, are presented in Table 2. Based on the new values obtained, it can be concluded that the four types of business strategy achieve unidimensionality and convergent validity.

Within the structural equation modeling framework, construct reliability (ρ) is conceptualized as the proportion of measured variance in the observed variables attributed to their underlying latent variable, and is calculated as the ratio of factor variance to the sum of factor and error variance. Thus, a ρ value greater than the recommended 0.7 value indicates that the factor captured at least 70% of the measurement variance. Returning to Table 2, one sees this to be the case for all four dimensions in the modified model.

Discriminant validity refers to the extent to which the measures of the four types of business strategy are unique from each other. This is verified when the square root of the average variance extracted by a factor from its associated items (i.e. $[\Sigma_{i=1,q}\lambda_{i,j}^2/q]^{1/2}$) is inferior to the correlation (i.e. [shared variance]$^{1/2}$) between this factor and any other factor. Looking at Table 3, this is shown to be the case for all four dimensions, thus confirming their distinctive characteristics.

When looking at the predictive validity of a construct, one ascertains if its measures relate to an antecedent or consequent construct in accordance to the theoretical framework from which it emanates. In this study, given Miles and Snow's (1978) arguments on the links between their typology and business performance and the use of this typology in subsequent empirical studies, the four types of business strategy were related to two fundamental dimensions of performance, namely growth and profitability, using Venkatraman's (1989) perceptual measure (3 and 5 items respectively). The results of correlating the business strategy and performance constructs are presented in Table 4 and discussed below.

Table 1: Unidimensionality, convergent validity, and reliability of initial model				
factor item	reactor	defender	analyzer	prospector
R1	.75[a]	-	-	-
R2	.73	-	-	-
R3	.67	-	-	-
R1	-	.69	-	-
D2	-	.68	-	-
D3	-	.62	-	-
D4	-	.07	-	-
D5	-	.18	-	-
D6	-	.61	-	-
D7	-	.25	-	-
D8	-	.65	-	-
D9	-	.59	-	-
AN1	-	-	.61	.67
AN2	-	-	-	-
AN3	-	-	-	-
AN4	-	-	.68	-
AN5	-	-	.34	-
AN6	-	-	.75	-
PR1	-	-	-	.67
PR2	-	-	-	.52
PR3	-	-	-	.59
PR4	-	-	-	..68
PR5	-	-	-	.13
PR6		-	-	.66
PR7		-	-	.71
ρ	.76	.74	.69	.78
[a] loading of observed variable on latent variable (a dash indicates a loading inferior to 0.40)				

DISCUSSION

Overall, the data analyzed seem to adequately support the notion that the four types of business strategy are unidimensional, and that the operational indicators used here show reliability and construct validity. One can further discuss the behavior of these indicators in terms of statistical and theoretical criteria by examining the relationships among the types, as well as between each type and performance. Looking at the intercorrelations of the four dimensions estimated by PLS (Table 3), one finds as expected that the more firms exhibit reactive behaviors, the less they act in both a prospective and an analytical manner. Whereas firms that exhibit more prospective behaviors also tend to be more analytical and less defensive. This empirical pattern of interrelationships among the four types of strategic activities thus appears to be coherent with Miles and Snow's underlying assumptions on strategic types.

Results presented in Table 4 show how each type of business strategy relates to business growth in terms of sales and market share increases, and to profitability in terms of financial position

relative to the competition. As predicted by the theory, reactor and prospector business strategies are respectively associated here with inferior and superior performance. However, the relationship of both defender and analyzer business strategies with performance was not significant. One could tentatively argue here from a contingency theory point of view. Being less extreme, more "middle-of-the-road", defender and analyzer business strategies would need to match other fundamental aspects of the organization to be effective, and thus cannot be shown to increase performance without taking into account other dimensions such as the firm's environment, structure and information technology.

Table 2 : Unidimensionality, convergent validity, and reliability of modified model				
factor item	reactor	defender	analyzer	prospector
R1	.75	-	-	-
R2	.73	-	-	-
R3	.67	-	-	-
D1	-	.70	-	-
D2	-	.71	-	-
D3	-	.59	-	-
D4	-	(removed)	-	-
D5	-	(removed)	-	-
D6	-	.61	-	-
D7	-	(removed)	-	-
D8	-	.64	-	-
D9	-	.57	-	-
AN1	-	-	(removed)	.69
AN2	-	-	(removed)	-
AN3	-	-	(removed)	-
AN4	-	-	.82	-
AN5	-	-	.43	-
AN6	-	-	.70	-
PR1	-	-	-	.47
PR2	-	-	-	.53
PR3	-	-	-	.64
PR4	-	-	-	.69
PR5	-	-	-	(removed)
PR6	-	-	-	.71
PR7	-	-	-	.81
ρ^b	.76	.80	.70	.84
[b] reliability coefficient = $(\Sigma\lambda)^2 / (\Sigma\lambda)^2 + \Sigma(1-\lambda^2)$				

Table 3: Assessment of discriminant validity				
Strategy	reactor	defend	analyzer	prospect
reactor	.72[a]			
defender	.08[b]	.64		
analyzer	-.32***	.10	.67	
prospect	-.52***	-.21**	.30***	.66
* p<.05 ** p<.01 *** p<.001				

Table 4 : Assessment of predictive validity				
Strategy	reactor	defend	analyzer	prospect
With Performance				
Growth	-.30***	-.01	-.02	.36***
Profit	-.15*	-.01	-.02	.24***

[a]diagonal : (average variance extracted from the observed variables by the latent variable)$^{1/2}$ = $(\Sigma\lambda^2/q)^{1/2}$
[b]subdiagonals : correlation between latent variables = (shared variance)$^{1/2}$
[c]correlation with the two Performance dimensions (whose measurement was assessed similarly to the Strategy dimensions, satisfying criteria of reliability, unidimensionality, convergent and discriminant validity)

CONCLUSION

It can be concluded from this study that Miles and Snow's typology of business strategy, as operationalized by Segev, is a valid instrument once modified through statistical analysis. The modifications consist in removing inconsistent items and assigning one item to a different strategic type. These changes may be due to the fact that Segev's instrument had been tested with students, and thus possibly lacked in external validity. An evolution in the concept of business strategy between the time the measure was designed (1987) and its present testing (1999) might be another reason. Overall, the redesigned instrument is now considered appropriate to pursue research on the strategic alignment of information technology.

REFERENCES

Abernethy, M. A. et C. H. Guthrie (1994), "An Empirical Assessment of the "Fit" between Strategy and Management Information System Design", *Accounting and Finance*, 49-66.

Ansoff, H. I. and J. M. Stewart (1967), "Strategies for a Technology-based Business", *Harvard Business Review*, *45(6)*, 71-83.

Bergeron, F and L. Raymond (1995) "The Contribution of Information Technology to the Bottom Line: A Contingency Perspective of Strategic Dimensions" *Proceedings of International Conference on Information Systems,* Amsterdam, pp 167-181

Chan, Y. E., S. L. Huff, D. W. Barclay and D. G. Copeland (1997) "Business Strategic Orientation Information Systems Strategic Orientation and Strategic Alignment" *Information Systems Research, 8(2)* pp 125-150.

Conant, J. S., M. P. Mokwa et J. J. Burnett (1989), "Pricing and Performance in Health Maintenance Organizations: A Strategic Management Perspective", *Journal of Health Care Marketing*, *9(1)*, 25-36.

Freeman, C. (1974), *The Economics of Industrial Innovation*, Penguin, Harmondsworth, England.

Hambrick, D. C. (1983), "Some Tests of The Effectiveness and Functional Attributes of Miles and Snow's Strategic Types", *Academy of Management Journal*, *26(1),* 5-26.

Hambrick, D. C. (1980), "Operationalizing the Concept of Business-Level Strategy in Research", *Academy of Management Review*, *5(4)*, 567-575.

Janz, B. D., J. C. Brancheau and J. C. Wetherbe (1996) "1994 Key Information Systems Management Issues" *MIS Quarterly, 20(2),* pp 225-243.

Julien, P.-A., L. Raymond, R. Jacob and C. Ramangalahy (1996), "Patterns and Determinants of Technological Scanning : An Empirical Investigation of Manufacturing SMEs*", Proceedings of the Babson College Foundation Entrepreneurship Research Conference*, Seattle.

Karimi, J., Y. P. Gupta et T. M. Somers (1996), "Impact of Competitive Strategy and Information Technology Maturity on Firms's Strategic Response to Globalization*", Journal of Management Information Systems*, *12(4)*, 55-88.

Miles. R. E. and C. C. Snow (1978), *Organizational Strategy, Structure, and Process*, McGraw-Hill, New York.

Namiki, N. (1989), "Miles and Snow's Typology of Strategy, Perceived Environmental Uncertainty, and Organizational Performance", *Akron Business and Economic Review*, *20(2)*, 72-88.

Parry, M. et A. E. Parry (1992), "Strategy and Marketing Tactics in Nonprofit Hospitals", *Health Care Management Review, 17(1)*, 51-61.

Porter, M. E. (1980), Competitive Strategy: Techniques for Analyzing Industries and Competitors, The Free Press, New York.

Raymond, L, G. Paré and F. Bergeron (1995) "Matching Information Technology and Organizational Structure: An Empirical Study with Implication for Performance" *European Journal of Information Systems, 4*, 3-16

Raphaelian, G and M. Broadbent (1999) "Top CIO Issues for 1999: Juggling Eggshells" *GartnerGroup*

Segev, E. (1987), "Strategy, Strategy-Making, and Performance in a Business Game", *Strategic Management Journal, 8*, 565-577.

Shortell, S. M. and E.J. Zajac (1990), "Perceptual and Archival Measures of Miles and Snow's Strategic Types: A Comprehensive Assessment of Reliability and Validity", *Academy of Management Journal*, *33(4)*, 817-832.

Snow, C. C. and L. G. Hrebiniak (1980), "Strategy, Distinctive Competence, and Organizational Performance", *Administrative Science Quarterly, 25*, 317-336.

Smith, K. G., J. P. Guthrie and M. J. Chen (1989), "Strategy, Size, and Performance", *Organizational Studies*, *10(1)*, 63-81.

Tavakolian, H. (1989), "Linking the Information Technology Structure with Organizational Competitive Strategy: A Survey", *MIS Quarterly, 13(3)*, 309-317.

Thomas, A. S., R. J. Litschert et K. Ramaswamy (1991), "The Performance Impact of Strategy-manager Coalignment: An Empirical Examination", *Strategic Management Journal*, *12*, 509-522.

Venkatraman, N. (1989), "Strategic Orientation of Business Enterprises: The Construct, Dimensionality, and Measurement", *Management Science, 35(8)*, 942-962.

Wold, H. (1982), "Systems Under Indirect Observation Using PLS", in Fornell, C. (ed.), A Second Generation of Multivariate Analysis, New-York: Preager, pp.325-347.

Zahra, S. A. and J. A. Pearce II (1990), "Research Evidence on the Miles and Snow Typology", *Journal of Management, 16(4)*, 751-768.

INTERNATIONAL PROJECT MANAGEMENT: TWO OPPOSING MODELS OF EFFECTIVENESS

Paul Burgar, Christian Brothers University

pburgar@cbu.edu

ABSTRACT

Two models of effectiveness offer conflicting guidelines to information technology managers who work in international business. The diversity model says that project managers must adapt their management techniques to local cultures. By contrast, the opportunity cost model says that project managers must measure their effectiveness by meeting deadlines regardless of culture. Diversity researchers have shown that culture affects business practice, even in multinational corporations where everyone seems to be cut from the same mold. In his analysis of IBM international operations, for example, Hofstede (1994, 1997) showed that even when business associates communicate in a common language such as English, their home culture affects how they think. Hofstede calls these thinking patterns "software of the mind". Monochronic versus polychronic time conception (Victor, 1992) is one culturally programmed difference of great importance for project managers. In monochronic business cultures, time is money and lost profit is usually the greatest cost of project delay (Goldratt, 1997). In polychronic business cultures, there is a tradeoff between human relationship issues such as quality time and traditional cost priority issues. In practice, international project managers use a variety of strategies to cope with these opposing models of effectiveness.

INTRODUCTION

This paper reports an important challenge for international project managers. They must cope with the diversity of mental software among members of an international project team. This diversity is likely to include widely divergent assumptions about the importance of meeting project deadlines. At the same time, the manager's career success depends on a track record of bringing projects in on time. The issue here is whether Western approaches to project management are compatible with the time concepts embedded across the world's cultures.

STRENGTH THROUGH DIVERSITY MODEL

One of the most important principles in international business is that diversity is an advantage when managed properly. Rather than demeaning other cultures from the perspective of Western culture, cultural differences should be understood, appreciated, and built upon to promote global

prosperity. The diversity model is a partly a matter of faith. Leading thinkers in international management believe that valuing diversity is the right thing to do, and therefore it ought to pay off. It is more than that, however. Researchers have demonstrated empirical support for it as well (Morosini, Shane, and Singh, 1998). It offers the promise of building prosperity on the contributions of all peoples.

Cultural diversity clearly has a big impact on the how business is conducted from one country to the next (Morrison, Conaway, and Borden, 1994). Does that mean, however, that managers are bound to accept extensive project delays as inevitable just because the project team is international? Or is it always best to enforce project deadlines regardless of culture when the cost of delay is enormous? In Western Europe and the United States, for example, it is extremely important to meet project deadlines. Projects that fall behind schedule may justify drastic action. These business cultures are known as monochronic in the international business literature (Victor, 1992).

Here are some of the major components of monochronic thinking, described for Latin American business people trying to understand U.S. business: (1) time is money, so every decision, every activity, every commitment is controlled by the clock, (2) a manager is under constant pressure to meet time commitments, and much of one's personal life is thereby sacrificed, (3) lack of punctuality is considered almost a disgrace, and excuses are seldom accepted, (4) life moves by the clock, and any disrespect for time has serious repercussions, and (5) everyday work life is a treadmill: to succeed you must stay on it; if you step off, you are lost (Kras, 1995).

Many other business cultures, however, are not so obsessed with meeting deadlines. Polychronic temporal conception, which is an alternative mental algorithm for scheduling time, places greater emphasis on personal interaction than on schedules. In polychronic cultures, a task is usually completed even if it is necessary to go beyond the time scheduled for doing so. The delay, in turn, forces the next task off schedule. Still, the people who have the next appointment are not expected to be offended or irritated by the delay, because they know that, in its time, their project will also be handled completely. Scheduling is approximate rather than specific. An appointment guarantees that an individual will be seen; it may not guarantee when (Victor, 1992).

Polychronic time runs on several tracks simultaneously. Tasks run on one time track. Personal relationships run on another track with equal urgency. Polychronic business people switch back and forth between these varieties of mental time. Even in U.S. culture, we have an inkling of this second track when we are exhorted to spend quality time with our families. Quality time means we are thinking about relationships, not business. We know what this means and may even feel guilty when we don't do it. In our business culture, however, work comes first. In our monochronic culture, enforcing project deadlines is accepted as legitimate if the stakes are high enough. We become accustomed to putting family needs on the back burner. That this happens so automatically is evidence of our cultural programming. When duty calls, we explain to friends and family that we have no choice but to give first priority to our work. We expect them to understand. They usually do.

Nevertheless, most of the world operates on polychronic time (Victor, 1992), so the assumptions made in the U.S. about enforcing project deadlines are not shared in many other business cultures. That spells trouble when a management method popularized in the United States is exported around the world.

OPPORTUNITY COST MODEL

A second important model in international business is the global attraction of project management as a business specialty. Universal concern about the millennium bug (Y2K) is a high profile example of the need for timely and effective project management. No country can indefinitely postpone system upgrades and expect to flourish in international business. In all countries, software development, systems conversions, and product development can present enormous challenges for project management. One study of 8,380 software projects reported that 75% of these projects were late, averaging 222% of their original time estimates. Cost overruns averaged 189% (Lynch, 1998). Because of these widespread difficulties, project management expertise is a growth industry. The premier professional organization for project managers is The Project Management Institute (PMI). There are some 100 PMI chapters in the United States. PMI's most explosive growth, moreover, is among international managers. Chapters are now forming in Bahamas, Brazil, Canada, China, Ecuador, Egypt, India, Italy, Mexico, Nigeria, Pakistan, Poland, Singapore, Spain, Taiwan, Trinidad, Turkey, and Zimbabwe (Carter, 1999). These chapters could all be approved in 1999, swelling the ranks of fifty international chapters already in place.

One of the leading lights in project management is Dr. Eliyahu Goldratt, an Israeli physicist (Newbold, 1998; Pinto, 1999). Goldratt (1997) published his ideas in a popular novel, *Critical Chain.* Focusing on opportunity costs associated with missed project deadlines, Goldratt's approach is very appealing to executives. Rigorous application of the critical chain approach can eliminate most project overruns. To do that, however, Goldratt's disciples mercilessly enforce project deadlines. The power of critical chain thinking is that it exposes causes of project delay that commonly operate but are not usually detected until it is too late. According to Goldratt, even projects that are very well designed using traditional methods are likely to miss their deadlines because of frequent problems such: Multitasking, Gold Plating, and Safety Time.

Multitasking exists when team project team members have too many distracting assignments. Project team members may be assigned to one main event, critical project. In addition, other little projects come up that must be handled right away and shouldn't take much time. No problem? Goldratt shows how these little projects end up costing huge amounts of money. They form a cancer that feeds on the main event. The resulting delay in the main project becomes a huge cost because it forces the business to delay profits that would have been realized if the project had come in on time. Think, for example, of the effect of a six month delay on a Y2K project for a financial institution. The personnel costs of keeping a project team together for another six months would be relatively minor compared to the cost of losing its customer base because accounts run into trouble in the year 2000. Goldratt thinks that the cost of multitasking is seldom calculated in terms of realistic opportunity cost. If it were, firm project priorities might stick.

Gold Plating becomes a problem when technical people on project teams add features and functions to projects that are nice to do and offer opportunities for improving skills, but are not essential to achieving core objectives. These activities capture the imagination and creativity of project members but end up taking far more time than planned. Again, the real cost of bells and whistles must be evaluated in terms of opportunity cost.

Safety Time causes project delays because experienced project teams have been burned by delays in the past. To cover themselves, they are tempted to build in fudge factors. This extra padding gives them enough time to catch up if they run into delays as the project schedule unfolds. Goldratt claims that most projects have 200% safety time built into the project schedule, although no one will admit it. Even with 200% safety time, though, most projects are still late. How can that happen? It happens because safety time is wasted at every project milestone or deliverable. Project teams are rewarded for bringing deliverables in on time, but they take political risks if they deliver anything ahead of schedule. Doing so means that their safety time on other phases of the project might be detected and cut. So, shrewd managers must waste any unused safety time along the way in order to keep up appearances. If they subsequently run into a justifiable delay, however, they might have no safety time left, and the final project deadline must be delayed. To combat this, Goldratt recommends generous monetary incentives for early completion of project phases. Safety time should be acknowledged and reserved for the end of the entire project and possibly not used up.

Goldratt's approach, if followed rigorously, could dramatically shorten project cycle times. His methodology provides international project managers with powerful new management tools. Although this approach is attractive for cost control, there is no accommodation for cross cultural differences in time perception.

In summary, the strength through diversity model and Goldratt's opportunity cost model are both important for the future of international project management. The problem, of course, is that they place conflicting pressures on international managers.

WHERE DO WE GO FROM HERE?

This paper reports a dilemma faced by managers of international projects. Should a manager bow to the reality that time urgency is culturally bound? That could mean accepting many more project delays on international projects than on domestic projects. Or should a manager try to reduce cultural diversity on the project team? That might risk successful implementation of the project in the host country.

One path for future research might deal with the construct of conscientiousness. Conscientiousness has been shown to be one of the best predictors of educational and career success in many fields of endeavor (Barrick and Mount, 1991; Behling, 1998).

Psychologists who specialize in individual differences argue that cultural conventions do not eliminate individual differences (Goldberg, 1993). Even in Western cultures, people vary enormously on individual difference characteristics such as conscientiousness. Goldberg and others argue that conscientiousness is one of five universal personality characteristics that can describe people fairly across cultures. This might be done, for example, through idiomatic expressions that have special meaning in individual cultures as well as terms that can be translated fairly across cultures. In English, people who score high on conscientiousness say that they "like order," "follow a schedule," "do things according to a plan," "continue until everything is perfect," and "make plans and stick to them." Further research is needed to determine whether these characteristics could be related to

success in project management and especially how well they describe members of successful international project teams.

REFERENCES

Barrick, M., & Mount, M. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology, 44*(1), 1-26.

Behling, O. (1998). Employee selection: Will intelligence and conscientiousness do the job? *Academy of Management Executive, 12*(1), 77-86.

Carter, V. (Ed.) (1999). Locate a chapter outside the U.S. [WWW document]. Available http://www.pmi.org/chapterinfo/acp_intl.htm [Accessed February 16, 1999].

Goldberg, L. (1993). The structure of phenotypic personality traits. *American Psychologist, 48*(1), 26-34.

Goldratt, E. (1997). *Critical chain*. Great Barrington, MA: North River Press.

Hofstede, G. (1994). *Uncommon sense about organizations: Cases, studies and field observations.* Thousand Oaks, CA : Sage.

Hofstede, G. (1997). *Cultures and organizations: Software of the mind.* New York, NY: McGraw-Hill.

Kras, E. (1995). *Management in two cultures: Bridging the gap between U.S. and Mexican managers.* Yarmouth, ME: Intercultural Press.

Lynch, B. (1998). Critical chain project management [WWW document]. Available http://www.prochain.com [Accessed February 14, 1999].

Morosini, P., Shane, S., & Singh, H. (1998). National cultural distance and cross-border acquisition performance. *Journal of International Business Studies, 29*(1), 137-158.

Morrison, T., Conaway, W., & Borden, G. (1994). *Kiss, bow, or shake hands: How to do business in sixty countries*. Holbrook, MA: Adams Publishing.

Newbold, R. (1998). *Project management in the fast lane: Applying the theory of constraints.* Boca Raton, FL: St. Lucie Press.

Pinto, J. (1999, August). Some constraints on the theory of constraints: Taking a critical look at the critical chain. *PM Network: The Professional Magazine of the Project Management Institute, 13*(8), 49-51.

Victor, D. (1992). *International business communication.* New York, NY: HarperCollins.

TEACHING ADVANCED BUSINESS STATISTICS: GENDER DIFFERENCES IN PERCEPTION OF EFFECTIVENESS OF USING STATISTICAL SOFTWARE IN LEARNING STATISTICS

Wayne Gober, Middle Tennessee State University

wgober@mtsu.edu

Gordon Freeman, , Middle Tennessee State University

bfreeman@mtsu.edu

Jacqueline Wyatt, Middle Tennessee State University

(no e-mail available)

C. Nathan Adams, Middle Tennessee State University

cnadams@mtsu.edu

ABSTRACT

The primary focus of this research was to investigate if there were gender differences in the perception of effectiveness of various methodologies of teaching advanced business statistics. A questionnaire was administered to students enrolled in advanced statistics in the fall semester of 1998 and the spring semester of 1999. Statistical analysis of the results indicates that there are differences in gender acceptance and opinion regarding the understanding of statistics when using statistical software (MINITAB). Females tend to see MINITAB as being less helpful in their understanding of both parametric tests and non-parametric tests than do the males. However, as the tests get more complex, both genders tend to disagree less with the statement that MINITAB aids understanding.

INTRODUCTION

In 1973 Lucy W. Sells identified mathematics as the "critical filter" that prohibits many women from entering the ranks of higher paying, prestigious occupations, and since the publication of that seminal work there has been a great emphasis upon gender differences in mathematical performance.

Studies of gender differences in mathematics performance indicate that females "showed a slight superiority in computation in elementary school and middle school. There were no gender

differences in problem solving in elementary or middle school; differences favoring men emerge in high school and college" (Hyde, Fennama, and Lamon, 1990). Leo (1999) states that females lag behind males in math and science test scores. Enzensberger (1999) goes so far as to state "…[mathematical ability] is established genetically in the human brain." These conflicting data are rather typical of the disagreement in literature regarding the evidence for a male advantage in math performance (Casey, Nuttall, and Pezaris, 1997). They do state that there is a gender difference favoring males among high-ability students at measured by the Mathematics Scholastic Aptitude Test (SAT-M), and this has major implications for women's entrance into math-science fields

OVERVIEW OF CURRICULUM CONSIDERATIONS AND PRESENT STUDY

Virtually all universities and colleges require students to take one or more statistics courses in many different majors, e.g., education, psychology, business, etc., for the non-specialist, and most Schools of Business require one or more courses in computer literacy. This paper focuses on whether there are gender differences in the perception of how helpful a statistical software package (MINITAB) is in learning statistical procedures for those non-specialists who are majoring in a field within business. The traditional method currently used in teaching statistics is widely viewed as being ineffective (Cobb 1993, Mosteller 1988).

The recommendations of the American Statistical Association and the Mathematical Association of America (ASA/MAA, 1998) Committee on Undergraduate Statistics should be integrated into the methodology utilized for teaching statistical courses. These recommendations are to teach statistical thinking; to emphasize more data and concepts, less theory and fewer recipes; and, to foster active learning. There are several approaches for teaching statistics to the non-specialists: (1) the use of manual calculations by using a hand-held calculator, (2) the use of a computer software package, and (3) a combination using both the manual and computer software package. A computer software package, such as MINITAB, could be selected which would enhance the student's ability to visualize and explore basic statistical concepts. MINITAB provides the means to generate the output and allows the student to become a statistical thinker.

MTSU business students must take advanced business statistics (Statistical Methods II), which covers topics in hypothesis testing and regression analysis after taking the introductory statistic course. While each faculty member teaching these courses must cover specific core topics, the method of presentation is an individual decision. Teaching techniques range from those faculty members who make minimal use of a statistical software package (MINITAB) to those who make minimal use of manual calculations (hand-held calculators).

The MTSU statistics faculty have had considerable discussions on teaching methodologies and outcomes, particularly with regard to the emphasis placed upon statistical software in teaching statistical procedures. In an attempt to satisfy faculty at both ends of the continuum, many statistics faculty members introduce new topics to students with manual methods (hand-held calculators) then reinforce the topic with the use of a computer statistical package (MINITAB).

RESEARCH METHODOLOGY

A questionnaire was created and administered to seven sections in the fall semester of 1998 and another seven sections in the spring semester of 1999 in the last scheduled class of the advanced statistics course (Statistical Methods II). The students were asked to relate their views on the effectiveness of the dual method of presentation, i.e., utilizing both the manual (hand-held calculators) and a computer software package, as well as their evaluation of the effectiveness of more or less presentation with either of the methods. Various demographic data were also collected, including gender. A Likert-type scale from 1 (strongly disagree) to 7 (strongly agree) was utilized in an effort to determine the student's perceptions of the benefits of one teaching methodology over the others, and whether these results would differ by gender.

DATA ANALYSIS

All statements, in which the male and female responses differed significantly were identified (α=0.05) using the Mann-Whitney-Wilcoxon test to check for gender differences. The results for the nine statements showing significant ($\alpha = 0.05$) gender differences are presented in Table 1 along with the Z-values for the normal approximation to the Mann-Whitney-Wilcoxon test. Notice that all the Z-values are negative. A negative Z-value indicates that the typical female response to each of these nine statements was lower than the typical male response.

With regard to statements 18 – 25, two observations deserve special mention. The two statements that show the highest degree of gender difference are {23 and 22}. These two state that MINITAB was particularly helpful in understanding multiple-sample parametric and multiple-sample non-parametric tests. The four statements showing the highest degree of gender difference are {23, 22, 19 and 21}. This set of four statements includes all the types of non-parametric tests covered in the QM 362 course.

The results shown in Table 1 illustrate which statements in the survey have the largest amount of gender difference, but they do not illustrate the type of gender difference. The negative Z-values show that the typical female response to a statement is significantly less than the typical male response for each of the nine statements in Table 1. However, at this point to determine the type of gender difference further testing was performed.

The list in Table 2 {18, 20, 22, 24 and 25} orders the statistical procedures by increasing complexity. The purpose was to see how the level of difficulty of the test correlated with the level of disagreement with the statement shown by each gender.

DISCUSSION OF RESULTS

Only nine statements showed a significant difference at the .05 level of significance. In all statements where there was a clear gender difference in the responses, the females had a higher level of disagreement with the statement than the males. If these nine statements are ordered by the degree

of significance with the statements having the most significant gender differences being listed first, the order of those six statements is: {23, 22, 19, 21, 20, 24, 25, 18 and 17}. In statements 23 and 22 both genders tended to disagree with these two statements, but the level of the female disagreement was significant ($\alpha = 0.05$). This result suggests the conclusion that females find MINITAB to be of less help than males in understanding multiple-sample statistical tests.

				Mann-Whitney					Z for	
	N	N for	N for	Wilcoxon			Female	Male	Mann-Whitney	Z
	Missing	Females	Males	Statistic	P		Median	Median	Wilcoxon	Ranks
C17	1	130	105	14274.5	0.0398		3.000	4.000	-2.05647	9
C18	0	130	106	14331.0	0.0396		3.000	3.500	-2.05871	8
C19	0	130	106	13859.0	0.0031		3.000	4.000	-2.96348	3
C20	0	130	106	13929.0	0.0047		3.000	4.000	-2.82929	5
C21	0	130	106	13900.5	0.0039		3.000	4.000	-2.88393	4
C22	1	130	105	13767.5	0.0024		3.000	4.000	-3.03500	2
C23	0	130	106	13794.0	0.0020		3.000	4.000	-3.08807	1
C24	0	130	106	14002.5	0.0072		4.000	4.000	-2.68841	6
C25	0	130	106	14183.0	0.0192		4.000	5.000	-2.34241	7

TABLE 1

TABLE 2
LEVEL OF DISAGREEMENT RANKS CATAGORIZED

Parametric Statistical Procedures					Non-Parametric Statistical Procedures				
	Female	Male	Wilcoxon	Sign		Females	Males	Wilcoxon	Sign
Statement	Ranks	Ranks	Ranks	Ranks	Statement	Ranks	Ranks	Ranks	Ranks
C18	1	2	1	1	C19	3	1	2	4
C20	2	3.5	3	3	C21	4	3.5	4	2
C22	6	6	7	6	C23	5	5	5	5
C24	7	8	8	8					
C25	9	9	9	9					

Statements 19, 21 and 23 were the only ones in the survey dealing non-parametric tests. Both genders tended to disagree with these three statements, with the level of the female disagreement

being significantly more. This result suggests the conclusion that females find MINITAB to be of less help than males in understanding non-parametric statistical tests.

Statements 18, 20 and 22 referred specifically to parametric tests. Both genders tended to disagree with these three statements, with the level of the female disagreement being significantly more. This result suggests the conclusion that females find MINITAB to be of less help than males in understanding one-sample, two-sample and multiple-sample parametric tests.

Number 17 stated that it was easier to learn to perform a hypothesis test with MINITAB than it was to learn how to perform it manually. Both genders tended to disagree with this statement, with the level of the female disagreement being significantly more. This result suggests the conclusion that females have a more difficult time than males do in learning how to use MINITAB to perform hypothesis tests.

The other two statements dealt with regression. In statement 24, the females significantly disagreed, while the males insignificantly agreed. This result suggests the conclusion that males see some benefit in using MINITAB to help them understand simple linear correlation and regression, but the females do not. In statement 25 the females insignificantly disagreed, while the males insignificantly agreed. This result suggests the conclusion that the females do not see as much benefit in using MINITAB to help them understand multiple regression analysis as the males do.

In both parametric tests and non-parametric tests, the females tend to see MINITAB of being less helpful in their understanding of those statistical procedures than the males do. However, as the tests get more complex, both genders tend to disagree less with the statement that MINITAB aids understanding. The females continue to disagree that MINITAB aids their understanding even up to the complexity of regression analysis, while the males start to agree that MINITAB is helpful when the complexity of regression analysis is reached.

SUMMARY AND CONCLUSIONS

A questionnaire was administered to students at MTSU who were enrolled in advanced statistics in the fall of 1998 and the spring of 1999 in an effort to investigate if there were gender differences in the perception of effectiveness of various methodologies of teaching advanced business statistics. Statistical analysis of the results indicates that there are differences in gender acceptance and opinion regarding the understanding of statistics when using statistical software (MINITAB).

In both parametric tests and non-parametric tests, the females tend to see MINITAB as being less helpful in their understanding of those statistical procedures than do the males. However, as the tests get more complex, both genders tend to disagree less with the statement that MINITAB aids understanding. The females continue to disagree that MINITAB aids their understanding even up to the complexity of regression analysis, while the males start to agree that MINITAB is helpful when the complexity of regression analysis is reached.

Further research is suggested to investigate the relationship between student's perception and actual performance using different teaching methodologies. Outcome assessment studies could be undertaken in order to analyze this relationship.

BIBLIOGRAPHY

Casey, M. Beth, Nuttal, Ronald L., & Pezaris, Elizabeth. (1997).   Mediators of gender differences in mathematics college entrance test scores: A Comparison of spatial skills with internalized beliefs and anxieties. *Developmental Psychology*, *33*(4), 669-680.

Cobb, G. W. (1992). Teaching Statistics. In *Heeding the Call for Change,* ed. Lynn Steen, (MAA Notes No. 22). Washington: Mathematical Association of America, 3-23.

Enzensberger, Hans Magnus. (1999).   Why no one knows we're living in a golden age of mathematics. *Chronicles of Higher Education*,   *XLV*(34), B9.

Hyde, Janet Shibley, Fennema, Elizabeth, & Lamon, Susan J. (1990). Gender differences in mathematics performance: A meta-analysis. *Psychological Bulletin*, *107*(2), 139-155.

Leo, John. (1999). Gender wars redux. *U. S. News & World Report*, 126(7) p.24.

Mosteller, F. (1998). Broadening the scope of statistics and statistical education. *The American Statistician*, *42*, 93-99.

Sells, L. W. (1973). High school mathematics as the critical filter in the job market. In R. T. Thomas (Ed.), *Developing opportunities   for minorities in graduate education* (pp. 37-39). Berkeley: University of California Press.

CONTENT ANALYSIS OF 1998
"BEST OF THE WEB" WEB SITES

Thomas P. Loughman, Columbus State University
loughman_tom@colstate.edu
Robert A. Fleck, Jr., Columbus State University
fleck_bob@colstate.edu

ABSTRACT

The authors analyze 36 web sites voted 1998 "Best of the Web" by web users. Nearly two dozen web site components such as frames, tables, animations, plug-ins, color, text, hypertext, and streaming media are classified and compared. Based upon their findings the authors make recommendations about web site design, layout, and content. Comparisons are also made to the 1997 "Best of the Web" winners. This research is particularly useful for both novice developers looking for effective web site construction elements and experienced developers who want to compare their own efforts with those esteemed by web users.

INTRODUCTION

One of the main differences between a content analysis of web site home pages and more traditional print media such as books, pamphlets, and speeches (Krippendorff, Weber) is that web sites often do not contain much "text" in the sense of extended passages of coherent sentences or paragraphs. Instead, one finds the text in some sites to function primarily as links or signposts to other locations. Also, the content of the page is often just as likely to derive from non-word elements such as pictures, animations, video, and sounds as it is to derive from words in traditional print media.

Another difference from traditional print media is that the web sites change, sometimes significantly, and often during one visit to the site. Unlike a printed letter, report, or magazine page with fixed content, the web page can be fluid. Also, unlike with a printed book, Web developers periodically update content, especially in sites devoted to news, sports or entertainment.

In addition, the medium itself can significantly affect the content. Depending upon how visitors to web sites have their retrieval and viewing systems configured, they may see quite different things from what other visitors see. Monitor or television size, screen resolution, network or modem configuration, colors displayed, plug-ins enabled--all affect the display of content at the site and one=s experience of it.

METHODOLOGY

For this study we revisited the Best of the Web (BOTW) site we had used for a content analysis (Loughman and Fleck) of 1997 web sites voted best of the web. In that analysis, as in this one, we wanted to discover what design, layout, and feature characteristics made web sites good, informative, interesting, or entertaining. Thinking first to analyze numerous sites and to devise our own ranking system for quality, we were pleased to find that the "Best of the Web" site had already performed that task. According to BOTW, its rankings come from votes received from users of the World Wide Web. Unlike other ranking sites, BOTW does not use "experts" and does not explain why the sites have been chosen as "best."

To arrive at its rankings, BOTW solicits nominations from web users. Based upon the number of nominations for each web site, BOTW narrows the choices into five for each of its categories. Some of the categories include best navigation aid, best news site, best education site, and most entertaining site. BOTW then conducts voting on the five chosen sites and ranks three of them first, second, and third place based upon the percentage of votes garnered.

Using the BOTW winners, we first "fixed" the home page using MS Frontpage$_7$ 98 to be sure we were using the same page each time we looked at it or checked its source code. Next, one of the authors reviewed the home pages for overall layout characteristics, appropriateness of home page elements to the site=s purpose, and any especially creative or unusual page components worth mentioning. Then, using the page itself to check for some items and the page source code for others, he counted the occurrences of the components we had chosen. Some of these included frames, background color, links, animations, and tables. The co-author then performed the same steps, they compared and discussed results, and both authors reviewed their findings based upon the comparison and discussion. The final step involved a comparison of the findings for the 1998 "Best of the Web" rankings with those from 1997.

FINDINGS

Overall Page Layout

Half of all the BOTW sites use what we call a "triboard" layout. This term attempts to convey the impression created by some of the three-column "professional" sites affiliated with major news organizations such as CNN, major league sports associations such as the National Football League, mega online stores such as Amazon.com., and members of the Infoseek GO Network.

At the tops and sometimes bottoms of these pages appear site search forms, navigation bars, and site maps plus the names of organization members. In the left panel or column one usually finds lists of site-related links. In the middle panel appear graphical images and headline-style links to news and entertainment stories pertinent to the subject of the site. In the right panel are more links to

stories and related affiliations. A primary purpose of these sites is to convey large amounts of information efficiently, usually in lengthy lists of hypertext links.

Other sites, however, place creativity, visual appeal and fun equally as high as efficiency in what they offer visitors to their sites. NOVA, for example, displays a stunning, deep blue background on which rests only one central image. The links on the page are easy to find, but they are not the focal point. Color, image, and atmosphere take central stage.

In another example of a creative site, when one opens the Disney.com home page, a gradient blue background emerges on the screen, then the well-known Disney castle seems to magically appear amid the blue. A bright gold Disney banner eases in from the left, a huge blinking disc moves in from screen right and up to center. In the middle of the disc appear colorful Disney images that change every few seconds. Children=s happy faces appear, Donald Duck pops in at the top, and several images on the screen pulsate when the cursor crosses. A few even make sounds. Clearly, because the experience of color, movement and fun is what a young audience would find appealing at this site, all the page elements such as animations, sounds, and pulsating colors fit well with the site=s purpose.

Background color

Twenty-nine (81%) of the home pages we reviewed had white backgrounds. With issues such as screen resolution, monitor capabilities, and the problems associated with sub-optimal color choices (Vasquez-Peterson, 161-184), white backgrounds help avoid many display problems and contribute much toward the visibility of page elements. With that said, however, colored backgrounds often create visual interest and contribute to the overall purpose of a site. The Disney and NOVA sites mentioned above are clear examples. In other examples, the Hellfire.com site displays a flame-red background with a she-devil image in the center, and as part of its overall bucolic theme, Ruralvermont.com displays a grass-green background with a cow and the town sign in the center.

Metaphors

Several of the sites use metaphors to help organize their page elements and make site navigation intuitive for visitors. The store metaphor, for instance, appears in such sites as Amazon.com. Here the visitor can fill a shopping cart, browse among the items available for sale, and check out when the shopping trip is finished, perhaps using a coupon to lessen the cost of the purchase. The Mapquest.com site displays a compass rose on its home page; visitors to the site can activate links by clicking on the direction points of the compass rose. A few sites use either a magazine (Eonline.com), or newspaper (Theonion.com) as their integrative metaphors.

Frames

In spite of the control over site navigation that frames give designers (Vasquez-Peterson), some users find frames confusing and disconcerting. This may account for the relatively low number of framed sites included in the 1998 BOTW winners. Only four (11%) of the 36 sites use frames, two of which occur in the "Most Entertaining" category.

Navigation bars

Being able to navigate efficiently among site elements is essential for visitors to most Web sites. An important feature of navigation is the navigation bar, a graphical or textual element that uses hyperlinks to pages comprising the site=s structure. Thirty (83%) of the BOTW winners use navigation bars.

Animations

Twenty-seven (75%) of the sites reviewed have animations. The California Institute of Technology (caltech.edu), for example, displays tiny animations of a strutting pigeon, munching squirrel, or creeping cart at the top of the classical style building that forms the backdrop to its home page. These alternating, playful images may suggest that, although much of the site is devoted to academics and scientific research, there=s still room for a sense of play, a bit of whimsy.

Graphical images

All of the BOTW sites use graphical images. The lowest usage (2 images each) occurs in Infoseek.com and Altavista.com, both Internet search engines. The highest usage (40 images) occurs in the NFL.com home page. In the BOTW categories, the "Best School/University" and "Best Navigation Aid" groups have the lowest occurrence (10 and 11, respectively). The highest occurrences of graphical images are found in the "Best Entertainment" and "Best Sports" categories (32 and 57, respectively).

Links

The essential work horse of the World Wide Web has to be the hypertext link. Without it, a site is mostly just a poster, an ad, or a standalone page, and the Internet itself is merely a collection of standalone sites. All of the BOTW sites employ links. The lowest occurrence appears in the Fedex.com and Hellfire.com home pages (1 and 2 links, respectively). The highest number occurs in the Refdesk.com and Abcnews.com home pages (376 and 158 links, respectively).

Tables

Another ubiquitous Web page element is the table, and all BOTW sites used tables. The Web site home pages with the fewest number of tables (1 table each) were NOVA, Hellfire.com and Ruralvermont.com. The home pages with the highest number included Refdesk.com and Abcnews.com with 24 tables each.

Plug-ins

A few of the 1998 BOTW sites included links to interesting plug-ins such as the WildBearCam showing live video of grizzly bears catching salmon at McNeil Falls in Alaska and the Viscape SVR player that allows the visitor to view a virtual reality tour of the solar system. Additional sites such as CNN.com, Abcnews.com, and Nfl.com have links to streaming audio, video, and radio. However, unlike the Pepsi.com home page, which required a download of Macromedia Shockwave in the 1997 BOTW, no 1998 BOTW site required the visitor to download a player to view its home page.

COMPARISONS WITH 1997 BEST OF THE WEB

The major difference between the 1997 and 1998 Best of the Web web sites is the loss of one category, "Best Personal Homepage". Considering the home pages themselves, one important difference involves the greater number of forms (26 in 1998 vs. 14 in 1997) used by the 1998 winners. This increase suggests a desire on the part of web designers to incorporate more interactivity and functionality into their sites. In addition, while 22 sites used white as the background in 1997, 29 sites did in 1998. This difference suggests that designers may be thinking more of site functionality and efficiency than of the aesthetic experience visitors are likely to have at the site.

The number of animations rose significantly, with 20 sites in 1997 and 27 in 1998 using them. As bandwidth increases and technology improves, more sites are likely to use animations as well as other multimedia components. The use of frames doubled in 1998, but since there were just two framed sites in 1997, reliance upon frames appears not to have increased significantly as a proportion of the whole. In both 1997 and 1998 the top site for graphics was Nfl.com (44 in 1997 and 40 in 1998). Also, in both 1997 and 1998 the category of "Best Navigation Aid" used the fewest graphics (8 in 1997 and 10 in 1998) while the category of "Best Sports Site" used the most (58 in 1997 and 57 in 1998).

REFERENCES

Flanders, V. and Willis, M. (1998). *Web Pages That Suck: Learn Good Design by Looking at Bad Design*. San Francisco, CA: Sybex Inc.

Krippendorff, K. (1980). *Content Analysis: An Introduction to Its Methodology*. Beverly Hills, CA: Sage Publications.

Loughman, T. P. & Fleck, R. A., Jr. (1998). "Content analysis of 1997 "best-of-the-web" web sites" ACM Mid-southeast Fall Conference, Gatlinburg, TN.

The 1997 Best of the Web (retrieved June 1998). http://botw.org/1997/awards.html.

The 1998 Best of the Web (retrieved July 1999). http://botw.org/1998/awards.html.

Vasquez-Peterson, A. R. and Chow, P. (1997). *Teach Yourself Great Web Design in a Week*. Indianapolis, IN: Sams.net Publishing.

Weber, P. R. (1985). *Basic Content Analysis*. Beverly Hills, CA: Sage Publications.

THE SIGNIFICANCE TO RESEARCH AND MANAGEMENT EDUCATION, OF INTERNET DATA SOURCES, ONLINE INFORMATION SYSTEMS, AND DATA WAREHOUSING IN THE 1990s

Robert Leinwand, Unitec Institute of Technology

Alastair Emerson, Unitec Institute of Technology

ABSTRACT

This paper presents a discussion of the impact on Management and Research of improved technology generating very large volumes of current and pertinent data, and the impact upon teaching methods of electronic data capture and analysis. Students completing high quality management programs must be aware of the ability to obtain large volumes of current data electronically, and be able to use software tools, which allow data manipulation, analysis, and possible reformatting. This requirement means that classroom lecturers must be able to provide either real world tools or a simulation that provides realistic performance.

In addition, recent developments in both data capture (especially via the Internet), and data storage and retrieval (especially Data Warehousing) mean that at times researchers have access to data representing close to entire populations, requiring rethinking of the validity of (ostensibly) anecdotal evidence, and requiring means for determining the reliability and validity of electronically published or supplied information.

Management and Research techniques which will be impacted by high technology data base methods include demographic information, population based servicing systems, market and segment analysis, targeting, decision making, and customer acquisition and retention.

The significance for educators is explained. Employer expectations of recent graduates are tending towards reliance on them for the provision of applications of current technology and methodology. In turn, this implies that teaching methodology must include a quantum amount of applied experiential content. The mechanics of such instruction present real challenges for current teaching in that a reasonable degree of Information Technology (I.T.) application knowledge is required, implying a possible need for alliances with I.T. staff and/or acquisition of I.T. knowledge by non I.T. teachers.

DATA SOURCES - THEN AND NOW

The availability of raw data, vs. processed information has been inexorably changed by technology over the past several years. Low cost personal computers with extensive processing power, relatively large memory and storage capacity, plus higher speed data communications protocols and hardware has changed the methodology for gathering, interpreting, reporting and distributing information.

Prior to the availability of this low cost technology, when a company sought market research information there was only one customary method utilised. A market research organisation would be hired and utilised to:

1. Generate a survey to provide data that would meet the clients stated requirements

2. Distribute the survey to the relevant market/customer base

3. Review and analyse the results of the survey

4. Provide a report to the client showing the findings of the survey and subsequent analysis

This method took a small sample of the actual market population, questioned the sample, interpreted the answers from the sample population, and extrapolated this to the population as a whole. The methodology was haphazard, lacking in scientific method, statistically inaccurate, and produced less than valid, legitimate information. Although flawed, this methodology was the best available and when properly conducted was capable of reasonable results.

In contrast to this previous process utilisation of personal computers combined with large-scale online data sources has effectively changed the type of playing field completely. Now a company wanting to do market research has available not simply a small sample of the population, but accurate, timely valid data of the entire population being questioned. Services such as Scan Data provide data of supermarket sales locally, regionally, or throughout New Zealand. Thus if a company is interested in how many 1.5 kilogram boxes of FBA lemon scented soap powder were sold yesterday, that data will be available to them online today! Sales numbers for an individual product can be determined for specific geographic areas, and other market demographics. Moreover, the data is available directly to them via a desktop personal computer within their own company. Instead of taking data from a statistically small sample, and extrapolating to the greater population, a huge volume of raw data is now available. Clearly this volume of raw data

Must still be analysed, interpreted, and summarised. This need then forms the basis for the needs of current management students. The current need as expressed by employers of our graduates is:

1.   The sources of data they can access, from both public and private online services

2.   To be able to use software tools to download large volumes of data

3.   To be able to use software tools to separate, segregate, and group appropriate data

4.   To be able to use software tools to analyse the data and extract valid information as required.

Thus, a significant challenge to management lectures is presented. Instead of presenting students with the tools to speak intelligently with research companies, it is necessary to provide students with the tools to select and analyse not small samples of a large population, but data provided by the whole population. Technology provides the means to perform this function, but how does one provide the knowledge to use the technology correctly, efficiently, and intelligently in the classroom? This must be the controversy for management educators at present.

DATA WAREHOUSING

Data warehouses have suddenly burst on the scene, and become the hottest ticket in Information Systems. "According to the Meta Group of Westport, Connecticut, USA, "the number of companies implementing data warehouses expanded nine fold from 1993 to 1994. (McElreath, 1995) As with any emerging technology, it is necessary to separate the hype from the achievable, real benefits, when this technology is applied to a specific organisation. It is clear that the impact for practitioner and teachers of management is significant, as larger quantities of up to the minute data become available electronically. Methods which allow the input of data from several sources, provide meaningful, accurate, and easy to use analysis tools, generate user formatted reports, and archive large volumes of information become as much a "tool of the trade" for working professionals in management as the simple spreadsheet, or a pen.

Data warehouse definition

William Immon coined the phrase "data warehouse" in 1990. Immon defined it as a managed database, which is:

subject oriented - designed to be an aid in decision making rather than a simple record of transactions

multidimensional - data is aggregated in several dimensions such as product, customer, time period, or geographical location

integrated - data is generally developed from different operational systems, and integrated in terms of units of measure, time frame, and format

> Time-variant - shows a distinction between operational data, which is valid only at the moment of access, and may not be valid moments later. Informational data has a time dimension, with each data point having an association with a point in time. Data points thus have a common time frame reference
>
> Non-volatile - new data simply is added to an ever-expanding database, and does not replace existing data. In this manner a historical archive of information is developed

The precise definition of what constitutes a data warehouse is not firm at the current time, but will evolve as theory and practice merge. In the simplest terms, a data warehouse has two main components: an information store of historical events constituting the data warehouse itself, and the tools to accomplish strategic analysis of that information, constituting a decision support system (DSS). All common definitions suggest that a comprehensive data warehouse be much more than a series of archived events equipped with a general-purpose query engine on the front end. While in fact, the data warehouse is really nothing more than a corporate electronic information system (EIS) which groups raw data in new ways. Thus it permits the executive to unearth market trends, suggest new focus for the business, and leverage the investment in data analysis into valid, timely and effective information, it can be very complex to implement. Data warehousing can be phrased as Business Process Reengineering of the Mind, which is a healthy way in which to view the impact of this technology. Warehousing has the ability to change the decision processes of an organisation, and the potential to provide operational improvement.

Therein lies its impact on management professionals. As with any technological innovation, the most successful applications will be those that are driven by the needs of the company, be it economic survival or improved performance. A warehouse development project must have clearly identified goals, and the managerial resolve to achieve those goals. The economic goals can include the basic need for cost reduction or increased revenue, to sophisticated reaction to competitors' actions over time. The intense focus of corporate strategy, as provided by such books as Competing for the Future by Gary Hamel and C.K. Prahalad, and works by Michael Porter provide little information without adequate data and data analysis tools. Data warehousing becomes especially important when corporate performance measures such as growth, leverage, and competitiveness, are to be realised in the basic daily terms of who, when, how many, and how much, need to be tracked and analysed over time.

Warehouse Characteristics

Characteristics of properly implemented data warehouses tend to differ from the standard I/S definition of data structures. While normal relational database design tends to provide detailed linkages, and answers to specific questions, data warehousing can provide more abstract answers allowing management to develop more strategic initiatives for the business. The data warehouse is built with the premise "that it is better to be approximately right than exactly wrong". (McElraeth, 1995) The data warehouse can provide information to the management practitioner that helps with

issues of risk avoidance, reducing time to market, or time to profitability. The fundamental approach is that the business will generate gain from different and innovative thinking processes, and this defines the need to store data in a form which can be easily processed, and provide suitable, convenient tools to extract and analyse this data. Queries that can be accommodated by common relational databases are always available from the warehouse through the DSS front end.

Historical Perspective

When examining data warehouse fundamentals the evolution of I/S within the corporate structure unfolds. Thirty years ago or so, closed events such as production, invoice and shipping details archived to tape to satisfy the need for future strategic analysis. Typically these systems were run in batch mode. Batch mode was often not adequate however, not because strategic decisions could not wait a day or a week, but because the several iterations might be required to resolve the needed level of data for a given query. Strategic analysis requires interaction, as answers often generate new questions. About 20 years ago, technology allowed some of the data to be made available interactively. This solved some of the turnaround problems, while the growing data structure and user requirements introduced capacity problems. When the I/S department was faced with a decision between tactical operational processing and strategic analysis of historical information, the tactical needs always won. Sales history is irrelevant if a business cannot enter and deliver orders to its customers. Approximately 15 years ago PCs began to proliferate in many organisations; individual users now had processing power at their desk, and were not limited to dumb terminals attached to untouchable mainframes, and unyielding software. Users then could end run around the I/S department by building their own applications with PC based spreadsheets and databases. Using their individual processing ability, users could extract information from the mainframe historical database and analyse it with quick and dirty home-grown applications. The I/S bottleneck was now circumvented, but control of information, security, capacity, and integrity issues became unwieldy in large organisations. Today online communications, low cost, ISDN high speed networks, larger and faster storage devices, and greatly improved processing power provide improved performance and capacity.

Table 1 illustrates that current, active, and process generated data will flow from the operational system to the warehouse. In the warehouse it becomes static, strategic, and historical data.

Table 1	
Operational Data	Warehouse Data
Short lived, rapidly changing as process operates	Long living, static
Requires access to record levels, immersing user in highest level of detail	Data is aggregated into sets, making it friendly to relational database design
Repetitive standard transactions	Ad hoc queries, with some periodic reporting

Updated in real time	Updated periodically, with mass download techniques
Event-driven; where the process generates the data	Data-driven; data analysis required governs the process

MANAGEMENT IMPLICATIONS

Management has evolved as a driver of strategy in the modern corporation, often the prime driver. This strategic role has meant, in turn, that relevant information, sourced from either market research or market intelligence, has become critical. Tapscott (1995) documents current developments in internet-working and the emergence of the "digital economy" where Information Systems become the central focus of business strategic management and control. He further predicts the continued growth and sophistication of such systems, leading to world-wide interconnection of companies for co-operation and market exploitation.

These developments are redefining the roles of both market research and market intelligence, whilst at the same time introducing new techniques and practices. It is therefore germane to consider the effect of the Information systems revolution on each of them

Market Research

Market research is affected by the availability of vast amounts of secondary data, in some cases to such an extent as to enable relatively authoritative analysis. To cite a non management example, the American Medical Association's Data Base MEDLINE contains anecdotal recording of patients presenting with a vast number of conditions at virtually every major teaching or teaching associated hospital in the developed world, as well as records of various medical interventions, to the extent where a significant proportion of the total population for some conditions is recorded - the sample frame is beyond the wildest dreams of researchers of a decade ago. This database and management related databases like it may now be accessed through Internet, or through CD ROM's comprising a core database with monthly updates.

Such databases also exist within the management environment, with access through Wide Area Networks or the Internet. Multi-national and other large companies construct their own, using data from a multitude of sources.

The scope and accessibility of these databases will require rethinking of traditional research - when secondary, anecdotal data is representative of say 50% - 60% of a population, it may take on greater validity than a primary sample of 3%! Scandata actually gives a total population of Supermarket purchasers of FMCG's for a given time period. Meta analysis of such data may well demonstrate that traditional market research based on observation or experimentation with small groups is less effective in some or even many cases.

The widespread and increasing use of data capturing systems such as Scandata, inventory bar coding, Point Of Sale customer profiling, smart cards, customer record/purchase analysis, and electronic consumer panels creates a new perspective on consumer research. Local communities can

be closely observed for reaction to, for example, promotional tactics and their feedback quickly put into place.

Geographic Information Systems such as Statistics New Zealand's Supermap[2] are revolutionising the way in which demographic research is both conducted and presented. Demographic target market identification is now very simple, even if the data may be dated. Perhaps the information systems revolution has yet to penetrate some Government agencies, in New Zealand at least.

As these developments progress, it seems likely that the distinction between market research and market intelligence will become less and less apparent, and that techniques will be evaluated more on the value of their outcomes than the "purity" of their inputs and processes. As the required speed of response to stay competitive increases through the increasing use of IS, so the ability to take time to conduct detailed studies and analysis will diminish.

Market Intelligence

Market Intelligence is where the expansion of information systems is having the greatest effect. Hithertofore management intelligence was based primarily on localised anecdotal sources such as Rep's reports, and such secondary data as could be gleaned from statistical records, demographic reports and so on. Without the means to readily determine macro trends and phenomena, the technique was of greater tactical than strategic focus. Because of this, intelligence has tended to be a localised, tactical tool of greater use to the Sales Manager and the Product Manager than the Management Manager.

The enormous amount of data currently available on databases and through the Internet has the potential to give the management professional an electronic equivalent of a satellite reconnaissance picture to the military - and like the satellite picture, the distant view is significant, but close up there is a confusing amount of detail. So management executives must use analytical tools in the form of statistical packages and criterion sensitive search engines to quickly filter or sort vast amounts of data to isolate the elements significant for their needs.

Data Warehousing with drill down and multi criteria search capabilities is dramatically enhancing such enquiries. Management professionals are now able and expected to analyse vast amounts of data to arrive at and anticipate developments. Techniques such as Content Analysis (as used by Naisbitt & Aburdene (1990)) are now within the reach of any executive with a PC and access to the Internet, or a WAN. Already there is evidence that companies are alert to the competitive edge available through information systems driven intelligence, with articles and commentary appearing in publications such as Computerworld and PCWorld.

Hicks (1993) describes the growth of Decision Support Systems and Executive Information Systems in American companies, giving several examples of highly sophisticated systems currently in use. He is at pains to point out the strategic and competitive advantages enjoyed by the companies concerned, points which should not be lost on New Zealand companies, for whom the information revolution can mean the overcoming of many problems associated with our relative isolation.

It would be an interesting and rewarding study to determine the current extent and rate of growth of the use of Information systems by management executives at various levels as a strategic intelligence tool. It would also be fruitful for academics to gain an insight into the practitioner's

perception of the reliability and usefulness of information gathered this way, and the uses to which it is being put.

The management professionals who utilise this data do so through what is becoming the routine use of a number of applications.

Attempting to clarify the New Zealand situation

A survey of adult students directly or indirectly involved in management, and taking management papers was conducted on the bass of a semi-structured interview. The initial purpose was exploratory, to gauge the level of interest amongst such students for the introduction of management specific information technology papers, and to determine whether further studies into IT usage and student's educational needs was justified. Working students in university level 2, 3 and 4 classes were asked if they personally regularly used IT in the course of their employment. Those who responded affirmatively were briefly individually interviewed to determine the level and type of current IT involvement, their perception of future IT involvement, and their perception of how adequately they were prepared for the current and future operations.

The data from thirty respondents revealed that the current usage of Information Technology is widening. In addition to competency in the use of spreadsheets and statistical packages of varying complexity, it was reported that some positions now require or are perceived as shortly to require competency in the use of databases, (with or without user friendly front ends), Geographical Information Systems, importing data from data capture systems, sophisticated presentation and word-processing applications, specialist accounting software (especially in relation to costing), and specialised applications developed for specific tasks within companies or groups of companies.

The same students reported that there is an expectation on the part of companies that graduates will not only have understanding of the role of Information systems, but also have at least elementary competence in the use of the common components outlined above. They expressed concern that the typical IT education available was either of an elementary nature or of an inappropriate application focus. Several expressed a wish to have large amounts of their management education delivered in an Information Technology context - either through simulations, or by electronically delivered case study approaches.

Management Education Implications

The authors of this paper, both of whom have Information Technology experience independent of their management educational roles, see a number of implications that need to be addressed by management educators. These will be discussed under the following headings:-

Professional Strategy

Of immediate concern for management educators is the question as to where Institutional Administrators will deem management specific applied information systems education to be domiciled. In many instances, departments of Information Systems and Computing jealously guard

the right to teach what they see as computer or software application skills, regardless (apparently) of the end use of those abilities. In our view, this is akin to the teacher of penmanship laying claim to the exclusive right to teach English Literature and Composition, since the pen is the technology required to manifest the student's thoughts.

Personal experience at two different Polytechnics has demonstrated to one of the authors that Information Technology education is better conducted, from the point of view of both student interest/enthusiasm and student understanding, within the context of the student's primary study interest. Advanced instruction by non-subject related teachers becomes a routine of learning processes without understanding fully the professional applications and significance of those processes. Both teachers and students eventually experience high levels of frustration and mutual distrust.

It then appears that if Information Technology teaching is to take place within Management Schools, management teachers must either be or become computer/application literate to an advanced level, or procure the services of Information Technology teachers who understand management principles and concepts.

A review of curricula offered through the Internet by various North American and British institutions revealed that MIS/MKIS courses were offered by both management/applied management and computer departments. One school actually had a dedicated department of MIS/MKIS.

Pedagogical

A number of issues arise in relation to academic practice - we address what we see as the most pressing below:

Curricula

What is the place of Information systems teaching within management curricula? We believe that the time is well past when every course of study in management should include papers entirely dedicated to the use of Information Technology in management, the question is how much, and to what depth? As noted above, experience suggests that management students need to be taught the use of advanced and specialist packages in a management context, which at least implies that a substantial area of teaching, currently the sole domain of Information systems and Computing departments, will in the future be offered in management departments.

A logical extension of this is to base those papers which are "reality" based (Management, Marketing Strategy, Strategic Planning, Sales Management, Product Management, Media Planning, etc.) wholly or substantially in computer laboratories, and use simulation, case studies, and/or the analysis of actual (but outdated) data as the primary teaching strategies. This approach raises questions of cost and feasibility for classes over say 25 people, but given the increasing pressure on management schools to give graduates some vocational advantage, it may be the way of the future.

Teaching Methodology

The curriculum issues give rise to issues of how we should deliver management education in the future. Since the mid 1980's the literature has reflected the ideas of those who advocate individualised, computer based learning, using programmed, discovery based, learner paced instruction. More recently, schools and tertiary institutions have focused on criterion referencing (mastery learning/competency assessment) as a valid way to formulate both learning outcomes and the assessing of the achievement of those outcomes. Clark (1989) proposes a system of integrated class room and computer based study, whilst Dick and Carey (1990) lay out a systematic approach to the development of instruction which would lend itself to most undergraduate management courses.

Romiszowski (1981, 1984 and 1986) details a system of instructional system design and production, including auto-instructional materials, which has been adopted by the armed forces of the Western Alliances for all training and education, from trades to post graduate level. This system has proved exceptionally successful over the past years in a technology driven environment which is moving even faster than business (survival is apparently a greater spur than profit), and would be readily adaptable to management education. Unlike traditional curriculum design methodologies, which could be described as "body of knowledge" focused, this system develops required behavioural outcomes from both the body of knowledge and current practice, which would satisfy those critics of tertiary education, who claim we try to ignore the vocational aspects of what our students learn.

The challenge for management educators will be to develop the computer based courses and exercises for delivery. In the light of the continuing drive to provide quality education, particularly vocation rich education at minimum cost to a maximum audience, the appeal of a system which provides total flexibility of student time, thus removing the need for employers to grant study time will be irresistible. Moreover, if computer largely delivers the education, the need for classrooms is greatly diminished - all the institution has to provide is a terminal for the students' laptop, or material on the Internet.

Teacher Training and Development

Finally, management educators have joined the rest of the business world on the Information Technology treadmill - we must be current with at the least the software applications commonly used by our students, which as of now means Microsoft Office Professional 95, Windows 95, SPSS for Windows, Minitab For Windows and so on.

We will also probably need to understand Internet conventions, how to construct and edit HTML links, the intricacies of programmed learning, authoring programmes, and a host of things presently only imagined - in short, we are going to have to be continually keeping pace with the Information Revolution, because, like it or not, we have been taken over.

BIBLIOGRAPHY

McElreath, J. (1995). Data Warehouses: An Architectural Perspective, Computer Sciences Corporation

Hicks, J. O   (1993). *Management Information Systems - A User Perspective* New York: West Publishing.

Tapscott, D. (1995).   *The Digital Economy - Promise And Peril In The Age Of Networked Intelligence*. New York: McGraw-Hill.

Naisbitt, J . (1990). *Megatrends 2000* London: Sidgwick & Jackson.

Kroenke, D. (1989). *Management Information Systems*. New York: McGraw-Hill.

Clark, R. (1989). *Developing Technical Training*   Reading, MA: Addison Wesley.

Dick, W & Carey, L. (1990). *The Systematic Design of Instruction* 3rd Edition Scott, Foresman and Company.

Romiszowski, A J (1981). *Designing Instructional Systems* London: Kogan Page.

Romiszowski, A J (1984). *Producing Instructional Systems* London: Kogan Page.

Romiszowski, A J (1986). *Developing Auto-Instructional Materials* London: Kogan Page.

Reibel, J *Pedagogy for the 21st Century* Institute for Learning Technologies, Columbia University. Published on the World Wide Web at http://daemon.ilt.columbia.edu

Girand, L *Welcome to Beyond Marketing Strategies* advertorial home page on World Wide Web at http://www.beyondmarketing.com

Widom, J. (1995). Research Problems in Data Warehousing Proceedings of the 4th Int'l Conference on Information and Knowledge Management (CIKM), November, 1995

Labio, W. (1996). Physical Database Design for Data Warehousing Technical Note.

Ferrara, R. (1994). *Building the Data Warehouse*, Maynard, MA: DEC Professional.

Dyer, R. (1995). *An Analytic Approach to Marketing Decisions* New York: Prentice Hall.

Poe, V. (1996). *Building a Data Warehouse for Decision Support* New York: Prentice Hall.

Inmom, W.H. (1996). *Building the Data Warehouse* Los Angeles, CA: QED Publishing Group

Hammergren, T. (1996). *Data Warehousing: Building the Corporate Knowledgebase*, San Francisco: International Thompson Computer Press

Sprague, Ralph. & Watson, H. (1996). *Decision Support for Management* New York: Prentice.

Parsaye, Kamran & Chignell, Mark, (1996). *Intelligent Database Tools and Applications* New York: John Wiley and Sons.

Simon, A. (1995). *Strategic Database Technology: Management for the Year 2000* Morgan Kaufman

THE CHANGING FACE OF COMPARABLE WORTH

Jason Hall, Sam Houston State University
Charlotte Hall, Sam Houston State University
Penny Layton, Sam Houston State University
Sara Hart, Sam Houston State University
GBA_SAH@SHSU.EDU

ABSTRACT

Since the emergence of women in the workforce, controversies over pay equity and treatment in the workplace have ensued. In more recent years, the efforts of the pay equity movement have brought the issues of comparable worth and gender-based wage discrimination into light. Despite the growing concerns, many companies are still slow to accept the reality of comparable worth issues within their organizations. Corporate restructuring, especially when dealing with pay scales, can be a long and tedious process at best. Without strong backing from upper-management, the issue of gender-based wage discrimination can become a moot issue. To ensure that the issue of comparable worth is addressed within an organization, all levels of a firm must take an active role in becoming knowledgeable about the problems with comparable worth as well as any court rulings surrounding this ever-growing dilemma.

INTRODUCTION

Perhaps the most confusing aspect of comparable worth is what actually defines gender wage discrimination. Comparable worth, also known as pay equity, is not to be confused with "equal pay for equal work," which is the law of the land. Equal pay for comparable work is an entirely different subject. Equal pay for equal work requires that a woman be paid the same as a man, or another woman, who is doing exactly the same job. Comparable worth, by contrast, focuses on paying an entire profession or occupation the same amount, which is determined by some outside authority to be of the same "worth" or value to an employer. The idea is that individual workers who perform jobs of substantially comparable value to their employer should be paid similar wages. For instance, if the work done by an accountant is deemed to be as valuable to an employer as that done by a typist, the law would require the two employees to earn the same wage.

Hattiangadi and Shaffer (1999) define comparable worth as the notion that the "value" of a job to an employer or to society can be objectively measured, and dissimilar jobs can be ranked based on their calculated value. The objectives of this article are to: define comparable worth and offer a perspective of the problem, to analyze current and future statistics, and to offer solutions to comparable worth based on current company policies implemented across the nation. Analysis of current trends in gender-based discrimination and factors leading to this bias will allow individuals and companies to recognize and define potential problems within an organization. In addition,

solutions based on plans implemented by companies will be addressed. The data gathered in this study came exclusively from secondary sources. The sources were limited to journal articles and books dated from the 1980's to the present.

THE CURRENT AND FUTURE STATUS OF COMPARABLE WORTH

The issue here is whether true worth can be established for jobs by workers who perform comparable duties; that is, can comparable worth become ingrained in public sector personnel practices? The concept of comparable worth, while fairly recent, fails to have a consensus for a universally-accepted definition. In fact, there continues to exist substantive controversy regarding the true meaning of this concept. For instance, the knowledge that these wage discrepancies exist can lead to resentment, poor job performance, tension, and conflict between the sexes. In addition, these wage discrepancies result in several unfortunate consequences for both the workers and society.

Based on 1997 U.S. Census Bureau figures, women's median annual earnings were seventy-four percent of men's, an all-time high. Women in all educational attainment groups experienced increases in income since 1963, with college-educated women showing, at 53 percent, one of the biggest increases ever, but women still continue to tell the U.S. Department of Labor that pay is one of their biggest workplace concerns. The average woman would still have to work from January 1 of 1997 to April 3 of 1998 to earn what the average man earned in 1997 alone. For women of color, the gap is even greater compared to white men (U.S. Department of Labor's Women's Bureau, 1997).

In the U.S. in the last ten years, a trend toward comparable worth programs has been evident. The issue has been debated in state and local legislatures, integrated into collective bargaining agreements, and tested in the courts. City employees in Chicago, San Francisco, and San Jose, and state employees in Michigan and New York, among others, have successfully negotiated pay adjustments for predominately female job categories. The private sector has been more resistant to comparable worth adjustments, but in at least one case involving comparable worth claims, the Sumitomo Corporation of America settled a long-standing dispute over pay inequities in jobs filled mostly by women by putting a comparable worth program into place (Siegel. 1989).

Siegel (1989) reported that comparable worth was clearly a public policy issue for the 1980's and will continue to be so during the 1990's, as questions of job value as determined by job evaluation criteria come to the fore. The latter are viewed as both partial solution and problem. That is, the main criticism of job evaluation systems found by Treiman in the 1979 National Academy of Sciences, were problems of the choice of factors and factor weights, the ultimate subjectivity of judgments, and the use of different job evaluation plans for different segments of an organization's work-force. Further, 40% of the difference between equally valued male and female dominated jobs (in terms of job evaluation factors and weights) appears to be attributable to differences in work-force experience and on-the-job training and, more fundamentally, attributable to motherhood. As a result, job evaluation systems and the market-valuation of occupations appear to have institutionalized the under-evaluation of female dominated jobs.

Those factors which should mitigate this situation in the evolving future are: interest in the issue by labor unions and collective bargaining on the issue; awareness and identification of bias in job evaluation criteria and weights; legislation; civil rights enforcement; the aggressive pursuit of

male-dominated jobs by career-oriented women and minorities; changing cultural values on the economic and social role of women and minorities; and, institutional supports, such as convenient access to child-care facilities. Golpher (1983) noted that a successful comparable worth lawsuit will be expensive and difficult to prove, which will invariably result in fewer such cases being pursued in the future. To infer, however, that comparable worth cases will no longer be pursued is untrue. Thompson (1996) noted that while the Ninth Circuit Court has effectively foreclosed future comparable worth actions, the Fifth Circuit and D.C. Circuit Courts appear more than willing to consider discrimination cases that are based on theories compatible with comparable worth. Thus, plaintiffs who can establish prima facie cases having gross statistical disparity can shift the burden.

Proportionately more women work today than a decade ago, and the percentages will increase still more in the years ahead. Even more significantly, women want job equality with men to an extent greater than ever before. But, aside from the ethical, social, and legislative pressures to achieve greater employment equality for women, the many employment prejudices against them make little sense from a business viewpoint. The bias does not exist to the same extent in education and government. Consequently, businesses are losing many promising young adults simply because of outmoded attitudes.

What role will women play in the labor force of the 21st century? According to the 1997 Labor Bureau, of the 26 million net increase in the civilian labor force between 1990 and 2005, women will account for 15 million or 62 percent of net growth. In 1990 women were 45 percent of the labor force and will become 47 percent of the civilian labor force in 2005. In 1970 and 1980, women's share of the labor force was only 38 percent and 42 percent, respectively. Projections for the period 1990-2005 indicate that men will leave the labor force in greater numbers than women--by more than 4 million. Men will, however, continue to remain the major segment of labor force participants.

Female labor force participation in all racial groups will rise during the period between 1990 and 2005. Women of Hispanic and Asian origin will have the fastest growth--both at 80 percent. Net labor force growth for all women between 1990 and 2005 is projected to be 26 percent. Black women's labor force growth of 34 percent will also exceed the average for all women. White women will remain the dominant female participants, but their labor force growth of 23 percent will be the lowest among all female groups. (U.S. Department of Labor's Women's Bureau, 1997).

Labor force participation rates--the percentage of persons of working age who are actually working or looking for work--are also expected to rise for women, while those of men will continue to decline slowly. Participation rates for both white and black women are expected to exceed 60 percent, but for the first time, during the decade at the turn of the century, white women's participation rate (63.5 percent) is projected to exceed that of black women (61.7 percent). The projected rate for women of Hispanic origin will be 58.0 percent in 2005, up from 53.0 percent in 1990. During this same period, the enormous rise in labor force participation for Asian women will result in a projected participation rate of 58.9 percent-just slightly above that of Hispanic women. (U.S. Census Bureau, 1997).

Of the 106 million women aged 16 and over in the United States in 1998, 64 million were in the civilian labor force–working or looking for work. Six out of every ten women age 16 and over–59.8 percent–were labor force participants in 1998. For women between the ages of 20-54, nearly three out of four were labor force participants. Historically, black women have had higher

labor force participation rates than white and Hispanic women. Between 1994 and 1996, however, black and white women had virtually identical rates–approximately 59 percent. Hispanic women participated at a rate of about 53 percent. Since that time, black women have edged ahead with a 62.8 percent participation rate in 1998. White and Hispanic women participated at 59.4 and 55.6 percent, respectively. Hispanic women are gradually narrowing the participation gap between themselves and their white counterparts (U.S. Census Bureau, 1997).

Women's share of the labor force reached 46 percent in 1994 and has remained at this level. By 2005, women are projected to comprise 48 percent of the labor force. Educational attainment is a reliable predictor of labor force participation. The higher the level of education, the lower the unemployment rate. The presence and age of children also affects the participation rate of women. Mothers with teenagers are more likely to be in the labor force than those with younger children. Mothers with children age 14 to 17, none younger, participated at a rate of 79.4 percent; with children age 6 to 13, none younger, 77.9 percent; with children under age 6, 65.2 percent; and with children under age 3, 62.2 percent. There were 61 million working women in 1998–74 percent (45 million) were employed full time, while 26 percent (16 million) worked part time (U.S. Department of Labor Women's Bureau, 1997).

According to the U.S. Census Bureau (1997) women continue to earn less than men. Median weekly earnings for full-time wage and salary women workers in 1998 were $456 for women and $598 for men. In other words, women earned only 76 percent of what men earned. When comparing median weekly earnings among women, white women at $468, continue to earn more than black women, $400, and Hispanic women, $337. In fact, the 1998 median weekly earnings for white women was identical to black men's and higher than that of Hispanic men, $390. Occupations with the highest median weekly earnings for women in 1998 were: pharmacists, $985; physicians, $966; lawyers, $951; electrical and electronic engineers, $931; computer systems analysts and scientists, $890; and physical therapists, $887 (Note: This is based on occupations with at least 50,000 employed women).

PREVENTION METHODS

Demographic, ethical and legislative forces have been moving slowly but inexorably to eliminate the gender-based wage gap that has characterized economies since the earliest times. There are eight states that have implemented comparable worth statutes: Connecticut, Iowa, Minnesota, Montana, New York, Oregon, Washington, and Wisconsin. Of the eight states, seven found gender-related disparities between its job classes. Gardner and Daniel (1998) noted public employee unions are comparable worth/pay equity's most influential political supporters, but union support usually diminishes in the wake of pay equity adjustments. Implementation has produced unanticipated consequences: in Iowa, for example, pay adjustments generally did not benefit more senior employees but rather, in many cases, raised individual employees' salaries above those of their supervisors. Gardner and Daniel (1998) noted each state analyzed job classes systematically, but several states modified the consultant-provided systems due to a belief that widely-used methods undervalued female predominant job classes. As comparable worth/pay equity implementation has both technical and political dimensions, important value choices must be made throughout the process.

For women, there is already evidence that work/family issues are a priority in employment policy considerations. As more women are not only working, but working longer hours, employers

are finding they must offer employee benefits which allow working women to better balance the demands of family and home. Unfortunately, current laws often restrict employers from offering some types of flexible work arrangements. For example, although women express a strong preference for measures that allow them to trade overtime pay for paid time off, Congress has been unable to enact legislation of this type. In general, current workplace laws and regulations reflect an industrial model based on a relatively low-skilled, homogeneous workforce. But this model is inappropriate in today's environment, and will become increasingly obsolete in the 21st century. What will be required instead, is a workplace model that allows for considerable flexibility for both firms and workers, and recognizes the heterogeneity of today's workforce (Daniel, 1998).

It is increasingly important to develop a strategy that involves all employees in building gender awareness for business growth and success. These strategies will empower managers and co-workers to develop a balanced understanding of news reports, legislative action and public and private corporate policy on gender issues such as sexual harassment, discrimination, comparable worth, family leave and equal access. First, if our socializing process, through education and counseling, is steering women into only the traditional female occupations, let's attack that problem. Already many companies are making available to schools women who work in non-traditional jobs to explain to America's youth the wide range of opportunities for women in the corporate world. More can and should be done. Schools should carefully review the way they steer young people into jobs – telling all students without regard to sex where the opportunities lie that will best suit their talent. Second, educational opportunities for women already in the workplace should be stressed. Companies should be committed to these programs and hope the Legislatures will work with industries to ensure that these human resource opportunities are fostered as a nationwide policy. Third, government and private employers should focus on individual merit, not rigid classification in determining wages (Gardner and Daniel, 1998).

The issue of comparable worth has emerged as a potentially serious challenge to unprepared personnel/human resource managers. Grider and Shurden (1987) suggest that personnel managers should prepare now to address comparable worth by taking the following five actions: become pro-active and learn more about the subject, review job analysis/job evaluation programs for any signs of male-female bias, check compensation programs and methods for male-female bias, conduct a Human Resource inventory, correlating job assignments with skills, experience, and knowledge, and finally review corporate strategic plans. Grider and Shurden (1987) believe personnel managers should constantly monitor the present environment to identify factors that may have a substantial impact on their organizations.

The management of public personnel will have to continue modification, consequently focusing upon such attendant issues as job evaluation, criteria evaluation, factor weighting, etc. Job evaluation, which entails any and all factors used to measure the value of jobs, skill and effort requirements, responsibilities, and working conditions will prove integral. Moreover, the procedures of job evaluation will need to be continually modified, given that the traditional job-to-job relative standard will have to give way to the application of fixed standards for factors to a set of jobs. Further, job evaluation processes will have to be more efficiently quantified, so the high amount of human subjectivity that is now present will be virtually eliminated. This will, in turn, negate the inconsistency among evaluators relative to interpretation and/or application of evaluation instruments (Abbasi, Murrey and Hollman, 1996).

This is particularly important, when jobs involve a small number of compensable factors. Further, job evaluation methods must be changed, so that there is increased capability of evaluators in reflecting differences among jobs. Here, the traditional job classification system must give way to the point-factor system that uses a sum of compensable factors to determine job worth, and thus wage and/or salary structure. While there are frequently legitimate reasons for pay differentials between women and men in comparable jobs, such as the length of service in a certain position, unfair differences still exist. The comparable worth issue will remain a major topic in the business world for years to come, and it will be an important issue to employers who want to stay out of the courtroom. The business world still has a lot to learn, but as times change so will our attitudes about women and minorities in the workforce (Abbasi, Murrey and Hollman, 1996)

DISCUSSION AND CONCLUSION

There has been a obvious change of attitude regarding comparable worth, in the last ten years, a trend toward comparable worth programs has been evident in the U.S., as the issue has been debated in state and local legislatures, integrated into collective bargaining agreements, and tested in the courts. For women, the driving force for change has been the dramatic increase in labor force participation. There is already evidence that work/family issues are a priority in employment policy considerations. It has become increasingly important to develop a strategy that involves all employees in building gender awareness for business growth and success. These strategies will empower managers and co-workers to develop a balanced understanding of news reports, legislative action and public and private corporate policy on gender issues such as sexual harassment, discrimination, comparable worth, family leave and equal access. Grider and Shurden (1987) believe that the comparable worth issue may provide the stimulus needed to revitalize what the P/HR department can contribute to an organization. Grider and Shurden (1987) believe comparable worth can also be the catalyst that restores an organization to a position of prominence and growth because of an improved image and increased productivity. Crockett (1997) discussed that as a nation, we must band together to ensure recruitment and retention of the best talent available, in our economy, e do not have a person to spare.

REFERENCES

Abbasi, Sami, John Murrey, and Kenneth Hollman. "Comparable Worth: Should You Reexamine Your Compensation Program?" Ed. John Matzer. Washington, D.C.: International City Management Association, 1996.

Deavers, Ken and Anita Hattiangadi. "Compensation, Pay Equity & Comparable Worth." Employment Policy Foundation. Online. Netscape. 21, Apr. 1999.

Gardner, Susan E. and Christopher Daniel. "Implementing Comparable Worth/Pay Equity; Experiences of Cutting Edge States." Employment Policy Foundation. Online. Netscape. Winter 1998.

Grider, Doug and Shurden, Mike. "The Gathering Storm of Comparable Worth." *Business Horizons. 30*(4) (1987): 81.

Golpher, Nancy. "The Current Legal Status of Comparable Worth in the Federal Courts." *Labor Law Journal. 34*.9 (1983): 577.

Hattiangadi, Anita U. and Terri Shaffer. "AFL-CIO's Equal Pay Initiative Equals Comparable Worth." Employment Policy Foundation Media Advisory. Online. Netscape. 24 Feb. 1999.

Mulcahy, Ronald M. and John E. Anderson. "The Bargaining Battleground Called Comparable Worth." *Public Personnel Management 15*.3 (1986): 235.

Reichenberg, E. Norma. "Pay Equity in Review." *Public Personnel Management*. 15.3 (1986): 230.

Schuler, Randall S. *Personnel and Human Resource Management*. Second Edition. St. Paul: West, 1984.

Schuler, Randall S., Norman J. Beutell, and Sammi A. Youngblood. *Effective Personnel Management.* Third Edition. St. Paul: West, 1989.

Scheibel, William. "AFSCME v. Washington: The Continued viability of Title VII Comparable Worth Actions." *Public Personnel Management. 17*.3 (1988): 316.

Siegel, Gerald B. "Compensation, Benefits and Work Schedules." *Personnel Management. 18*.2 (1989): 177.

Steel, Barbara S. and Nancy P. Lovrich. "Comparable Worth: The Problematic Politicization of a Public Personnel Issue." *Public Personnel Management. 16*.1 (1987): 33.

Thompson, Ronald. "Arguments in Favor of and Against the Comparable Worth Issue." Pay Benefits – New Ideas for Local Government. Ed. John Matzer. Washington, D.C.: International City Management Association, 1996.

DATA WAREHOUSE:
EMPHASIS IN DECISION SUPPORT

John Malley, University of Central Arkansas
Ken Griffin, Francis Marion University

ABSTRACT

Historical information and technology trends have allowed many companies to expand and maximize prof its in the past two to three decades. Information and the strategic use thereof have created a need for proactive information specialists who are able to perform multiple tasks and utilize information across functional boundaries. In a competitive ana global marketplace it is essential that key managers have a grasp on the strategic use of information. Information can make or break an organization. The development of information warehouses has allowed management to harness the technological processes and put the strategic results to work as soon as possible.

A data warehouse is the main essential element to the development of strategic information for the majority of corporations. A data warehouse is a read only analytical database that is used as the foundation of a decision support system (Baum, 120c). A decision support system supplies information to assist employees in making decisions and to enhance job performance. Decision support systems can be used for short term tactical decision making or for long term strategic decision making (Davis, 146). Many support systems provide for operational systems which run the day-to-day business of the company.

Analytical databases provide information which is used to analyze a problem or situation. Analytical processing is primarily done through comparisons, or by examining patterns or trends. Analytical databases provide a snapshot of data (generally time specific) and are often quite large because they track huge volumes of historical data (Baum, 120c). A data warehouse is an analytical database that is used as the foundation of a decision support system.

Overall, a database warehouse system is a strong development tool for providing information to key managers for decision support. The process is ad hoc in nature and no predefined established rules govern particular companies. The data warehouse is not an operational system and in many cases users are not required to use it. If the system is too difficult to use and appropriate levels of support and training are not provided, then personnel may not use them. From the development of personal computers and the use of strategic information many companies have realized the importance of decision support information and the advances that it can bring to their organizations. The strategic use of information is an important component of successful businesses and will continue to he very important in the future. Managers should develop the skills necessary to manage this technology into the next millennium.

DEVELOPING MECHANICAL UNDERSTANDING IN BUSINESS STUDENTS USING SYSTEMS ANALYSIS AND SIMULATION

Connie Nott, Central Washington University
Don Kenward, mid America Valve Exchange

ABSTRACT

Realistic-interdisciplinary problems are one way to expose students to new processes and to challenge critical thought. In this example, a laboratory receives samples of oil, performs a series of tests, and reports the results of the tests to the customer. While documenting and analyzing the system the student develops an understanding of the processes and the meaning of the results of these tests. During the classroom discussion an animated simulation of the system helps students visualize the logistics of product flow and illustrates the inherent variability of the system.

INTRODUCTION

The Production and Operations Management instructor has the responsibility to expose students to new processes and to encourage analytical thought. One way to stimulate interest and develop the students' ability to apply concepts to new situations is by utilizing realistic situations from diverse industrial settings. This promotes an active learning environment, a challenged student and opportunities for critical thinking applied in an industrial setting.

The example presented here can be used as a simple situation discussion, as an opportunity to perform systems analysis or to demonstrate the business reengineering process. Assignments vary with the knowledge and skills of the students, but all include an element of group discussion, a demonstration using simulation software, and a written evaluation.

DESCRIPTION OF THE SYSTEM

The company provides lab testing of oil samples as a service to customers purchasing their petroleum lubrication products. This lab support is often the critical decision criteria for customers selecting the lubricating product for expensive equipment. For example, samples are drawn from the crankcase of diesel engines on ocean-going ships. The salesman can assure the customer that the analysis will indicate when the lubricated machines in their system are operating satisfactorily or not. Early recognition of engine malfunction can prevent costly down time and extensive repairs. This testing laboratory receives approximately 350,000 samples per year This testing laboratory receives an average of 1400 oil samples daily. Samples are identified with a bar code and then run through a series of automated standard tests for viscosity, profile comparison and mineral content. Other tests are available but only performed when the results of the standard tests indicate a particular problem or when the customer specifically requests them. The special tests are often performed manually and

include analysis for water content, an additional viscosity test and a gas chromatograph. The test results are compared to the manufacturers profiles of the same type of clean, unused oil. The customer is notified of the results of the tests and then invoiced by mail within one week of the receipt of the sample. The entire process takes place in a single building (see Figure 1 - Floor Layout).

Receiving

This testing laboratory receives an average of around 7000 oil samples weekly. On Mondays They receive about 40% of the samples on Monday, the remaining 60% is received evenly on Tuesday through Friday. Customers ship boxes containing from one to twelve oil samples in plastic holding bottles. The boxes are opened, each sample is bar coded with customer information and placed in a plastic tray. The tray number and location of the sample in the tray is recorded for each sample in the computerized tracking system. The samples (in the holding bottles) remain in these positions throughout the entire process. When the trays of samples (8 by 10 across) are ready to be tested they are placed on a wheeled cart referred to as a "tea cart". The carts are lined up near the viscosity testing machines (first of standard tests).

Laboratory Testing Process

After labeling with the bar code the used oil samples are run through a series of automated standard tests for viscosity, profile comparison and mineral content. Special tests are available but are only performed when the results of the standard tests indicate a particular problem, or when the customer specifically requests them. The special tests are manual and include tests for water content, an additional viscosity test and a gas chromatographic test. A four-person crew is available to run the standard tests on each of two shifts. One person runs all the manual/special tests on the first shift only.

Viscosity Test

Four identical machines are available to perform the automatic viscosity test. One operator pours a portion of the sample from the holding bottle (also the customer's shipping bottle) into a plastic cup that is compatible with the viscosity testing machines. This operator loads each of the four machines with approximately 56 plastic cups to be tested during each machine's cycle. The machines pull a small amount of oil from the cup, regulate the temperature and record the results of a viscosity test of that sample in the computer system. After the viscosity testing the "tea carts" containing the plastic trays of samples are moved across the room to the profile test area.

Profile Test

An operator uses a small syringe to load the used oil sample onto a 4" x 5" plastic slide. The profile test is performed by a machine which applies a specific voltage across the test fixture. The resulting profile is recorded in the computer tracking system. The teacarts of samples are then moved to the minerals test area.

Minerals Test

A portion of each sample is poured into test vials (shaped like a small test tube) from each holding bottle. The vials are inserted into a machine-driven belt. A suction tube pulls the sample from the vial into the machine for testing. One "tea cart" of samples is run at a time. The results of the mineral test are automatically recorded in the computerized tracking system. Minerals test sample failure indicates that a customer's machine is breaking down and small amounts of the minerals that make up the moving parts of the machine are wearing out.

The three standard tests are now complete. The results from these tests are compared to the manufacturers profile of new clean oil. If the comparison indicates special tests are needed the customer is notified immediately by phone. The special tests for water content, the gas chromatograph and the manual viscosity test are only performed when test results indicate a need or at customer request. (About one sample in 1000 needs additional chromatographic testing. About one sample in 400 needs additional tests for water content and one sample in 500 needs manual viscosity testing.) One operator working 40 hours per week completes all three of the special/manual tests in one area of the lab.

Manual Viscosity Test

The manual viscosity test is conducted in the same laboratory setting. Samples are placed in suitable testing apparatus and the time for the sample to pass through a small opening in the test apparatus is noted. Charts give the viscosity of the sample.

"Pop" Test for Water Content

The results of the water content test indicate the presence of water in the sample, about 1 in 400 require this manual test. To test for water content, a portion of the sample is poured from the holding bottle on to a hot plate held at 275 degrees centigrade. If the sample material pops when it hits the hot plate, an excessive amount of water is in the sample.

Gas Chromatograph

The gas chromatograph gives a more complete analysis than the mineral test, but it is more expensive to run. It alerts the customer to mineral contamination in the sample. This would indicate the breakdown of metallic parts such as gears and bearings.

Staffing and time per test
Approximate time required for average of 1400 samples per day

Viscosity test	14 Hours (Two Shifts) one person
Profile test	12 Hours (Two Shifts) two people
Minerals test	13 Hours (Two Shifts) one person
Special/Manual Tests	8 Hours (One Shift) one person

Interpretation of the results

Samples originate from a wide variety of equipment that must continue to operate correctly. Test results should correspond with the manufacturer's specifications for the same oil type number. For example a sample of 10-weight oil from the customer is compared to unused, clean 10-weight oil with the same additives from the same manufacturer. Often when an internal part is wearing out the only early indication of that problem will appear in the lubricant. If the results are alarming, the customer is called and the results are explained. If test results are normal or within prescribed limits the computer tracking system automatically prints the results of each of the tests in a letter, which is sent along with an invoice for services to the customer.

About one in 500 of the samples is too viscous to be tested automatically. These samples are set aside for manual viscosity testing. The profile test indicates the amount of contaminant in the sample. Excessive water (or ethylene glycol mixed with water) indicates that the cooling system and the lubricating system are intermingling, likely the block is cracked or a gasket has failed. The minerals content measurement is in parts per million and the results are either pass or fail. The degree of failure determines how serious the problem is. Most alarming is the content of aluminum, brass or steel in the oil sample. These pollutants indicate a breakdown of a moving part in the customer's system.

Storage

After the testing process is complete, the remaining portion of the samples in the bar coded holding bottles are stored in racks for a least 22 working days. After the storage period, the samples are taken to a machine that chops up the plastic bottles. Any remaining sample oil is drained off and pumped into a tank for recycling.

ASSIGNMENTS

Depending on the topic being discussed there will be a variation of class level student assignments. Each assignment begins with a product flow diagram, the logistics of the systems, and a recommendation for internal storage during processing. Each group of from four to six students should pool their knowledge during the class period to document and draw the system, describe the potential variability of the stock and flow of the system. At each processing stage students consider the form of the test results and the metrics to evaluate the process. Students are then challenged to display the results in a visual and customer-friendly form for the customer. Other assignments require a list of questions to clarify the process for a business reengineering assignment, and an analysis to "lean down" the system (reduce space, cycle/wait time, improve customer service, etc.) A short paper is required of each student giving a definition of the processes involved in making the product, what weak points may exist in the existing operation, and what recommendations are appropriate to improve the operation.

CLASS DISCUSSION USING ANIMATED SIMULATION SOFTWARE

The simulation model shown below was developed using Taylor II software from F & H Simulations. A full description of the parameters and programming is available from the authors. A lively class discussion accompanies the questions of how to enter parameters into the simulation software and the effects of the parameters on the flow of the product in the system. Graphical icons and different colors indicate products received on different days, and at different stages of completeness. The animation allows students to identify with the waiting times and lines that form in a batch processing system. The analysis of utilization, idle time and waiting time is particularly interesting. The assumptions as changes are made in associated model parameters and staffing make interesting discussion material. Simulation allows the instructor to quickly demonstrate a dynamic system and illustrate that even minor decisions often have system-wide implications. (see Figure 2)
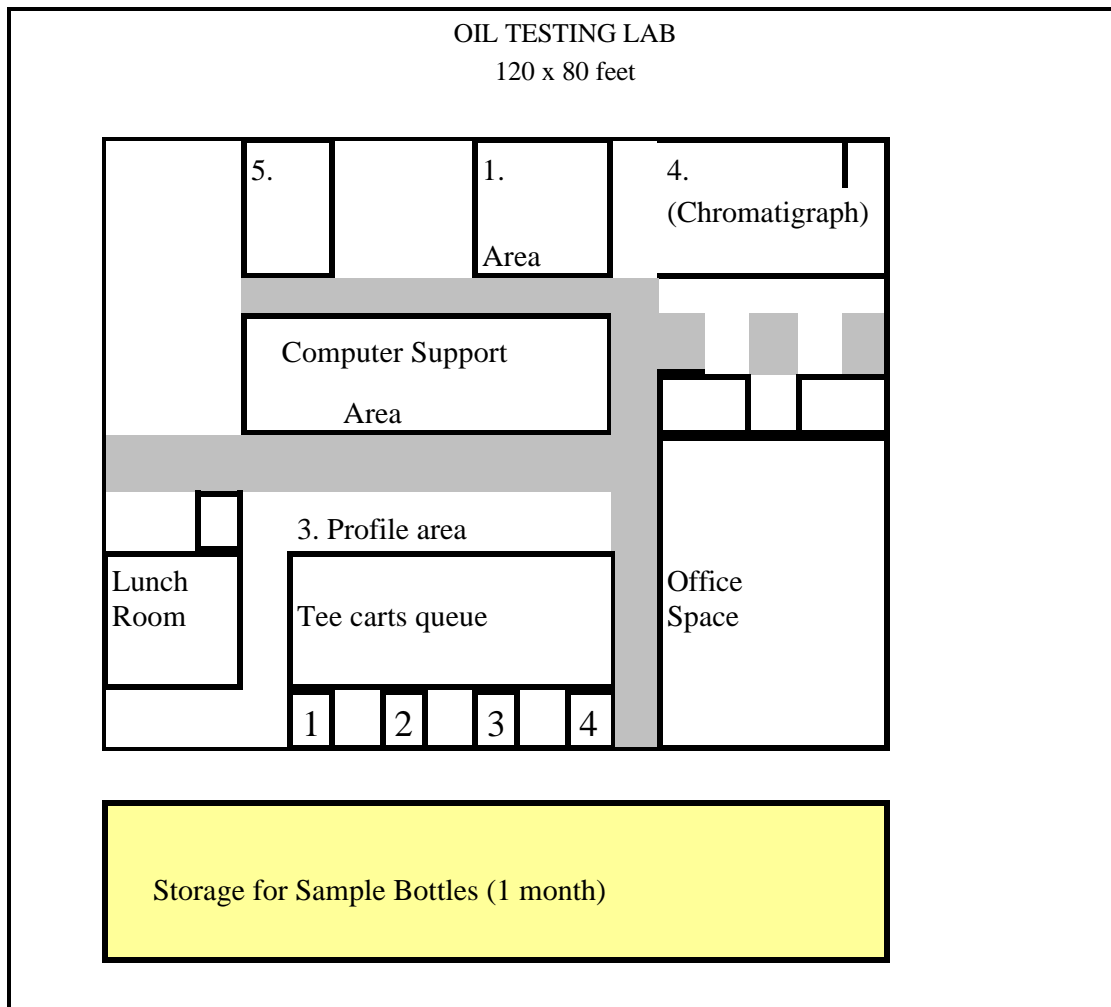
CONCLUSION AND RECOMMENDATIONS

This example stimulates interest and consequently a more in-depth understanding of a variety of topics, both in business and in science. It allows the students to actively participate in a work group, to be emerged in a real (though simplified) situation and to see the usefulness of an advanced systems analysis tool - simulation. Utilizing cross-disciplinary problems and cases is an efficient way to also stimulate interest and to expose students to the vast array of business processes. Animated simulation software is used here as part of the classroom discussion to help students to visualize the product flow and understand the results of statistical variation

REFERENCES

Elliot, Lance (1997). "Using Simulation as a Real Tool" Decision Line, December/January 1997.

Angelo, Thomas (1999). "Seven Shifts and Seven Levers" keynote address at 1999 Learning Paradigm conference.

OIL TESTING LAB
120 x 80 feet

| | 5. | | 1. | | 4. |
| | | | | | (Chromatigraph) |

Area

Computer Support

Area

3. Profile area

Lunch
Room

Tee carts queue

Office
Space

| 1 | 2 | 3 | 4 |

Storage for Sample Bottles (1 month)

BUSINESS PROCESS REENGINEERING AND SOFTWARE IMPLEMENTATION

Rahul Singh, University of San Diego
rsingh@acusd.edu
Gary P. Schneider, University of San Diego
garys@acusd.edu
Carol M. Bruton, California State University San Marcos
cbruton@csusm.edu

ABSTRACT

In recent years, managers of many large organizations have used business process reengineering to align the detailed tasks performed in their organizations with the overall strategies of those organizations. In this paper, we outline the key elements of business process reengineering and software implementation. We conclude that there are many opportunities for using business process reengineering as a part of software implementations. We make suggestions for further research in this area.

INTRODUCTION

As organizations have grown and become more complex, an increasing disconnect has arisen in many firms between their overall strategy and the day-to-day tasks in which their employees engage. This disconnect has, in many cases, caused firms to lose their focus on providing the best products and service to their customers. Large organizations have difficulty maintaining goal congruence throughout their operations because of their complexity and geographic dispersion. A potential solution has been considered and tried by many of these organizations during the past decade, business process reengineering. In this paper, we examine the key elements of business process reengineering and identify opportunities for synergy in the software implementation process. We conclude the paper with suggestions for future research in this area.

BUSINESS PROCESS REENGINEERING

Business Process Reengineering (BPR) is a management philosophy that realigns an organization's business processes so that they create value for their customers. Davenport and Short (1990) define business processes as logically related tasks that achieve defined business outcomes. Hammer and Champy (1993) define reengineering as realigning a company's business processes to maximize value for its customers. Reengineering aims to identify and eliminate tasks that do not add value for the customer. Since every reengineered business process should contribute value for the customer, reengineering creates a common focus within the organization on customers and their needs.

Reengineering creates an intense customer focus and causes the organization to restructure its businesses processes so that each process element adds value and plays a role in fulfilling customers' needs. Hammer and Champy (1993) note that reengineering often requires a fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in cost, quality, variety of services offered, and speed. Davenport and Stoddard (1994) outline five primary elements of reengineering: a clean slate approach, cross-functional orientation, need for radical change, information technology as an enabler, and willingness to change organizational structures and human resource demands. We discuss each of these elements in the following paragraphs.

Rigby (1993) attributes the success of reengineering to its attraction as a clean slate approach for eliminating non-value adding administrative and bureaucratic procedures. Hammer and Champy (1993) state that reengineering is best described as an asking of the question "If you were to start your company today, given today's technology and knowledge, how would you go about it?"

The careful identification and redesign of essential business processes with a strategic view is essential to achieve fundamental high-impact change (King, 1994). Business premises must be examined for relevance in terms of future strategic objectives and their contribution to the strategic initiatives of the organization. Effective organizational processes are driven by their contribution to measures of economic performance of the organization. Such processes aim to reduce economic constraints and increase the flexibility and quality delivery of the product (Craig and Yetton, 1992). Many business process reengineering efforts fail because managers mistakenly believe that reengineering is a mere realignment of business processes, similar to management techniques such as total quality management and continuous improvement. According to Maglitta (1994), up to seventy percent of reengineering efforts fail because top-level managers do not clearly define the scope and nature of the reengineering project. Narasimhan and Jayaram (1997) note that reengineering implementations require managers to control key aspects of complex projects and that reengineering implementations benefit from project management techniques in the planning, design, and execution of reengineering projects. Reengineering projects involve the identification and redesign of business processes that typically cross the traditional functional areas of business. Project management techniques are required to keep track of and integrate the details of the effort.

Business process reengineering focuses on the management of these processes to maximize their effectiveness in delivering services to the customer. The first step in a BPR information systems project is the identification of the business organization's core processes. Such processes are then radically redesigned to eliminate unnecessary steps that do not contribute to adding value for the customer. Reengineering, by definition, creates radical change in an organization's business processes and its environment. The entire organization has to make the transition to the new business processes. A change management process is essential to the success of reengineering effort. The members of the organization should clearly see that the goal of the reengineering effort is to empower their roles in the organization. It is critical that risks to employees and other organizational barriers must be identified in the planning stages of the reengineering effort and managed so that the human resources of an organization are a stakeholder in the process of creating value for the customer.

Information technology plays an enabling role in this redesign (Hammer, 1990). Hammer and Champy (1993) identify the tendency to fix a process rather than change it as a key problem in failed reengineering efforts. As information technology continues to evolve, it increasingly permits more and more radical solutions to be implemented in new business processes. The millennium bug is an

excellent example of how the rapid improvements in information technology have provided a path to radical reengineering. Many businesses and other organizations that faced the millennium bug decided to replace their information systems rather than fix them. Information technology guides the redesign of essential business processes to create value for the customer (Davenport and Short, 1992). Information technology alone has little intrinsic value by itself. Its value stems from its useful application by enabling process innovation. This marks an evolutionary change from the traditional view of using existing business processes to guide the selection of information technology to the ability of new technologies to allow the visualization and development of new business processes. Organizational changes that reflect the role that information technology plays in linking activities inside and outside the company. Companies must employ information technology with the sophisticated understanding of the requirements for competitive advantage (Porter and Millar, 1985). The information systems area in the organization can also provide leadership in the areas of project management and providing the vision and creativeness for the innovative use of technology to redesign essential business processes.

Many organizations in a variety of industries have implemented business process reengineering projects of various magnitudes in the past few years. BPR is widely recognized as having the potential to effect significant improvements in the performance of an organization. Many factors have led to the downfall of ambitious reengineering projects. The lack of complete process re-design, lack of innovation in the use of technology, poor project management, lack of adequate top-level management support, are often cited among others (Hammer and Champy, 1994).

KEY ELEMENTS OF BUSINESS PROCESS REENGINEERING

A number of key business process reengineering elements have appeared in the academic literature—these tend to be prescriptive treatments—and in the business press—these tend to be descriptive treatments—literatures. Including these key elements in a reengineering implementation can help make the implementation a success. Ten of the most commonly noted key elements include:

- Identification of business processes that create customer value.
- Strategic alignment of information resources of entire organization.
- Significant redesign of business processes.
- Cross-functional teams that contribute to the success of the reengineering effort.
- Team members that are stakeholders in or owners of the process.
- Attempt to obtain radical improvements in essential performance factors.
- Information technology plays a key role in the success of the project.
- Strategic partnerships between information systems department and operational units.
- Project management tools and techniques employed in the reengineering effort.
- Results include an enterprise-wide flow of customer requirements information.

BPR is an enterprise-wide effort to redesign key business processes to create value for the customer. Information technology plays a major role in this effort by providing the means for developing the new processes. After a successful reengineering project, information technology is more seamlessly integrated into the organizational processes and information flow within the

organization is significantly more fluid. The redesigned information flows for the new business processes integrate the firm's resources better and in a more focused way. These information flows cross the traditional functional boundaries that exist in many large organizations. The redesigned business processes obtain and use information from both inside and outside the organization in a variety of effectiveness-enhancing ways.

SOFTWARE IMPLEMENTATION

A number of researchers and consultants have offered recommendations for firms contemplating software implementations. Kempfer (1998) recommends linking software to existing or new systems for product development and engineering systems. Large and complex manufacturing firms found themselves implementing information systems that met very specific needs more rapidly than vendors could incorporate those needs into software. Computer-aided engineering and design is an example of an area that has seen rapid improvements in the software available.

Weinberg (1998) recommends a thorough review of network capacity and detailed capacity planning before implementing software. He argues that software implementation changes business processes sufficiently to expect a major change in network traffic levels and patterns. Brakely (1999) recommends that firms prepare a detailed business-model blueprint prior to software implementation that describes how the new organization will look. This communicates to users, implementers, customers, and other stakeholders some ideas about what to expect when the implementation is complete. It also helps the firm develop metrics that can measure the level of success achieved at each stage of the implementation. When new business processes are introduced in a firm, the software system must be flexible enough to accommodate those new processes.

Plotkin (1999) outlines three key steps that should be included in any software implementation: create a flowchart of operations to better understand what is happening in the firm now, build an implementation road map that includes milestones for significant events, an recognize the rollout formally in a way that builds morale among stakeholders in the system. These ideas are adapted from Kapp's (1997) recommendations for software implementations and his (1996) recommendations for conducting business process reengineering. Kapp's USA (understand, simplify, and automate) approach to both software implementation and BPR requires managers to understand the goals of the business processes first. The second step is to find ways to simplify those processes. Only then should information technology be considered as a way to automate the simplified processes.

CONCLUSION

In this paper we have provided an outline of the issues that arise in BPR initiatives and in software implementations. Drawing upon the work of Broadbent and Weill (1999), we argued that their conclusions regarding the dependency of BPR effectiveness on information systems infrastructure may be extended in research that examines the opposite question; that is, is the effectiveness of information systems infrastructure dependent on prior or concomitant BPR initiatives. We suggest that, based on the similarity in key elements that we identify here, BPR initiatives may indeed improve the likelihood of success for subsequent software implementation efforts. Case studies

that examine the relationship between BPR initiatives and software implementation success would provide a valuable addition to the literature on information systems implementation success.

REFERENCES

Brakely III, H. (1999). What makes ERP effective? *Manufacturing Systems*, March, 17(3), 120.

Broadbent, M. and Weill, P. (1999). The implications of information technology infrastructure for business process redesign. *MIS Quarterly*, June, 23(2), 159-182.

Craig, J. and Yetton, P. (1992). Business process redesign: a critique of *Process Innovation* by Thomas Davenport as a case study in the literature. *Australian Journal of Management,* December, 17(2), 285-306.

Davenport, T. and Short, J. (1992). The new industrial engineering: information technology and business process redesign. *Sloan Management Review*, Fall, 34(1), 11-27.

Davenport, T., and Stoddard, D. (1994). Reengineering: Business change of mythic proportions? *MIS Quarterly*, June, 18(2), 121-127.

Hammer, M and Champy, J. (1993). *Reengineering The Corporation: A Manifesto for Business Revolution*, London: Nicholas Brealey Publishing.

Hammer, M. (1990). Reengineering work: Don't automate, obliterate. *Harvard Business Review*, 68(4), 104-112.

Kapp, K. (1997). The USA principle: The key to ERP implementation success. *APICS*, June, 7(6), 62-68.

King, W. (1994). Process reengineering: The strategic dimensions. *Information Systems Management*, Spring, 11(2), 71-73.

Maglitta, J. (1994). One on one, Michael Hammer. *Computerworld,* January 24, 28, 85.

Narasimhan, R. and Jayaram, J. (1997). Application of project management principles in business process reengineering. *Production and Inventory Management Journal*, Third Quarter, 38(3), 44-50.

Plotkin, H. (1999). ERPs: How to Make them Work. *Harvard Management Update*, March, 1-4.

Porter, M. E., and Millar, V.E. (1985). How information gives you competitive advantage. *Harvard Business Review*, July-August, 149-160.

Rigby, D. (1993). The secret history of process reengineering. *Planning Review*, March/April, 21(5), 24-27.

Weinberg, N. (1998). Preparing for ERP. *Network World*, November 2, 15(44), 47-49.

LIST OF AUTHORS