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System Conversion: Teaching versus Reality

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ABSTRACT

This paper summarizes the coverage of conversion in 17 current textbooks from major publishers: ten for introductory MIS and seven for systems analysis. It compares this coverage with current practice, as determined by (a) studies of 53 organizations by the author's students and (b) conversions reported in the trade press. Differences between typical textbook coverage and practice are documented, and recommendations for remedying the situation are made.

INTRODUCTION

Conversion is central to the implementation of any information system. One would expect that such an important part of the system life cycle would have been studied extensively and that textbooks would reflect current best practices. This is unfortunately not the case.

There are discrepancies between what textbooks say about conversion and what MIS managers do (or should do). Authors, publishers, MIS faculty and IS managers should be aware of these to take appropriate corrective action.

DEFINITION AND DISCUSSION OF CONVERSION

"Conversion" is the process of moving from use of one information system to general use of its replacement throughout an organization.

Conversion involves several steps. It may involve replacing hardware, installing new software, importing a database to a new DBMS. People must learn new software and procedures. Working with people is harder than the technical side, since one cannot run a program or plug in a box and be done with it. People, unlike hardware and software, have opinions and preferences. It is necessary to move them emotionally off the old system and onto the new.

This may surprise those whose conversion experience has involved primarily personal productivity software. How could anyone become so attached to Release n of, say, Excel, that it interferes with moving to Release $n+1$? However, enterprise software conversions are not so simple. People associate much of their professional value with their knowledge of the old system. A new hire knows as much about the new system as they do—or more. While they may not be aware of these feelings, they exist, and can lead to various (perhaps unintended) negative behaviors. Managers must handle them appropriately.

Four approaches to conversion are in common use today or have been in the past. These are:

- Direct conversion: The entire organization stops using one system and begins using the other immediately thereafter.
- Parallel conversion: Both systems are used with identical inputs. Results are compared until confidence in the new system permits removing the old one.
- Pilot conversion: Part of the organization uses the new system until it is working satisfactorily. Remaining units then start to use it.
- Phased conversion: Part of the new system is introduced and used until it is working satisfactorily. The next module is then introduced.

Combinations of, and variations on, these are possible.

COVERAGE IN

MIS Textbooks

Ten introductory MIS textbooks, [1] through [10], were examined for this study (An eleventh, [11], was removed from the sample because its coverage was nearly identical to that of [3] by the same authors.) With the exception of [2], from 2003, all are copyright 2004–05. Their coverage of conversion is shown in Box 1.

Systems Analysis Textbooks

Seven systems analysis books, [12]–[18], were also examined. (Two more, [19] and [20], were removed from the sample because their coverage was nearly identical to [12] and [14], by the same or overlapping groups of authors.) They were slightly older than the MIS texts, with one from 2000 and the rest from 2003–05. (The smaller market for systems analysis books reduces pressure for frequent revisions.) As befits their subject, these books devote more space than introductory books to conversion. The table therefore gives it in pages, not lines (see Box 2).

These findings are disappointing. Aside from the fact that four books intended to teach business students what they must know about IS devote little or no space to conversion, conceptual errors and out-of-date information abound.

PRACTICE

"Real world" conversion was studied in two ways in order to evaluate the accuracy of this coverage objectively.

Survey

The author assigned Spring and Fall 2004 introductory MIS students to study conversion at local businesses. Their assignment required finding an organization which had gone through a significant conversion during the past three years—i.e., more recently than dealing with Y2K issues. They studied its use of IT, including decisions leading to the current hardware-software environment. They then examined the conversion.

The students studied a total of 53 organizations. These tended to be small local businesses. Some were larger, such as a city government agency, a three-hospital group or the headquarters of an eight-restaurant chain, but few approached "large" in the *Fortune* 500 sense.

Reason for Conversion

See Box 3.

The most common reason for converting was to obtain new functional capabilities. Next was to update the firm's technology: "keeping current," moving off unsupported software, standardizing on one vendor or platform, eliminating paper, replacing unreliable peripheral devices.

Box 1.

| Ref. | Lines | Notes |
|------|-------|---|
| 1 | 0 | — |
| 2 | 4 | Barely mentioned |
| 3 | 28 | Confuses pilot and phased, defining phased conversion with “if the system is introduced by organizational units ...” |
| 4 | 25 | In noting a “risk [of parallel conversion] is that employees will continue to use the old, familiar systems,” misses the point that the old systems are only used as long as necessary to verify the new system and then removed |
| 5 | 0 | — |
| 6 | 21 | Confuses phased and pilot conversion when it uses converting a few departments, branch offices, etc., as examples of the phased approach |
| 7 | 43 | Mentions labor cost as a parallel conversion issue, though it stops short of noting that the extra work can be impractical even if cost is no object |
| 8 | 46 | The only book to discuss human issues intelligently, noting that “if people feel the new system is taking away some of their important responsibilities or personal prestige, they may not try very hard to make it work. In fact, they may even want it to fail.” Unfortunately, it does not follow up with implications for managers. |
| 9 | 0 | — |
| 10 | 18 | The statement “Most large systems have a parallel conversion to lessen the risk” is embarrassingly outdated. |

Box 2.

| Ref. | pp. | Notes |
|------|-----|--|
| 12 | 6 | Recognizes the three orthogonal axes of style, location and modules as discussed in [21]; points out “employees must ... enter data into both the old and the new systems” but does not pursue the implications of doing so |
| 13 | 9 | Ignores pilot conversion as inappropriate to small enterprises; finds parallel conversion practical though “costs are high because the enterprise must operate two systems rather than one” |
| 14 | 3 | The only book to recognize that “a parallel approach may not be feasible if the users, such as customers, cannot tolerate redundant effort.” |
| 15 | 2 | Misses the point of parallel conversion as a test of the new system by saying “the new system was created to improve on the old one. Therefore, outputs from the systems should differ.” Improvements in ease of use, capacity, technology, etc., do not imply different outputs. Also, “employees who are faced with a choice between two systems will continue to use the old because of their familiarity with it.” |
| 16 | 6 | Notes correctly that parallel operation may be impractical if “inputs to one system [are not] usable by the other, and it may not be possible to use both types of inputs.” However, does not mention pilot conversion at all. |
| 17 | 2 | Parallel conversion is impractical “if the operating environment cannot support both systems,” though paradoxically its main example of parallel conversion involves factory scanners. Factory workers cannot be expected to scan all their work twice. |
| 18 | 5 | Uses non-standard terminology, calling pilot conversion “location” and phased “staged;” says incorrectly that parallel is practical only if the old system is manual. |

Inability to handle growth or a need for improved performance accounted for another seven. Conversion from character-based systems to GUIs or similar changes to improve ease of use can be seen as a form of technology conversion but was distinct enough to mention separately. (While many believe that the world abandoned character-based systems a decade ago, the reality is that users move more slowly than theoreticians believe or than vendors would like.) The same could be said for adding networking capabilities, within the firm (one company networked three locations) or in going to e-commerce. Four resulted from mergers or acquisitions, while the final three were to integrate multiple applications in one (often including moving to a firm’s first DBMS, which the conventional wisdom also holds should have happened ages ago).

Conversion Method

The 40 organizations which provided usable data on this point used the methods in Box 4.

Direct conversion was used mostly by smaller organizations. Because students were free to study any organization that would work with them,

the fraction of small firms in the sample exceeded their fraction of the economy overall.

Direct conversion was followed by pilot, the most popular approach among larger organizations. However, its use was not limited to them. One accounting firm with three professionals introduced a new system by having the owner use it first. Once he was satisfied that it was stable and met the firm’s needs, his two associates switched. Other small organizations used similar strategies. The statement found in one book that pilot conversion is inappropriate to small enterprises is not supported by reality.

Some larger organizations also used phased conversion. One combined pilot and phased, introducing the system in phases with a pilot group for each phase.

The only case resembling parallel conversion was a decision support system where both the old and new systems remained in place for a time. Users could use either or both, as they preferred. This is not a true parallel conversion, since DSS results do not have to be identical as long as they are comparably useful, but some people used both and compared results as part of their personal transitions to the newer system.

Box 3.

| <i>Reason (multiple answers allowed)</i> | <i>No. of Firms</i> |
|--|---------------------|
| Functionality | 26 |
| Technology | 14 |
| Growth, capacity, performance | 7 |
| Char to GUI, other ease of use | 6 |
| Networking | 4 |
| Merger/acquisition | 4 |
| Application integration, incl. DBMS | 3 |

Box 4.

| <i>Performance</i> | <i>No. of Firms</i> |
|--------------------|---------------------|
| Direct | 21 |
| Pilot | 11 |
| Phased | 6 |
| Pilot/Phased | 1 |
| Optional Parallel | 1 |

Trade Press

Twelve conversions discussed in *InformationWeek* during September 2004 were examined to get a sampling of real-world practice at the large enterprise level.

Reason for Conversion

Eight conversions involved improved functionality. Six involved new technology in some way. Two of these related to standardization across a large retail chain, three involved new databases and the last was a conversion to XML. Three of these also involved improved functionality.

These two fractions may be higher than one would find overall, since reporters do not try to provide a statistically accurate mirror of the world. New functionality and updated technology make for more interesting articles than do more mundane conversions.

The final conversion was the move of a large manufacturing firm to a converged voice, data and video IP network.

Conversion Method

Ten of the twelve conversions used the pilot method. These were almost all in large organizations: Fortune 500, near it, or the equivalent in areas (such as financial services and government agencies) that are not measured by this yardstick. The two exceptions were:

- One direct conversion, involving a knowledge-based system for call center operators. Its functions were not previously automated.
- One phased conversion, involving Internet ordering of custom consumer products. The sequential nature of ordering/manufacturing/shipment lent itself to phased introduction of the system.

Allowing for the impact of organizational size on conversion method—pilot groups in these firms were typically larger than the entire organizations studied by most students—these findings confirm those of the students. We can accept their joint picture as reflecting reality as regards system conversions in 2004.

DISCUSSION

Approaches to Conversion

Parallel conversion is, for all practical purposes, extinct in the real world. Its use is limited to a few well-defined situations, such as financial reporting systems. The reasons are:

- Duplicate input to two interactive systems is not practical, especially from customers. Today’s conversions are nearly always from one interactive system to another. A customer, or even an internal user, having completed a complex input sequence, will balk at going through it again for a second system. *Out of the entire 17-book sample, only one systems analysis text [14], discussed this point. Two others, [16] and [17], alluded to it indirectly. No introductory MIS book mentioned it at all.*
- Timing differences can lead systems to provide different answers. Suppose the checks that arrive at a bank for one customer on one day, plus cash he wants at an ATM, exceed his available balance. One system might process checks early in the day, later refusing the cash withdrawal. Another, processing checks later, might deliver the cash and bounce a check instead. Either can be correct, each system is internally consistent and can be used by itself, but they cannot both be used at the same time. *None of the 17 books mentioned this important conceptual point.*

The cost of duplicate runs, cited as a drawback of parallel conversion by some books, is not a real issue. It was in the era of punched cards or sequential tape files, but has not been for decades.

Having both old and new systems are available for a time, allowing users to choose either, is not parallel conversion. The essence of parallel conversion is entering identical input into two systems and comparing their outputs. If only one system is used, even if users can choose which it will be, or if inputs cannot be guaranteed identical in every respect, parallel conversion is not possible. This is a pilot conversion with a self-selected pilot group.

There is also some terminology variation from the standard and occasional confusion between the pilot and phased approaches, the latter especially among the introductory texts. While these issues should be corrected, they are not as conceptually serious.

Reasons for Conversion

The reasons that organizations move from one information system to another have evolved over time. The descriptive model is generally considered to go something like this:

- The first conversions were motivated largely by hardware or system software upgrades. Since early file systems, programming languages and operating procedures were system-dependent, such a conversion involved a total change-over of files, applications and everything else.

Such upgrades are rare today. Improvements in system scalability, together with industry consolidation on a few operating systems, make conversion from one platform to a totally incompatible one rare. (The major exceptions are moving from Windows to Macintosh or vice versa, not typically an enterprise-level issue, and adopting Linux for servers.)

- The second generation of conversions involved consolidating files under a DBMS.
- The third wave was to on-line interaction, usually through “dumb” terminals. It was followed, fourth, by conversion to integrated enterprise-level applications such as ERP and application suites. Finally, the fifth wave of conversion took advantage of the Internet as a communication tool and/or the Web as a user interface.

The conversions studied tended to follow this pattern, confirming the general validity of the model. However, the transitions are not as systematic as it suggests. Real users retain older technology far longer than is commonly thought. Then are often behind the curve that academics and vendors want to believe is the norm. For example, four of the organizations studied by students still used character-based systems as late as 2001–2. Two converted from paper-based scheduling systems. Three of the 12 conversions described in *InformationWeek* introduced database management technology to large organizations as late as 2004.

RECOMMENDATIONS

It has been shown that introductory MIS and systems analysis textbooks do an unsatisfactory job of covering system conversion. The following recommendations can help remedy the situation.

For Textbook Authors

Audience

Authors of introductory MIS texts should also recognize that their primary audience does not consist of future MIS students or professionals. Statistically, the majority of business students concentrate in something else. (Ref. [11] does an excellent job of recognizing this with its "What's in IT for me?" sidebars.) A discussion of conversion in a book to be used by all business students must cover the role of user-side managers. Only they can lead the change process.

Conversion

It is high time to bring coverage of conversion into at least the 1990s. Parallel conversion should be dropped as an option, or as a minimum its limitations should be discussed so that students are not taught that it is generally viable.

Technology Adoption

Students learn about the latest technologies and are led to believe that those technologies are, or at least will soon be, in general use. This just doesn't happen. With the exception of rapid transition to solid-state hardware in the early 1960s, motivated by order-of-magnitude improvements in reliability and reductions in maintenance costs, inertia rules. Existing systems tend to remain until something comes around to drive them out. The mere availability of a newer alternative seldom qualifies as such a "something."

For Textbook Publishers

Publishers must recognize that "conventional wisdom" tends to propagate from one book to the next with no reality check. This is not entirely the fault of authors. Much of anyone's knowledge comes of necessity from earlier books. Most authors are experts on many important things, but none can be an expert on everything. Conversion is not a hot topic for faculty expertise. Promotion and tenure committees do not value spending one's summer in an MIS organization as much as they value using it to write a publishable paper. Textbooks are reviewed and adopted by other faculty members who, like authors, obtained much of their own knowledge from earlier textbooks and are often therefore unable to recognize these problems.

Publishers must break this cycle by obtaining manuscript reviews from practitioners with current real-world knowledge. They must do so early enough in the publication process for authors to make the necessary content changes.

For MIS Faculty

Faculty members teaching introductory MIS and systems analysis courses must recognize that textbooks are never perfect. It is their professional obligation to be aware of major imperfections in order to correct the misconceptions that their students might otherwise receive.

Conversion, due to documented textbook deficiencies, is a prime area in which this awareness is necessary.

For IS Professionals

It is important not to be misled by the out-of-date information in many textbooks, even those with copyright dates as current as 2005. Today's best practice in conversion is a pilot approach where a suitable group can be identified or will self-identify, phased conversion where data mismatches between modules do not prevent it. Direct conversion may be suitable for small organizations or where returning to the previous system in the event of disaster is possible.

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