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Increasing Productivity: Another Approach

Fred J. Norton

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Increasing Productivity: Another Approach

Fred J. Norton
Plant Engineering
Lawrence Livermore National Laboratory

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INCREASING PRODUCTIVITY: ANOTHER APPROACH

Abstract

An engineering information (EI) and information technology (IT) organization that must improve its productivity should work to further its business goals. This paper explores a comprehensive model for increasing EI/IT productivity by supporting organizational objectives.

Introduction

Current trends in both technology and business are reshaping all areas of the Department of Energy (DOE). The DOE National Laboratories are becoming leaner and flatter; budgets in most of the National Laboratories, and their associated organizations, are being cut; responding in a nimble fashion to the more dynamic conditions has become an important objective. The organizations (large or small) in the DOE Laboratories must deliver new products or services, cost efficiencies, and competitive advantages faster than ever before. Corporate and government leaders quickly generate increased business benefits with sharply limited resources.

Getting more out of less is hardly a new idea. Many principles for achieving productive efficiency have been tested and refined. In industrial settings, for example, proven technique can help increase material output per unit of input. The base of experience with engineering information (EI) and information technology (IT) productivity, though, is too limited to generalize very far.

As EI/IT organizations respond to their leaders' mandates, they must make some basic changes. Employees and managers must learn new technical and interpersonal skills. Organizational shapes and lines of communications may have to be redrawn. Although EI/IT organizations are enjoying new-found importance because of their broader impact, corporate managers also are finding that EI/IT's traditional rigid systems and methods limit the possibilities for collaboration, responsiveness, and timely results. In short, improving EI/IT productivity has moved from being a budgetary response to becoming a strategic initiative.

As a result, systems and technology are no longer strictly the bailiwick of the EI/IT organization; the larger enterprise must assume more responsibility for improving EI/IT productivity than it has in the past. Given that EI/IT must support business objectives, the business must shape an IT organization to deliver information services in line with fundamental organizational strategy. Senior management must provide direction for the business and decide what the priorities and tradeoffs will be.

In their article entitled "Customer Intimacy and Other Value Discipline," Michael Treacy and Fred Wqiersema[1] illustrate how successful companies focus their energies on delivering operational excellence, customer intimacy, or product leadership (see Figure 1). To prosper, a company must continually strive toward superiority in one of

these areas while maintaining basic competence in the other two. Trying to do everything well means that resources will be wasted in a mediocre overall performance. Similarly, settling for acceptable levels of performance across the board or resting on past triumphs leaves a business with no current mechanism for value leadership.

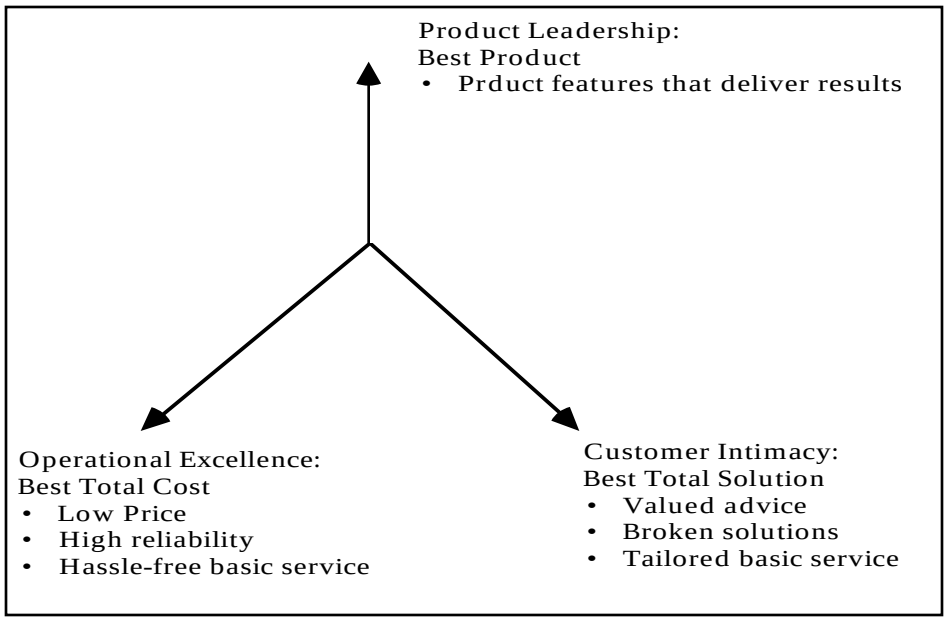

Figure 1. The three value disciplines.

This need for focus has important implications for the EI/IT organization as it seeks to improve productivity. EI/IT leaders must know what the business objectives are in order to work in alignment with the larger organizational goals. For example, organizations that are product or service innovators typically emphasize speed over cost effectiveness. An operationally excellent organization, however, typically demands an efficient EI/IT organization.

Definition of EI/IT Productivity

The definition of EI/IT productivity is therefore not universal, but depends on the setting. Conscious decisions must guide the pursuit, both within the EI/IT organization and at the top levels of organizational strategy. A farsighted architectural overview should guide EI/IT with business goals rather than technological specificity.

Why is increased EI/IT productivity necessary?

Within corporate and worldwide economic contexts, change has become the overriding imperative. Rapid and fundamental paradigm shifts are forcing EI/IT and business leaders to rethink many of the following basic assumptions of just a few years ago:

- *Old assumption 1: Information technologies* allow *EI/IT to perform manual operations faster than before.* Transferring accounting records into databases or having clerical workers type into a word processor instead of an a typewriter merely

automated existing business tasks. A new generation of managers has begun using EI/IT for its strategic possibilities rather than viewing it as a better tool for an existing job. Instead of merely speeding up performance of a task that adds little value, new applications of EI/IT use its capabilities to redesign and improve key business processes.

- *Old assumption 2: Staying with a single vendor allows the organization to standardize operations and optimize system performance.* Although proprietary or closed environments do offer some advantages, most buyers now recognize the benefits of competition and specialization. The "plug and play" approach allows purchasers to own the "best" database management software, network server, or storage technology for their particular needs. Finding out what those needs are, and what the best product or service is, can be a demanding process even before confronting the task of putting the whole system together.
- *Old assumption 3: Staying with tried and true approaches maximizes current resources and ensures compatibility with previous work in place.* These sentiments held true for much of the past 30 years. The new technological architectures and capabilities, however, necessitate an increasing commitment to updated approaches and tools. The result is that, according to the *Gartner Group's ADM Report* of November 25, 1992, "by 1997, 85 percent of new applications will require a mixture of skills sets not prevalent in current EI/IT organizations."(2)
- *Old assumption 4: Thorough investigations of system requirements and documentation of system applications are essential to proper performance of the EI/IT function.* Exhaustive definitions of system requirements and voluminous documentation manuals are becoming increasing anachronistic in today's business environment. The world changes too fast for system requirements to be frozen, and it moves too unpredictably for managers to anticipate future requirements more than a few months in advance. The embodiment of this assumption is the waterfall model of system delivery, which gradually is being replaced by new approaches (such as accelerated application development) that are more flexible and that generate systems that are much more closely matched to user requirements.

New Forces Reshaping EI/IT Environments

In contrast to the prevailing wisdom of the recent past, new forces are reshaping the IT environment. Today's application development environment must accommodate the following realities:

- EI/IT has become a strategic, not merely tactical, contributor to the enterprise.
- Strategic applications require systems development approaches different from those needed by applications that simply automated manual processes. The analytic emphasis has shifted from functions to organizational processes. Successful business solutions anticipate and accommodate changes to organization and jobs, rewards and incentives, and management systems.

- The EI/IT organization's internal rigidity cannot be allowed to hamper business initiatives that emphasize agility and responsiveness.
- Systems developers and business users must work in close collaborations to generate solutions. The ability to communicate and cooperate is critical to successes.
- Open architectures require more investigation of intercomponent synergies.
- Systems developers are being forced into entirely new ways of thinking. Client/server systems and object-oriented programming are leading the way, but the need for portability across platforms and network architecture's also introduces more new dynamics.
- Today's emphasis on time-based competition effects EI/IT as well as the rest of business. Detailed systems requirements no longer hold steady over the duration of systems, so application development must become more responsive.

Productivity of EI/IT Systems

Fundamental differences exist between EI/IT productivity and traditional efficiency. Simple measures of output divided by effort do not present an adequate definition of EI/IT productivity. New business dynamics lead management to measure success in new ways, most importantly through time rather than only with money. Because EI/IT drives so much of the current organizational strategy, and because it is so central to time-based competition, EI/IT productivity must be evaluated with new indexes.

There are three aspects of IT productivity that can be rated to present a composite picture (see Figure 2)[3]:

- *Speed***.** To reflect the importance of time, leaders should rate their EI/IT organization(s) on how quickly it/they can deliver the necessary solutions for the organization to meet its competitive objectives.
- *Effectiveness***.** Measurements of output per unit of human input help indicate effort as it relates to computational complexity. Solutions that use the right people, business processes, and EI/IT tools are highly effective.
- *Quality***.** A system can be developed rapidly and with a minimum of labor, but an adequate notion of productivity also must consider how well the system works in practice. A solution should have the right amount of quality—to make it "—fit for use," but should leave out the unnecessary features that can lengthen development time or bog down the system's performance.

Speed, effectiveness, and quality exist in a dynamic tension that affects cost considerations. These three aspects can be thought of in terms that parallel the three value disciplines shown in Figure1. That is because no organization can do everything superbly; each organization should establish an optimal mix of priorities. Strategic considertion of tradeoffs can focus resources to achieve maximum synergy with business goals. In customer-intimate organizations, for example, speed is desirable, but never as important as quality (i.e., richness of functional capabilities). Levels of detail that would be jettisoned in accelerated development must be included; productivity

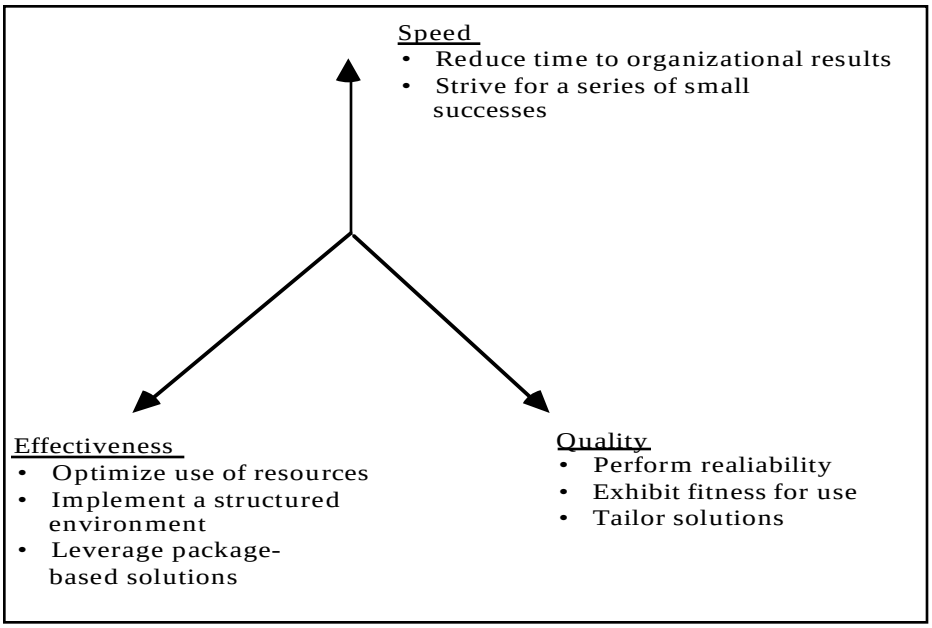

Figure 2. Three aspects of EI/IT productivity.

in this setting does not resemble the goal structure of a time-based product innovator or a cost-effective mass merchandiser. Suitability for organizational strategy, not raw numbers, defines EI/IT productivity.

Clearly, productivity is NOT one thing but many things, depending on the enterprise. Cost is a tradeoff with each of the three aspects of productivity and must be considered within the context of the business case for action. Once this is established, EI/IT organizations must respond.

There are prerequisites to sustained improvement in EI/IT productivity.

Many EI/IT leaders are tempted by an incredible array of techniques and technologies that promise higher productivity. Although tools certainly have important roles to play, they do NOT by themselves increase in any meaningful way. Instead, fundamental organizational factors must be well aligned before any tactical maneuvers are attempted.

These managerial objectives should reflect the organization's basic strategic commitments and not merely encourage people to work smarter. Two mandates in particular will undermine future progress if they are NOT addressed. They are:

- The company's legacy asset base.
- The human component of information technology.

Legacy Asset Management

Despite the appeal of client/server systems, dumping legacy systems overnight and adopting newer technology is expensive, risky, and for most organizations, impractical. As a result, EI/IT organizations find themselves in a difficult predicament.

On one side, understanding and managing client/server systems, object-oriented development, and wide and local area networks are major challenges. Maintaining

legacy systems, meanwhile, is also a complex and demanding occupation. When these divergent architectures overlap, the EI/IT leader must meet both sets of expectations at once—and manage the navigation between the two worlds: flat versus hierarchical, flexible versus rigid, object-based versus rule-based, distributed versus centralized, open versus closed.

To meet the challenge of living with both paradigms, EI/IT leaders must work with organizational leaders to develop a strategy for legacy renewal, retirement, and redevelopment. Episodic flurries of activity distract attention from long-term goals and strategies, so planning ahead with a methodology of assessment and action is critical. Within this strategy, it is crucial to identify and exploit legacy assets that can be leveraged into future productivity gains. All legacy activity should fit into a carefully defined architectural overview, one that is business-driven (e.g., Engineering/Construction Department, Maintenance and Operations Department, etc.) rather than technology-specific.

Human Resources

The other prerequisite—people issues—is a much broader and harder to codify, but it determines not only the degree of EI/IT productivity but also the overall health of the enterprise. Without the right people doing the right things in the right way, software engineering and other proven methodologies are likely to enjoy limited success.

Every organization has a different set of priorities, depending on what the business goals dictate. For example, if speed is the key goal, certain skills will be particularly valuable. In accelerated application development projects, group dynamics and interpersonal skills are as important as technical abilities.

Unlike traditional programming—in which EI/IT employees worked in isolation among like-minded peers—developers in an accelerated environment often work side-by-side with the ultimate users of the system, who most likely do not know the fine points or even the broad outlines of system architecture. These users do know, however, that they want a system that works, that is delivered on time, and that is easy to use. Expressing these desires in terms of a formal specification is not their forte, nor should it be. EI/IT must learn how to translate user feedback into system functionality that supports strategic objectives.

As important as listening skills are, EI/IT leaders also must know how to negotiate with and provide direction to the user community. For example, EI/IT organizations often select representative users to speak for a constituency of fellow users. Who is best suited for this role? The first person to volunteer? Probably not. The spectrum of users ranges from a technically sophisticated user who can swap jargon with the EI/IT staff to a belligerent opponent of all things electronic. Knowing where to go on that spectrum for the right kind of user representative can increase the speed and effectiveness of system development all by itself.

Motivation is another key area. In the past, systems development worked on a variant of the Big Bang theory, with huge projects progressing at a snail's pace followed by wrapping up in a flurry of system rollout. Now, however, many managers operate on a prototyping basis in which many small steps are emphasized. A series of small

successes can help maintain energy and morale; failing quickly on a small scale makes fixes relatively easy to generate without destroying enthusiasm.

The following checklist should help managers assess the productivity potential of their organizations from a human resources perspective:

- Does the EI/IT organization understand its mission as a function of the business's core objectives?
- Is a language in place that allows business users and EI/IT people to collaborate and build solutions together?
- Does the EI/IT organization support a set of technical standards and common tools that facilitate standardization without limiting options that support business objectives?
- Do the members of the EI/IT organization understand the fundamentals of high-performance team behavior? That is, can they communicate effectively, do they understand the team's various roles and responsibilities, and are they managed by people who differentiate between leading and telling?
- Does the organizational culture support project assignments with fast starts, rapid learning, and constructive feedback to project leadership?
- Do project managers provide leadership to the user community in an effective manner?

Countless other examples apply, but the point is that people issues can make or break systems development. EI/IT leaders must ensure that their people are equipped with all the necessary skills–technological, methodological, and human resources—for the organization to thrive.

Tactics for Optimizing Development

Once the fundamentals of the existing EI/IT infrastructure and human resources are attended to, more technical considerations can be entertained. Although each of the following can itself increase the productivity of system developers, dramatic increases appear only when a coordinated development environment is situated in a supportive cultural context. Finally, having business rather then technological objectives drive EI/IT activity generates business results, which in turn feed greater organizational support for /EI/IT. The same cannot be said for projects that meet purely technical goals.

Methodology

One fundamental basis of EI/IT productivity that supports corporate strategy lies in a robust, comprehensive methodology. It should be a broad and flexible framework for implementing business change. Such a methodology should respond to business dynamics with a program for strategic visions, process redesign, and change management. Several modes of effective project management should be available to ensure design and implementation.

Knowing which development approach to take in a given situation requires experience and insight. Traditional waterfall methods are generally out of favor, but choosing between standard iterative development and an accelerated methodology can be tricky. The tradeoff is choosing to emphasize either functionality or speed. Repeated iterations produce extensive refined functionality—sometimes at great cost in time or money. (Innovations in rapid prototyping can be important here.) In accelerated development, building is emphasized over documenting to increase speed.

At the same time, many EI/IT leaders who encounter documentation lapses in their legacy applications may question the tradeoffs inherent in an accelerated approach. Either objective—speed or functionality—can lend itself to acceptable productivity, and either objective can ruin a project if used in the wrong context.

Workflow Management

The mechanics of getting a job done vary, but certain principles hold true. Work groups should be supported with appropriate technologies—including groupware whenever possible—and workflow tracking should be used to allow managers to plan, estimate, schedule, and monitor the project's activities in relation to predetermined goals. The recent improvement in metrics generators and wider agreement on the definition issues relating to the use of function points enable project managers to compare productivity across jobs, platforms, and applications.

Development Coordination Approaches

All aspects of system development must fit together in fluid relationships over time. Changes in process design, organizational behavior, technical infrastructure, and facilities are highly interdependent. They should be planned, performed, and managed together.

Productivity efforts can be greatly enhanced with a common framework and shared techniques. In addition, a vehicle for coordination and communication across a wide and complex program of business change improves productivity throughout the organization.

Broad Commitment to Reuse

Although it is often identified with object orientation, reuse is a separate technique that can improve traditional development as well. Designing and managing a shared collection of work products, however, is a great challenge for many organizations. The following elements contribute to a comprehensive reuse repository:

- Architectural templates.
- Design and development models.
- Process models.
- Prebuilt source code.
- Drop-in technical infrastructures.
- Project progress and development coordination data.

These elements should be widely accessible within a unified and distributed development environment. The contents of a centralized repository should be indexed and cataloged to maximize their availability and specify their functionality.

Management processes must be implemented to certify the quality and maintain the availability of reuse assets. In addition, perhaps most important, the organizational culture should support reuse with the necessary incentives, training, and tools.

Productivity Benefits of a Comprehensive EI/IT Strategy

A successful EI/IT strategy demonstrates several salient characteristics. It integrates methodology with business needs as well as technological capabilities to generate a nearly seamless progression from user to code. It accommodates an organization's systems development needs.

In legacy management as well as leading-edge applications, metrics are generated and recorded to track progress and justify leaders' support. Reuse of all layers of a system is encouraged and leveraged into further productivity gains as application development moves from handicraft setting into an automated exercise in software engineering. People are organized, trained, and led to maximize their contributions. With the right cultural infrastructure and the appropriate tools, developers can anticipate productivity gains approaching an order of magnitude by the end of the century (see Figure 3).[4]

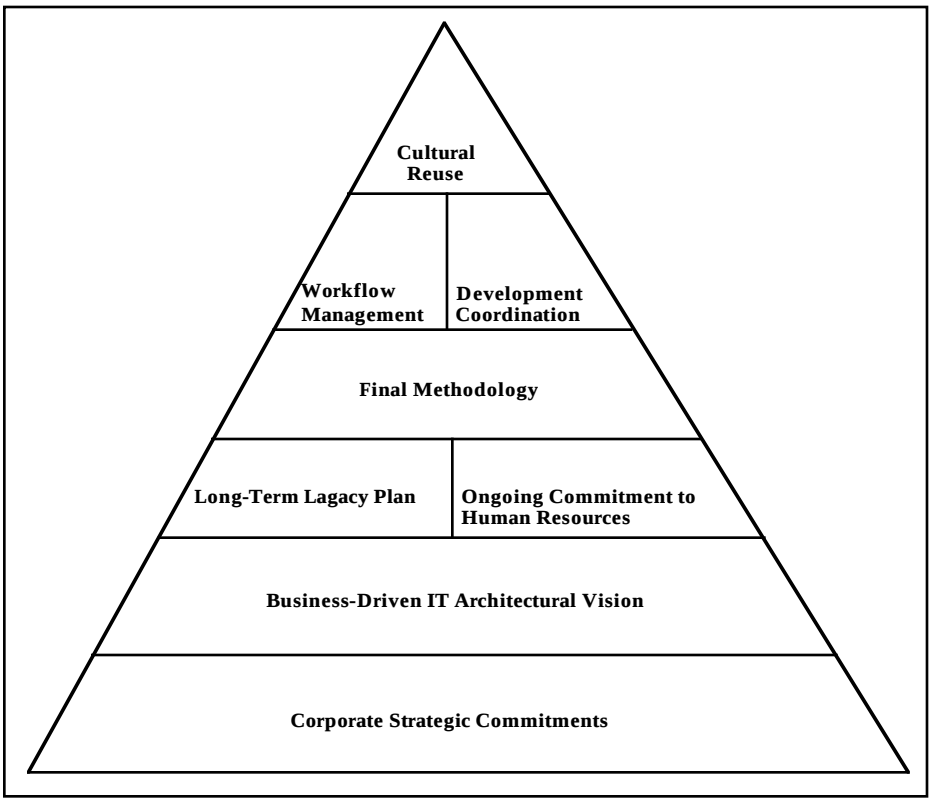

Figure 3. A holistic approach to increasing EI/IT productivity.

These productivity gains result from a managerial strategy that brings EI/IT closer to the business culture and objectives of the enterprise.

Closing Comments

When systems development can respond nimbly and decisively to help the DOE National Laboratories or business reach time-based objectives, everybody wins. Measured standards of speed. quality, and effectiveness can help EI/IT demonstrate its contribution to overall success and build constituencies that will support the information organization in the future. Finally, a comprehensive strategic vision makes EI/IT leaders the masters of their fate rather than firefighters dashing from one crisis to the next.

Acknowledgment

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