

## Management Under Market Constraint in the Hi-tech Industry

*Shimeon Pass and Boaz Ronen*

### Introduction

The globalisation trend of the last few decades is clearly a threat to many firms, but it also offers them the opportunity to penetrate markets around the globe. Most firms have excess capacity in production, services and logistics, and conduct their business under a market constraint. If a firm does not conform to lead-time, price, quality, and performance requirements, it may not survive in the global buyers' market.

This paper addresses the issue of managing a market-constrained hi-tech firm, from the vantage point of the Theory of Constraints (TOC), first introduced by Goldratt and Cox (1992). Acknowledging the market as a severe and common constraint facing the organization, TOC-based methods and techniques are helpful in coping with this environment. Research and practice have produced methods to build better decision-making processes for costing and pricing, but no comprehensive method has yet emerged for addressing the issue of management in a market-constrained environment.

We will present an integrative and consistent method to cope with the market constraint for a hi-tech firm, defined as one that uses technology as a key strategic component. Its competitive edge lies in the ability to apply innovation and technology in a way that will better satisfy customer needs. In this industry, time to market (TTM) is a key success factor.

### The Generic Resource Model

It is usually easier to cope with an internal resource constraint where management has more control over its activities than with an external market constraint. A market constraint is defined as a situation in which the production/operations resource capacity exceeds market demand, and lack of profitable orders prevents the system from achieving higher value to its shareholders. Although the capacity of production/operations and logistics resources in a hi-tech firm may be higher than the pertinent market demand, it always has two internal Permanent Bottlenecks: the R&D and the Marketing and Sales (M&S) departments. Though these Permanent Bottlenecks exist whether or not a market constraint exists, the firm can control and improve its position in the market by managing them properly.

The R&D department is a bottleneck since the demand for development always exceeds its capacity. There are more internal and external requests for development than resources to execute them. Whatever the size of the R&D work force, the potential demand will always be infinite with respect to the available resources. The M&S personnel are also an inevitable bottleneck, since they could bring in more sales if they had more hours available. The load on M&S includes processing ongoing orders, pursuing leads on potential customers, increasing sales to existing customers, participating in

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### DIRECTOR'S NOTE

Last October, the Alliance inaugurated a Seminar Series in Technology Management, in collaboration with the Columbia University School of Engineering and Applied Science. Our lead-off speaker was Dr. Boaz Ronen, Professor of Technology Management at Tel Aviv University and Visiting Professor at the Howe School of Technology Management.

Dr. Ronen's subject was a novel management approach to enhance shareholder value for firms operating under the market-constrained environments typically faced in hi-tech industries. The management practices discussed have been implemented successfully by dozens of organizations. For those who did not hear Dr. Ronen's lecture, as well as those who did, we are pleased to present a paper co-authored with his colleague Shimeon Pass outlining the implementation of this approach.

*Larry Gastwirt*

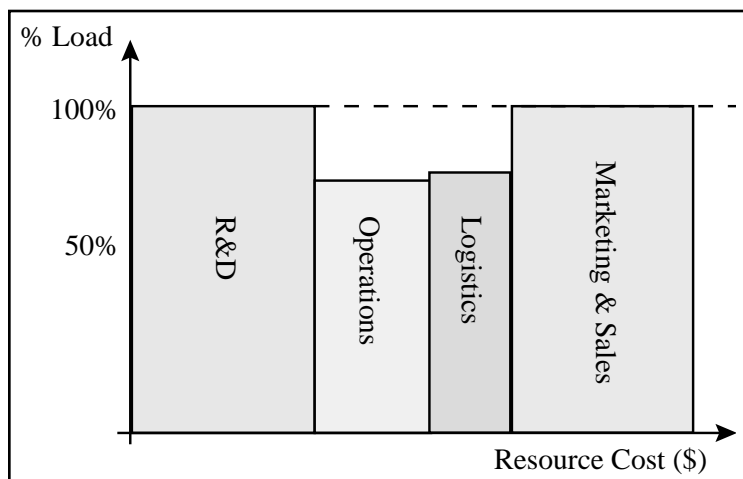
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exhibitions and conventions, and tracking down all potential customers. Clearly, in such a situation the demand exceeds the supply, no matter how many new salespeople are recruited. In the case of M&S, as in the case of R&D, adding more resources will probably add some throughput to the firm at a substantial cost, but it will not change the fact that these departments will still remain bottlenecks, and should be managed as such.

A generic market-constrained hi-tech firm is presented in Figure 1 using a CUT (cost-utilization) diagram (Ronen and Spector 1992) depicting the various resources in the system as bars. The height of the bar represents the load on the resource (department, in our case) while the width represents the relative cost of this resource. As can be seen in the CUT diagram, Operations are under-loaded and can take an extra load of at least 20% without adding extra resources. The same holds for Logistics.

The diagram shows that even in a market-constraint environment we have two internal



**FIGURE 1.** CUT diagram for the typical market-constrained hi-tech firm

Permanent Bottlenecks, which should be treated accordingly. As the Permanent Bottlenecks can be controlled, management can influence and improve the firm's shareholder value.

## The seven steps of management by the market constraint

The seven focusing steps (Ronen and Spector 1992) are a modification of the five

focusing steps of the TOC (Goldratt and Cox 1992). Each of these steps is described below.

### Step 1: State the goal of the system.

The goal of a business organization is to increase shareholder value.

### Step 2: Define global performance measures

A reasonable and versatile set of performance measures for a firm (Goldratt 1992, Eden and Ronen 1991) comprises:

- Throughput
- Operating expenses
- Inventory
- Lead-time
- Quality
- Due-date performance

### Step 3: Identify the system constraints

For business firms, constraints are divided into four categories. The four categories of constraints are policy, resource, market, and dummy (spurious).

The traditional definitions of TOC relate mainly to the production/operations department. Thus, a resource constraint (Cox and Spencer 1998) is apparent when demand for production is higher than capacity, and a market constraint occurs when there is excess capacity in production/operations.

A deeper analysis reveals that we need to be more specific:

1. Every firm faces a market constraint. As noted by Schragenheim and Dettmer (2001), the market constraint always exists, even in firms with shortages of production/operations resources. This

means, for instance, that all firms should subordinate their decisions to market requirements and tastes, regardless of their production capacity.

2. As noted, the M&S and the R&D departments are always resource constraints (Permanent Bottlenecks).
3. Policy constraints occur when some wrong or outdated policy limits the throughput of the firm.
4. Dummy (spurious) constraints occur if some very inexpensive resource is the bottleneck of the system.

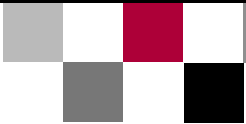
Once management has identified the system constraints, it should look for ways to improve the situation in order to better achieve its goal.

### Step 4: Decide how to exploit the system constraints

This step introduces short-term actions for system improvement. It aims at making more with the same resources. At this stage no substantial investment is required, and improvements are usually realized in a short time. The action items fall into three categories: effectiveness improvements, efficiency improvements, and elimination of policy and dummy constraints. More than one of these actions can be applied concurrently.

**Action 1: Exploitation of the Permanent Bottlenecks** is achieved by using the gating mechanism, defined as screening, prioritising and scheduling the release of jobs, orders and entities to the system. One should differentiate between Strategic Gating and Tactical Gating.

Strategic Gating is the strategic screening and prioritising of products, services, projects, clients and markets on which the firm wishes to focus. It guides management in the selection of long-term activities—focusing on the valuable activities and refraining from engaging in activities that are low in value and high on resource consumption. The leading tool used in Strategic Gating is Specific Throughput (or specific contribution). The Specific Throughput of a certain entity (job, activity, customer, project, market, service or order) is the expected present value of the throughput gained, divided by



the number of time units of constraint that are required to process this particular entity. In other words, for a given entity,

**Specific Throughput = Throughput / Time units of constraint**

Also known as the criterion for the Product Mix algorithm (or rule), this equation means that the higher the expected throughput of a given entity and the less constraint time it consumes, the higher its Specific Throughput score. The Specific Throughput can be used to rank jobs. Since M&S and R&D are the Permanent Bottlenecks, the system is unable to process all the demanded jobs. Management has to make the difficult decision of what should be processed by these bottlenecks and what should be rejected, using the Specific Throughput as a leading argument.

While Strategic Gating directs the firm to the most valuable directions, one has to take account of the day-to-day screening and scheduling decisions that need to be made. These decisions include accepting or rejecting a certain order, project, or customer and prioritising them. These tactical decisions should be delegated to the specific VPs and their subordinates. The leading tool for these decisions is also the Specific Throughput. Thus, the highest Specific Throughput jobs are selected, one by one, until the capacity of the Permanent Bottleneck is fully utilized. The lowest priority jobs are either rejected, or delayed for further consideration.

According to Tactical Gating, M&S employees have to weigh the expected throughput of each marketing or sales activity against the expected time required to accomplish it. They have to focus on the highest priority activities, until their time is exhausted. Similarly, the R&D personnel have to prioritise all the jobs to be performed by their Specific Throughput and select those activities that are at the top of the priority list. Thus, the Tactical Gating mechanism will increase shareholder value by picking the most valuable jobs and preventing the bottlenecks from wasting their time on non-productive work.

Tactical Gating also involves the day-to-day scheduling and the controlled release of

jobs and entities to the system, with its Permanent Bottleneck departments, ensuring that the selected jobs and entities enter the system in an efficient way.

A partial form of Tactical Gating is incorporated in the drum-buffer-rope (DBR) mechanism (Goldratt and Fox 1986, Cox and Spencer 1998), in which jobs are released to the system according to the pace of the bottleneck (drum), and in synchronization (rope) with the level of the jobs in the buffer in front of the bottleneck. The Tactical Gating mechanism presented here is an augmentation of the DBR mechanism, entities being released to the M&S and R&D departments according to the following additional guidelines:

Tactical Gating. Additionally, one can use the focusing matrix shown in Figure 2, a graphical tool that is an approximation for the Specific Throughput, especially in cases where quantitative measures are difficult to assess. When using this tool, each candidate activity is ranked from 1 to 5 on its contribution to shareholder value. It is also ranked from 1 to 5 according to the ease with which it can be carried out, in terms of the bottleneck resources required. The various activities are mapped in the focusing matrix. The preferred activities are those on the right-hand side and the top of the matrix.

The focusing matrix can be used by R&D and M&S managers in hi-tech firms to

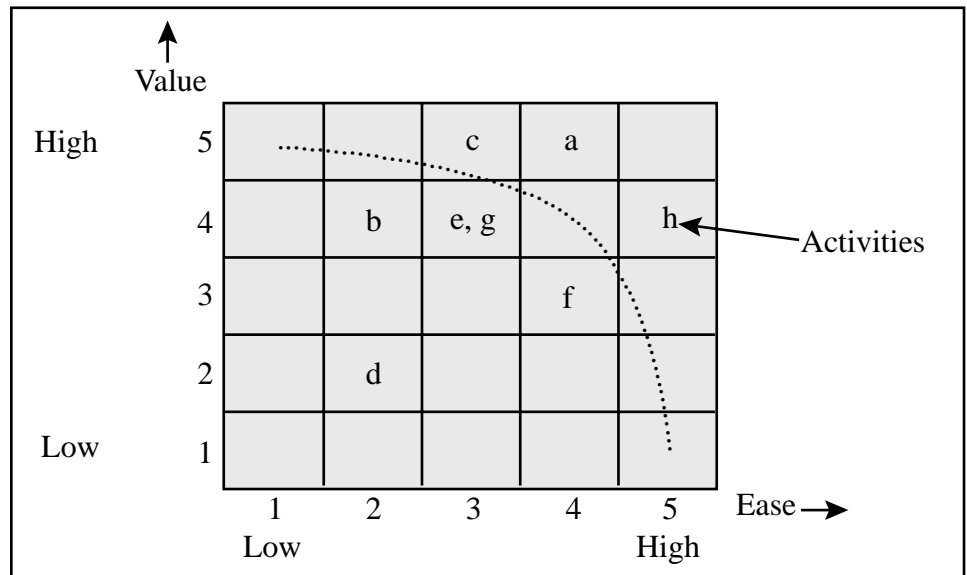


FIGURE 2. The focusing matrix

- Jobs are released only if they contain a Complete Kit (Ronen 1992) of materials, components, information, tools, required operators, etc
- Jobs and entities are not released earlier than planned
- To avoid bad multi-tasking (Goldratt 1997), release is stopped whenever the work in process (WIP) is high
- Jobs, work orders and work packages released to the system should be appropriately small.

Specific Throughput is the main screening criterion for both Strategic Gating and

analyse all current and potential projects, assessing the long-term value of each against the effort required. The M&S department estimates the expected value of each entity, while R&D managers estimate the expected effort.

**Action 2: Efficiency Aspects of the Permanent Bottlenecks.** A bottleneck resource should work full time on the matters that contribute most to the firm's value. The authors' observations of over 500 firms worldwide reveal that salespersons waste over 50% of their time on irrelevant and non-value added jobs. Thus, for example, only too often have they seen salespersons

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trying to expedite a certain order on the production/operations floor or in the logistics department, when the problem could have been taken care of by non-bottleneck resources. Ineffective sales meetings are also included in this category. Salespersons should utilize their precious time on sales activities, resulting in increased value.

The same argument applies to R&D people. In one organization the authors actually observed a senior system engineer (a major bottleneck within a Permanent Bottleneck department) wasting hours of his precious time on upgrading the Windows software at workstations.

Hence, Tactical Gating is an effective mechanism for increasing the throughput of the Permanent Bottlenecks.

### **Action 3: Elimination of policy and dummy (spurious) constraints that affect the Permanent Bottlenecks.**

The following policy constraints prevent the system from achieving higher M&S value to its shareholders:

#### • **Improper measures of performance**

As the goal is to increase shareholder value, performance measures should follow this line: common measures like market share, number of units sold, and value per subscriber should be thoroughly and carefully examined and discarded if not in line with the overall goal.

#### • **The use of traditional cost accounting**

The use of full allocated costing, especially in a market-constrained environment, undermines throughput and may lead to the firm missing business opportunities (Goldratt 1990, Eden and Ronen 1991, Noreen, Smith and Mackey 1995).

#### • **Minimum order size**

Small orders are sometimes rejected automatically. However, small orders from existing customers for ongoing products should be considered a blessing, since production/operations and logistics are not constraints and these sales contribute to the firm's throughput.

#### • **Sales force compensation**

Salespersons usually work on a commission basis, according to their sales volume, which encourages them to sell at any price. Breaking the policy constraint and using throughput as a basis for the compensation scheme may motivate the sales force to strive for more profitable orders.

#### • **Incomplete kit**

Salespersons often waste their valuable time by coming unprepared to meetings and bidding with an incomplete kit. The effectiveness of the sales force can be easily increased by applying the Complete Kit Concept (Ronen 1992) to all their activities

The following dummy constraints have been observed in M&S departments:

- Shortage of low-cost administrative assistance.
- Lack of computers, communication or other IT tools.

Obviously, such constraints should be resolved immediately.

Similarly, the following policy constraints exist in R&D:

#### • **Misunderstanding the goal and improper measures of performance**

It should be clear to all R&D people that the goal is to increase shareholder value. R&D should develop products and services that fit market needs, and create cash throughout the product/service life cycle. The authors have witnessed instances of the behaviour of R&D people being dictated by the desire to develop state of the art products, or the desire to become a technology leader. The performance measures should be defined according to the goal.

#### • **Over-specification and over-design**

R&D people tend to challenge the state of the art technology, and develop systems that are over-specified and over-designed. Marketing people do not always know the exact needs of the market and tend to define products that are too versatile.

Sometimes, especially in the defence industry, a third player is added to the over-specification and over-design conspiracy: the clients' engineers. When facing market constraints, eliminating over-specification and over-design can increase R&D throughput enormously. The authors' experience shows an improvement of at least 25% in firms that control this harmful tendency.

#### • **Incomplete kit**

The compulsion to start working before the product specifications and characteristics are properly defined is one of the sources of wasted R&D Permanent Bottleneck time (Ronen 1992).

#### • **Reluctance to reuse existing solutions or incorporate off-the-shelf subsystems**

NIH (not invented here) is a policy constraint that prevents R&D people from using existing modules and subsystems or commercially available solutions.

Dummy constraints found in R&D departments are:

- Shortage of low-cost components and accessories
- Shortage of low-cost administrative assistance.
- Lack of computers, communication and IT tools.

### **Step 5: Subordinate the system to the constraint**

In a market-constrained environment, all decisions should be subordinated to market needs and market demand.

Actions to be taken:

- Persuading managers and workers that meeting customer needs, demand and requests is the key to survival.
- Actively listening to customers' needs. When the hi-tech firm sells through OEM (original equipment makers), distributors or VARs (value added resellers), management should make every effort to maintain close contact with the end users and understand their preferences and needs.



- Changing the business/organizational structure to meet market and customer needs.
- Shortening the time to market for new services and products.
- Responding quickly to the customers: information, quotations, confirmations, etc.

An important inference from the foregoing is the need for subordination of all parts of the organization to M&S, which represents 'the voice of the customer'. In case of a conflict between operations/production, logistics, R&D or finance and M&S, M&S should lead the way. A major obstacle in many hi-tech companies is the dominance of R&D over M&S. In many of them, the core problem is that they are technology-driven rather than market-driven.

### Step 6: Elevate the constraint

Elevation is a long-term improvement step. A reasonable direction is to add more resources to the Permanent Bottleneck: increasing the sales force, enlarging the R&D department, investing in marketing channels, etc. Elevating the system constraint is also achieved by offloading (Cox and Blackstone 1998) the Permanent Bottlenecks. Usually this does not require large investments and is very effective:

- Offloading M&S for small accounts by creating partnerships with distributors.
- Adding good low-cost administrative

assistance to senior M&S persons.

- Selling through alternative channels that do not consume much of M&S resources, like Web sales.

Similarly, the R&D department can find ways to offload internal bottlenecks such as project managers, team leaders and technical experts.

Elevation also means taking actions that add throughput to the system by:

- Offering added value to existing customers: adding complementary new products or services; managing customers' facilities; keeping and managing customers' inventories; creating loyal customer clubs, etc.
- Applying customer relationship management (CRM) systems. Tracking and managing past and current contacts with customers can generate more sales orders.
- Entering new markets and products. Following the focused strategy model, management may try to enter new markets and develop new products for current and the new markets. A related and proven route for increasing the firm's value is 'brand extension', whereby the firm develops additional products and services under the umbrella of a known and successful brand.

### Step 7: When a constraint is broken, return to step 3

According to TOC, whenever a constraint is broken one should identify the new constraint and manage the system accordingly. The constraint may shift from the market to a resource. The outcome of such an iterative improvement process is a continuous increase in the throughput of the system, resulting in increase in shareholders' value.

### Conclusions

This paper presented a method to cope with a market-constrained environment in the hi-tech industry. The claim was made that the M&S and R&D departments are always the system's Permanent Bottlenecks and that the system can be improved by managing them as such.

The five focusing steps, originally defined for resource constraints, were modified to manage the market constraint. The method presented here suggests that the M&S people can actually increase the expected throughput by focusing on fewer markets and clients, rather than spreading their efforts in all directions, hoping to glean more orders. Treating R&D as a constraint enables managers to focus on projects that provide high Specific Throughput, and thus increase shareholder value. Strategic and Tactical Gating in R&D and M&S were presented as effective tools to control and manage the facilities. ■

*Adapted from Special Issue on the Theory of Constraints (TOC) in The International Journal of Production Research, January 2003*

## About the Authors:



**Shimeon Pass** is an expert in applying the philosophy and tools of the Focused Management methodology in industrial, service, retail and non-profit organizations. Formerly with IBM in their Enterprise Resource Planning group, where he specialized in the application of advanced managerial methods to enterprise information systems, Mr. Pass is now a partner with Focused Management Ltd., a leading consulting group in Israel.



**Boaz Ronen** is Professor of Technology Management and Information Systems at Tel Aviv University. He has been a visiting professor at NYU, Columbia, and the Howe School at Stevens Institute, and has published over 100 papers in leading academic and professional journals. Prior to his academic career he worked for over ten years in the Israeli hi-tech industry. Dr. Ronen developed the Focused Management approach for increasing shareholder value, and his work has influenced thinking and practice relating to the Theory of Constraints.

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# Roundtable Meeting Take-Aways

## WORKPLACE TRANSFORMATION FOR THE KNOWLEDGE ECONOMY

*The November 2003 Roundtable meeting was held at Lucent Technologies in Whippany NJ. This was a follow-up to the July Roundtable meeting, at which Dr. Brad Allenby (ballenby@att.com), Vice President for Environment, Health and Safety at AT&T, introduced the subject of the virtual office – organizing around networks, not buildings – as an example of how the workplace is being transformed in light of the knowledge economy.*

Brad's provocative presentation at the July meeting raised much interest on the part of attendees, who recommended devoting a full meeting to the topic, and he kindly agreed to return as facilitator. The November attendees were not disappointed, as evidenced by the very spirited discussion.

- Brad claims that "virtual work" among physically separated individuals is a necessity of the knowledge economy, in which knowledge inputs and outputs will contribute more and more to value generation than traditional sources. It is a fundamentally different model for the workforce.

- The new knowledge economy demands much more than classic tele-work. In fact, Brad claims that the drag on implementation of a virtual operation is the prevailing impression that it is equivalent to the old manufacturing companies' use of tele-work.

- There is evidence that virtual work is much more efficient and, therefore, is a real and lasting trend. It is hard to come up with appropriate metrics, however. Metrics being used to measure productivity improvement are often those established in the old manufacturing environments, e.g. number of work hours, amount of paper used, etc.

- Dramatic growth is occurring in the use of virtual organizations in the U.S. Boeing, for example, is a leader in implementing virtual design and expects that future aircraft will be designed almost exclusively in this way.

- Bob Vik of IBM said that his organization was strongly into virtual operations. They are having good success with using their instant messaging system ("Sametime") for exchanges between people who are not face-to-face with each other. It has gotten to the point where colleagues are missed when they are off-line.

- For AT&T, implementation is much slower outside the U.S., mostly due to cultural differences, e.g. Japan promotes personal contacts. It is a punishment to the Japanese to be sent home. European implementation is mixed; France remains traditional, but England is experiencing good progress towards virtual workplaces.

- For IBM, the same is basically true. In Europe they are finding that it is necessary to have face-to-face meetings, at least at the beginning.

- The availability of tools that let people work together whether or not they are co-located is key to the success of the virtual office. Tools for facilitating virtual operations are

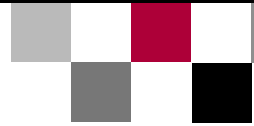
improving. Webcasting, Instant Messaging, up-to-date corporate databases, technical support, etc. are making interactive communications easier. Video conferencing is not yet as effective as desired but the Internet should make major improvement here.

- There was some discussion around the thought that "innovation" workers may need more face-to-face interaction. Brad feels that webcasting promotes strongly interactive, real time conferences, and is helping to drive the trend.

- The growth in broadband communications is the hope for future virtual communications. The higher content capability with broadband will facilitate communications to the individual worker.

- The issue of trust in a virtual organization was discussed. Brad said that AT&T, and others, were assigning virtual work to those employees that demonstrate the characteristics of personal availability, openness and responsiveness. It was pointed out that the real test of trust is whether people achieve their deliverables on time, in either virtual or face-to-face worlds.

- An important factor to remember is that younger people filter information differently



and are already comfortable with working virtually. They are used to getting information from the Internet and are more acclimated to multitasking. This also creates a large generational culture clash between older and younger employees.

- The most serious issues facing virtual work are the legal, security and human resources aspects. For example, the more net-centric an organization is, the more susceptible it is to security breaches. Also, unions are concerned that it will be harder to unionize a dispersed work force, affecting the balance of power between unions and companies. However, Brad believes that these issues will be dealt with and solved because of the driving force for this workplace shift.

- A good discussion concluded that organizations must find the appropriate balance of virtual and on-site work; judgment is required depending upon the functional nature of the activities. This will demand a flexible organizational structure that accommodates both environments, recognizes the management change from the manufacturing economy to the information age, and necessitates the broader recognition of the acumen of the new/younger workforce.

- Brad proposes that the shift to net-centricity happens in an evolutionary way. The first step is an organizational assessment to determine when and where virtual is necessary/desirable. This is followed by technology and process changes to provide the enhanced infrastructure required for network-based work.

- Once the implementation is begun, Brad emphasized that it cannot be "dribbled out" to the organization, lest it be regarded as a privilege for the few.

- Management must face the serious potential problem of retirement (baby boomers), whereby knowledge and experience could be lost. The question may turn into how to sustain businesses as these demographic shifts occur.

- Management must recognize the change in how work gets done and agree (support) when virtual work is in the best interest of the company. HR efforts must deal with how to identify employees that can/cannot work at home; for example, employees with small

children or elder-care issues at home may not be good candidates.

- The work output of virtual work must be transparent to the customer (including the internal customer).

- Virtual work affords opportunities for people with disabilities. We need to redefine the role of disabled persons in the new knowledge economy. Indeed, the whole legal structure of "disability" needs to be revisited in the knowledge economy. Brad reports that AT&T's HR managers are excited by the new opportunities.

- A good question was raised about the skills required for managing in net-centric environments. This may be good topic for a future Roundtable.

- IT managers have a huge challenge in establishing robust design and supporting help desks to ensure stability of the base platforms and to prevent viruses, etc.

- Companies must invest in security without infringing on worker's personal lives (confidentiality, trust). This culture must be established right at the beginning.

*AT&T is experiencing savings of \$35M/year in real estate costs, and over \$100M/year in increased productivity. These kinds of productivity gains may explain in part why employment data is lagging the growth in the current economy.*

- There is a real challenge for employees working virtually. There are pluses and minuses with making work a more integral part of an individual worker's life. AT&T is finding that the biggest problem is that employees work too hard and too often in a virtual setup, yet they are happier and their families are also reported to be happier.

- Brad cited some "soft" evidence on productivity gains. People who tele-work work on average an hour a day more than those who do not. Also, "virtual" order processors are on average 25% more productive than office people. Yet, all these metrics have problems associated with them, and Brad has no

answer to the question of productivity measurement in virtual organizations.

- Another piece of evidence from AT&T: they find a clear correlation between virtual office workers and their higher performers. They cannot tell the direction of causality, but it's an "interesting straw in the wind".

- Karen Sobel Lojeski, Stevens, brought attention to a Brookings study on productivity growth in services industries and its measurement (available from the SATM office). It shows that services companies are the most intensive users of IT and that labor productivity in the services sector has recently advanced more rapidly than labor productivity in the goods-producing sector.

- The focus, as always when making a change, needs to be on the bottom-line to ensure cost savings and productivity gains. Managers are telling AT&T that they see improvements in productivity; 17% of ATT managers work from virtual offices. An additional 33% tele-work at least two days per week. The higher the management level, the higher the percentage of tele-work.

- AT&T is experiencing savings of \$35M/year in real estate costs, and over \$100M/year in increased productivity. These kinds of productivity gains may explain in part why employment data is lagging the growth in the current economy.

- AT&T and IBM report that tools (computers, printers, connections, etc.) are provided to home workers depending on the specifics of the job. Neither AT&T nor IBM provides anything special in the way of training of virtual workers. Web sites help.

- The precursor to implementation of tele-work is that the company already has established a web-based workplace environment. ■

# SATM

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## UPCOMING EVENTS

### Roundtable Meeting, April 20

The next SATM Roundtable meeting will be held on Tuesday, April 20 from 2:00 - 5:00 PM at ISO in Jersey City, NJ. Following up on the February meeting on general issues in managing the outsourcing of technology development and support, the topic is **Sustaining Innovation While Outsourcing Technology Development**. The meeting will be facilitated by Karen Lojeski, formerly a principal with Xansa Consulting where she oversaw the Outsourcing and Enterprise Systems practice, and currently Program Director for the Howe School's Undergraduate Business and Technology Program.

### 2004 SATM Conference, May 11

The Fifteenth Annual Conference will take place on Tuesday, May 11 from 8:30-4:00 at AT&T Laboratories in Florham Park, NJ. The topic is **Retaining and Motivating Key Technical Personnel**. Speakers will be Joan McManus-Massey, Director of Human Resources at AT&T Laboratories, Ann Langbein, Director of Human Resources for IBM's Watson Laboratories, David Lenzner, former Vice President of Human Resources at Xerox and General Instrument Corporations, and Richard Reilly, Professor in the Howe School of Technology Management of Stevens Institute of Technology.

### Seminar Series in Technology Management, June 21

The third seminar of this series, sponsored in collaboration with the Columbia University School of Engineering, will be on Monday evening June 21st from 6:30-9:00 PM at Stevens Institute. The topic is **Next Stop on the Information Superhighway: The Open Information Society**, presented by Dr. Niv Ahituv, Academic Director for the Center of Internet Studies of Tel Aviv University and currently Visiting Professor, Howe School of Technology Management.

Dr. Ahituv will explain why an open information society -- in which individuals and organizations will for the most part give up the effort to protect their private databases, so that electronic information will be accessible to everybody -- is inevitable, and how this stage of development will be reached. In particular, the implications for business processes and management will be discussed.

For further information on these and other Alliance activities, contact Dr. Lawrence Gastwirt: **212-794-3637 • lgastwirt@aol.com**

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### SATM- Stevens Alliance for Technology Management

Wesley J. Howe School of Technology Management  
Stevens Institute of Technology  
1 Castle Point on Hudson, Hoboken, New Jersey 07030

Sharen Glennon 201-216-5381 [sglennon@stevens.edu](mailto:sglennon@stevens.edu)

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*Dr. Lawrence Gastwirt*

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