



# What managers should know about ERP/ERP II

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## Abstract

**Purpose** – This paper aims to examine the impact of enterprise resource planning (ERP) on organizations and discusses critical issues that should be considered by managers and decision makers who are considering implementing an ERP/ERP II system.

**Design/methodology/approach** – Extensive literature review and the author's professional experience on the topic provide the foundation for this article.

**Findings** – ERP/ERP II are designed to improve competitiveness by upgrading an organization's ability to generate timely and accurate information throughout the enterprise and its supply chain. The goal of an ERP/ERP II is to integrate all business units of an organization and to create a system that is capable of providing up-to-date and relevant information for the corporation's decision makers and employees as well as business partners. The investment that is required is significant, sometimes running into the hundreds of millions of dollars and the decision to purchase and implement an ERP system is one of the most important decisions a manager will have to make.

**Practical implications** – Implementing ERP systems often requires organizational change and commitment by top managers. Participation by decision makers and executives from the acquisition phase to the end is essential to the success of ERP/ERP II. Factors that managers should consider are outlined in the study.

**Originality/value** – This paper provides useful information to both academicians and practitioners who are interested in ERP.

**Keywords** Competitive advantage, Organizational change, Resource allocation, Management strategy, Benefit-cost ratio

**Paper type** General review

## Introduction

Advances in information technology, expansion of the Internet and electronic business as well as an ever-growing global competition have made running a successful business more difficult than ever before. To remain successful and to be competitive, managers of manufacturing and service organizations must use technology to improve information flow, reduce costs, streamline business processes, offer product variety, establish linkage with suppliers, and to reduce response time to customer needs and expectations.

Information and communications technologies have become major components of the competitive strategy of many businesses. This strategic emphasis has made it possible for managers to integrate information and communications technologies throughout the organization and link all business units together. Corporate-wide technology integration allows information users of the company to have access to the needed information in a timely fashion and make intelligent decisions. Currently, a popular approach to the development of an integrated enterprise-wide system is the implementation of an enterprise resource planning (ERP) system, also called enterprise system.

An ERP system is a set of business applications or modules, which links various business units of an organization such as financial, accounting, manufacturing, and human resources into a tightly integrated single system with a common platform for



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flow of information across the entire business. With the use of the Internet as a business medium, organizations can use the expanded version of ERP, ERP II, to connect their internal business systems with the systems of customers and suppliers. The purpose of ERP/ERP II is to enhance an organization's competitiveness by improving its ability to generate accurate and timely information for managerial decision making.

A review of the literature suggests that ERP systems are used by small, medium and large corporations as well as government agencies and non-profit organizations. In recent years a growing stream of research has focused on the competitive advantage of ERP and the importance of considering the organization's business models and core competencies when making decisions for or against ERP implementation (Lengnick-Hall *et al.*, 2004; Davenport, 1998; Prahalad and Krishnan, 1999; Holland and Light 1999). ERP systems can provide management with cost and operational information necessary to make strategic decisions concerning their competitive position. To take advantage of the competitive capabilities of ERP systems, managers and employees must understand the basic principles of ERP so that it can be used to its fullest potential.

Commitment by management is necessary to the success of an ERP system. This commitment needs to be incorporated into the business culture and employee population through the use of training programs, team building efforts, and recognition of each success.

The failure rates for ERP projects are relatively high and could lead to the bankruptcy of the corporation. In 1994, Dell Computer began to implement an ERP system- SAP's R/3- to run its manufacturing operations. Two years later, the company aborted the project claiming incompatibility with their business model. Allied Waste, the second largest waste management company in the US, found the ERP implementation too expensive and abandoned it. Applied Materials, the world's largest supplier of products and services to the semiconductor industry, claimed changes required by the ERP system were too overwhelming to continue with the project. FoxMeyer, a large pharmaceutical distribution company, filed for bankruptcy in 1996 claiming a failed ERP implementation ruined their business. Later, a bankruptcy trustee for FoxMeyer sued both SAP America, Inc. and Anderson Consulting firm blaming them for its financial ruin. The case was settled out of court (Mabert *et al.*, 2001; Davenport, 1998; Brickley, 1998).

To successfully implement an ERP system and to avoid failure, the firm must conduct a careful preliminary analysis and develop a plan for ERP acquisition and implementation. The most important success factors for ERP implementation include top management support, effective project management, extensive user training, and viewing ERP as a business solution. Factors such as inadequate technology planning, user involvement and training, budget and schedule overruns, and availability of adequate skills are considered reasons for ERP failures (Sumner, 2000; Umble and Umble, 2002; Wright and Wright, 2002). This paper covers critical issues that managers need to consider before investing in an ERP system.

### **Background**

Historically, ERP has its roots in the manufacturing industry and is the successor to material requirements planning (MRP) and MRP II. ERP is the most recent in a number of manufacturing and financial information systems that have been developed, over

the last several decades, to synchronize the information flow with the physical flow of goods.

The first step was taken in the early 1960s when manufacturers began to use MRP software to organize information flow around the manufacturing processes. In the late 1970s the scope of MRP was expanded to include resources and MRP II software became available. The focus of MRP II is on internal operations and provides insight into the implications of the master production schedule and materials plan. Finally, since the 1990s, software developers created ERP/ERP II software, a fuller suite of applications capable of linking all internal processes as well as interorganizational processes such as supplier and customer relations management.

ERP modules are integrated through a set of common definitions and a common database. When data such as an order from the customer becomes available at one point in the business, the impact of this information is immediately reflected in all other areas, such as accounting, production scheduling, purchasing, and logistics. Employees are able to view the order, locate the required items, decide on shipping details and review the customer's credit information on the same computer screen.

ERP systems are based on a value chain view of the business where functional departments coordinate their work, focus on value-adding activities and eliminate redundancy. In order to implement an ERP system, a company may need to make changes to organizational structure, corporate culture, and business processes. ERP can be a valuable tool for managers to improve operational as well as financial performance of the firm. Long-term financial gains can be realized only when a company delivers increased customer value while simultaneously lowering the cost of delivering that value.

### **ERP benefits**

Benefits derived from ERP system implementation varies from one company to another. However, there are some common benefits that all companies can receive from the system. It is important that these benefits outweigh the costs of the system and they should as long as the correct system for the organization is chosen and the system is implemented properly. These systems can, in the long run, save millions of dollars, an enormous amount of paperwork, and considerable hours of work.

Many organizations have several different legacy systems that have developed over the years to meet their information needs for planning and decision making. Often, there is little or no integration among departments and application programs used by separate departments do not communicate with each other. This means that data has to be entered into each separate department of the organization resulting in data redundancy and at times inaccuracy. The same data is available but in a different format making it difficult and time consuming to collect information and present a coherent picture of what is happening in the business. ERP systems can virtually eliminate the redundancies that occur from these outdated and separate systems. ERP systems integrate various systems into one and data is entered into the system only once. Because data is entered once, there are greater chances that it is accurate. If inaccurate data is discovered, it can be corrected once instead of going through each department for every change. Different employees can access data simultaneously in ERP systems, whereas in separate legacy systems this is much less likely.

Process improvements are another important benefit of ERP. The common denominator in every business is the processes performed to produce a product or service. ERP systems require firms to examine their internal processes in order to

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increase business efficiency and profitability. Firms manufacture their products or provide their services by performing a set of processes that create value. These processes form a value chain. A firm is profitable if the outcome of the value chain provides a service or product that can be sold for more than the producer spent in product creation and delivery. By improving or reengineering business processes, poor quality and the most costly areas of the operation can be identified and improved or eliminated, thus increasing the value of the processes in the value chain. ERP/ERP II implementation enables the organization to analyze the value chain as a system, from supplier to firm to customer.

ERP systems generally come with standard applications centralizing the information of separate departments into a common database. The use of a common database and standardization of business applications provide companies with a similar appearance and use of software programs. These programs become more universal throughout the company. Standardizing the appearance and applications of various programs that are used in individual departments can create greater ease of use and improve efficiency. Whether a company is local or global, ERP systems can be used to install consistent operating practices throughout the enterprise. Most ERP systems have a customized browser that allows managers and employees to configure their own view of the program. Managers can set-up access control preventing unauthorized access by employees, customers, and business partners to sensitive information. Companies with multiple locations can alter their ERP applications to suit the needs of each location while sharing a core of common information.

Manufacturing and business organizations are not the only beneficiaries of ERP systems. Many local, state, and federal government agencies as well as colleges and universities are also benefiting from ERP systems.

The city officials of Pasadena, California decided to implement an ERP system in 1996. Before the implementation, it took the city 10 days per month to generate various financial reports; ERP reduced this time to 1 day, leaving 9 days for other important tasks to be performed (Ferrando, 2000). The state of Georgia's Department of Administrative Services spent a year and a half and \$52 million dollars to implement an ERP system. The system serves eighty agencies and 5,000 users. The implementation reduced annual contract reviews from weeks to hours; audit preparation time was cut by more than 50 per cent and financial information inquiries can be done online in real time instead of weeks (Songini, 2000). The US government plans, for the fiscal year 2009, to spend \$7.7 billion dollars on ERP products and services (Chabrow, 2004). Government contractors who do not have enterprise systems and wish to stay compliant with government standards may be forced to implement ERP systems.

Colleges and universities such as the American University in Washington DC, Dominican University of California, College of the Holy Cross of Massachusetts, and Columbia College Chicago are using ERP to allow students to register and make payments online; generate reports for top administrators; provide access to high school counselors; track faculty teaching records; check instructor and classroom availability for course scheduling; and enforce registration rules and conduct degree audits among others (Savarese, 2003).

ERP is becoming a platform for electronic business, B2B and B2C, applications allowing organizations to reduce their inventory costs and to better manage their supply chains and customer relationship. Manufactures, suppliers, and retailers can coordinate their activities and track items. Tracking items is a well-used and

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convenient benefit of ERP systems. By using bar codes or placing radio frequency identification tags on items companies can find exactly where the item is in the value chain, prevent theft, and determine its delivery time accurately so that the customer receives the goods on time. Kohler Co., a large manufacturer of kitchen and bath products, uses an ERP system to track items in the shipping process, solve problems associated with orders, forecast monthly sales, and ensure on-time delivery of its products (Bartholomew, 2002).

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### **Organizational change and the costs of ERP implementation**

ERP systems are extremely expensive to implement. Managers must carefully weigh the costs and benefits of such a system to ensure if it is worth implementing. The costs of an ERP system come in various forms and there are a wide variety of different costs stemming from numerous areas both internal and external to the company. The cost of ERP software is relatively small, ranging from 10 to 20 per cent of the overall implementation costs (Mabert *et al.*, 2001). Process reengineering costs, support costs, training costs, data conversion costs, and the cost of changing information technology architecture are just a few of the many expenses a company has to consider when adopting an ERP system.

The cost of the ERP package varies among vendors and depends on the size of the corporation, type of package, and the degree of customization and integration. Some companies require more customized versions of ERP systems than others. Customization increases the cost of an ERP package. The more advanced and complicated the company and the system, the greater the cost. According to a study performed by the Meta Group, out of 63 companies examined, they found the average total cost of a complete ERP system to be approximately \$9 million. However, this figure seems relatively low compared to many companies who spend hundreds of millions on their systems (Leitch, 2002).

ERP systems costs include both fixed and up-front costs as well as recurring costs that continue annually to keep the system running and updated as needed. There are several primary fixed cost drivers associated with ERP systems. The majority of the fixed costs of an ERP system include software costs, changes in the operation environment, consulting costs, as well as implementation and integration costs.

Implementation of an ERP system often requires fundamental changes in the way employees and functional areas do their work. Support for change could be for two reasons:

- (1) to remain competitive, or
- (2) to gain advantage over the competition.

Clearly, top management must understand the scope of change when implementing an ERP system. Noticeable change requires a strategic response that includes a collection of factors such as the organizational structure, the strength of competitive position, and the competitive environment of the industry.

One method of managing change effectively is the establishment of an ERP planning and implementation team. This team is comprised of representatives from all major functional areas and top management. Formation of a team provides a structure for determining the impact of ERP on the organization. The team should develop a set of priorities for ERP modules to be implemented. Involvement of the functional units in the implementation process is particularly important since ERP applications cross-functional unit lines. This participation facilitates implementation activities and

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a sense of ownership in the system, which leads to further use of the technology. Top management participation during implementation ensures conformance to corporate policies and procedures. In order to better determine the amount of change that an ERP system requires and to ensure its success, often companies hire outside consultants. Although there is no guarantee that the consultancy will be effective, these consultants have considerable experience in specific industry and/or comprehensive knowledge about certain software. Successful implementation of ERP systems at Marathon Oil, located in Houston Texas and at Pratt and Whitney, headquartered in Longueuil, Quebec, Canada are examples of effective change management and team efforts (Stapleton and Rezak, 2004; Tchokogue *et al.*, 2005).

Organizational changes always require personnel, both management and staff, training and education and it is expensive. However, superior training of personnel is imperative for the success of an ERP system. Employees will be asked to change the way they perform their daily tasks. The new way of doing business will require everyone to work together because the information of one business unit will be dependant on the accurate entries by employees of another. Training is a continuous process and it must be done during the entire implementation process of the system as well as when the ERP applications are changed or updated.

Aside from all the fixed costs that are associated with ERP systems, there are also numerous recurring costs that companies have to budget for each year in order to keep the system running effectively. In addition to the initial purchase of the system, annual support fees must be paid in order to keep continuous support from the vendor. Operation and maintenance fees, technology upgrades, as well as project upgrades are some of the recurring costs associated with ERP implementation.

Choosing, implementing, maintaining, and updating an ERP system takes an extraordinary amount of time. Company time, time when other functions could be performed, is a huge opportunity cost of ERP systems. Along with the time that it takes to train employees and keep them up-to-date with the newest innovations within their present system, it takes a lot of time to determine which system to choose, implement the system and keep it running. It usually takes at least a year to implement an ERP system. In some instances it can be shorter than that, possibly in smaller companies; however that is extremely rare. In many cases it takes much longer than a year for full implementation of ERP, sometimes as much as 3 years (Leitch, 2002). It is very difficult if not impossible to quantify the opportunity costs associated with the adoption of an ERP system. For this reason, quantifiable costs associated with an ERP system have to be even more carefully weighed and comprehensible performance indicators should be established prior to installation.

There are several methods that organizations can use to reduce the costs of ERP systems. Some of these include using a single vendor solution, eliminating customization, and outsourcing. By using a single vendor solution, rather than integrating several different vendors for different purposes, a company can save money in the long run. Due to ERP market consolidation, in recent years, large corporations are more or less left with either SAP or Oracle ERP platforms. However, more choices are available to small and midsized enterprises (SMEs). SMEs can buy their system directly from a software vendor or indirectly through a value added reseller (VAR). SME managers must decide whether to buy their system from a large vendor or a smaller VAR. Large vendors offer more variety of modules and have considerable resources for ongoing support and upgrades. However, these systems cost more and have a higher degree of standardization requiring more change. Systems offered by

VARs are more flexible and offer modules geared toward the needs of specific industries and require less organizational change, thus reducing the overall costs.

Instead of buying, outsourcing can be a viable option for companies to reduce the costs of an ERP system. Outsourcing allows the organization to convert fixed costs to variable costs by leasing only the modules or suites they need. This option shifts the cost of maintaining and upgrading the system to the vendor. Because the corporate data is maintained at the vendor's site, outsourcing requires a great deal of trust. Because data entry is done via the Internet, controls and security measures must be established to ensure data integrity and to prevent unauthorized access.

### **Vendor selection and implementation**

Companies choose vendors for various reasons. Some choose a vendor with a superior corporate image or being a market leader. Others predominantly look at the functionality and the quality of the products and services offered for evaluating ERP vendors. However, selecting the appropriate vendor is a long and important process. The best approach to vendor selection is to form a study team. Individuals who are familiar with various business processes as well as information technology and management representatives should be on the team. If needed, outside consultants may be hired on an advisory position to aid the team in the selection process. There are different approaches to vendor selection. Some of these are:

- Limit the study to one or two vendors and their products and services. This reduces the time required for the study. The main disadvantage of this approach is possible elimination of the best system.
- Make a detailed study of all vendors. This reverses the advantages and disadvantages of the previous approach.
- Make an overall survey and then limit the choice to one or two vendors. This is probably the best approach. It is a compromise on the first two approaches.

Once the potential candidates are identified, the team invites proposals from them and makes the final selection. Management at this point should be in position to negotiate the contract for delivery and implementation schedules.

Enterprise wide projects, such as ERP, are costly and slow to implement. It requires skillful planning and hard, dedicated work in executing the plan. The most important step toward a successful ERP implementation is the selection of a project manager who has a good understanding of the business and the technologies involved in the project. The project manager should recruit the best managers and employees from every department to ensure that the needs of all departments are considered. The team will be involved in all aspects from the planning stages to the end. Executives ought to be involved in the development of an implementation plan, be the driving force behind every phase of the implementation, and resolve any problem encountered to secure the desired outcome.

A budget to cover the costs of implementation and a detailed schedule of activities associated with ERP functions and modules from the start of implementation to the end should be developed. Many activities can be going on simultaneously, some cannot start before others are finished, some should be done as early as possible, and some should be delayed. Project management tools such as a Gantt chart, critical path method, or program evaluation review technique are useful to estimate project completion time, evaluate progress, and signal delays. The budget for implementation

should be broken down into small enough elements to assure control of the expenses associated with the project.

There are several different methods that a company can use to implement an ERP system. One approach to ERP implementation is the one time conversion from old to new. In this implementation process the company removes the legacy programs and immediately installs and begins the use of the new ERP system. However, this method could be risky and difficult if the employees are not properly prepared and trained. Another implementation method is the gradual replacement of legacy programs with ERP programs. This approach is best suited for those organizations in which their programs tend to be vastly different. In this way, within the individual units of the organizations the ERP programs can be implemented in a piecemeal fashion, one at a time, and then integrated with each other. Smaller organizations can choose to implement an ERP system one module at a time and slowly, as the organization grows, they can add more modules over time.

Throughout the implementation process, the team should keep the employees informed about the progress of the project. A good way of communicating with employees is the creation of a web page to provide information to and receive feedback from them. Periodic e-mails and newsletters are also effective means of communication. Along the way, executives should sponsor information sessions to pass on project updates and at the same time, answer questions, and solicit input from employees. Having an executive sponsor these sessions will indicate to the employees that the organization is taking the ERP implementation seriously.

Employees should have an individual to go for information and problem solving. This is where the team members can be most helpful to workers of their respective departments. A help desk should be established for the employees to express concerns during the preparation, implementation and follow up stages as well as resolve problems once the system is in operation.

## **Conclusions**

In today's global business environment firms must be competitive in order to survive. A popular method of using technology as a competitive tool by organizations is the implementation of an ERP system. In order to take advantage of this technology, the firm must analyze the nature of its particular industry and environment. Once the firm understands where it needs to position itself within its industry, then it can determine if ERP/ERP II is the right technology for maintaining or enhancing its competitive capabilities.

The popularity of ERP is attributed to its ability to improve the profitability potential of an organization by reducing the time and costs of completing business activities. This system is particularly useful in providing management with the types of information necessary for making critical decisions.

Managers of organizations, especially SMEs, who are concerned about the costs of an ERP system, should view ERP as a potential investment that can reduce current costs and reward the firm with a substantial return on the investment. The costs and benefits associated with investing in business solution efforts such as ERP should be studied to determine whether it is necessary for the company to invest in such a system or can the improvements or changes in their current system be implemented in other ways.

By performing a cost/benefit analysis about the entire process of adopting an ERP system, the firm can determine whether the investment will pay off in the long run. It is

the responsibility of the top management to form a team to study the feasibility of ERP implementation and be a part of the decision process from the beginning to the end. Because ERP requires a substantial amount of capital investment, the feasibility study involves a greater degree of effort than the typical capital investment analysis. The organization's existing business processes, legacy systems, and the impact of change on the organizational structure, corporate culture, and personnel are important factors to consider during the study.

Before implementing an ERP system, such tactical decisions as vendor selection, employee training, project management, consulting needs, and the implementation method should be made. Regardless of the implementation method, implementation is one of the initial steps in the use of an ERP system, and if this step is not performed correctly the chance of success is greatly reduced.

Managers should consider ERP acquisition and implementation as a capital investment decision with the following expectations:

- The ERP system is a business solution and not another IT project.
- There is a degree of uncertainty with ERP acquisition and implementation because (a) it is hard to estimate the savings, and (b) it is difficult to anticipate developments because of constant changes.
- The ERP has a greater impact on the organization than traditional system changes.
- Intangible benefits of an ERP system are difficult to put into monetary terms.
- There is a definite emotional element in the implementation of an ERP system because of the drastic organizational changes involved.

Outsourcing ERP applications can be a viable method of reducing the initial investment needed for an ERP system. When considering outsourcing, managers must keep in mind that it is not the ownership that is of paramount importance, but the effective use of an ERP for increasing performance and profitability of the business.

### References

- Bartholomew, D. (2002), "Maximizing ERP: manufacturers extend enterprise resource planning's value with links to MES, business information", *Industry Week*, Vol. 25 No. 3, p. 58.
- Brickley, P. (1998), "Defunct outfit firm blames IT firm; in liquidation, firm alleges Andersen consulting added to its troubles", *Philadelphia Business Journal*, Vol. 17 No. 40, pp. 3-4.
- Chabrow, E. (2004), "Big bucks for ERP", available at: [www.governmententerprise.com/showArticle.jhtml?articleID=47901151](http://www.governmententerprise.com/showArticle.jhtml?articleID=47901151)
- Davenport, T. (1998), "Putting the enterprise into the enterprise system", *Harvard Business Review*, Vol. 76 No. 4, pp. 121-31.
- Ferrando, T. (2000), "ERP systems help with integration", *American City and County*, Vol. 115 No. 11, p. 12.
- Holland, C.P. and Light, B. (1999), "A critical success factors model for ERP Implementation", *IEEE Software*, Vol. 16 No. 3, pp. 30-5.
- Leitch, J. (2002), "The cost of cutting costs", *Contract Journal*, pp. 8-10.
- Lengnick-Hall, C., Lengnick-Hall, M. and Abdinnour-Helm, S. (2004), "The role of social and intellectual capital in achieving competitive advantage through enterprise resource planning (ERP) systems", *Journal of Engineering and Technology Management*, Vol. 21 No. 4, pp. 307-30.

- Mabert, V.A., Soni, A. and Venkataramanan, M.A. (2001), "Enterprise resource planning: common myths versus evolving reality", *Business Horizons*, Vol. 44 No. 3, pp. 69-76.
- Prahalad, C.K. and Krishnan, M.S. (1999), "The new meaning of quality in the information Age", *Harvard Business Review*, Vol. 77 No. 5, pp. 109-18.
- Savarese, J. (2003), "Is ERP your panacea? Will the benefits of ERP outweigh the hard and soft costs? Ask those who know-the users", *University Business*, Vol. 6 No. 3, pp. 42-5.
- Songini, M. (2000), "Despite odds, Georgia hits it big with ERP system", *Computerworld*, 9 October, p. 10.
- Stapleton, G. and Rezak, C. (2004), "Changing management underpins a successful ERP implementation at Marathon Oil", *Journal of organizational excellence*, Vol. 23 No. 4, pp. 15-22.
- Sumner, M. (2000), "Risk factors in enterprise-wide/ERP projects", *Journal of Information Technology*, Vol. 15 No. 4, pp. 317-27.
- Tchokogue, A., Bareil, C. and Duguay, C. (2005), "Key lessons from the implementation of an ERP at Pratt and Whitney Canada", *International Journal of Production Economics*, Vol. 95 No. 2, pp. 151-63.
- Umble, E.J. and Umble, M.M. (2002), "Avoiding ERP implementation failure", *Industrial Management*, Vol. 44 No. 1, pp. 25-33.
- Wright, S. and Wright, A.M. (2002), "Information systems assurance for enterprise resource planning system: implementation and unique risk considerations", *Journal of Information Systems*, Vol. 16, Supplement, pp. 99-113.

#### **Further reading**

- Haug, M., Wang, F., Yu, S. and Chiu, C. (2004), "Value-added ERP information into information goods: an economic analysis", *Industrial Management and data Systems*, Vol. 104 No. 8, pp. 689-97.
- Scheer, A. and Habermann, F. (2000), "Making ERP a success", *Communications of the ACM*, Vol. 43 No. 4, pp. 57-60.

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