

Return on Investment and Organizational Adoption

Jonathan Grudin
Microsoft Research
One Microsoft Way
Redmond, WA 98052 USA
<http://research.microsoft.com/~jgrudin>

ABSTRACT

This paper considers the complexity of measuring the return on investment for technology adoption. A brief case study of technology adoption in a large design and construction firm provides a clear view of factors that came into play. The technology considered is simple; the apparent costs and benefits are relatively clear. Four parties are involved: diverse employees interested in using dual monitors, the information technology support group in the organization, an executive who had worked his way up from drafting, and employees of a software company that is considering expanding their support for dual monitor use. In the construction company, a seemingly logical and inexpensive hardware upgrade was subject to a wide range of technical and social pressures, some obstructing and others promoting adoption. Decisions are made in a manner that did not fit the model held by the product planners and designers in the software company.

Categories and Subject Descriptors

K.6 [Management of Computing and Information Systems]

General Terms

Management, Measurement, Performance, Economics

Keywords

ROI, IT, adoption, displays, multiple monitors

1. INTRODUCTION

Individuals typically do not try to measure the economic return on a technology investment. They are happy if it makes life easier, more enjoyable, or garners respect. Organizations are different. Although technology may in fact be introduced primarily to make life easier or gain respect, it is often assumed that this will translate into a positive return on investment (ROI). Predicting such a return may be more art or guesswork than science; measuring costs and benefits after a technology is deployed is difficult. Yet ROI is almost inevitably a focus of people who advocate technology adoption, whether they are internal evangelists or external marketers.

I have been party to innumerable discussions in a range of organizations that explored how one might get concrete evidence of a positive ROI for this or that technology. The focus is always

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on productivity, showing that more can be done faster. At first glance this seems logical and convenient because productivity is important and is often measured. But on closer inspection, the effects of a change in technology on productivity is difficult to measure and may be too limited a measure anyway.

If adoption decisions are not based on firm data supporting a positive ROI, how are they made? The next section examines and challenges the focus on productivity in technology adoption. The case study that follows outlines the interplay among stakeholders in one extended example of technology adoption. In one discussion with planners and designers from a software company, a principal in the organization struggled to communicate on the topic of return on investment.

2. ACTIVITY IN ORGANIZATIONS

2.1 The focus on performance

Joseph McGrath [6] categorizes the activities of groups or teams into the functions and modes shown in Figure 1. He stresses that although we think primarily in terms of a group's productive purpose (left column), activities in support of team health (center column) and to insure that team members get what they need as individuals (right column) are also essential and ongoing.

Furthermore, we emphasize the execution of a group's assigned task (bottom row), but other activities center on team formation (top row) and episodes of problem-solving and conflict resolution.

The ROI perspective leads to an exclusive focus on the lower left cell of the matrix. Performance is the group's *raison d'être* and is more easily measured than the others. However, unanticipated beneficial or adverse consequences in other cells can outweigh short-term performance effects. They can determine the acceptance or rejection of a technology altogether.

	Production	Group Well-Being	Member Support
Inception	Production demand and opportunity	Interaction demand and opportunity	Inclusion demand and opportunity
Problem-Solving	Technical problem-solving	Role network definition	Position and status attainments
Conflict Resolution	Policy resolution	Power and payoff distribution	Contribution and payoff distribution
Execution	Performance	Interaction	Participation

Figure 1. Group functions (after McGrath [6]).

Technology designed to support groups or teams is particularly susceptible to this oversight. Consider electronic group meeting support systems (GSSs), which include anonymous idea generation and other tools. Marketed commercially by IBM and others beginning in 1990, GSSs can provide impressive performance improvements, yet they have not been widely adopted. The following account suggests why:

“The founder of a very successful medical technology firm called together key personnel from multiple levels in the organization for a GSS session. Thirty minutes into the meeting he turned red in the face and stood up. Pounding a fist on his PC for emphasis, he shouted, “I want to know who put in the comment on the problem with the interface for the new system. We’re not leaving this room until I know who made that statement!” He glared around the room waiting for a response. Everyone greeted his outburst with silence. (The founder then terminated the meeting.)” [7]

This executive had been convinced that the technology would improve performance, but the loss of prestige from being openly challenged was unacceptable. Similarly, anonymous idea generation might demotivate an inventive person who wants credit for contributions. Dennis and Reinicke [1] argue broadly that face to face meetings provide greater status (member support) and social interaction (group well being) benefits that can outweigh substantial short-term performance gains in determining reactions to GSSs.

I observed a distributed group that met several times using an audio teleconference and application sharing. They insisted on meeting face to face when the agenda included an award ceremony. They felt that this quintessential member support and team-building activity would not be as effective if digitally mediated. Might video have helped? Video communication systems provided no performance advantage over audio in countless experiments (but see [9]), yet people like them. Perhaps lightweight video will be used despite having no measurable short-term impact on performance.

2.2 Efforts to demonstrate positive ROI

The manufacturing assembly line showed that technology could increase performance efficiency. But there are limits to “scientific management.” Organizing a secretary’s desk and posture might produce a 10% performance gain, but if the loss of comfort or autonomy leads to 15% higher absenteeism or 20% greater turnover, it is not worth it. Determining such secondary effects is generally far too difficult and time-consuming to undertake.

Nevertheless, in marketing efforts and acquisition decisions, “positive ROI” in terms of performance is the holy grail. As detailed in Greenbaum’s classic work “In the Name of Efficiency,” early mainframe computers were acquired not because they improved performance efficiency, but because of their effect on organizational image. Kling made a similar observation in an influential case study of the political economy of computing [4]. Of course, an improved image can lead to real benefits. The investments could have positive returns, but not based on greater efficiency.

Yet performance efficiency is how technology is marketed, so IBM fought to the Supreme Court to try to avoid disclosing that it could not show efficiency benefits from computer use [2].

This issue is reflected in “productivity paradox” arguments of the 1980s and 1990s. An influential 1996 book argued that most computer use was non-productive [5]. Some predicted that organizations would abandon email once they measured productivity losses [8]. But email went from under suspicion as a time-waster to regarded as mission-critical without any proven ROI. Today the same argument is heard around Instant Messaging, which will also resist solid evidence of positive ROI.

We try to tease out costs and benefits. Does distributed application-sharing reduce travel? Does email curtail expensive phone calls? Does IM reduce the time needed for email interaction? Collecting the data is difficult. Application-sharing might reduce the need to travel, but if it allows groups to work together could not have without it and they occasionally get together, it could *increase* travel. It might reduce relocation costs, or it might lead to more mergers and acquisitions and increase overall relocation costs. And then there are McGrath’s considerations. Confusion and delay in starting meetings that rely on application-sharing could affect motivation as much as performance. A definitive analysis is impractical if not impossible.

2.3 Conclusion: Distorted processes

Acquiring and adopting a new technology is usually expensive. Potential customers want evidence that they will benefit. This can result in a focus on identifying a positive ROI that can become obsessive. Performance efficiency is the lamppost, the easiest place to look for data. Mere facts—that solid data is not to be found, and performance is not a broad enough focus—cannot stand in the way. The resulting expenditures of energy in quantitative measurement can be less useful than a broad qualitative examination of workplaces and technology.

Any bit of positive data that comes along is often taken out of context and exaggerated. This seems problematic and can set unrealistic expectations, but if the technology actually is useful, weak data can overcome inertia and start the process. Of course, this can also occur when the technology is not useful, but marketers and evangelists believe in the utility of their product.

The next section describes a case in which an organization adopted a technology based on informal observation and intuition. A discussion between the principal in the case and designers looking for hard data illustrated the gulf between practice and a quantitative ideal.

3. CASE STUDY: ARCHITECTURE AND DISPLAY TECHNOLOGY

3.1 Homebuilders

Homebuilders (not real name) is one of the three largest house builders in the United States. It also does business in Europe. It employs 7000 people. The approximately 250 responsible for drafting use AutoCAD for modeling. Homebuilders has a 400-person internal IT organization responsible for installing and maintaining computer systems and operating a telephone hot line.

“Scott Vinek,” the Vice President of Architecture and Design, has many years of drafting experience and a degree in Computer Science, with strong technical interests and abilities.

We initially visited Homebuilders to interview Vinek about his use of dual monitors. His laptop was used with a second monitor when he was in the office, and his desktop computer was also being equipped with a second monitor. Our discussion expanded to cover the use of multiple displays throughout Homebuilders. Later, Vinek gave a one hour presentation on multiple monitor use at Homebuilders to a group of product planners and designers. He spent another half day using an experimental large monitor, and provided us with data on monitor use at Homebuilders. This account presents his perspective drawn from these events.

3.2 Multiple monitors: motivations for adoption and challenges in use

Adding a second monitor helps manage the ever-increasing quantity of digital information. Displays size has grown slowly, and the clear demarcation of space that a second monitor provides can be advantageous [3]. Display space is more useful because computers now support several applications running simultaneously. Also, the web provides a host of opportunities for communication and notification. Architectures to support ubiquitous sensors and computing amplify this trend.

Not long ago, when desktop machines only supported one or two applications gracefully, a major demand for display space was from graphics-intensive applications. Graphic artists used a second ‘palette monitor’ as a place to park software tools. Financial analysts, with a need to survey up-to-the-second data, were also early adopters of dual monitors. Now a second monitor is often used for collaboration tools: email, IM, application-sharing, and so on.

Adding a monitor is conceptually simple. Use requires little training. But complications, particularly in installation, hindered adoption at Homebuilders.

Adding a monitor requires either a graphics card that supports multiple monitors or a second graphics card. Graphics cards have different properties and interact with each other and with monitors in unpredictable ways. Some cards are built in and aren’t friendly to intruders. As a result, upgrading from one to two monitors can be a technical challenge.

People can learn to use dual monitors pretty well on the fly, but operating systems and most applications are designed with little or no consideration for multiple monitor (multimon) use. This produces inconsistent or ineffective responses (such as dialogue boxes popping up in unexpected or unnoticed places), and more serious problems. A common complaint at Homebuilders (and elsewhere) is the “phantom monitor.” When a multimon user detaches a monitor (for example, takes home a laptop that was also driving a large desktop monitor), the system often assumes that objects that were displayed on the now-missing monitor are still there. It is difficult to see how to access them without reattaching a second monitor. Such problems lead to support calls.

3.3 Evolving multimon use at Homebuilders

For several years, laptop and notebook computers have been capable of supporting AutoCAD. Used by half of the draftspeople, early laptops struggled to support dual monitors running this processing-intensive application, leading to crashes and support calls. Resolution differences between notebook and desktop displays produce awkwardness, confusion—and support calls.

Homebuilder’s IT group opposed dual monitor use. It would create more work in a new area of responsibility.¹ When people installed a second monitor anyway, technical support considered them in violation of policy and did not help.

IT felt that everyone could do their job with one machine, one network connection, and one monitor. This had been enough for draftspeople. As AutoCAD releases added toolbars, requiring more space, displays grew from 15 to 17 to 19 and 21 inches. However, AutoCAD 2000 introduced a quantum jump. Additional dialogue boxes permitted objects to be dragged and dropped into models. The display space crunch became more pressing.

At this point, Vinek’s drafting experience and technology expertise played a role. “I suggested, off-hand in a meeting, and it went through the drafting departments like wildfire, that they go to dual monitors... It was clearly *the* solution for us.”

Vinek had no data showing productivity benefits to help overcome resistance. But he was convinced that it would pay off. In McGrath’s terms, he expressed it as both member support and performance enhancement: “One, there’s an enthusiasm—I mean that’s kind of the immeasurable thing—but two, they’re now able to draft with the full screen open, they’ve got the full AutoCAD screen to draft and they’ve got these other things happening over here (pointing to the second monitor).”

As Vice President of Architecture and Design, he could authorize expenditures within his organization. Hardware was not costly. The cost of graphic cards had dropped, and “All of our divisions had 15-inch monitors laying around all over the place.” Soon 15” wasn’t enough for the second monitor. Those upgrading to flat panels kept their 19 or 21 inch desktop monitor.

To avoid IT objections, Architecture and Design handled hardware and software complications internally. The Vice President himself became the principal Homebuilders multimon technical expert. Draftspeople were told not to contact IT with dual monitor issues.

This was not the first time Architecture and Design acted independently. They upgraded from Windows 95 to Windows 98 a year before the rest of the company because AutoCAD was more stable on it. And Windows 98, unlike 95, supported multimon. Vinek said, “I took the heat from IT... I threw my body between the IT people and the drafting people.” A users group formed.

Anecdotal evidence for productivity gains was reported. In one office of 4 draftspeople, two adopted dual monitors. Not previously faster, they seemed to be the most productive. Thin evidence of this nature can help technology get traction.

3.4 Adoption spreads to other groups

At the time of the study half of the draftspeople used dual monitors, acquired over two years of scavenging small displays and upgrading to flat panels and notebooks.

Because drafting is done in dark rooms, dual monitor arrangements were very visible to people walking by.

¹ Technology innovation in construction was described this way: “You’re dealing in an industry where we’ve had two things happen in the last twenty years that are just great: we’ve got a nail gun, and they’ve now put a port-a-potty on every job site.”

Homebuilder accountants who constantly monitor an automated payment system at their desks realized that they too would benefit by acquiring a second monitor.

Division presidents and “people with O’s in their names,” corporate officers, saw a cool technology being used by draftspeople, considered “the lowliest people in the office” because they had no visible impact on the bottom line. The executives acquired second monitors. This was helpful in promoting the technology, but it was driven by considerations other than performance efficiency and return on investment.

At the time of the study, approximately 100 people other than draftspeople used dual monitors at Homebuilders. This did not include anyone in IT. IT referred dual monitor helpdesk calls to Vinek, an untenable solution in the long run.

4. A CONVERSATION WITH DESIGNERS

Following his presentation, Vinek answered questions from designers and product planners interested in questions such as “will people will gravitate toward a single large monitor or toward two- and three-monitor configurations?” and “how should software systems and applications focus monitor support efforts?”

Much of the discussion involved a productive give and take, but the issue of metrics, performance efficiency, and return on investment was repeatedly raised. The audience was reluctant to accept Vinek’s lack of concern with quantitative evidence.

Q: “Do you have any metrics that (let) you say ‘This drafts person can do three houses—’?”

Vinek: “Interestingly all we’ve done in the last two years is we’ve just simply relied on ‘is it faster, is it better?’—there’s not been any actual measurement... There really weren’t any metrics in the company... watching them, that’s what their managers came up with. You stood and watched two people draft side by side...it was obvious, it was very obvious it was a time saver, incredible time saver.”

Twenty minutes later in the discussion:

Q: “There’s no metric you can apply to each one to say the average throughput of the dual monitor group is this—” and the thought was finished by a colleague: “the ROI thing?”

A few words into the above query, Vinek began shaking his head slowly and continued shaking it while watching the speaker finish the question. He continued shaking slowly, saying nothing, until turning to take a question on another topic.

A third try came five minutes later, as Vinek described the process in which draftingpeople complete sheets during a day:

Q: “Looks like (measuring) that would be almost black and white, for upper-level management to put the heat on the IT department?”

Vinek, who is high level management himself, smiled agreeably and noted that maybe that could help him escape serving as corporate IT support for multiple monitors. Given his two-year effort to promote the technology and his technical skills, he could have undertaken such measurements had he thought they would help. He didn’t.

5. CONCLUSION

Many of the factors that affected adoption in this case are rarely discussed. Technology deployment at Homebuilders was initiated

and sustained without quantitative data. The Vice President had an intuitive sense of its value, which included enhanced performance and enthusiasm, “the immeasurable thing.” He felt that adoption was guided by more than performance payoff. He did not try to marshal a quantitative argument.

Dual monitors are not inherently a collaboration technology, but this case illustrates phenomena that are even more likely to arise when team activity is supported, as in the examples of GSSs, application sharing, and videoconferencing in Section 2.

There is an inherent tension among IT goals. IT is charged with insuring the smooth use of the existing infrastructure. They are also charged with deploying new technologies. Unless a new technology is just a more reliable or secure version of the old one, these goals conflict: the new technology is initially disruptive and draws on IT resources.

Certainly a demonstration of a meaningful productivity benefit would help make a case for adoption. Valid demonstrations are difficult, due to elusive indirect consequences and the time needed to establish conventions and practices governing use. As a result, studies focus narrowly on limited aspects of organizational activity. The results may not convince knowledgeable customers. Effort might better be directed elsewhere; for example, qualitative descriptions of successful deployments.

6. ACKNOWLEDGMENTS

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