Increasing work efficiency through tax calculation automation

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Abstract

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In an environment of ever-increasing price competition organizations need to find ways to renew business models in order to increase their total work efficiency. One way of accomplishing this is to automate certain work tasks. This paper introduces a partial solution to the aforementioned challenges in the form of creating an automated tax calculation tool.

Design research in information systems was used as the primary research method and the actual research process was carried out in the target organization from July 2013 to June 2014. The target organization is a consultancy firm operating mainly in the Helsinki metropolitan area. The research was developed and implemented in the firms tax department's Global Mobility team. During the research a comparison was made between performing tax calculations for tax returns (n=460) using manual process (old method) and automated process (new method). Measurements were made for time consumption and the amount of errors between the two methods. Also, the cost/gain-ratio was measured for both.

The most important result of the research is that using the automation tool to perform tax calculations remarkably increases overall work efficiency. Another key finding is that using automation will substantially decrease the amount of errors in tax calculation results, when compared to manual calculations performed by staff. Tax calculation automation also frees staff resources to be allocated more efficiently towards tasks that require more specialized tax expertise.

Creating automation processes also brings challenges to the organization. Resistance toward change can be seen as one example. Other challenges include e.g. realizing what automation is doing from the staff point of view and how changes in laws and regulations are taken into account when automating tax calculations. In the conclusion of this paper, solutions to the aforementioned challenges are presented and future research possibilities are introduced.

Keywords: automation, work efficiency, tax return, design research, information system, IS design

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Tietojärjestelmäosaamisen koulutusohjelma

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Työtehokkuuden kasvattaminen verolaskelmien automatisoinnilla

Vuosi 2015 Sivumäärä 45

Globaalin hintakilpailun kiristyessä organisaatioiden tulee löytää keinoja liiketoimintamallien uudistamiseen lisätäkseen työn kokonaistehokkuutta. Eräs tapa vastata tähän haasteeseen on automatisoida tiettyjä työvaiheita. Osittaisena ratkaisuna edellä esitettyyn tehokkuushaasteeseen esitellään tässä opinnäytetyössä veroilmoituksen verolaskelmien suorittamiseen kehitetty automaatiotyökalu.

Tutkimusmetodina käytettiin suunnnittelututkimusta (design research in information systems). Tutkimus toteutettiin kohdeorganisaatiossa kehitysprojektin muodossa heinäkuun 2013 – kesäkuun 2014 välillä. Kohdeorganisaatio on pääkaupunkiseudulla toimiva konsulttiyritys, jonka Global Mobility osastolle työkalu kehitettiin. Tutkimuksessa vertailtiin veroilmoituksien (n=460) verolaskelmien laatimisen nopeutta ja virheherkkyyttä sekä automaatiotyökalun että ihmisen suorittamana. Tutkimustulosten mittareina olivat muun muassa ajankäyttö, virheiden määrä sekä tuotos per panos-suhde.

Tutkimuksen keskeisimpänä lopputuloksena voidaan todeta, että automaatiotyökalun käyttäminen verolaskelmien tekemisessä nopeuttaa ja tehostaa veroilmoituksen laatimista huomattavasti. Tutkimuksen toinen olennainen havainto on, että automaation käyttö alentaa merkittävästi verolaskelmissa tapahtuvaa virheherkkyyttä verrattuna ihmisen suorittamaan, käsin tehtävään laskentaan. Automaation käyttämisen johdosta vapautuvien ihmisresurssien tehokkaampi ja kannattavampi hyödyntäminen substanssiosaamista vaativiin tehtäviin on myös tutkimuksen keskeinen havainto.

Automaatioprosessien luominen tuo mukanaan myös haasteita organisaatioon. Esimerkkinä näistä tutkimuksen aikana havaituista haasteista ovat muun muassa muutosvastarinta, työkalun toiminnan ymmärtäminen käyttäjän näkökulmasta ja lakien sekä säännösten muuttumisen huomioonottaminen laskelmien automatisoinnissa. Tutkimuksen loppuosassa analysoidaan tarkemmin näitä haasteita ja pohditaan jatkotoimenpiteitä niiden ratkaisemiseksi.

Asiasanat: automaatio, työteho, veroilmoitus, tietojärjestelmäkehitys, tietojärjestelmä, suunnittelututkimus

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ABBREVATIONS

SD – Systems development

IS – Information system

TR – Tax return

IT – Information technology

DR – Design research

1 Introduction

In a constantly changing and increasingly competitive market, companies need to find new ways to renew their business models and increase their total efficiency. Automating certain tasks can be seen as one effective solution to increase and reallocate work resources in a more efficient way.

As regulations relating to tax return preparation keep getting more complex, companies need new ways to ensure that they stay compliant and are aware of the latest developments in tax laws. Many companies have become increasingly aware of this development and have pursued to develop tax return automation tools in order to take into account as much of the risks as possible. (Fisher 2011, 12.)

Also, significant price competition can be identified within consultancy firms who offer tax return preparation services for their clients. This has led to development where the business model has changed from providing tailored and detailed individual tax return service to a more volume concentrated service model. In other words, the client requires the service provider to offer services to a growing number of employees at an ever-decreasing price per employee rate. (Fisher 2011, 12.)

In order to minimize tax liability and overall audit exposure the self-assessed use of tax calculation automation tools should be utilized. As a direct result, this will ultimately improve the client company's bottom line. Effective use of tax calculations can realize true expense management and saving for the client. Error-prone and time consuming manual processed should be replaced by automation tools that are present for most common tax and financial applications. (Reiner 2004, 19-48.)

Automating certain parts of tax return preparation can be seen as an effective way to reckon with these challenges. Automation can be seen beneficial in many ways, e.g. significantly decreasing margin of error, improving staff resourcing and thus increasing work efficiency. In order to create a solution to the above mentioned risks, an artefact (or tool) needs to be created. The company needs either to plan, design and build a tool in-house or license an existing tool and implement it into their organization. (Tankersley 2011, 21.)

The main reason for implementing an Information System, or IS, within an organization is to improve the efficiency and effectiveness of that company. The success of implementing such system is measured by the systems capabilities, organizational characteristics, work systems, people, and development and implementation methodologies (March & Smith 1995). A rising, significant factor in organizational decision making and strategy planning are the available and emerging IT capabilities. State-of-the-art information systems enable organizations to restructure and change the way they do business in order to increase overall efficiency. (Drucker, 1991; Orlikowski, 2000.)

This paper describes a development process where a tax return automation tool is created for the target organization (service provider). First, the theoretical framework, research questions and objectives around tax return automation are introduced. Secondly, a case study related to data transfer automation is presented and analyzed. The next section describes the tool build up process based on the findings from the case study and related theory. Finally, in the results and discussion sections, final outcome and results are discussed and illustrated in form of a SWOT-analysis.

1.1 Operative environment

As background information, the target organization is a business consultancy company servicing clients in various areas including tax, law and assurance. More specifically, this research is targeted to the firms tax department's Global Mobility team where one of the core services is tax return preparation for expatriates in home and host countries.

During the past few years, the organization has identified and internally discussed about the possibility to create a tool that would help automate certain parts of the tax return preparation process. This need has raised as some of the clients have large rather homogenous assignee populations inbound to Finland. In some of these cases the tax position in Finland tends to be quite standard and straightforward. This means that certain tax calculations (e.g. gross-to-net calculation) are relatively simple to prepare and mainly follow the same formula for each assignee in the population.

Based on the above background, the objective of this paper is to describe and document the building process of an artifact, new tool, for automating part of tax return preparation process. The tool is used automate the preparation of tax calculations before transferring the results onto tax return draft before filing the final tax return to the tax office.

1.2 Tax return process

In order to understand the reasoning and logic for creating a tool for tax return calculation automation it is important to first introduce the actual tax return service process from a service provider point of view. In summary, the tax return service process follows a yearly cycle with the following steps (see figure 1 below).

Figure 1: Simplified illustration of tax return service process for assignee

In the first step the client authorizes the service provider to assist its assignee (employee) in preparing his or her tax return. The client sends the service provider information about assignee population and determines in which countries (home and/or host) the service is required (usually with the help of service provider).

After final confirmation of the assignee population has been received, the service provider needs to determine what information is needed from the client (assignee's employee) in order to prepare the tax returns. Usually this information consists of salary data provided directly by the client or via an external payroll service provider. The second step is very important in relation to the tax return automation process, as the automated tax calculations and their correctness is based on the background (compensation) data supplied by the client.

The actual tax return automation processes can be applied to step 3 at which point the actual tax return is prepared and tax calculations are done. The idea is to automate all such calculations that follow a predetermined formula and then run these calculations through the whole assignee population, one after one. After the calculations have been completed and reviewed, the results are transferred to the tax return form and filed to the tax office on behalf of the assignee, thus ending the tax return preparation process.

This paper concentrates mainly in steps 2, 3 and 4, as these steps are related to the development of the tax calculation automation tool. Therefore, steps 1 and 5 are not covered in much more detail as they are not relevant for the research.

1.3 Software development

The biggest trend during the past 10-20 years in software integration has clearly been combining different smaller systems into bigger software assemblies, or main systems. The basic principle is that all systems communicate with each other in a way or another. A general expression used of this trend is “System of Systems”. (Haikala et al 2011, 18-19.)

Software development is usually organized as projects with an emphasis on the supplier point-of-view. Simply put, a software development project aims to simply develop a software that answers to the needs of the customer. In reality, these projects do not “rise from nowhere” but they are always based on real business requirements and objectives.

A customer can mean either an internal customer within the company or an external customer. Respectively, also the supplier of the software can be either internal or external. One main identifier of an external customer is that a contract is made between the counterparts. The main point is to provide the customer with a software solution that solves their problem(s). (Haikala et al 2011, 18-19.)

Software development project from a Client perspective

The customer usually sees a software development project in a larger perspective than the software provider as the objective is directly linked to business targets. Development projects can be scaled upwards to larger development programs which are carried out through in smaller, individual projects. Single programs have a clear life cycle, starting from an idea to production and ending to pulling out from production. In order to avoid overlong projects it is recommended to divide projects into smaller sub-projects, such as pre-planning, specification and implementation. Below, the abovementioned sub-project types are introduced in more detail.

1) *Pre-planning*
   In this phase mapping of different alternatives for software development is made. It needs to be assessed which development method (do-it-yourself, subcontract, or buying software) is most cost-efficient and serves overall business goals in the best way. Other typical activities in this phase include: cost & gain-analysis, need-analysis, risk-analysis and decision about when to (or not to) move on to the next phase (specification).

2) *Specification*
   The specification phase initially describes the end product of the project. This phase

includes functional specification and preliminary development planning which are both used as basis when planning risk management, human resource and budget allocation for the project. The results from the aforementioned planning is also used to support management decision making before proceeding to the next phase.

3) *Implementation*
The implementation phase starts the building of the actual software based on the plans mapped in phases 1 and 2. In other words, this phase puts theory into practice. The majority of the programming is made in this phase and testing plays a major part as well. (Haikala et al 2011, 19-21.)

Software development project from a Supplier perspective

From supplier side, the main framework for software development forms from the requirements given by the customer. These requirements should describe the content and objectives of the project as accurately as possible. If the requirements are communicated with clear detail, the project is, in theory, a description from needs to implementation. In practice, describing project needs this accurately is virtually impossible as there are always additions, clarification and amendments throughout the project life cycle. Also, many details from the implementation phase may affect the customer's initial plans as it "may come out in the wash" that e.g. some technical requirements are not possible to be met.

Another challenge from the supplier side is that all requirements and risks cannot be 100 % reckoned with, although a comprehensive planning phase has been done. Therefore, during the planning phase, the customer and supplier usually agree upon "adequate enough" requirements and emphasize on managing issues rather than over-excessively avoiding them. (Haikala et al 2011, 22.)

When building large integrated system assemblies, multiple different types and sizes of software is usually required. The properties of these different software components normally vary greatly. Thus, a program that consists of various smaller software components may grow out to be a very complex, decentralized system. This may lead to the risk that a system may become too complex for a single designer to control.

The above mentioned challenges should be considered in the planning phase of SD. Thus, following basic requirements should be emphasized: 1) Pre-assessing compatibility of different software components before combining them in the main system; 2) Communication between different software components in the system; 3) Designing and developing layers between these components. (Haikala et al 2011, 18-19.)

Total cost for a development project

When developing an existing system, or creating a whole new one, the total cost is always something that needs to be taken into account and evaluated. The total cost for a development project consists of many different factors, i.e. needed tools, programs and licenses, skilled staff, operational support and marketing costs. (Toikkanen 2013.)

For a single tool development project the “Total Cost of Ownership” can change from year to year, e.g. due to changes in the client requirements or work amount. It is important to review the original cost-to-benefit ratio to meet the current requirements. When determining the total cost, indirect benefits (such as goodwill and client satisfaction) should also be evaluated side-by-side with the direct benefits (i.e. actual profit/revenue). (Toikkanen 2013.)

Continuous development should be identified as a crucial success factor in the beginning of the development project. Every software that is in active use will also need continuous development and maintenance. By utilizing “continuous and dynamic development”-approach, the project team can better manage total costs when compared to ending and starting separate projects each after another. (Toikkanen 2013.)

1.4 Research questions

The main research questions of this paper are: A) How can tax calculation automation increase overall work efficiency?; B) How can risks and threats related to tax calculation automation be identified, avoided and understood?

The first question raises out the need to understand actual advantages of tax calculation process automation and how this is linked to increasing work efficiency in an organization. Answers to this research question will be brought up in the results section when calculating the cost efficiency and identifying the tools to measure increased work efficiency.

The second research question focuses on bringing up potential risks, treats and pitfalls. Additionally, answers to this question should be taken into account when planning and designing tax calculation automation process.

On a more practical level, the answers to the above research questions will serve as guidance for management when making decisions about implementing process automation in future or ongoing client engagements. The findings from the research questions will be summarized in form of a SWOT-analysis in the results section of this paper.

1.5 Reliability and validity of the research

The reliability of the research measures ability to reproduce the research results or provide non-random results. The reliability can be determined in many ways, for example if two researchers arrive to the same result can the research result be defined as reliable. (Hirsjärvi 2000, 213.)

If another person would have conducted the same research, using the same materials and data, the same results could have been reached. Thus, from my perspective, the reliability of this research is fulfilled.

The importance of reseach validity is that it reflects the accuracy of how findings are actually happening in the field (Miles & Huberman 1994). The validity of the research is defined by its ability to measure what it is supposed to measure. The key aspects of qualitative research is portraying and describing individuals, places and events as accurately as possible. Validity means "the compatibility between the described matter and explanations derived from it". (Hirsjärvi 2000, 213-214.)

Patton (2001) describes validity and reliability as factors that need to be taken into account through the whole research, from planning to analysis of results. The reliability of any qualitative research is a consecuence of its validity (Patton 2001).

In this research the validity has been met by collecting relevant material with respect to the research subject. The research method answers to the questions that the theoretical framework, empirical target and research methodology raises. The results and findings from the research target have been processed and analyzed as original and unique as possible. Therefore, the needed level of validity of this research has been reached.

2 Research methodology

2.1 Information systems research

An information system is the confluence of people, technology and organizations (Davis & Olson 1985; Lee 1999). Research of IS can be categorized in two main paradigms: behavioral science and design science. Behavioral science concentrates to develop and verify existing theories that can be used to predict or explain human or organizational behavior. Design science relies on existing behavioral science and natural laws and is used to broaden and build up from behavioral science by creating new and innovative artifacts. (Hevner et al 2004.) Design research can be seen as an artificial science that is strongly based on practical needs of the engineering field (Simon 1996).

The theories derived from behavioral science lay the foundation and set up the framework upon which design decisions are based upon. Again, these design decisions are made based upon the functional capabilities, content, selected development methodologies and implemented human interfaces of the information system. (Hevner et al 2004.)

In IS research, when designing new artifacts, the lack of existing theory can increase the complexity of the research. Information technology is applied to new application areas that have not been believed to be utilizable before (Markus et al 2002). This leads to the conclusion that providing new intellectual and computational tools, or IT artifacts, expand the existing human and organization problem solving skills (Hevner et al 2004).

The co-relation and interplay between business strategy, information technology strategy organizational infrastructure and IS infrastructure is becoming increasingly important. This is due to the fact that information technology is more and more serving as the enabler of business strategy and organizational infrastructure (Kalakota & Robinson 2001; Orlikowski & Barley 2001). This interplay between strategy and infrastructure is illustrated below in figure 2.

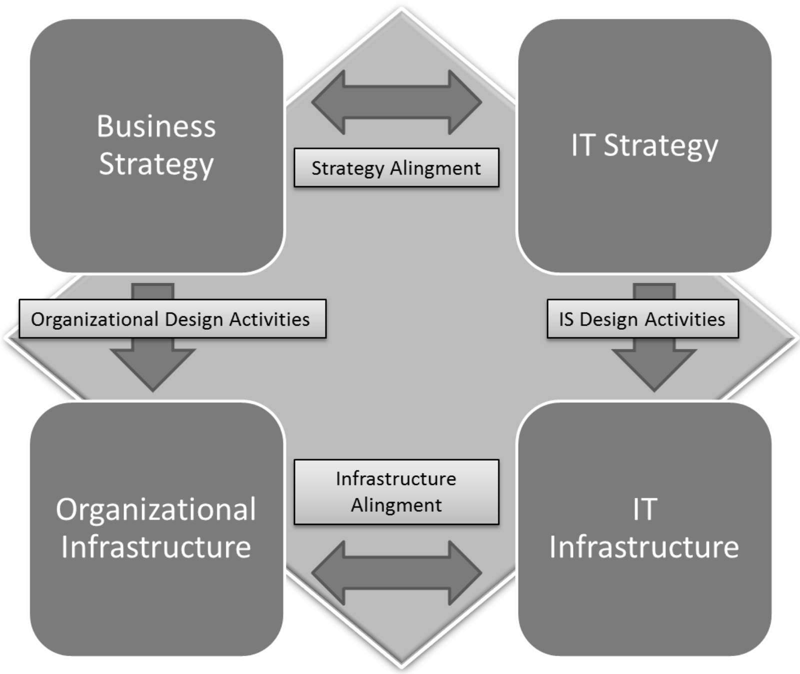

Figure 2: Design activities in Organizational and IS Design (Henderson & Venkatraman 1993)

As all the four dimensions need to be evaluated when planning information systems, the planning process becomes complex. In order to efficiently transfer strategies into infrastructures, intensive design activities are needed on both sides. In other words, IS design is needed to create effective IT infrastructure, and organizational design is needed to create effective organizational infrastructure. (Hevner et al 2004.)

2.2 Design science guidelines

When planning an IT artifact several general guidelines should be followed in order to take into account the advantages and disadvantages of creating such artifact. Hevner et al (2004) have identified seven guidelines to serve as a framework for the construction. It is important to understand that in design science process the actual design problems and solutions are not always pre-existent but evolve during the building and application of the artifact. The following analysis and summary of the seven guidelines serve as the principles for the planning, building and testing of the tax calculation automation tool.

1. *Design as an Artifact*
   The end product of design-science research must be in the form of model, method, instantiation or construct. The designed artifact should be a purposeful tool to solve an important organizational problem. According to Orlikowski and Iacono (2001), an IT artifact can be seen as the "core subject matter" of the IS field. Information systems can be efficiently constructed when utilizing the results of ideas, practices, technical capabilities and products (Tsichritzis 1998).

2. *Problem Relevance*
   The ultimate goal for design research is to create technology based solutions for yet unsolved and important business problems. Behavioral science approach to this would be development and justification of theories that support or predict the occurred phenomena. On contrary, design science approach is the construct of a new, innovative artefact that aims to change the phenomena that occurred. Both methods are required in IS creation and it is important to identify their differences.

3. *Design Evaluation*
   In order to demonstrate i.e. the quality, efficacy and utility of the design there needs to be well planned evaluation methods. The basis for evaluation of the artifact is established in the business environment by integrating the artifact to it. Determining appropriate metrics and gathering relevant data is essential for evaluating the artifact. Different evaluation methods include: reliability, usability, performance, completeness, accuracy, among others. Artifacts can be reliably evaluated if analytical metrics are appropriate. A design artifact has achieved its objective when it delivers the solution to the problem it was designed to solve. As conditions (e.g. technology or

business environment) change, the assumption made in earlier evaluations become obsolete and invalid.

There are five main methods for design evaluation: 1) Observational (utilizing case or field studies); 2) Analytical, i.e. examining structure of artifact to analyze its static qualities; 3) Experimental, e.g. a simulation of certain function using artificial (test) data; 4) Testing, in order to detect failures and defects; 5) Descriptive, where different scenarios are built to demonstrate an utility of the artefact.

4. *Research Contributions*
   The design methodologies and foundations should be clearly identified in order to evaluate the contributions of research. According to Hevner et al (2004), there are three types of research contributions based on the novelty, generality and significance of the designed artifact. However, beyond these, the research must always solve an important problem and provide a significant contribution to the business environment.

5. *Research Rigor*
   Rigor provides information on how the research is actually conducted. Design research relies in the application of rigorous methods in evaluation and design of the artifact. As an example, an artifact might designed to follow certain mathematical rigor in its basic functions. However, when the artifact is put into use in the business environment it can defy the excessive formalism. Therefore, rigor must be assessed from a practical point of view as overemphasizing on rigor can lead to lessening of relevance. Claims about artifacts increasing efficiency are usually based upon performance metrics. Therefore, measurement of different metrics should be constantly evaluated in order to maintain desired level of rigor in the research.

6. *Design as a Research Process*
   In order to reach desired results, the research must follow laws of the environment it operates in while utilizing all available means (Simon 1996). Representation of laws, means and ends make for the crucial components of design research. These components are dependent on the environment and always include innovation and creativity. Laws present the uncontrollable forces within the operative environment. Means identify the set of actions and resources available to reach a solution, while ends are goals and constraints on the solution. An effective design needs information on both the application and solution domain.

7. *Communication of Research*
   Communication of research should be targeted to both management- and technology-orientated audiences. The technology-orientated audience needs information on how to construct and implement the artefact into the desired environment. Management-orientated audience look for information in relation to the cost and allocation of organizational resources when constructing or using the artefact in the desired environment. According to Zmud (1997), when presenting an artefact to the managerial audience it is important not to concentrate on the inherent features and functions of the artifact itself. Instead, the highlight should be on the importance of the problem it solves and how effectiveness is realized when the artifact is utilized.

2.3 Systems development

Systems development can be seen as a methodology within information systems research (or IS research) which argues that the research question should be observed multi-dimensionally and multi-methodically. Essentially systems development is an integrated research method utilizing theory building, experimentation and observation as its key drivers for development. (Nunamaker et al 1991.)

In their journal, Nunamaker et al, explain in detail each of the three angles of view. The most important finding of their theory is that modern systems development process should be seen as multidimensional (see below figure 3). This is important in order to keep up with the ever increasing level of technical innovation and organizational acceptance. E.g. when creating a system it should not be built only based only on theory (i.e. mathematical models) but the other viewpoints (observation and experimentation) should also be utilized in order to create effectively functioning system that fits the modern requirements. Next, these viewpoints will be opened up and analyzed one by one in order to create the theoretical framework around the research subject. (Nunamaker et al 1991.)

Theory building

Per Nunamaker's model, theory building accounts for developing and inventing of frameworks and models used in the system being created (for example data or simulation models). This means that theories are usually very general and contain many constraining assumptions. Thus, they are often limited in their practical relevance. For example a certain mathematic formula usually only provides an answer to one specific question. Therefore, theory building is as a part of information systems research that only provides the body of knowledge for the new domain but does not create anything new based on the knowledge. (Nunamaker, et al 1991.)

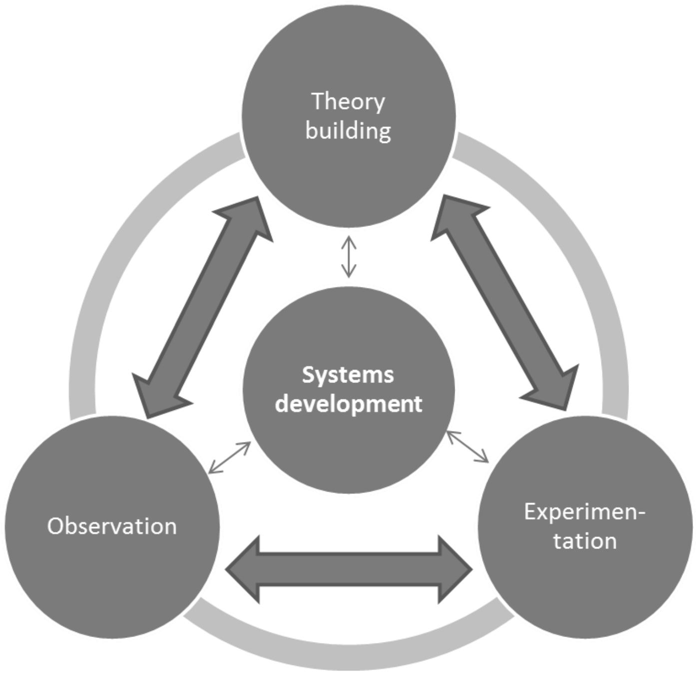

Figure 3: Nunamaker et al (1991, 94) - Approach to multidimensional IS research

Experimentation

This dimension consists of the practical research of the system using e.g. laboratory tests, computer simulation or field testing. Result from the research can be used in order to improve systems or redefine theories. Theories serve as the guidelines for designs created by experimenting and these designs are facilitated by systems development. Experimentation can be seen as a two way method, either looking forward or backward along the research life cycle. (Nunamaker et al 1991.)

Observation

Observation, on the other hand, is used when there is very little information available of the research subject and the researcher needs to establish a “feeling of what is related” to the subject. Observation uses unobtrusive methods like case studies, sample surveys and field studies to gather information about the subject. (Nunamaker et al 1991.)

Systems Development

Finally, in the core of the model is systems development or SD. According to Nunamaker et al (1991), it consists of five different stages: concept design, constructing system architecture, prototyping, product development and technology transfer. Systems development serves as a hub and interacts with other research methodologies. In IS research no single research method should be regarded the dominant one as no one methodology is adequate by itself.

The motive for selecting systems development as the main methodology for this research is, that it is specifically used in computer science and computer engineering, thus very closely related to the research subject. Later in this paper the research process will be described using systems development perspective.

2.4 Case study research

The second relevant type of research methodology used in this research is case study method. In order to plan and develop a new automation tool it is good to review what has already been done in order to identify and avoid risks related to the project. Case study method is an excellent way to get this information to support the planning of the new tool.

Case study research is one method of qualitative research. The most distinctive feature for case study research is its objective to find information about a specific case or a small group of similar cases. Another obvious feature for case study research is identifying and defining the specific case or cases. The research target can be an individual, group or organization. The main objective is usually describing the occurrences in the case study. (Hirsjärvi et al 2000, 123.)

According to Yin (2009), case study research is the most suitable research method to use when quantitative methods cannot be reliably used or when it is not meaningful to separate the research subject from its context. Another distinctive feature for case study research is that the researcher does not have any possibility to affect the research subject (Yin 2009). Using case studies improves research validity as group comparison and wide range of data is used (Miles & Huberman 1994).

In this research, case study research was used because the objective is to gather information and learn about a specific process (data automation) by observing an existing process documentation (tax calculation preparation).

The data for this case study research was gathered using two of the six “primary source of evidence categories”: direct observations and documents (Yin 2009). John Curry’s (et al 2010) article " Achieving Greater Efficiency Through Tax Automation" will serve as the document source. My own direct observations and analyses are used to evaluate the suitability of implementing Curry’s findings when planning the new artefact, or tax calculation automation tool.

2.5 Case study: Achieving Greater Efficiency Through Tax Automation

An article named "Achieving Greater Efficiency Through Tax Automation" by John Curry (et al 2010) was selected as the case study target. In the article, Curry considers using automation processes to achieve greater efficiency in tax return preparation.

2.5.1 Assessing need for tax return automation

As organizations face increased monitoring of correct tax treatment and compliance in tax jurisdictions the need for improving efficiency, minimizing mistakes from manual work, has increased. As a result, discussion and topics related to automation of tax return preparation has grown and become more popular. (Curry et al 2010.)

Tax automation always requires an investment both time and resource wise. For example, creating a tool (artifact) to automate a tax calculation will allocate time (hours needed for programming of the tool) and human resources (person(s) needed to do the programming). Therefore, when making decisions about automating tax return process, Curry (et al 2010, 3) emphasizes the importance of estimating the complexity of the process as a whole. The amount of manual work needed in each process step must be analyzed and documented. It is also important to identify the sources of different data types (e.g. which data comes from the client or assignee and which from the tax authorities). Also, the average time allocated to the old manual processes should be measured in order to compare the two methods (automated and manual).

The results of these analyses and measurements serve as important background information and are compared against the amount of total tax returns to be filed. The conclusion of this analysis should be used when assessing the need to build a tool for tax return automation. (Curry et al 2010.)

2.5.2 Implementing tax automation process

When implementing tax automation it is important to understand the linkages and need for cooperation between different departments in the organization. For example IT department could support with programming of the tool. On the other hand, IT department would need support from tax department in order to understand and create the tax calculation formulas. John Curry (et al 2010) introduces the following three step model as guideline when implementing tax automation process:

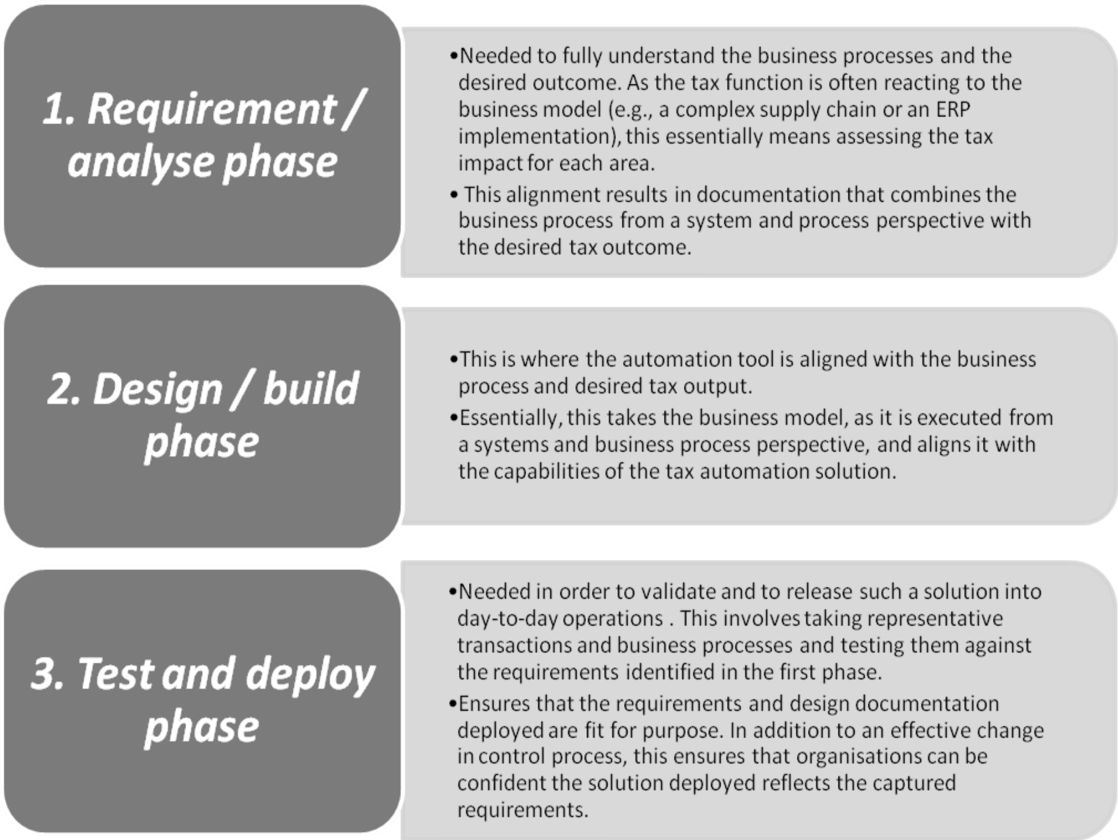

Figure 4: Guidelines for implementing tax return automation (Curry et al 2010)

As the industry is increasingly regulated and audited by tax authorities, it is important that the documentation requirements in each above step are followed. For example, in case of a tax audit at the client, it is critical to have documentation proving that laws and relations were followed during tax return preparation. (Curry et al 2010.)

2.5.3 Case study findings

The key findings of this case study research concentrate around answering to the research questions presented earlier. The key points and findings, from both the advantage and disadvantage perspective, will be assessed in the subsections below.

2.5.4 Advantages of tax return automation

When analyzing how tax return automation can contribute to increasing efficiency in an organization the below findings were made (based on the case study). Automation of tax return preparation will: 1) Minimize the risk of errors in data transferring (compared to manual process); 2) Decrease the amount of manual work phases; 3) Enable more efficient time allocation for staff; 4) Increase total effectiveness of work.

Tax return preparation usually includes many steps that are done manually. Manual transfer of data, be it writing numbers on a tax return or inputting data to tax calculations, always includes risk of typing errors. Therefore, when automating e.g. tax calculation data feed process it can be stated that the chance for typing errors is minimized.

The substance value of manual work phases in tax return preparation is very low. Usually the manual phases e.g. transferring salary data to tax calculator or calculating social security contributions are done by the trainee level staff. By automating these processed the amount of manual or routine work phases can be decreased substantially.

As a direct result of decreasing manual work phases, more time can be allocated to work that requires more substance competence that cannot be automated (or at least cannot be seen as automated based on this research). This type of work includes e.g. determining tax filing liabilities in different countries.

In summary, all the above mentioned steps will contribute to increased total effectiveness of tax return preparation related work. This will then result as increased profit as resources can be allocated in a more efficient way.

2.5.5 Challenges in tax return automation

As with all development related research, treats and weaknesses are always present. By analyzing the case study the following findings related to threats and weaknesses can be made: 1) One simple error in e.g. calculation formula will result as error on all calculations affected; 2) Changes in e.g. laws and regulations will not be automatically reflected in the tool; 3) Usage and understanding of working logic of automated processes can be challenging; 4) Is the needed amount of documentation created for e.g. audit trail.

Clearly the biggest threat to tax return automation is related to the actual planning and designing phase. If a wrong value is used, e.g. when creating a formula to calculate social security contributions on a tax return, it will reflect to all the calculations that the automation creates. In order to manage such risks, the organization should focus on developing a comprehensive review and testing process. To ensure data validity, the results derived from automated calculation formula should be reviewed and compared to calculation results derived from using manual calculation to see if same result is reached.

Another threat to data integrity in tax return automation is presented from the changes in laws and regulations. As the calculation formulas are created using “to date” information the changes in e.g. municipal tax rates are not automatically updated to calculation formulas. The result of ignoring these changes can result as incorrect calculations and, again, this has multiplied impact on all tax calculations created with the automated process.

As stated in the case study article, creating documentation about the tax automation process is very important. Two key findings of required documentation can be made. Firstly, creating documentation about the working logic and usage of tax return automation tool is essential. In order to prepare the tax return the tax advisor needs to understand the logic behind the calculation results. How was this amount calculated? What was the different income types used to arrive such calculation results for total earned income? These would be just couple of examples that would likely arise among the tax advisors. The documentation should explain how the automated calculations arrive to each result.

Secondly, it should also be considered what documentation regarding the calculations is necessary to be compliant with regulations issued by authorities. In case of a tax audit, it is needed to go back to review e.g. how a certain calculation was accomplished. The organization should review the automation process and be confident that at least the same level of compliance is reached in comparison to manual process.

2.6 Research process

In order to build the tax calculation automation tool, a software development plan was created based on Curry's model (introduced in the case study). The tool building process was separated in to four phases: 1) Requirement/analyse; 2) Design/build; 3) Test; 4) Deployment.

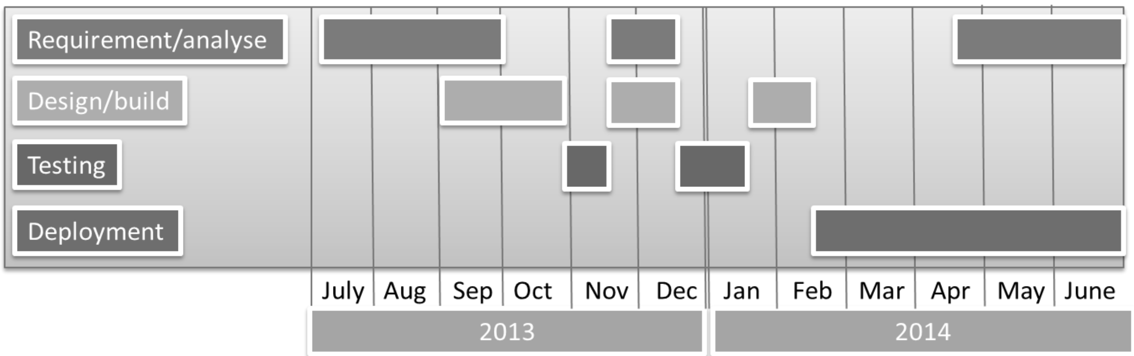

Figure 5: Software development plan for tool creation project

2.6.1 Requirement/analyse phase

In an internal initiation meeting (held in Autumn 2013) the requirements for the salary data were identified. A detailed and in-depth analysis of the required salary data was done and need for different salary components was examined. This data analysis can be seen as an essential part of the tool creation process as it determines the values needed for preparing the tax calculations.

Once the data analysis had been completed, the team compiled a list that included all the salary components that were not included in the preliminary salary data received from the client. Such components included, e.g. income/deduction types, possibly paid bonuses or allowances, etc. Please refer to appendix 1 for comprehensive listing of different salary items, including income and deduction types.

After repeated correspondence and meetings with the client representative the team was able to get the salary data file finalized. At this point a final review of the data was performed. The objective was to find any obvious invalid data entries which could be easily corrected before processing the data further. Examples of such invalid entries would be positive amount of paid tax (should be negative value) or if amount of tax paid over salary would be bigger than paid salary or if a value for paid allowance would seem to be too high, etc. Such issues were actually detected, e.g. assignment dates were wrong way around and this resulted in negative value when calculating days spent in Finland. All the identified issues were summarized and communicated to the client. Corrected values were then received from the client, thus the validity of data was significantly increased.

2.6.2 Design/build phase

Tool design phase began with identifying the most efficient way to combine the different elements needed in the tax calculation automation tool. The three main components (or database classes) needed, are salary data (provided by client), tax calculator (internal existing tool), and results database (to store result feed from tax calculator). Each of these three components were named as a main class of the database, namely 1. Salary data; 2. Tax calculator; 3. Results database. At this stage both, the salary data and tax calculator, were already compiled/built and ready for use. As the aforementioned database components were constructed in Excel spreadsheets, it was decided that the result database would also built in the same format. The results database was a simple spreadsheet that included different columns for each result item (see appendix 1).

Once all of the three main components were built, it was time to combine them into one single database. This was accomplished by moving the different Excel sheets to one master database. The tax calculator served as the master file where other sheets were moved in to. The reason for this was that the tax calculator spreadsheet itself includes multiple sheets, formulas and references between them. Thus, it was the fastest and simplest way to move the less complicated sheets to the tax calculator file. Before the transfer, a file compatibility check was made for all the different spreadsheets. It was ensured that all the files were stored in the same Excel version in order to avoid any compatibility issues when moving data between the different tool components. Finally, sheets that included only background data and calculation formulas were hidden to increase overall usability of the tool.

After the master database was compiled the next step was to design how the data would be transferred between different tool components. First of all, it was needed to determine what relevant data from the salary main class would be needed to be transferred into the ax calculator class. A separate internal meeting was held where these requirements were assessed. As a conclusion of the meeting, the salary data inputs (displayed in table 1 below) were determined as the required values for the tax calculator in order to calculate the correct results to be reported in the tax return.

The calculation formulas (displayed below) were built in the Salary data spreadsheet and results from the calculations were added in new data columns, namely "Net salary" and "Compulsory social security contributions".

Required tax calculator value	**Related values in salary data (subclasses)**	**Calculation formula to reach required value**
Net Salary	Car benefit Daily Allowance Deductions Foreign salary (taxable additional) Foreign salary net Housing benefit Other benefit Phone Benefit	Net salary + Deductions + Foreign salary net + Other benefit + Phone Benefit + Housing benefit + Car benefit + Foreign salary (taxable additional) - Daily Allowance = Net Salary for Gross up
Compulsory social security contributions	Pension contribution Unemployment insurance contribution	Pension contribution + Unemployment insurance contribu tion = Compulsory social security contributions

Table 1: Calculation formula determination for tax calculations

After all the required values to be transferred to tax calculator were identified and available, it was time to create the actual process for transferring the values from the salary data class to tax calculator. This was done by recording an Excel macro that copies one salary data figure at a time and pastes it to the correct value field in the tax calculator data collection sheet. At first, a starting point (cell reference) is needed to be determined inside the spreadsheet to begin. The macro would use this as the starting point of the loop and return to this value after the loop ends.

Once a value has been entered in the data gathering sheet, the calculator automatically starts the computation of appropriate tax amount based on the integrated formulas working in the background. Therefore, calculation result sheet displays calculation results and immediately updates the figures based on the values entered in the data collection sheet.

When all required salary data inputs have been completed the macro starts to feed values from the calculation results sheet to the predesignated cell in results database using the copy/paste commands. At this point the macro has finished its process and has returned results needed for one assignee's tax calculation. In other words, the tool has completed one successful loop. In order to fully automate the process the macro needs to be programmed so that it loops until there is no more data to process (a blank cell is found).

As explained above the loop ends at the starting point of the macro. In order to create a continuous loop, a "*Loop Until IsEmpty ActiveCell.Offset(-1, 0)" function* was used. Basically this function orders the macro to continue the loop using value from below cell (Offset -1), or if the value in the below cell is empty, to stop the loop.

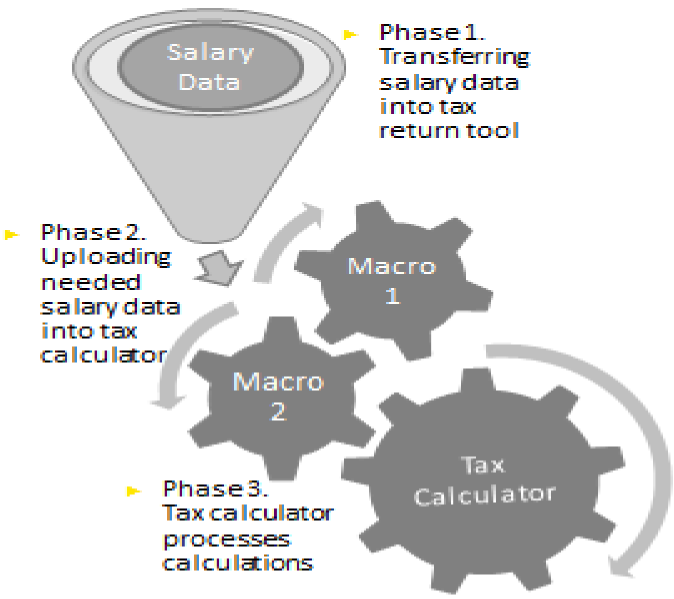

Figure 6: Tax calculation tool operating model

2.6.3 Test phase

Testing was seen as a very important phase in the project. Fewster & Graham (1999, 101-110) refers to testing as a process of determining whether or not the software has produced the correct outcome. This outcome can be reached by performing comparison between the data produced by the software and the data the software is expected to produce. This comparison method is also referred to as comparator. In general, there are two main types of testing methods: dynamic an post-execution. Dynamic testing means that testing is run at the same time the tool is executing, while post-execution testing focuses on testing the actual end result.

Clearly post-execution testing is more cost efficient way to perform testing as it does not consume time in testing tool functionality. For the same reason reason, this testing method was chosen for testing the tax calculation automation tool. In case the comparison would result in any difference in the final amounts, the test run would be done again using dynamic testing in order to detect the cause for difference (e.g. manual calculation versus automated calculation script or macro).

In order to test the automation process a test group of ten randomly picked assignees were selected from the input (salary) data. The rationale for this was obviously that performing calculations and reviewing all 460 assignees would have taken lot of time and resources. The second reason was that, if the automation process was working as supposed, the results should all be correct. This is because the exact same macro and calculation steps were used and therefore it could be trusted that the results would be as correct (or incorrect) for the whole data.

In order to run through the testing a specific test team was for formed. The 3 person team consisted of one employee who did the calculations by-hand, e.g. inputting the values into the calculator and extracting the results manually. I served as the second member of the test team and ran the same 10 test assignees through the automation tool using the loop macro.

The third team member was not involved in performing the calculations, but his role was to review the test results. The test results were in line with the expectations that the team had. We had estimated that there might some errors in the manual process resulting from human error. For the automated process the estimation was that it will deliver the exact results what it was programmed to do. Table 2 below summarizes the test results.

Test ID	Result value for automated process	Result value for manual process	Reviewed correct value	Root cause for error
1	6546,10	6546,10	6546,10	
2	6576,21	6576,21	6576,21	
3	6700,80	5500,72	6700,80	Human error, copied wrong cell
4	6709,66	6709,66	6709,66	
5	6821,17	6821,17	6821,17	
6	7003,20	7003,20	7003,20	
7	7037,01	7037,01	7037,01	
8	7134,84	7134,84	7134,84	
9	7147,82	7147,82	7147,82	
10	7227,73	7227,83	7227,73	Human error, misspelling of value

Table 2: Summary of results for test batch (n=10)

2.6.4 Deployment phase

Once the testing had been completed the deployment phase was initiated. A start up meeting was held in January 2014 where the design and testing phases were reassessed. The idea of the meeting was to reinsure that every aspect of the tax return preparation process had been taken into account and that the automation tool was working as planned before initiating the final run for the full assignee population. Any issues identified at this stage would be easier to correct by reconfiguring the tool, e.g. calculation formulas or macro programming.

As a result of the meeting the only amendment to the tool was to add a column that compares the difference (in percent) between the original tax (net amount) to the grossed up tax value calculated by the tool. This value would then act as a safeguard when reviewing the calculation result per each assignee. It was agreed that if the difference exceeds a threshold of 40 %, such cases would then be reviewed in more detail. The logic for determining such threshold is based on previous experience of performing similar calculations with the tax calculator. Any difference above 40 % would raise concern towards the reliability of the calculation result.

After final configurations had been done the date for running the whole assignee population was set to Friday 2nd May 2014 at 15:00. Choosing this date and time was based on the fact that it was the quietest day of the week and network usage relatively low. This would ensure optimal conditions for running the macro loop and reduce any network usage peaks that might disturb the process.

3 Results

In order to evaluate the performance of the tax calculation automation tool the following set of performance and results indicators were created (Mondaq 2011). Performance indicators (PI's) include: A) Time allocation; B) Amount of errors. Results indicator (RI): Cost and gain relation analysis.

3.1 Time allocation

The time allocation indicator was created by measuring and comparing the time allocated between new and old model when preparing tax calculations. This was carried out by setting timing the both of the preparation processes using a stopwatch. Automation process was named as Option A and it covered the full population of 460 assignees. As it made no sense time wise to run through the whole assignee population using the manual model, it was decided that a random ten assignee batch would be used for measuring the manual model, Option B. The average result for ten calculations would be used as the benchmark figure per assignee for the manual model.

The method for the manual tax calculation is basically the same as for what the macro does (explained in detail in chapter 2.6.2.). However, as every copy/paste action and change of datasheet is made manually, by hand, the time allocated in this process is significantly longer. Table 3 below summarizes the results of the time allocation measurements between Option A and Option B. Results are displayed in the following format:Minutes:Seconds,Hundreds. The detailed results of the test batch run can be found in appendix 2.

	Option A	**Option B**
Average time per assignee	0:00,28	0:35,41 (average from 10)
Formula for determining total time	3:38,05/460	0:35,41 * 460
Total time processing all 460 assignees	3 min 38 s 05 hund	4 h 31 min 27s 22 hund (based on average)
Difference between A/B (%)	7 469%	

Table 3: Processing time for Option A/B

As expected Option A is significantly faster method to perform the calculations and, in fact, Option A is about 75 times faster than Option B. It is noteworthy that the comparison does not take into account the need for rest when performing the manual calculations. It is obvious that a human is not able to perform the calculations continuously for about 4,5 hours without adequate breaks in between (at average rate of 35,41 sec/calculation).

3.2 Amount of errors

The performance indicator for errors can be either measured by the amount of total errors found in data or their relative occurrence in percent. After running through the final data, (n=460) using the automated macro and reviewing the results, no errors were identified. However, during one of the test runs that were done earlier, the development team spotted one error in the calculation formula. This mistake led to the harsh fact that all results provided by the tool were incorrect. Hence amount of error for the test run was 460 and 100 % error percentage. The error related to a social security contributions that was not taken into account in the formula, thus resulting in too high gross salary amount. However, after fixing the formula and testing the tax calculation result, the errors were cleared and error percentage decreased to 0 %.

In the manual calculations, two of the 10 example calculations included errors. Both of these errors very due to human error. The first error related to copying and pasting data from the wrong cell (the cell next to the right one) and the other one related to misspelling a value. The error percentage in the manual model is therefore 20%, which seems surprisingly high.

3.3 Cost and gain relation

When estimating the cost and gain relation for implementing tax return automation process in an organization the following formulas can be used to get a rough estimate to support business decision making. The formula takes into account the estimated profit gained if tax return automation is used in certain client engagement.

ESTIMATED NET ENGAGEMENT PROFIT

ER - TEPSC = Estimated net engagement profit

ER= Expected Revenue. Total estimated revenue from client (e.g. tax return fee x assignees)
TEPSC = Total Estimated Process Setup Costs (tool setup, programming, testing, reviewing etc.)

ENGAGEMENT PROFIT INDEX

$$\frac{\mathbf{ER}}{\boldsymbol{TEPSC}}$$ **= Engagement profit index**

Figure 7: Calculation formula for engagement profit index

If engagement profit index is ≥ 1 engagement can generally seen as profitable.
If engagement profit index is ≤ 1 engagement can generally seen as not-profitable.

In case the engagement profit is smaller than 1 the organization should carefully consider whether to utilize tax return automation. In this situation, additional calculations that take into account the expected revenue from e.g. next year's tax return preparation could be used to estimate the expected "payback point" for the investment.

4 Discussion

This paper concludes that tax return process automation can be seen as an effective method to increase the efficiency and quality of the tax return process. Results show that the automation process can significantly reduce the staff time investment needed for performing tax calculations. This then makes more staff resources available for other tasks that i.e. require such core competence that cannot or is not meaningful to automate.

When planning tax return automation there are a lot of matters to consider. First of all the organization has to analyze and decide if the estimated gain of using such process is greater than the costs of resource allocation to the process. In other words, is the implementation of such process reasonable business wise and does it support the overall business goals? Is it in line with organizations strategy?

4.1 Implications

Based on the findings of this paper the below SWOT-analysis framework was constructed to summarize the strengths, weaknesses, opportunities and threats related to tax calculation automation process.

Even many benefits can be seen from automating tax return processes, still, before making any decisions about building such tool for automating part of the process, the cost and gain relation should be assessed. The assignee population plays a significant role in the decision making. The time and resource allocations for planning and designing a tool can be seen to pay off for rather large assignee populations where the tax positions are simple and homogenous. If the tool is designed for a small assignee population the relative time gain for tax calculation per assignee lowers. Also the complexity of the tax return calculations needs to be evaluated in order to decide upon automating such process.

It is also essential to understand the importance of the design and testing phases. Making sure that all calculation formulas are correct and that the salary data is properly reviewed minimized the risk of potential errors in the calculation. Another important fact is that one mistake in the automated macro results as a mistake in every calculation that the macro performs. This may lead to time consuming correction procedures, especially if the mistake is only spotted only after the tax return is filed to tax authorities.

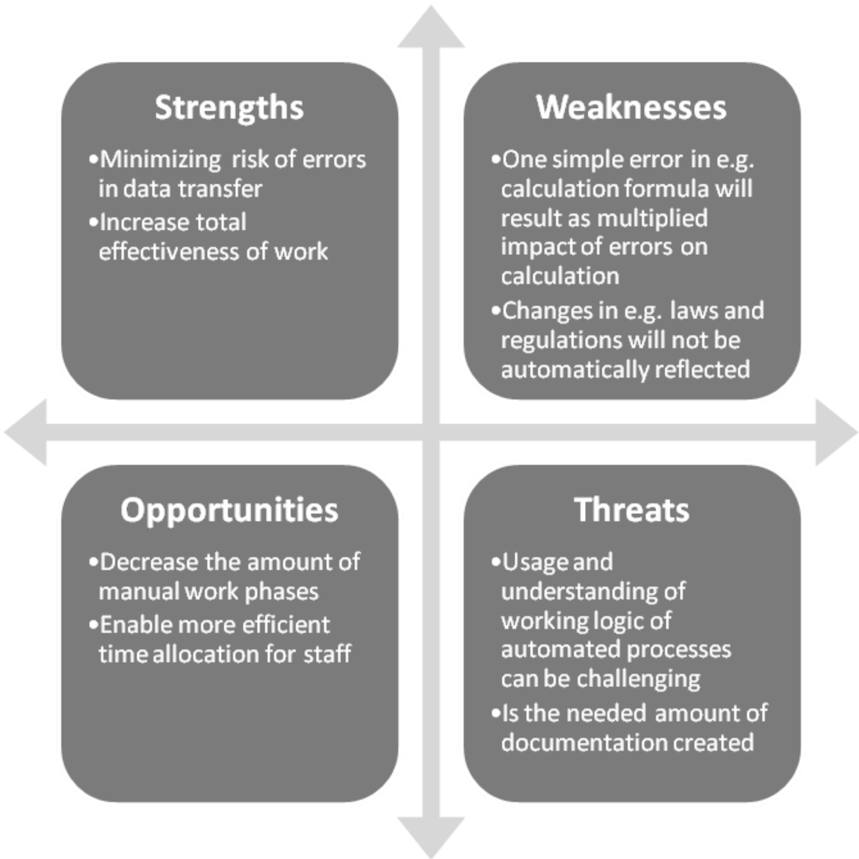

Figure 8: Swot-analysis

4.2 Changes in target organization

As always, changes in the work processes and utilizing new tools creates changes also within the work environment, its methods, attitudes and employees. Some of the changes are seen as good, some bad. It is fundamental to announce and bring forth all changes in ways of working to employees well in advance. It is also important to explain what is happening and why. In addition the employees should be given a chance to participate in developing the tool.

4.2.1 Leadership

Changes related to leadership can be seen to consider mainly the allocation of resources. The implementation of the tool frees time resources from routine tasks (e.g. preparing tax calculations) to more advanced tasks that require more expertise (e.g. analyzing tax position in different countries). This shift in work tasks should also be taken into account when planning the recruitment of new employees. What type of expertise is needed? More experienced tax consultants instead of unexperienced ones?

Good leadership can also been seen as a factor in lessening resistance towards change. It is important that leaders lead by example and use the tool as one of the first and underline the benefits towards the employees and work environment as a whole.

4.2.2 Employees

It is important to keep the organization up to date on what is being developed and why. One good idea is to include updates of the development project as one of the agenda points in e.g. weekly team meetings and request employees to participate with any comments or new ideas they might have. As preparation of tax return is an essential part of the day-to-day work tasks, it is essential to give the employees possibility to develop the tool and that the development process is as transparent as possible towards them. The members of the development team should be open towards the employees and offer a possibility to discuss on how automation will affect their work in the future.

Another essential thing is to keep employees involved sales work up to date what can be done with the tool and how it could be “advertised” towards potential clients. However, this should be done with caution as too high promises might be made to the clients (cannot be eventually implemented). Therefore, a sales person should always consult the tool development team before drafting the final quotation to the client.

4.2.3 Interest groups

The most significant interest group is the client. Going forward, during client negotiations it is important that the client understands the capabilities and what can be done with the tax calculation tool. Explaining the automation process and why the company is able to offer our services at a lower cost rate and better quality level, compared to competitors, is relevant. In some cases, including a technical expert to the client meeting might be a good idea in order to go through any possible questions relating to the functionality or design of the tool.

Additionally, it might be advisable to bring reference data from similar already completed projects in order to factually show the benefits of using the tool. However, when planning this it is important to take into account client confidentiality and the anonymity of the referred client.

Another vital interest group is the Finnish tax authorities. It is essential to ask the tax authorities opinion e.g. if you are planning to file tax returns for a big mass of clients. In example, it would be advisable to ask the tax authorities how they would like to handle tax return filing for large populations. Should the tax return be filed in one batch or separate batches? On different days? To which tax office should the batch/batches be delivered to? Following all the aforementioned advices helps to build and keep up a good and flexible relationship with the tax authorities.

4.3 Resistance towards change

Implementing a new tool within an organization presumably creates certain amount of resistance towards such change. In order to minimize resistance it is important to, as already mentioned, give the employees a possibility to participate in the development process from the beginning. The most important thing is to ensure that employees understand as well as possible the impacts that the new tool will have on their work. When communicating the changes in work processes, the focus should be that amount of routine work is decreased and amount of more meaningful work is increased. Another substantial thing is to allow employees freely comment or offer development ideas and provide a direct line of communication with the tool development team (user to developer).

Comprehensive training sessions should also be held for employees that will be using the tool. The training should also include a part where the technical functionality of the tool is presented. The employees should also be shown how they can review the actual calculation formulas the tool uses so that they are able to trust the results the tool gives.

4.4 Future research

As a future research target, a more comprehensive case study review could be made by adding others case studies to this research. Then, a cross-case-analysis could be made in order to find more scientific evidence to support the planning of a tax calculation automation tool. The problem with this lies in the fact that there are not much publications related to the subject. This might present difficulties when trying to find other suitable cases. However, it is likely that the amount of such publications will increase in the future as more and more organizations concentrate in automating their processes.

From the findings of this research it can be determined that tax return preparation automation can be used to significantly increase the effectiveness of the tax return process and utilization of time and human resources. However, investing on testing and planning of the tool is very important and should be prioritized. The 0 or 100 % principle (if the tool calculates one data record wrong, all other records are wrong as well) should be taken into account from the beginning when designing the tool. The tool designer(s) should have perfect understanding how all calculation formulas have been created and the correctness of such formulas should be tested by calculating them manually. Also the data on which the calculation is based upon (salary data) should be analyzed and reviewed in detail. The development team should also ensure that each automatic calculation formula works in the desired way for each data record.

Based on this research, it is recommended that tool and automation of processes is broadened to cover other areas in the tax return process as well. One of such areas could be the automation of data transfer directly to tax return forms used by the tax authorities. This would enhance the tax return process ever more and make the final steps of the tax return preparation process (review and filing of tax return) more efficient.

In a nutshell, the data transfer automation process would flow in the following order. First, the tax return tool would calculate all the required values needed for the tax return preparation based on the salary data. Secondly, the values would be transferred directly to Finnish tax authorities pdf-forms using an excel macro. Each field in the pdf-forms has a unique field name and the macro would transfer the respective values to the assigned form fields. After this the macro would continue to loop to the next data record and continue until it runs into a blank field after which the macro would stop looping (automation of the process). At the moment this work phase (data transfer to form) is done manually in the target organization. Therefore, it can be assumed that automating this part of the process would speed up the data transfer process and significantly decrease the risk of error, presuming that the salary data and calculation are correct.

Another area of future research, from the target organization’s point of view, could be taking the tool in use in other countries as well. This would require careful investigation of the differences in tax law and regulations in the target country. This would of course require to build calculation formulas in a different way. However, the technical functionality of the tool, e.g. transferring data between salary data and tax calculator would be already in place. The question would be how to integrate and reconfigure the tool to suit the local requirements.

References

Davis, G. B., and Olson, M. H. 1985. Management Information Systems: Conceptual Foundations, Structure and Development (2nd ed.), McGraw-Hill, New York.

Drucker, P. F. 1991. The New Productivity Challenge,"Harvard Business Review (69:6), pp. 45-53.

Fewster, M & Graham, D. 1999. Software Test Automation: Effective use of test execution tools. 1. painos. Great Britain: Biddles of Guildford Ltd.

Fisher, S & Holt, M. 2011. Automatic Automation. Accounting Today, Sep 2011, 25, 9; ProQuest Central. pg. 12.

Haikala, I & Mikkonen, T. 2011. Ohjelmistotuotannon käytännöt. 12. painos. Hämeenlinna: Talentum.

Henderson, J. & Venkatraman, N. 1993. Strategic Alignment: Leveraging Information Technology for Transforming Organizations, IBM Systems Journal (32:1)

Hevner, A.R., March,T., Park, J., Ram, 2004. Design Science in Information Systems Research, MIS Quarterly (28:1), pp 75-105.

Hirsjärvi, S & Remes, P & Sajavaara, P. 2000. Tutki ja kirjoita. 5. painos. Helsinki: Tammi.

Kalakota, R., and Robinson, M. 2001. E-Business 2.0: Roadmap for Success, Addison-Wesley Pearson Education, Boston, MA.

Lee, A. 1999."Inaugural Editor's Comments, MIS Quarterly (23:1), pp. v-xi.

March, T., and Smith, G. 1995. Design and Natural Science Research on Information Technology, Decision Support Systems (15:4), pp. 251-266.

Markus, M. L., Majchrzak, A., and Gasser, L. 2002. "A Design Theory for Systems that Support Emergent Knowledge Processes," MIS Quarterly (26:3), September, pp. 179-212.

Miles, M.B. & Huberman, A.M. 1994. Qualitative Data Analysis: an expanded sourcebook (2nd ed.), Sage Publications, Thousand Oaks.

Mondaq. 2011. Key Performance Indicators (KPIs) – What They Are And What They Do. TCii Strategic and Management Consultants. (http://www.mondaq.com/x/140520/Operational+Performance+Management/Key+Performance+Indicators+KPIs+What+They+Are+And+What+They+Do)

Nunamaker J, Chen M & Purdin T. 1991. Systems Development in Informations Systems Re-seach. Journal of Management Information Systems. M. E. Sharpe Inc.

Orlikowski, W. J. 2000."Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. Organization Science (11:4), pp. 404-428.

Orlikowski, W. J., and Barley, R. 2001. Technology and Institutions: What Can Research on Information Technology and Research on Organizations Learn From Each Other?, MIS Quarterly (25:2), pp 145-165.

Orlikowski, W. J., and Iacono, C. S. 2001."Research Commentary: Desperately Seeking the IT' in IT Research:—A Call to Theorizing the IT Artifact," Information Systems Research (12:2), pp. 121-134.

Patton, M. Q. 2002. "Qualitative evaluation and research methods (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Reiner, K. 2004, "using automation to minimize audit risks for businesses self-assessing use tax", Journal of Multistate Taxation and Incentives, vol. 14, no. 4, pp. 12-19+.

Simon, H. A. 1996. The Sciences of the Artificial (3rd ed.), MIT Press, Cambridge, MA.

Tankersley, B. 2011, "Tax Document Automation Tools Come of Age", CPA Practice Advisor, vol. 21, no. 3, pp. 21-23.

Toikkanen, T et al 2013. Ketterää kehitystä. 1. painos. Vantaa: Hansaprintti Oy.

Tsichritzis, D. 1998. The Dynamics of Innovation, in Beyond Calculation: The Next Fifty Years of Computing, P. J. Denning and R. M. Metcalfe (eds.), Copernicus Books, New York, pp. 259-265.

Yin, R. K. 2009. Case Study Research Design and Methods. 4. painos. Thousand Oaks: Sage Publications.

Zmud, R. 1997. Editor’s Comments,” MIS Quarterly (21:2), pp. xxi-xxii.

Research data

Curry, J & Clarkson A. 2010. Achieving greater efficiency through tax automation, International Tax Review. (http://www.internationaltaxreview.com/Article/2606409/Achieving-greater-efficiency-through-tax-automation.html)

Figures

Tables

Appendixes

Appendix 1: List of salary items /calculation results database structure

Detailed listing of salary items

ASSIGNMENT INFORMATION							
SR.No	**Person number**	**Name**	**Status**	**Start date**	**End date**	**No of days in Finland**	**Soc.sec. Number**

INCOME								
Gross salary	**Taxable daily allowan-ce**	**Bonus**	**Car bene-fit**	**Housing benefit**	**Phone benefit**	**Other benefit**	**Daily allo-wance**	**Taxable income**

DEDUCTIONS							
Tax	**Tax with-held %**	**Pensi-on**	**Unem-ployment**	**Pension + Unemplo-yment**	**Deduc-tions**	**Foreign salary net**	**Daily al-lowance**

Calculation results database

CALCULATION RESULTS / COMPARISON						
Net salary	**OPT A - Net Sala-ry For-mula re-sult**	**OPT 1 - Net Salary amount**	**OPT A: Grossed-up taxable in-come**	**OPT A: Tax amount**	**Original Tax amount**	**Tax amount Diffe-rence (EUR)**
Original salary data	Calcula-tion for-mula for determin-ing net salary	Data feeded **to** tax calcula-tor from salary data	Data feeded **from** tax cal-culator to results	Data feeded **from** tax calculator to results	Original salary data	Original tax - OPT A tax amount

Appendix 2: Option A/B processing times

Option A/B test batch results (n=10)

Time displayed as: Minutes:Seconds,Hundreds

Assignee N:o	OPTION A	OPTION B
1	00:00,27	00:38,00
2	00:00,30	00:37,22
3	00:00,27	00:36,50
4	00:00,29	00:36,22
5	00:00,27	00:34,40
6	00:00,29	00:37,30
7	00:00,27	00:32,11
8	00:00,27	00:33,00
9	00:00,30	00:34,22
10	00:00,27	00:35,10
Average time per assignee	00:00,28	00:35,41
Total time	00:02,80	05:54,07

Option A/B processing time for full data (n=460)

Time displayed as: Hours:Minutes:Seconds,Hundreds

Time for running macro-loop for full assignee batch:	0:03:38,05
Estimated* time for running full batch using Option B: (460*0:00:35,41)=	4:31:27,22
Difference in total time between Option A and B (percentage) 4:31:27,22/0:03:38,05=	7 469 %

* Estimated per the average/assignee time from n=10 test batch