Industry Directions and Their Impact on SAS® Programming

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ABSTRACT

There are many issues being faced today by individuals in business responsible for setting information technology directions and strategies. Business is changing so rapidly that there is rarely sufficient time for fully customized application development.

SAS Institute Inc. has increasingly incorporated computer science concepts into their product line, opening up new opportunities for increased functionality with the SAS® System. Many people have used SAS® software for years but have found themselves falling behind its current capabilities. Computer science graduates frequently ask questions regarding the future of becoming a SAS Programmer, especially those who wish to become heavily involved in GUI development and object oriented programming.

GUI and RAD approaches to development tend to be contradictory to structured analysis, design and programming. How can managers know if people are working on the right things, that standards are appropriate and that the organization is positioned for necessary change? This paper reviews areas of SAS software usage in business, outlines some of the challenges faced by business today and suggests some approaches to evaluating current IT capabilities.

THE MANAGEMENT QUESTIONS

Many of the management gurus in the business world have outlined the key to successful businesses in the future as a combination of traits. A company must be provided with a *vision* that stretches the capabilities of the company; a *common purpose* to make the organization and its product the customer's first choice; and a *strategy* that blends a strong customer service philosophy with a learning environment that promotes continued dynamic learning for its IT needs. Even for those companies that choose to outsource their technology needs, a basic understanding of how to bridge the gap between business needs and technologies is necessary. Decision makers who have technical backgrounds continually stretch to understand the implications of today's technology. Decision makers without a technical background find themselves at even more of a disadvantage.

Business theorists state that a leader's role is to "Manage change at optimum speed". How can that be achieved when new concepts seem to evolve faster than the ability to grasp even a basic understanding of each? Thinking about even a few; Internet resources, object oriented programming, data warehousing, and data mining is mind-boggling.

Discussing trends in industry and the uses of SAS products will begin to formulate a basis for understanding our changing business environment. Following that we will look at some approaches for evaluating an organization's current maturity level and technology development options.

INDUSTRY TRENDS

Industry trends have shown many changing technologies over the past two decades. While the 50's were the pioneering decade of mainframes and the 60's introduced mini-computers, the 80's and 90's have brought about changes that are a marvel to comprehend. The 80's brought PC's onto desktops. The 90's puts us in the midst of some controversy about whether the future will take us away from desktop power with the introduction of network computers and the Internet.

In this past decade the evolution seemingly occurred gradually to provide PC's on desktops. The decade began in the 80's with personal workstations initially providing little more than word processing and mainframe emulation. That short decade is closing out having seen radical changes in minimal requirements for people to do their jobs. Today Microsoft Windows is on the majority of workstations with hard drives now manufactured in excess of 2 gig. Each year PC speeds double while staying at the same price. Manufacturers predict that speeds will increase at least 8 times by 2000.[1] By the year 2000, RAM standards will be closer to 1 gig than the standard 8 or 16 meg today. The bottom line is that the basic $2000 machines on desks now have much more power than a couple of years ago.

Software Development has changed as the expectations of users have increased. Throughout the industry, the capabilities of hardware and software products are increasing. Issues that used to cause major development constraints such as CPU speed, memory and disk space are now frequently mute points. This has caused a major "relearning" curve for programmers to keep up-to-date. More complexity is being introduced to programming tasks while low end routine processing is becoming increasingly mechanized.

Application deployment has evolved away from highly customized, difficult to modify, systems. Today the standard is set to expect rapidly developed systems that provide dynamic coverage of rapidly changing business needs. The future is turning toward increased integration of "Best of Breed" applications (Greenberg 1996).

The Internet has woven the world into its web of intrigue and opportunity. Not only has the Internet provided a way to tie world-wide computers together, it has provided that long awaited integration opportunity for corporate internal systems with intranets. Intranets will be providing opportunity to blend components of all types, both software and hardware, in ways that have never been possible before.

SAS INSTITUTE DIRECTIONS

SAS Institute has invested significantly by committing 35% of revenues to Research & Development, despite the industry average of 15%. The Institute has significantly increased advertising in recent years, formed alliances with industry leaders and made great strides in stepping up to increased competition. They have redirected energies from the development of a primarily end-user tool to a portfolio of business solution products, the Vision line. This impacts the industry by speeding the delivery of functionality to people who need to get quick, dynamic results from applications. Web development is a priority for integrating SAS applications into both the Internet and organizational Intranets.

Business solution products for finance, human resources, and information technology organizations[2] can be integrated into existing operational systems by programmers who have been trained to customize those products for specific needs. IT organizations can now provide functionality for their internal customers without the need to continually develop new, fully customized systems. Those organizations use fewer programmers and bring new systems on-line quicker.

Most industry analysts now assume that the 1980's saw the solution to "data capture" and that the 1990's are the era of business solutions. This is generally true for the applications industry as markets for data capture applications have been locked in for various business operational areas. That is not always true for individual businesses who are still looking for solutions to integrate for changing or new business needs.

This combination of industry changes and SAS product directions puts programmers in a rapidly changing environment. They now require skill in integration of package systems with customizing limited to specific business exceptions for their company.

With an emphasis on exploitation of data with Data Warehousing, much of the ad-hoc reporting that used to consume many man-hours of programming time is being minimized. Large stores of data resulting from data warehousing initiatives now provide mining opportunities that require yet another set of technical skills.

THE BREAKDOWN - WHAT'S WHAT IN PROGRAMMING THESE DAYS?

Understanding the potential functionality of SAS software requires us to give basic definitions of its uses. The programming capabilities of SAS Software can be categorized into two areas; applications development and research, which frequently cross paths to exploit the greatest strengths of the product. A basic understanding of these skills will help to highlight how ill-prepared most of today's programmers are for these new directions just discussed.

One point to emphasize is that having a good background in research programming does not infer strength in applications development, nor vice versa. Many business people do not understand this distinction therefore getting the wrong set of skills for their projects. Skills necessary for research programming are attention to detail and an aptitude for understanding data content. Applications development by contrast is more abstract and concerned with process.

Applications Development

My usual definition for applications development is programming that results in a "system" that, once complete, is run repeatedly by non-programmers to do their jobs. Graphical User Interfaces (GUI) bring strength to this process by providing systems for users with an intuitive look and feel. With SAS/AF® Frame entries, there is great strength in the SAS System for providing systems for non-computer science users. These systems need to work for future unknowns defined as upgrades, enhancements, or maintenance.

Successful programmers must have skills in user interface design which is critical for making a system look and feel comfortable and functional for the client. This is an area that more programmers need to develop skills in. Many programmers naturally gravitate to honing skills in screen design, as they receive immediate, visual feedback and gratification from their efforts. However, unless those programmers also have strength in underlying system design, the result will be a pretty system that does not hold up to long term change. As a programmer, those underlying design principles are harder to find motivation to learn as they don't give immediate gratification in exchange for hard learning.

System design approaches which have been debated in the computer science field include object orientation and hierarchical design. Database approaches have been advancing steadily also with relational database and data warehousing topics evolving through the phases of software development. Many languages offer support for these topics including Visual Basic, Powerbuilder and Delphi. Every language has strengths, as well as weaknesses. One thing that the SAS System has excelled at is a balance of theory with functionality.

Statistics and Research Programming

Again, using my definitions, Research Programming focuses on getting answers from data through programs that theoretically produce a one time result. This type of programming is frequently used in conjunction with data entry and statistics intertwined with data clean-up. Base SAS programming normally involves frequent changes to specifications based on the dynamic directions of research. It is a very iterative, ongoing process that can be very time consuming and difficult to automate.

Data manipulation has always been a strength of the SAS System. It is very easy to use for exploratory analysis and data intensive operations. There are other languages frequently used for this type of programming including S-plus, Fortran and SPSS. While these languages provide strength in iterative analysis, they cannot match the higher level applications development feel that the SAS System can provide.

Data Entry can be easily implemented with the SAS System, which provides excellent tools for data clean-up and verification. One limitation is the lack of an automated transaction log and roll-back capabilities for high volume transactional systems.

Within the Research realm, Statistics is and always has been a strength of the SAS System. It can easily provide statistical analysis for Survey Development and Analysis, Clinical Trial Analysis and Market Research to name a few. SAS software covers the full spectrum from providing good, basic statistical analysis for non-statisticians through heavy statistical functionality for professionally trained statisticians and mathematicians. People have used SAS software for years because they get solid results quickly.

The "Hybrid" Advantage

Probably the biggest strength is that SAS software provides the opportunity to blend complex GUI approaches with highly technical statistical systems. Many packages provide strong statistical support or heavy applications environments. However, the SAS System allows applications developers the ability to provide highly specialized statistical functionality in easy to use formats that provide the dynamic necessary for ad-hoc research and reporting. SAS software has an open database option allowing the data to be stored in SAS format or one of many standard database products.

ORGANIZATIONAL APPROACHES

With those definitions behind us, what can management do to keep current? What directions should be taken to prepare a programming staff for future directions yet maintain marketability and results?

Obviously, those are not questions that have a single answer. However, there are several approaches that can be taken to look for direction. First, it is critical that management determine an approach that is a good fit for the mission of the company: What are the results that are necessary to keep the company product marketable and profitable?

Given that the goal is to strive for "user independence", a staff must be prepared to provide highly graphical systems. It is no longer feasible with today's headcount limitations to have ad-hoc programmers awaiting requests. Nor is it feasible to allow that amount of time for a request to be processed when competition has answers at the click of a mouse.

In order to stay on the edge, a paradigm shift is necessary. Status quo is no longer adequate for staff development. Most companies have taken one of the following alternatives to learning the new technologies.

Develop Technical Skills

Form a dedicated focus group within a company for various topics. These small groups are dedicated to research of one specific topic with a blend of learning, development and eventual productivity. Shifting to object oriented programming, for instance, requires a major shift in thinking and approaching a problem. Until a programmer has gone through a couple of small development projects, with a low anticipated productivity level, they will not have made an adequate shift. These pioneers will require skills in tough learning as well as training to bring the rest of the organization on board.

Outsource Programming Needs

Transition IT staff to project management minimizing the technology needs of the company. Those project managers are responsible for outsourcing all programming needs to vendors who can provide the technical expertise needed for each project. Even with this approach, the company depends on those project managers to have some level of technical competence.

Partner With Other Firms

Another option is to blend project management with dedicated technical resources by forming partnerships with technology firms. Programmers dedicated to learning technologies teamed with technical consultants provide a blend of internal business expertise and cutting edge technology.

Part of the challenge with these approaches, looking at company mission, is to balance proprietary corporate assets with the need for sharing discoveries and approaches. It is thought that the great success of Silicon Valley came from the frequent collaboration and sharing between companies and individuals resulting in an accelerated learning and results environment. (Warren 1996)

VENDOR OR PARTNER?

Partnering and consulting are words that have been pretty heavily misused, so I will further define several levels of service that various technology companies provide. These levels are not necessarily exclusive to individual companies as each may provide any range of these levels. Any potential client of these companies will need varying levels of service and needs to evaluate the appropriate service to seek.

Vendors provide product knowledge, basic skills and services. As an example, a programming vendor would provide coding services. Preferred suppliers are vendors familiar with their client organizations allowing the development of relationships providing differentiated levels of service. Continuing with our example, a programming preferred-supplier would provide coding along with familiarity of the client's common needs.

Consultants step up one more level providing an understanding of the client's business. Their technical knowledge is broader and solutions are provided along with training. Frequently, these firms have interaction with a higher management level in a client organization. Programming consultants provide not just coding but a higher understanding of the business solutions being sought, examples being Data Warehousing or Data Mining expertise.

The highest level is a **Partner**, a desirable but hard-to-obtain position. A true partnering of organizations results in a sharing of a vision and resources. There is a flexible value for both sides of the partnership. By providing co-development, foresight and collaboration, the organizations work together to mentor each other and work together for mutual benefit. For example, a partnering of technology and manufacturing organizations would result in profitable gains for manufacturing through new, profitable design and programming approaches. Both firms achieve wins for their individual company missions.

ORGANIZATIONAL MATURITY

In order to determine how a current organization is doing, there are several approaches possible for evaluation. By looking at organizations defined as a business unit, we can look not just at an IT group but at business in general.

Many management theories and approaches do not take into consideration the organization's size, age or culture, but they should. A company, but more specifically a department, must be evaluated for its life curve position. Is it a small organization structured like a large, old one? Is it a large, mature organization broken into smaller units that are dynamic and "small"?

Young, entrepreneurial organizations tend to be quite reactive, dynamically changing to jump into a particular market. Such an organization is normally quite tight knit with heavy communication between the principals. It is organic, as its direction can be easily turned and adapted to market changes. Being new, without a track record to fall back on, survival is dependent upon quick turn-around with decisions and results. Most efforts are directed toward composing products, approaches and a client base.

As an organization matures the number of decision points increase, bureaucracy evolves, and individuals become absorbed by their narrow scope of responsibility. New companies have nothing to maintain. Existing companies have to divert energies to maintaining existing software. This history limits the ability to build the future.

Comparing these two types of organizations, it becomes obvious that the younger organization is hungrier with a higher profitability potential. Somehow, today's business organizations, along with IT organizations, must find a way to emulate the entrepreneurial organizations. This must be done in a

manner that maintains the history of products while giving clients a new look and feel.

Process Evaluation

The effectiveness of a organization is measured by the repeatability and dependability of its processes relative to its ability to change for an increasingly dynamic market. Processes must be somewhat ad-hoc for change while providing structure and measurement for repeatable success. Each organization must determine the appropriate level necessary for their mission, dynamics and marketability. It is becoming increasingly critical for organizations to develop an ability to quickly adapt ad-hoc R&D concepts into higher levels of productivity for profitability and broad range results.

CONCLUSION

Looking for the answer? There is no single answer. That is what keeps business as much an art as a science. Many managers feel that they lack the ability to change an organization. That constraint can be tied to the mission of the company and organizational size. However, the important question that remains is: can organizations retain a certain dynamic ability, smallness and effectiveness? What is known is that the future is a time of great change. In order to gain a competitive advantage, organizations must be positioned to quickly adapt to unpredictability.

NOTES

[1] "Moore's Law: The observation that the logic density of silicon integrated circuits has closely followed thecurve (bits per square inch) = 2^{(n - 1962)}; that is, the amount of information storable in one square inch of silicon has roughly doubled yearly every year since the technology was invented." (Raymond, 1993)

[2] CFO Vision™, HR Vision™, IT Service Vision ™

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