

# **User and developer - User systems development using a spreadsheet program**

## **Summary in English**

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### **Introduction**

In this thesis the conditions and effects of User Systems Development (USD) using a Spreadsheet Program (SP) are discussed. USD is performed by a User-Developer (UD), a person who acts both as a user and a systems developer. A typical feature of USD is that the UD has a good knowledge of the business and the work related to the Information System (IS) in question, which is called the User Developed Application (UDA).

In the early days of computers, expertise was needed in order to use computers. As IT tools have become more powerful and user friendly, more and more people have been able to use computers and programs as tools when carrying out working tasks. Nowadays it is even possible for people without special IT training to construct ISs that only IT specialists could have done some years ago. In this thesis UDs' use of SP as a systems development tool is discussed.

The basic research questions in the thesis are the following:

What new possibilities can computer users develop in order to perform tasks, when they can develop ISs without help from IT specialists?

The question can be subdivided into the following questions:

How can UDs take not-easily-formulated knowledge into consideration when performing USD?

What kind of tool knowledge does a UD need in order to perform tasks?

What other conditions affect the UD:s possibilities to perform USD ?

Which effects are the results of USD?

The aim of the thesis, apart from answering the questions above, is to formulate a conceptual model where the conditions and effects of USD are categorized.

## Methods

This thesis is the second part (D2) of a larger project, divided into two parts where the first part (D1) resulted in my licentiate thesis (Avdic 1995a). The strategy can be described as qualitative, hermeneutic, abductive, and Grounded Theory (GT) influenced.

The *qualitative* aspect is manifested through the aim of understanding and interpreting the reality of the UDs. A typical feature of qualitative methods is triangulation. The methods used are in depth interviews, studies of SP-UDAs, participant observation (only D2), theoretical studies and survey studies (only D1). The *hermeneutic* approach is manifested through the explicit use of the researchers preknowledge of USD and of the respondents. Interviews and contacts have been frequent. The researcher's knowledge of USD has resulted in long discussions of the best way to solve specific problems. This has resulted in an atmosphere where the researcher has gained access to the respondents' situation as UD in a way that would have been impossible if survey studies had been performed. This change of perspective is also typical of hermeneutic studies. In the empirical studies the focus has changed/alternated?? between product and process (SP-UDA and USD). Another change of focus also closely related to USD is the change of focus between the actual work and UDA-development. While the UD is focused on the tasks at hand, the observer has been focused on the developmental aspect. The *abductive* label is relevant since the studies can be described as a combination of deductive and inductive methods. The research methods can be labeled as *Grounded Theory (GT)* influenced since the empirical research has proceeded the theoretical studies as can be seen in the whole perspective of the thesis. Another GT aspect is the aim of an unbiased data collection situation. The choice of both research questions and respondents has been a result of a specific intention but the data collection has been performed with an awareness of the importance of not knowing what really happens when UDs perform USD. The data analysis has therefore been performed according to GT, methods (data collection, open coding and selective coding). The coding activities have aimed at finding a key variable. The variable found is "integration". The importance of this is discussed below.

## Empirical studies

Four empirical studies have been conducted. Two studies have focused on UDs, interviews have been conducted with three people in an industry and three persons in a public authority. In the third study three IT specialists are interviewed and in the fourth study the process of developing a multi-user UDA is described and analyzed.

### The Company

The company is a multi-goal, dynamic business acting in a keen competitive market. The findings show that the UDs have an aim to perform tasks through USD by making analyses based on precise and updated information. UDs need flexible analytical tools and a good knowledge of the business in order to evaluate the appropriateness of the information produced. The ongoing revaluation of the business and its conditions

results in revaluation of models and measuring methods. SP can support decisions by making formalized models transparent and open to criticism. The formulation?? results in turn in discussions at a higher level than if values themselves were discussed. The distribution of models in local networks positively promotes analysis and criticism.

### **The Public Authority**

Activities in the authority are characterized by their public nature. This means that business should neither be profitable nor involve a loss. Other important goals are that the inhabitants' best interests should always be taken into consideration and that activities should be carried out with openness. This demand for openness means that the grounds on which decisions are taken should be both available and comprehensible. The findings show that USD can help UDs achieve the goals mentioned.

### **The IT-Specialists**

The three IT-specialists were an IT-manager, a systems developer and a consultant systems developer. Findings show that the problems related to the USD were lack of documentation, unstructured applications and limited data processing capabilities in SP. The solutions proposed to these problems were SP training, SP-version upgrading and more structured UDAs.

### **Application**

The construction of a budgeting SP-UDA has been studied. The findings show that the construction of a complex, multi-user system can be initiated, monitored, , verified, , evaluated and even partially executed and administrated by UD:s.

## **Framework**

Since the thesis claims to be GT influenced, studies of related theory have been greatly influenced by the empirical studies. As a framework model, the generic practitioner's model is used (Goldkuhl & Röstlinger 1998). The model consists of a set of conditional categories, *assignment, basis of decision, knowledge, norms, and tools*. Other categories are *producers* and their *activities* as well as *results* and *experiences*. When a UD develops UDAs he acts in at least two practices (praktiker) (types of praxis?), the developer's praxis and the main praxis. Each praxis has its own set of conditions e.g. knowledge, norms and tools.

### **Information Systems (result)**

A UDA is an IS . The difference between a traditional information system (TIS) and a UDA is mainly a question of how it is built. UDAs are built by UDs with a good knowledge of the business, while TIS:s are built by IT specialists.

### **Systems development (activities)**

Traditional Systems Development (TSD) can be characterized by the notion of the "Life Cycle". User Systems Development (USD) and TSD are profoundly different in many ways.

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Category	TSD	USD
Distribution of tasks	Specialization	Integration
Change analysis	Separation	Integration
Type of system	Complex	Simple
Process	Sequential	Integrated
Duration of the process	Project	Work integrated
Developers	IT-specialists	UD:s
System delivery	When constructed	Work integrated
Environment	Multi-user	Single-user
Tools	Programming skill needed	Directly manipulated or declarative tools
Methods	Designed for large complex multi-user systems	No standardized methods

### User Systems Development

Researchers have different perspectives on management and control of USD. Whether USD is adapted in an organization depends on the presence of informal channels of communication and how common training on USD tools is. Some basic conditions (suitable tasks, equipment, knowledge, and certain independence) must be fulfilled to make USD *possible*. If business and information needs are dynamic, USD can be *justified*. USD is *appropriate* when UD:s also have access to well organized data and get support from management and the IT-department.

When discussing the effects of USD, advocates of *high control* recommend (strict) organization of USD activities. Advocates of *low control* consider USD as time saving and appropriate because of the lack of detailed monitoring.

When discussing working methods, “Traditionals” looks upon TIS as an example of USD. “Organizers” aim to organize USD, preferably with the help of an Information Center. Yet another way to view USD is to regard the specific characteristics of USD as a basis. This is done by “Reformers”.

### Actors

A UD is a person with a good knowledge of the business who develops ISs with tasks and activities which the UD provides as a basis. The UD integrates several roles when performing USD, e.g. different IT specialists.

### Intention and Decision Support

The assignment initiating USD often aims to produce a basis for decisions. SP-UD:s are therefore often to be looked upon as decision support systems (DSS). Research on DSS is therefor relevant when discussing USD.

### Knowledge

At least two kinds of knowledge are relevant to the UD namely a knowledge of the tools and knowledge of the business. Since the latter is the most important for the UD, the former can be used to deepen the latter. UD:s can make tacit knowledge explicit

when developing USD, which in turn makes it possible for others to evaluate and criticize the UDA.

### **Norms**

Norms and knowledge are closely related and sometimes hard to keep apart. The same can be said of norms and goals, concepts that somewhat overlap. One set of norms that are central to the thesis are professional ethics. Professional ethics are crucial to the UD since the professionals' activities are monitored not by procedures but by professional and business ethics. Findings show that investigations made by the UD when performing USD can change organizational norms.

### **Tools**

USD tools are closely related to norms and knowledge, since norms and knowledge are implemented in tools. The main tool when performing SP-USD is of course the SP. The SP is interactive and integrated. It contains a) functions for adapting the development environment, b) functions for editing, formatting etc, and c) functions for interactive development and use. The open nature of the SP can cause different kinds of errors. Knowledge of the business-and the tools, as well as professional expertise can prevent some of these errors.

## **Conclusions**

### **User Systems Development**

SP-USD is characterized by *integration* in several dimensions: 1) aspects of ISs (collecting, storing, processing, and distribution), 2) roles (developer, user, manager), 3) roles of actors in systems development (analyst, programmer, database designer, etc.), and 4) processing functions of the IS. The integrated nature of USD results in *interactivity*. Interactivity means that the UD can change quickly between developing and using the SP-UDA. During the USD-process the UD knowledge of the business and USD increases. Since the UD knowledge of the increases when performing USD, the UD can analyze and also *question* aspects of business (e.g. production measuring methods).

### **Knowledge**

When developing business supporting ISs professional expertise, and knowledge of the business and the tools use are crucial. When performing USD, knowledge is divided between the UD and the tool (SP). Certain kinds of (not too complex) knowledge are formalized into the SP and can be used in the SP-UDA. Other kinds can be formalized by the UD into the SP-UDA. Some kinds of knowledge, (e.g. of critical evaluation of the relevance of formulas) cannot be formalized at all. Still this kind of not-easily-formalized (sometimes tacit) knowledge can be taken into consideration when using the UDA, since the UD (with business knowledge) is the user of the system. The findings also show that goals, not easily formalized, can be taken into consideration when performing USD. Also, USD can make formalization of tacit knowledge possible. This can happen when repeated analyses make the UD aware of circumstances not known before, which in turn make other analysis possible.

## User and developer

The use of local area networks makes the distribution of models within the organization easier. Since the nature of the SP can make algorithms visible to the reviewer, the discussions regarding the relevance of aspects of the systems more detailed and thereby more reliable.

Because of the integrated nature of USD, learning, using and systems development take place at the same time. Learning applies to both the business and the tool. One conclusion of this is that training in the use of a tool can improve the quality of USD. One way for the management to support USD is to initiate and encourage UD-tailored training in the use of tools.

In the thesis SP-USD is discussed as a means of controlling continuous changes in the environment of the organization. A business analysis (1) can result in a revaluation of the business (2), which can result in a revaluation of its goals (3) (and norms), which can result in a revaluation of methods of measurement(4), which can result in new analytical models (5) (UDA), which can lead to a new business analysis (1) and so on. USD is discussed as one way to meet change as a permanent business condition, which differs from traditional methods for systems development.