Software Engineering Approach on Administrative Management

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Abstract: In this paper the administrative management system is analyzed for a software design based on software engineering approach. First, the three levels architecture of software is presented having strategic, tactic and execution levels. Second, is developed the SWOT analysis and based on the results the strategy of ITC solution is assumed. The general objective is defined based on software engineering principles and methods. Next, the elements of software engineering are structured in a comprehensive diagram together with the requirements, lifecycles and quality assurance. The algorithm block diagram is built based on the software engineering in order to develop a software platform. This platform has as inputs data and taxes and as output documents and payments. This solution can solve such administrative problems having more success chances then others.

Keywords: software engineering, administrative management, lifecycle, requirements, design

1 Introduction

In order to design a software platform for informatics treatment of the databases from administrative activities it is necessary first to systemically analyze such a complex management activity.

1.1 Software platform architecture

At the macro level, like a country, there are three levels of ITC applications, as follows:
- Level 1, on government strategic decisions;
- Level 2, on regions or county tactic decisions;
- Level 3, on local executive decisions.

The characteristics of ITC systems are:
- Each level has its own ITS support with distributed databases in each operative unit. The database contains data regarding the contributors assigned to that unit.
- On each superior level the significant data are consolidated for operative management and working.
- There are tens of work stations at the strategic level, connected to hundreds of work stations at the tactic level, also connected to thousands of work stations at the execution level.
- There are used joint applications implemented at all the levels.
- The entire system coherence is achieved based on account books, nomenclatures and administrative territorial structure.
- There is a communication network for data, voice and image connected to all the strategic and tactic units. The link between the tactic and execution levels is achieved by other methods.

In fig. 1 is presented the block diagram of the software architecture and the cooperation mode between the components.

![Software Platform Block Diagram](image-url)
1.2 SWOT analysis of the administrative activity
The SWOT analysis highlights the most important characteristics of such a system.

- **Strengths**
  - There is a governmental national strategy to promote and implement the information society.
  - There is an appropriate legislative context, like: electronic signature law, electronic commerce law, electronic bidding law, electronic taxes payment law, electronic identity protection law, public information free access law, electronic IDs law, electronic bank transaction and internet banking laws, informatics crimes combat law etc.
  - There is a performance management and professional development system, with the purpose of software upgrading, maintenance and development.

- **Weaknesses**
  - There must be allocated adequate and regular financial resources in order to develop the ITC infrastructure and to motivate the personnel.
  - The weak cooperation between the hierarchical levels, an incoherent definition of each level’s attributions which lead to the requests blurring and inconsistency.
  - The present level of hardware and software capacity and speed do not allow the use of more complex applications.
  - The low level of promotion of the ITC strategy application.
  - There isn’t any information security policy that could ensure integrity and security even in disaster cases.
  - There isn’t well used the maintenance and software development stage.
  - Under sizing of the ITC human resources.
  - Weak coordination of the execution levels, that leads to database inconsistencies.
  - There isn’t a strategy to promote the ITC technology at community level so that the access to the software platform becomes efficient.

- **Opportunities**
  - The E.U. accession means better cooperation and software platform compatibility.
  - Possibility to access European funds to develop the ITC system.
  - Admission at strategic level of the necessity for measures to facilitate the passing towards information based society.
  - Accession to eEurope type programs and maintenance of the development rate for the information society according to the adopted policies and action plans.
  - The ITC market is diversified and the available services cover the necessities, which allow a realistic approach strategy.

- **Threats**
  - Lack of procedures in some administrative activities leads to implementation delays in qualitative software platform implementation.
  - Reduced stability of the macroeconomic frame and its insufficient predictability which leads to quite frequent changes to the settlements.
  - Inflation rate and economic crisis.
  - Growth of banks interest in introducing new modern payment instruments.
  - Insufficient financial resources to develop ITC systems.
  - Increase of the administrative activities computerization gap reported to the E.U. countries.
  - ITC field labor force migration towards other companies.

In fig.2 is presented the SWOT analysis block diagram regarding the ITC strategy for administrative activities.
Based on the above, results the following general conclusions regarding the difficulties in ITC systems implementation:

- Lack of coherence of the present software platforms for these complex activities;
- Implementation of software platforms without a previous requirements analysis;
- Difficulty in use, need for new application development and low reliability.

All these lead to the necessity to find a new approach for the implementation of software platforms based on software engineering principles.

The strategic solution to be applied for administrative activities data processing, in the presence of social unbalances, represents the use of modern scientific methods for software platforms design based on the software engineering principles.

2 Problem formulation

First, there will be formulated the problem to be solved, that is to determine the software platform design methods for the administrative activities data processing. We will take into account the identified threats and the software development difficulties due to complexity and peculiarity of these activities.

2.1 Objective

The main objective is to determine the best methods in order to achieve the ITC strategy in due time, with minimum costs and at high quality. This fact needs the application of software engineering principles in the system design.

For this reason there will be presented the software engineering principles in order to get reliable and minimum cost results in due time and at high quality.

Software engineering is an engineering approach on the software design process, as it was defined by IEEE: “Software engineering is the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software, and the study of these approaches; that is, the application of engineering to software.”

There are taken into account the following aspects:

- The approach methods used by the software engineering: achievement only based on the requirements; elaborated managerial design, step by step testable using ordered stages, as follows: design, code and test. There will be considered that if the design time is decreased, this could produce errors which will increase the test time by ten times.

- The requirements determination is the first activity in the process of software design. A requirement is defined as a system characteristic, a system constraint or a description of what the system can do in order to achieve its objective. The requirements are specified by expression like: “must do”, “should do” and “will do”. The requirements determination consists of two stages: requirements capture and requirements validation.

- The experience from past software design processes show that there could be introduced risks due to the following causes: the total software achievement time could be too big; the total software cost could be inadequate; the final quality
could be not appropriate; unsolved bugs presence could create difficulties and so on.

2.2 Software engineering principles and methods

The software engineering can decisively support the software elaboration for complex cases, if there are taken into account the followings:

- The use of basic software engineering principles for design
  - The software requirements: time estimation; cost estimation; quality estimation; maintenance and development;
  - Approach solutions: modularization; team work; multi-version approach; use of UML; management;
- Methods to solve: engineering methods, which are systematic, disciplined, quantifiable approach and risk control.
  - The design based on the requirements capture: capture and validation;
  - The choice of a well suited software lifecycle: waterfall; V-form; prototype; version; risk driven (spiral); extreme programming (XP);
  - Quality assurance: maintainability; correctness; reusability; reliability; portability and efficiency.

In fig. 3 there is presented the block diagram of software engineering principles usage in software design.

![Fig. 3. Block diagram of software engineering principles](image)

As a conclusion, a modern solution for software design consists of software engineering principles usage, selection and fulfillment of a lifecycle appropriate for the system requirements and software quality assurance.

The solution is approached in the case that the SWOT analysis show that there exist application chance. The design starts with the requirements determination, followed by the prototyping, testing, validation and user acceptance. After finishing these stages, there follows the choice and qualitative fulfillment of a lifecycle from the above presented ones.

3 Problem solution

In this section a software algorithm designated to administrative software design platform, at the executive level, using the main elements of software engineering is presented. This platform collects the data and taxis and returns the documents and payments. In fig. 4 the block diagram of the design algorithm is presented.
The algorithm has the following steps:

- Begin with SWOT analysis of chance. If there is no chance abandon and wait to come;
- Requirements determination (capture and validate):
  - Use interviews and scenarios;
  - Validate by simulation and user acceptance;
  - Issue a requirements document of acceptance signed by user;
- Choose the appropriate lifecycle and fulfill it:
  - V-type combined with XP programming is recommended;
  - The UML and MatLab/Simulink modeling and simulation is recommended;
  - A team programmer consisting of 4, 5 programmers can be used to code;
  - For coding are recommended the programming platforms: Fox Pro, Visual Studio.NET & SQL, Oracle etc;
  - Use the white and black box tests, alpha and beta versions;
  - There are not accepted new requirements during or after coding;
  - Maintenance and development documents must be provided;
- Will be taken into account the constraints:
  - Budget dimension;
  - Time constraints;
  - Human resources;
  - Other risks;
- Quality assure:
  - Maintainability;
  - Correctness;
  - Reusability;
  - Reliability;
  - Portability;
  - Efficiency;
- Documents and training:
  - Project description;
  - User manual;
  - Maintenance book;
  - Other documents.

4 Conclusions
The general objective of this paper is to emphasize that the best methods to achieve the ITC strategy are software engineering principles and methods, for administrative management system applications.

This type of software platform has the architecture on three levels: strategic, tactic and execution levels. In order to develop such a platform the SWOT analysis is necessary and based on the results the strategy of ITC solution is
assumed. In order to apply the elements of software engineering in design, a comprehensive diagram, together with the requirements, lifecycles and quality assurance, is bided. The results are applied for a local level administrative software platform design which has as inputs data and taxes and as outputs documents and payments. This solution can solve such administrative problems having more success chances then others.

References