Four Dampillars against the Errone ous Spreadsheets

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A review of the papers from past EuSpRIG conferences shows that they may be classed into four distinct areas: tools, education, auditing and management..

1. Introduction

User-friendly, flexible and widely applicable, spreadsheets are used to support numerous business functions and frequently take roles for which the implementation of any other solutions would be too slow or too expensive. As a result, the spreadsheets have silently grown into the key components in the analyses and reporting processes in numerous organizations, including the critical areas of financial reporting.

There is ample evidence that errors in spreadsheets are usual and by no means trivial. The number of errors in spreadsheets is proportional to the number of errors occurring in other intellectual activities and they are caused by the fundamental limitations of the human intellect, not only by carelessness. The warning ”be careful” cannot by itself eliminate errors, nor can it reduce them to at least an acceptable level.

The research so far, presented in the papers at the annual conferences of the EurSpRIG – European Spreadsheets Risk Interest Group can be classed into four groups:

Tools – methodologies and software used in spreadsheet modelling
Education – raising awareness, training and research
Audit – methods and software toold in spreadsheet auditing
Management – standards and controls in development management

The first letters of the names of these areas make up the word TEAM. This proved to be rather apt, since the thus created word further explains that the team work is the key to solving spreadsheet problems in corporations: implementation of development tools, training the users in order to raise their awareness of the errors in spreadsheets, an appropriate organization and implementation of the spreadsheet auditing processes, as well as adopting a clear managerial policy to support standards and controls.

2. Tools

Spreadsheets are generally approached as intuitive tools which are deceptively user-friendly and, although they are widely used in organizations, it often turns out that the information obtained is incorrect. Spreadsheet itself has certain limitations that prevent the development of complex business models, however, the spreadsheet user (creator) himself may lack the necessary skills in developing such a model.

There is undoubtedly a need to define and implement a structured approach in the model design, using the software tools that would serve as guidelines to the spreadsheet creator, so that he should avoid (or prevent) possible error situations, as well as document his activities.

Among the papers presented at the conferences so far there were some that advocate the use of programme languages to ”code” the logic of the models and then design the spreadsheet interface in rows and columns together with its in-built logic. One author advocates the implementation of a mathematics area known as the ”theory of categories” [13]. The theory of categories, as well as logic, is a tool for studying mathematical and computer concepts and is focuses upon the form rather than upon the contents.

A large number of participants at the conferences insisted on the need to create methods based on the principles of software engineering. They argue that the implementation of these principles of software engineering – which would make spreadsheet engineering – has a potential to improve the performance of spreadsheets programmers, reduce the frequency and gravity of errors in spreadsheets, improve the manipulation with spreadsheets in time.

Rajalingham, Chadwick and Knight [14] propose the application of tools that create Jackson structures to obtain a graphic type of spreadsheets description in the course of

[1] **Spreadsheet models can be presented in the form identical to the data structure diagram – Jackson structure which is used in software engineering.**

their development[1]. This allows for an easy check of the logic and a reverse spreadsheet engineering in its "Jackson" structure. Hence every spreadsheet model can be defined by its canonic form that will remain intact even when the spreadsheet form suffers cosmetical changes.

There is a lot of spreadsheet software on the market. The list of the best known software can be seen at the website http://en.wikipedia.org/wiki/List_of_spreadsheet_software. New spreadsheet alternatives have also been proposed at the conferences. The combination of the most recent object technologies with new approaches are indeed genuine alternatives to spreadsheets that are directed towards responding to the so far identified resistance to spreadsheets. For example, the XBRL (Extensible Business Reporting Language) is the language for electronic communication of financial data that revolutionized the financial reporting worldwide. It is used in the preparation, analysis and communication of financial information. The XBRL is an application of XML for business information and uses the structure to describe the data, make them instantly operable, interactive and intelligent.

As regards the spreadsheet documentation, the proper documentation:

- Describes the substance and method of model implementation in that it allows the others to implement the model, but is useful in reactivating the model after a period of time it was idle.
- Reduces the risk of discontinuing the use of the model because only one man or a limited number of people know how to use it and have trust in it.
- Reduces the number of irritating stoppages to the person responsible for further development of the model.

The documentation should include the facts such as: what the model serves for, what it can do, how it does what it does, which premises are included in its design, which constants are used and where they lie, who developed the model and when, who modified the model after it was put to use, and when he did it, the presence of macros and their purpose.

The systematis implementation of Excel comments may be viewed as an efficient method of spreadsheets documentation.

3. Education

In order to design and implement an efficient spreadsheet solution, it is important that one should know how to do the work so that the data may be turned into useful information. The knowledge of this know-how is already present in the organization. The knowledge of technique is achieved through training. If the technical knowledge does not take the knowledge of how to work into account, the solutions will not be optimal.

A most efficient spreadsheet system management in an organization is the result of the training based on working out the solutions to concrete problems (task-based management). Using one and only approach the user is being trained how to solve a concrete problem using the spreadsheet tools, contrary to the approach where the spreadsheet tools and techniques are studied independently of any concrete problem.

The trainers that favour the "task-based" approach are experienced as to the manner in which the spreadsheets are actually used in real situations. They combine their experience with the client's knowledge of the business environment. This is a better way compared to dry and boring theorizing on how the spreadsheets should be used.

At the end of the training the attendant:

- ✓ Completed his task
- ✓ Set the system for future tasks
- ✓ Learned about the solutions to some of his problems
- ✓ Worked on an actual spreadsheet

The attendant learned the task-related mechanic techniques, as well as the rationale of implementing these individual techniques in task situations.

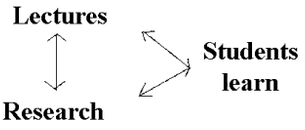
The "task-based" training is neither the only type of training, nor is it the most popular one. A largely widespread type of training is the general training where the trainees are introduced to the spreadsheet programme package, since the attendants are usually people who already use spreadsheets for various purposes.

The third type of the "training" is most common and includes the users that have never had any formal training concerning spreadsheets. They learned how to use spreadsheets at work, from their predecessors or colleagues, or are entirely self-taught.

A quality training in using spreadsheets is offered at the Faculty of Organizational Sciences in Belgrade and at a number of other faculties. The training in how to work with spreadsheets, however, displays a rather poor approach to spreadsheets:

- Spreadsheets are presented as simple expressions of likewise simple accounting models
- Spreadsheets are easy to learn and their intellectual contents are limited

Students became familiar with spreadsheets even before they enter university and thus acquired wrong habits that are difficult to correct at university.



The greatest problem, however, may be how to convince the lecturers that the training for work in spreadsheets requires an entirely different approach which is not based only on the changes in the teaching contents, but in the teaching methods, too. A solution may be to encourage them to use the feedback loop RESEARCH ● LECTURE ● STUDENTS LEARN.

4. Audit

The types of testing are numerous and the majority of them cannot reduce the errors to the point at which there are no singnificant errors in the spreadsheet. Here we mention some of the test types:

1. **Testing along spreadsheet development** – Testing applications, unit (module) testing, integral testing.
2. **Spreadsheet observation** – Review of tables in spreadsheet in order to get the impression of logic.
3. **Error scanning software** – Software that browses the spreadsheet searching for errors on the basis of the built-in detection rules in the software. The automatic error scanning tools are similar to spell-checkers and grammar-checkers in the text processing programmes. Excell has the built-in tools for error detection under the commands Tools, Error Checking. These tools are rather simple, but limited. There are several commercial tools available in spreadsheet auditing: SpACE (Spreadsheet Audit for Customs & Excise), OAK (Operis Analysis Kit), Spreadsheet Detective and Spreadsheet Professional, and others. Much more sophisticated scanners are now available on the market. The web site containing the list of such products is http://www.sysmod.com/sslinks.htm#auditing.
4. **Auditing** – The option that is in Excell activated by the Tools, Formula Auditing commands. Such commands allow us to select the links of the formula with the previous cells the result of the formula depends on, that is, with all the cells to which the value of the formula observed serves as input data. One problem with the real auditing is the question on which section of spreadsheet is audited. The most obvious candidate for auditing is the "most risky section" which includes complex formulas and links among the worksheets of the work ledger. While the errors are more likely to occur in this type of formulae in comparison with the ordinary formulae, by the law of probability, there is probably a larger number of errors in ordinary formulae than in the complex ones (the ordinary ones are more numerous) will occur. Very complex, but also very expensive automated auditing softwares for spreadsheets are now available on the market.
5. **Testing through performance** – The tester tests a number of sets of input values to find out whether the spreadsheet produces (or does not produce) correct results. Here, typical and extreme values (paranoid testing) can be used. The problem here is how we can know whether the values obtained are accurate and correct. In the best case, there are possibilities to compare the resulting values to the already known values. A mathematical model would be welcome that can yield values which could be expected as a result in the spreadsheet, too. Without such values for comparison, testing through performance is meaningless.
6. **Logic inspection** – The inspector examines all the cells with formulae, searching for errors. For practical reasons, we recommend the team inspection: an individual usually manages to detect fewer than half the number of all the errors present. In this case the reduction of all the errors cannot be requested, since this is impossible to do. Therefore a reasonable limit is set, in accordance with the importance of spreadsheet in business decision making.

The inspection process should consist of seven steps:

1. Planning. Provision of materials, getting the peer and working out the meetings schedule.
2. Discussing the meeting agenda. Presenting software, role delegation, process description.
3. Preparation. Inspectors check the spreadsheet individually. The aim is not to detect errors, but to understand software modules. Many inspection methods, however, detect errors as early as this phase.
4. Inspectors' meeting. The task is to detect and explain errors. Nothing else is discussed. The meeting has to be reasonably short, so that concentration should not weaken.
5. Improving the process. Inspection has to produce a feed-back information to the guide process inspection of the firm. Each inspection must generate a statistics on the time consumed, errors detected and the gravity of error.
6. Processing. The remedy to /repair of the software is effected after the meeting.
7. Monitoring. Ensuring that the change is correctly made.

5. Management

There are many, some argue too many, issues related to spreadsheet management which should be taken into

consideratin by the organizational policy. There are the issues of choice and of adopting a set of controls that should be analysed over a reasonable time interval. These may be the spreadsheet version controls, the insight and self-auditing during the spreadsheet creation, team review and "close inspection" of spreadsheets models, the documentation policy, the use of "proven" models as templates, as well as recording usual errors and their storage at set sites such as corporate knowledge bases.

In order that only a small number of these requirements be met it is necessary to ensure the support of the firm top management and create a strategy to establish good practice based on the reasonable selection of standards.

Such a standard can be found in the CobiT (Control Objectives for Information and Related Technology) approach. The CobiT is a set of tools that helps business managers to understand and manage the risk related to introducing new technology. It also demonstrates to the interested parties or stakeholders how well the job was done. The CobiT is based on the best international practice of IT management.

The CobiT ensures a generic framework for all the main IT processes. It does not necessarily specify spreadsheets. However, this generic framework can be applied to all IT development solutions, from the entire ERP system to a relatively simple spreadsheet.

For example, the "Provision and Maintenance of Software" control is described as follows:

The control of the IT processes of provision and maintenance of software that satisfies the business requirements of function automation for the purpose of an efficient support to business processes is ensured by the definitions of functional and operational requirements and the phase implementation with clearly set performance and takes into account:

- Functional testing and adopting
- Application controls and security requirements
- Documentation requirements
- Software application life cycle
- Company infromation structure
- Methodology of development system life cycle
- User-machine interface
- Package adjustment

This is backed up by 17 detailed goals of control, covering:

- Design methods
- Principal changes in the existing system
- Project approval
- Defining and documenting necessary files
- Programme specification
- Source data collection project
- Defining input requirements and documentation
- Defining interfaces
- User-machine interface
- Defining necessary processes and documentation
- Defining necessary outputs and documentation
- Opportunity of control
- Accessibility as key factor of design
- Measures of IT integrity in software programme application
- Software application testing
- User manuals and other logistic material
- Re-evaluation of system project

The CobiT approach is based on the "Maturity" model of the software development possibilities, defined by the Software Engineering Institute. The Maturity model offers a method for a quantitative expression of the level of IT control procedures on the 0 (non-existent) to 5 (optimized) scale. The management used the "Maturity" model to map the current status of:

- Their own organization
- Best practices or an overall state of practice in their industry
- International standards

and to determine where the organization desires to be as regards those levels.

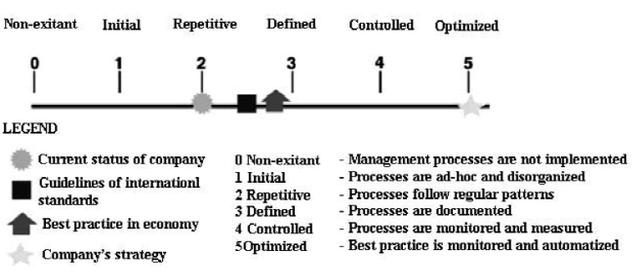


Figure 1: CoBIT Maturity Model

The development and maintenance processes control of spreadsheet models and applications that satisfy the business needs to obtain accurate business models and error-free analyses in order to efficiently support business processes is provided by defining the specific features of functional and operational requirements as well as by a phase implementation with clear performance and takes into account:

- design methods
- protection and data storage requirements
- testing and adopting
- documentation requirements.

6. Conclusion

In order that an appropriate spreadsheet information system be provided in an organization, it is necessary to improve four areas of intellectual activity:

TOOLS – adopt the methodology of the structural description of the data and their connexity as a basis of the business model description which is further developed in the spreadsheet; select an adequate software for the spreadsheet; ensure the spreadsheet documentation;

EDUCATION – select the most suitable user (creator) training and establish an appropriate system of permanent education together with research;

AUDITING – establish a spreadsheet audit system implementing most recent auditing tools (software);

MANAGEMENT – adopt standards and controls related to the management of versions, storage, usage of templates, spreadsheet systems performance measurement and continual improvement.

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