

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

FACULTY OF ECONOMICS AND MANAGEMENT

DEPARTMENT OF INFORMATION TECHNOLOGIES



BACHELOR THESIS

APPLICATION OF ENTERPRISE INFORMATION SYSTEM

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Department of Information Technologies

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BACHELOR THESIS ASSIGNMENT

Čamborová Michaela

Thesis title

Application of enterprise information system

Objectives of thesis

Main objective of bachelor thesis is to analyse the application of information system in selected enterprise. Partial goals of the thesis are:

- To characterize enterprise information systems,
- To analyse types of used applications in an enterprise and
- To prepare a case study that focuses on usage of an application of an information system.

Methodology

Methodology of the thesis is based on study and analysis of specialized information resources. The analysis of application of information system is comprising macro and micro economic evaluation of corporation effectiveness of used applications. Case study documents the usage of applications in a selected enterprise. Based on a synthesis of theoretical knowledge and the results of own solution, the conclusions of the thesis will be formulated.

Schedule for processing

- 1)) Preparation and study of specialized information resources, refinement of partial goals and selection of work process: 05/2011
- 2) Processing of collected information: 06 – 09/2011
- 3) Development of the case study, discussion and evaluation of results: 10 – 12/2011
- 4) Creation of final document: 01 – 02/2012
- 5) Submission of thesis and abstract 03/2012

The proposed extent of the thesis

30 - 40 stran

Keywords

Information technology/information systems (IT/IS); Enterprise application integration, (EAI); Life cycle of information system;

Recommended information sources

STAIR, Ralph ; REYNOLDS , George. Fundamentals of Information Systems . Sixth. United States of America : Course Technology Ptr, 2011. 476 p. ISBN 0840062184.

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CIO. Chief Information Officer [on-line]. Available at WWW: <<http://www.cio.com>>.

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Prague November 21, 2011

Declaration

I declare that I have worked on my bachelor thesis "Application of Enterprise Information System" by myself and I have used only the sources mentioned at the end of the thesis

In Prague, 23rd March, 2012



.....
Michaela Čamborová

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I would like to thank Ing. Miloš Ulman, Ph.D. for his advises and supervision of my bachelor thesis.

Application of Enterprise Information System

Používání informačního systému ve firmách

APPLICATION OF ENTEPRISE INFORMATION SYSTEM

SUMMARY

Information systems are used in every profession. From small companies like flower shops to multinational companies like Coca Cola. Information systems are used to help managers make million dollar decisions, to contact clients anywhere around the world, to advertise product and to make accounting and finance operations.

The first part of the thesis brings brief introduction of the history and development of information systems. The second part deals with business information technology by describing its three major components – hardware, software and networks. Third part is focused on Enterprise Information Systems – basically, focusing more about how software is used in companies. Fourth part is case study based on research made in selected company about their used software applications.

KEYWORDS:

Information technology (IT), Information Systems (IS), Hardware (HW), Software (SW), Application software, Operation software, Enterprise Resource Planning Systems (ERP), Network, Internet,

POUŽÍVÁNÍ INFORMAČNÍHO SYSTÉMU VE FIMÁCH

SOUHRN

Informační systémy jsou používány v každé profesi. Od malých společností typu květinářství až po mezinárodní společnosti jako je Coca Cola. Informační systémy pomáhají manažerům činit milionová rozhodnutí, slouží ke kontaktování klientů, kteří mohou být kdekoliv na světě, k reklamě na produkt a také pro účetní a finanční operace.

První část bakalářské práce se věnuje historii a vývoji informačních systémů. Druhá část práce se zaměřuje na podnikovou informační technologii, kterou rozděluje do 3 základních skupin – hardwaru, software a sítě. Třetí část práce je zaměřena přímo na podnikové informační systémy, jakým způsobem se v podnicích používají. Čtvrtá část je případová studie zaměřená na používání informačních systémů ve zvoleném podniku.

KLÍČOVÁ SLOVA:

Informační technologie (IT), Informační Systém (IS), Hardware (HW), Software (SW), Počítačové aplikace, Operační systém, Systém pro plánování podnikových zdrojů (ERP), Síť, Internet,

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1. INTRODUCTION

Information systems are important and valuable part of business organizations. As Francis Bacon said in 1597 – “Knowledge is power.” In nowadays business this sentence could be translated to – “Information is power.” Having the valuable information can be crucial for company’s decisions. Knowing for example when to introduce a new product to the market in the perfect time can turn small underestimated brand into a cult (like happened with Apple). All this is due to effective usage of information systems. Not only that company has to have the right information systems but it also has to know how to use them.

Nowadays all successful companies are dependent on their information systems. Every business process is controlled and performed on computers. Everything is connected through networks and it is much easier to keep track of information. Controlling of data is faster and more efficient then it was before.

Biggest development was made in the telecommunication. Especially Internet is very important “figure” in this development. Author will discuss this development in the chapter Development on Information Systems and chapter Business Network.

2. OBJECTIVES AND METHODOLOGY

2.1 OBJECTIVES

In bachelor thesis Application of Enterprise Information Systems should be summarized the well-known and less known information about information systems. The objective of first part of thesis includes organizing of the basic information into brief summary about information systems. In structured chapters History and Development of Information Systems, Business Hardware, Software and Networks and Enterprise Information Systems.

The objective of second part is author's own research in selected company – Desk_Table Company – based on data collected within the company (KPI – Key Performance Indicator report, list of used applications with brief descriptions (e.g. SUN 5.2.1, Vision, Hrnet, and Finance Addins). This research will include analysis of effectiveness of used applications in Desk_Table Company.

HYPOTHESES

Accounting application software used in Desk_Table Company is a cheaper way of processing invoices in company in comparison with outsourcing of accounting services by specialized Czech company.

2.2 METHODOLOGY

Information and facts for this bachelor thesis are especially from literature resources and internet resources. The materials used for the analysis part are from internal documents of Desk_Table Company.

Methodology of the thesis is based on study and analysis of data collected during author's research in Desk_Table Company.

For analysis of collected data microeconomic evaluation has been used – the cost analysis of used application. This computation was based on fact that Desk_Table Company wanted to know whether it made the right decision when it bought specialised accounting software in comparison with outsourcing of accounting service.

Based on a synthesis of theoretical knowledge and the results of own solution, the conclusions of the thesis will be formulated.

3. INFORMATION SYSTEMS

This chapter will provide brief summary about information systems displayed in the in two parts – the History of Information Systems and Development of Information Systems.

3.1 HISTORY OF INFORMATION SYSTEMS

SMOKE SIGNALS

People think that information systems are directly linked with computers. That is not true. Humankind has been using information systems (methods how to share information) since the discovery of fire. The smoke signals for example. Oldest recorded form of communication. Thanks to smoke signal people were able to communicate on very long distances (for example in Ancient China soldiers distributed along the Great Wall were able to send information about enemy attack from one end to another in just few hours). However, smoking signals are still used. In Vatican. During the election of a new Pope by the College of Cardinals.

MORSE CODE AND TELEGRAPH

Nevertheless, when we are talking about history of information systems, we have to talk about the Morse code. First universal communication method developed in 1840's by Americans Samuel F. B. Morse, Joseph Henry, and Alfred Vail for interpreting the indentations marked on paper tapes left by electric telegraph. The electric telegraph was sending pulses of electric current along wires, which controlled an electromagnet that was located at the receiving end of the telegraph system using paper tape and stylus to leave the indentations when it received a signal. (<http://w1tp.com>)

Morse code was adapted by radio communication and the dots (in vocal interpretation “dit”) and dashes (“dah”) – the interpretation of codes – became much easier for receivers.

Telegraph was the first instant global communication tool. Allowing people to connect each other on different ends of the world (e.g. America with Europe). Thanks to

telegraph information was passed to significant destination before the information lost its value (especially in trade).

TELECOMUNICATIONS

Telecommunication changed the business. It almost erased the barriers of time and distance. It allowed businesses to communicate with clients, co-workers and partners nearly anywhere in the world. It has also reduced the time needed to send information that influences business actions.

It has changed the nature of commerce. *“As networks connect to one another and transmit information more freely, a competitive marketplace demands excellent quality and service from all organizations.”* (Stair, Reynolds; 2010)

TELEPHONE

Invented by Alexander Graham Bell, or Innocenzo Manzetti, Antonio Meucci, Johann Philipp Reis, Elisha Gray, and Thomas Edison – no one really knows; but Bell was the first to patent it. Uses telephone wires – single-user circuit – to transmit human voice converted to electric signal by the microphone. These signals are sent to telephone network and received by other phone and again converted by the earphone to human voice. Telephone network uses telephone lines and undersea telephone lines.

INTERNET

Started with ARPANET (Advanced Research Projects Agency Network). First functional packet-switching (called Interface Message Processors (IMP's)) network communication created in 1969. First network created with ARPANET was consisting of three universities (University of California, Los Angeles, University of California Santa Barbara, University of Utah) and Stanford Research Institute. First message sent by this network was the word “login”. In 1973, the first non-US computer has been connected to the network – Norsar (Norwegian Seismic Array, geo-science organization). Short after than connection in Institution of Computer Science in London was established. (<http://news.bbc.co.uk>)

In 1982, TCP/IP (Transmission Control Protocol/Internet Protocol) was standardized and worldwide network of TPC/IP networks, called the Internet, was created.

3.2 DEVELOPMENT OF INFORMATION SYSTEMS

Development of information systems is linked with history of computer science.

The word “**computer**” was originally expression connected with someone who was **using calculator for computing**. Calculators have been developed during a long period of time. In the beginning, (1930) desktop mechanical calculators were only able to add, divide, subtract and multiply numbers.

First medium, which stored data and could be read by machine was **punched card**; invented by Herman Hollerith. For processing of these punched cards he also invented the tabulator and the key punch machine. And these three inventions are the beginning of the **modern information processing**. This invention was used in 1890 United States Census and thanks to that “*census count, was finished months ahead of schedule and far under budget.*” (www.census.gov)

THE NULL GENERATION OF COMPUTERS (1934 – 1944)

Computer circuits containing relays (electrically operated switches)

The **Z3** was the first practically usable computer (designed by German engineer Konrad Zuse). “*It was the first automatic, program-controlled, fully functional, general purpose digital computer. The Z3 also utilized a punched film for program input. The Z3 computer used 2,600 telephone relays.*” (www.computermuseum.li)

In USA Claude Shannon constructed a relay based computer Model K in Bell Labs which than was remodelled to **Complex Number Calculator**. It was able to calculate complex numbers and Shannon was able to send remote command through telephone lines to the calculator. Thanks to this, the Complex Number Calculator was the first machine to be used remotely.

Another machine was built under supervision of IBM labs. Machine **Harvard Mark I** (officially known as **Automatic Sequence Controlled Calculator**) was built under the supervision of Howard Hathaway Aiken. “*Consisting of 78 adding machines and calculators linked together, the ASCC had 765,000 parts, 3,300 relays, over 500 miles of wire and more than 175,000 connections.*” (www-03.ibm.com)

But then, came **ENIAC (Electronic Numerical Integrator And Computer)** constructed by the United States Army to compute artillery of firing tables. It could add or subtract 5000 times a second, which was thousand times faster than any other machine. It was built by John Mauchly and J. Presper Eckert at the University of Pennsylvania. *“ENIAC was a grotesque monster. Its thirty separate units, plus power supply and forced-air cooling, weighed over thirty tons. But ENIAC was the prototype from which most other modern computers evolved.”* (<http://ftp.arl.mil>)

FIRST GENERATION OF COMPUTERS (1945 – 1951)

Vacuum tubes (device through which flows electric current; in vacuum)

Computers were defective, expensive, inefficient, had high power demands and low computation speed. Program was created on interconnected plates, later on punched cards and tapes, which also served as to preserve results.

Because of limitation with ENIAC Eckert and Mauchly started to work on next generation of computers – stored-program computer (machine that stored program instructions in its electronic memory). They build **EDVAC (Electronic Discrete Variable Automatic Computer)** based on John von Neumann’s proposed architecture – known nowadays as Von Neumann architecture*. Revolutionary was the replacement of relays by vacuum tubes which was a good idea at the first moment but on the “second look” the tubes were expensive, generated high temperatures and were unreliable – valves were very often failing. So yes, EDVAC was the first stored-program designed computer, but it did not work.

The real first working stored-program computer was the **SSEM (Small-Scale Experimental Machine; also known as Baby)** build in 1948 in University of Manchester by Freddie C. Williams and Tom Kilburn based on the Williams Tubes (cathode ray tubes used to electronically store data). *“Although small and primitive, it was the first working machine to have all the basic ingredients we would regard as essential to the von Neumann computer, in particular it had a true Random Access Memory and used the stored-program principle”* (www.computer50.org)

* Von Neumann architecture - scheme where computer would consist of processing unit (divided into arithmetic logic unit, processor registers, control unit containing instruction register and program counter), memory, external mass store and input and output mechanisms

SECOND GENERATION OF COMPUTERS (1951 – 1965)

Transistors (semiconductor device used as switch of electrical power or amplifier)

By the year 1955 transistors replaced vacuum tubes in computers. Advantages of transistors over vacuum tubes were that they were smaller (which reduced the size of computer), used less power and therefore generated less heat. Batch systems are introduced (performing a series of programs without user participation), which are entered to the computer via punched tape, magnetic tape or labels.

The first transistor based computers allowed “paper work” to be replaced by simple data entering. Systems were repeatedly able to execute simple operations and create output documents.

The most widely distributed computer of second generation was **IBM 1401**. Introduced in 1959 and withdrawn in 1971. IBM was used by small businesses. Over ten thousand pieces were sold during its “lifetime”. (www-03.ibm.com)

THIRD GENERATION OF COMPUTERS (1965 – 1980)

Integrated circuits (an electronic component which integrates many simple components which together form an electric circuit and perform a complex function; individual components are created and connected to each other on a single semiconductor plate)

Over time, the number of transistors in an integrated circuit increased, so computers become cheaper, smaller and more powerful. Multiprogramming appeared – while one program waits for execution, the processor is processing next job. Terms process (program carried out) and multitasking (programs performed by processor reciprocate) are developed.

During this period minicomputers and mainframe computers were created – for example IBM’s **IBM System/360** or Hewlett-Packard’s **HP3000**. (www-03.ibm.com)

FOURTH GENERATION OF COMPUTERS (1981 - 1990)

Microprocessor (highly complex integrated circuit)

Executes machine code of running computer program, which is composed of individual machine instruction (stored in operational memory).

First microprocessor was released by Intel. **The 4004**. It was capable of 60,000 instructions per second. Microprocessors allowed reducing number of circuits on the motherboard, increased reliability, reduced size, increased speed and memory capacity of computers.

Mainframe computers were eliminated by workstations - the personal computers. Such as Commodore PET, Atari 8-bit family, Apple II and IBM PC (<http://lowendmac.com>)

MODERN COMPUTERS (1990 – PRESENT)

Since the IBM PC released in 1981 there have not been any major changes in the design of computers. Only thing that is improving is the technology used for manufacturing of computer components. For example first Intel processor – 4004 – had 2300 transistors worked at frequency 750 KHz. Latest Intel processor – in Sandy Bridge architecture – is using the 32 nm technology process – Intel i7 core – has 1.16 billion of transistors, working at frequency 3.5 GHz.

However, true is that nowadays computers could be performing faster than they are right now. Thanks to object-based architecture of hardware. Unfortunately, there is no such a thing. The could have been if in 1981 Intel have not stopped their development of object-oriented chip **Intel iAPX 432**. Research was stopped due to fact that this chip had lower performance than microprocessors used at that time. Therefore, because of this “microprocessor misunderstanding” all hardware used today is using the “old technology” – the machine code.

Even though most of programs are object-oriented (using Java as the “translator” of their objects into machines code) hardware is not. If hardware would be object-oriented, there would be no need for Java to be running the programs. Since the hardware components (specially CPU) would be able to read the programs directly they would be able to perform operations much faster than nowadays.

Author, in an ironic way, thinks that all we can do for object-oriented hardware to be used is another world war. Because wars are the best software and hardware developers...

4. INTRODUCTION TO INFORMATION TECHNOLOGY

Information technology (of as we can put it – **Computer Based Information System**) is composed of three basic elements – hardware, software and networks. Each element is connected to each other in a way that none can work on its own. Screen is useless black box if there is no application displayed on it. Microsoft Outlook would not be working if there were no computer to run on.

4.1 BUSINESS HARDWARE

“Hardware consists of computer equipment used to perform input, processing, and output activities.”* (Stair, Reynolds; 2010)

INPUT DEVICES

Enable users to put data into computer – though pointing devices (e.g. keyboards, mouse, touch pads, trackballs) or with technologies (e.g. scanning, handwriting and voice recognition).

Pointing devices

All of pointing devices are functional thanks to **GUI** (Graphical User Interface) which displays icons and windows and toolbars on the screen. Gone are the times when the only way how to execute an application was to write command into the command line.

Technologies

Speech recognition systems seem to be the future of data entering because it is the easiest and the most natural way of human communication. It is becoming usable for several applications. *“The software compares speech patterns to a database of sound patterns in its vocabulary and passes recognized words to application software.”* (O’Brien, MARAKAS; 2011).

Optical scanning devices read documents and convert these documents into digital form – machine code – readable for the computer. Some scanners – OCR (Optical Character Recognition) scanners, read codes (tags, product labels, airline tickets etc.).

* Hardware is something you can kick when the software does not work.

Magnetic stripes technology help computers to read credit cards. Each stripe contains information about the credit card holder – name, number of the account and pin-code.

PROCESS

CPU (Central Processing Unit) “is the main processing component of a computer system” (O’Brien, Marakas, 2011) CPU is divided in three parts – the arithmetic logic unit (**ALU**) which performs calculations and makes comparisons, than the **control unit** that coordinates flows of data and the last one are **registers** that hold data for CPU. There is always a question if a computer can perform its tasks faster. Answer to this is the **Moore’s law** *.

OUTPUT DEVICES

Display information derived from computers – either in printed or video output.

Video output

Is the most popular way of computer output. **CRT (Cathode Ray Tube)** technology is mostly used in television sets. **Liquid crystal displays (LCD)** are commonly used in microcomputers. LCD’s needs much less energy than CRT and they have better colours and clarity.

Printed output

After video displays the printed output is the most common form of output and business and legal communication. Performed by **laser** or **inkjet printers**

4.2 BUSINESS SOFTWARE

Software is program used for operating and manipulating of computer and its peripherals. It is divided into two categories – Application and System software.

APPLICATION SOFTWARE

Help users solve specific problems. It is also divided into two groups – general-

* Moore’s law - the number of transistors on a chip can be doubled every two years.

purpose application programs and function specific applications.

Function Specific Application Software

These packages are available to help end users in business with their specific wishes. For example Business Intelligence, Marketing, Procurement, Financials, Contracts (all from Oracle E-business suite).

Software suites

Widely used programs put together to form a suite – Microsoft Office, Lotus SmartSuite, Corel WordPerfect Office, Sun’s StarOffice and OpenOffice.

Web browsers

Very important software component, which is having big influence on the business world. Many applications today are Internet based and this trend is growing. That is why the browsers are becoming the “*universal client*” (O’Brien, Marakas; 2011) – application installed on all computers through the company.

General-Purpose Software

Word processing

Changed the process of writing. Word processing packages are e.g. Microsoft Word, Lotus WordPro, Corel WordPerfect, and OpenOffice Writer.

Spreadsheet packages

Are used by every business to analyse, model and process their data. Microsoft Excel, OpenOffice Calc, Corel QuattroPro and Lotus 1-2-3 belong to this group. These spreadsheets help businesses to answer the what-if question by formula computations.

Presentation graphics software

Convert numerical data into charts (graphical display). Line charts, pie charts, bar charts, flow charts, organizational charts, etc. Microsoft PowerPoint, OpenOffice Impress, Lotus Freelance, or Corel Presentations have these features.

Personal organizational manager

Helps end users organize their work. It holds all their schedules, meetings, tasks even information about customers and clients and provides access to the Internet. Lotus Organizer and Microsoft Outlook represent these applications.

Groupware

Helps work teams to work together on a collective assignment. Lotus Notes, Novell GroupWise, and Microsoft Exchange support help share information via e-mails, scheduling, video conferencing etc.

SYSTEM SOFTWARE

Helps computer manage hardware. System software is divided into two categories. operating systems and utility programs.

Operating systems (OS)

OS provides **user interface** (allows users to “communicate” with computer), **resource management** (keeps track of stored data and programs), **file management** and **task management** (sequences of tasks sent to the CPU – allows multitasking)

CURRENT OPERATING SYSTEMS

Microsoft Windows

Windows 7 is the latest operating system released in 2009. It did not bring many new features but is more focused on the compatibility with of applications and hardware. But in the business world, the most used version is **Microsoft XP**. This operating system was reliable, faster, user-friendly, supported USB 2.0, expanded international support, better application compatibility, remote desktop controller etc.

Apple

Mac OS X Lion (version 10.7) is the latest operating system released in 2011. Over one million copies were sold on the first day. Apple is claiming that the 3-D user interface of his operating systems is more intuitive than Windows. “*Because Mac OS X runs on Intel processors, Mac users can set up their PC to run both Windows Vista and Mac OS X and select which platform they want to work with when they boot their PC.*”

Macs are also considered very secure, with no widespread virus or spyware infections to date.” (Stair, Reynolds; 2010)

Linux

Mandriva Linux is the latest version released in 2011. It is an open-source operation system – source code is available to anyone. This allows users to download it, improved it and pass it on. Therefore, Linux systems are reliable. Big companies – like IBM, Hewlett-Packard or Dell are supporting Linux.

4.3 BUSINESS TELECOMMUNICATION AND NETWORKS

TELECOMMUNICATION

Important feature of telecommunication is the speed at which the information is transmitted. It is measured in bits per second (bps).

General model of telecommunication

Computer, person, terminal sends message → Signal is transmitted → Signal is received by telecommunication device → Telecommunication device sends signal through medium → Another telecommunication device received the signal and sends it to receiving device → Receiving device receives the message

Telecommunication protocol

“Standard set of rules and procedures for the control of communications in a network.” (O’Brien, Marakas; 2011). Goal for this protocol is to provide efficient, error-free and fast communication to encourage businesses to build products to cooperate effectively.

Telecommunication channels

Physical devices through which messages are carried. They are divided into three groups – simplex channels (can carry message in only one direction; doorbells), half-duplex channels (can carry message both ways but not at same time; walkie-talkie) and full-duplex channels (carry messages both ways at the same time; Ethernet)

Telecommunication media

For selecting the best telecommunication media for business, company has to evaluate how many information they want to send, with what speed, under what level of data privacy and more. Media can be divided into two categories – guided transmission media and wireless transmission media.

Guided transmission media

Use solid (physical) media to connect devices in networks. Either twisted-pair wires, coaxial cables or fibre optic cables.

Wireless transmission

It has revolutionized the gathering and sharing of information. It provides freedom in communication. It can be conducted anywhere. Many businesses are considering shifting to this technology.

Types of wireless transmissions - Infrared transmission (IR; short distance transmissions), Bluetooth (up to hundred meters connections), Wireless Fidelity (Wi-Fi; enables computers and other devices to connect to the Internet and other networks), 3G (standard for cellular networks IMT 2000) and in the future 4G (*“is expected to deliver more advanced versions of enhanced multimedia, smooth streaming video, universal access, portability across all types of devices, and eventually, worldwide roaming capability”*)

NETWORKS

Are two or more computers or any other devices connected together by communication channels. When connected, computers or devices (referred to as “**nodes**”) can share information.

Network types

Local Area Network (LAN)

Network connecting nodes in a small area (home, office, several floors of a building). LAN uses many types of connecting media – telephone cables, coaxial cables, twisted-pair wires or fibre-optic cables or IR connections. They can be used for sharing of peripherals like printers. Alternatively, computers can be connected to network server and

share data stored on this server.

Wide Area Networks (WAN)

Connects large geographic regions. “WANs usually consist of computer equipment owned by the user, together with data communications equipment and telecommunication links provided by various carriers and service providers.” (Stair, Reynolds; 2010)

They are long-distance networks. Within counties or between countries. But because of that WAN networks are heavily regulated many laws (national or international).

Client/Server Networks

Clients (computers or workstations) are interconnected to the server. Server can be any computer on which program applications and data files are stored. They are accessible by any computers connected to this network.

Network computing

Consist of network computers and application software and database servers (which provide, as the name suggests, operating and application software, databases and database applications software).

INTERNET

World’s largest network of computers. Or more likely, a global collection of interconnected networks sharing information. It works on the basis of client/server (user sends request and server send answer to user).

Nobody knows how “big” the Internet is. There is no evidence of how many networks are there. However, these is evidence of how many domain names (DNS *) are registered. In January 1993 there were 1,313,000 domains registered. In January 2012 there were 888,239,420 domains registered. (www.isc.org)

* Domain Name System (they have to have at least two parts separated by dot; for some addresses, the right part of Domain Name is code for the county; like .cz for Czech Republic, .co.uk for United Kingdom, .de for Germany and so on.

5. ENTERPRISE INFORMATION SYSTEMS

“Enterprise systems is a system central to the organization that ensures information can be shared across all business functions and all levels of management to support the running and managing of a business”. (Stair, Reynolds; 2010). Companies use integrated enterprise systems to perform basic business processes and save records about them. Such as accounting, finance, marketing, operations management and human resources management. Without these enterprise systems it would take enormous amounts of organization’s resources to collect and process information.

5.1 TYPES OF INFORMATION SYSTEMS

MARKETING INFORMATION SYSTEMS

Marketing function in business is focused on planning, advertising and selling of products. Businesses are turning towards information systems to help them with marketing functions in today’s fast changing environment by using interactive marketing, targeted marketing or sales force automatization.

Interactive marketing

It is customer-focused marketing using Internet as an advertisement tool. It helps to find potential customers who will not only buy their product but eventually help in with the development, improving and services connected with the product.

This is possible via Internet tools like chat, forums, questionnaires, instant messaging and e-mail.

Targeted marketing

Helps businesses develop promotion strategies by these five targeting components:

- **Context** (advertising oriented on people who are looking for s specific product on the website focused on this product)
- **Online Behaviour** (companies are using “cookies” (information about person’s activity on web sites) to advertise their product according to “online behaviour” of customer
- **Community** (customizing of Web advertisements according to specific communities –

sport enthusiasts, science-fiction fans, etc.)

– **Content** (so called pop-up windows of advertisements displaying the on-going campaign of a company)

– **Demographic** (advertisements aimed for specific types or classes of people – twenty something people, college graduates, woman, disabled, seniors etc.)

Sales force automatization

Help sales people to keep track of sales data. How many contracts have been signed, number of potential customers, sales forecasts, how are the orders managed, what is the product knowledge, how many people have order product via online building system (application which helps customers model the product according to their needs; in automobile industry).

MANUFACTURING INFORMATION SYSTEMS

Support production/operation company function. It helps companies to control and plan their operations. Like ordering of raw materials, storage of raw materials, production process, inventory movements, equipment maintenance, sending of finished goods etc. Many of MIS are Web-enabled.

Computer Integrated Manufacturing (CIM)

Is an approach of using computers for the control of whole manufacturing process using three objectives:

“Simplifying of (reengineer) production processes, product designs, and factory organization as a vital foundation to automation and integration. Automatization of production processes and the business functions that support them with computers, machines, and robots. And integration of all production and support processes using computer networks, cross functional business software, and other information technologies.” (O’Brien, Marakas; 2011)

Systems, which are using computers for the manufacturing process, can then control materials, personnel, physical process of manufacturing, equipment, machine performance and facilities.

HUMAN RESOURCES SYSTEMS

Human resource information systems (HRIS) are basically designed to hold employee details (name, address, bank account, his health insurance company, vacations, holidays, emergency contacts, training history), emergency evacuation plans, safety guidelines.

On-line Human Resource Management (HRM)

Internet has been influential part of HRM systems. Many companies have Web-based HRM systems, which make it easier for employees to communicate with their superiors. When for example requesting a holiday, they just simply fill on-line form and send it to their superior and he or she accepts it or denies it by simple click with their mouse. And this data is then stored for every superior to see.

ACCOUNTING INFORMATION SYSTEMS

Longest used information systems. AIS are used for recording and reporting of financial and accounting data (sales data, purchase data, investment data, and payroll data). They produce financial reports (balance sheet, income statement, cash flow statement). *“Typically, these systems include transaction processing systems such as order processing, inventory control, accounts receivable, accounts payable, payroll, and general ledger systems.”* (O’Brien, Marakas; 2011)

FINANCIAL MANAGEMENT SYSTEMS

Helps managers to make valuable financial decisions by collecting and analysing financial data. Such systems evaluate profitability of decisions, return on investments, solve the financial needs of company, evaluate risks of capital expenditures, economic situation, types of available financing methods, stock prices, interest rates, expected cash flows, they build financial models, etc.

5.2 ENTERPRISE RESOURCE PLANNING SYSTEMS

“Enterprise resource planning software, or ERP, doesn’t live up to its acronym. Forget about planning—it doesn’t do much of that—and forget about resource,

a throwaway term. But remember the enterprise part. This is ERP's true ambition. It attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments' particular needs."
(www.cio.com)

Description of Enterprise Resource Planning system (ERP)

The backbone of any organization, which links all processes. Production, order management, distribution, logistics, finance, sales, human resources and management. ERP gives company an overview of all its basic processes by ERP application system and common database that holds all necessary data.

Benefits of using ERP

- Better access to data (due to one integrated database holding all company data)
- Efficient usage of software (company substitutes all their separate software systems by only one set of applications for whole company)
- Efficient business processes (ERP systems help companies to improve their business processes)
- Upgrading of technology (when implementing ERP company can improve their information technology)
- Complex HR information (is standardized HR information from all business units)

Disadvantages of ERP

- Cost and time (full implementation of ERP system takes years to implement and can cost millions of dollars)
- Difficult to adapt (some ERP systems are so different from the ones the company was using before that it can be very hard to adapt to this change)
- Integration with other systems (there can be difficulties in integrating of other systems to the ERP systems; sometimes additional software is needed for this operation)
- One vendor (nearly impossible for company to switch to different vendor when is not satisfied with ERP system)
- Implementation failure (some large ERP installation have tendencies to fail; caused by underestimation of complexity of ERP, insufficient training of employees)

Development of Enterprise Resources Planning systems

Flexible ERP

Systems developed in 1990 were very inflexible. Companies developing them were pushed to make their system more flexible, meaning that it would be easier for the applications to be integrated with other applications and make it possible for companies to make small modifications to adjust the system to their needs.

Web-enabled ERP

Web-enabling software made ERP easier to use because software companies were adding Web-interfaces into ERP systems.

Interenterprise ERP

Web-enabled ERP systems are now connecting not only inter-company applications but also external applications (suppliers, customers and business partners).

eBusiness Suites

“Modular, Web-enabled software suites that integrate ERP, customer relationship management, supply chain management, procurement, decision support, enterprise portals, health care functionality, and other business applications and functions.” (O’Brien, Marakas; 2011)

ERP vendors

The most widely used ERP vendor is Oracle – almost 20% of companies use their software. Then there is SAP (14%); PeopleSoft (14%), which is owned by Oracle; Microsoft (11%); Infor (10%); JD Edwards (8%), also owned by Oracle; Lawson (6%); Sage Group (5%) and QAD (2%). (www.cio.com)

Oracle Corporation

“Oracle Corporation is one of the major companies developing database management systems, tools for database development, enterprise resource planning software, customer relationship management software (CRM) and supply chain planning (SCM) software. Oracle was founded in 1977, and has offices in more than 145 countries around the world. As of 2005, it employs over 50,000 worldwide.” (Rain, 2012)

SAP AG

“The largest European software enterprise. SAP was founded in 1972 as Systemanalyse und Programmentwicklung by five former IBM engineers in Mannheim, Germany. SAP is the fourth-largest software company in the world. It ranks after Microsoft, IBM and Oracle in terms of market capitalization. SAP is the largest Enterprise Resource Planning (ERP) solution software provider in terms of revenue.

Sap’s products focus on ERP, which it helped to pioneer. The company’s main product is SAP R/3; the “R” stands for real-time data processing and the number 3 relates to a three-tier application architecture: database, application server and client” (Rain, 2012)

The Sage Group

“The Sage Group is a leading UK based supplier of accounting, CRM and business management software (including manufacturing and construction-specific ranges) as well as related services to small and medium-sized enterprises (SME).” (Rain, 2012)

Infor Global Solutions

“Infor is the third largest provider of enterprise applications and services. Infor offers deep industry-specific applications and suites, engineered for speed, using groundbreaking technology that delivers a rich user experience, and flexible deployment options that give customers a choice to run their businesses in the cloud, on-premises or both.” (www.infor.com)

OPEN SOURCE ERP

This type of ERP is mostly adopted by smaller companies. Open source ERP are very flexible and companies are able to customize applications to meet their specific needs without paying astronomical prices for these specifications. *“Flexibility means money.” (www.cio.com)*

“SAP and other developers are not serving the mid-market—they provide more functionality than customers need at a price they can’t afford, but open source is meeting the needs. And open source has proven itself in many other enterprise applications, so any concerns centre around the software’s fit and support system.” (www.cio.com)

Apache

“The Apache Software Foundation provides organizational, legal, and financial support for a broad range of open source software projects. Through a collaborative and meritocratic development process, Apache projects deliver enterprise-grade, freely available software products that attract large communities of users. The pragmatic Apache License makes it easy for all users, commercial and individual, to deploy Apache products.” (www.apache.org)

Compiere

“Compiere, a Consona ERP solution, is supported by the comprehensive resources of Consona Corporation - a leading provider of software and services that enable organizations to achieve continuous business process improvements. Compiere is the most widely used open source enterprise resource planning (ERP) and customer relationship management (CRM) solution with more than 1.4 million software downloads.” (www.compiere.com)

OpenBravo

“Downloaded almost 2,000,000 times, Openbravo is the world’s leading web-based Open Source ERP solution. As the Agile ERP Company, Openbravo sells 100 per cent of its Professional Edition software through channel partners, whose local expertise provides rapid, cost-effective on-site implementation services. Openbravo partners also provide deployment expertise for OpenBravo’s rapidly growing selection of the nearly 400 ERP modules that add localization and rich functionality to the core product.” (www.openbravo.com)

WebERP

“webERP is a complete web based accounting and business management system that requires only a web-browser and pdf reader to use. It has a wide range of features suitable for many businesses particularly distributed businesses in wholesale, distribution and manufacturing. It is developed as an open-source application and is available as a free download to use. The feature set is continually expanding as new businesses and developers adopt it.” (www.weberp.org)

6. CASE STUDY – DESK_TABLE COMPANY

Following details have been modified due to protection of Desk_Table Company.

6.1 INTRODUCTION AND HISTORY

“Desk_Table company is the world’s largest provider of workplace solutions, offering the widest range of products and services that allow individuals and companies to work however, wherever, and whenever they need to.

It operates across 500 cities in 85 countries. Products and services include fully furnished, equipped and staffed offices, world-class business support services, meeting conference and training facilities and the largest network of public videoconference rooms all serving over 200,000 clients daily.

Desk_Table also supports the growing trend of mobile and home working. Supporting workers at home and on the road, with services such as Virtual Office providing dedicated business addresses as their business base as well as mail and call handling services. Desk_Table also operates business centres in airports and other commercial hubs to serve clients wherever they find themselves working.
(www.desk_table.com)

6.2 USED APPLICATIONS

System software

System software used in Desk_Table Company is **Microsoft Windows XP Professional**. Is used by all departments on all computers (whole company is using Hewlett-Packard computes – desktop or notebook).

Application software*

Microsoft Office

This software suite is crucial aspect of Desk_Table company operations. Not only

* Author chose applications only used by the Accounts Payable team

that the spread sheet application (Excel) is used for collection of all necessary data but it is also used for creation of reports.

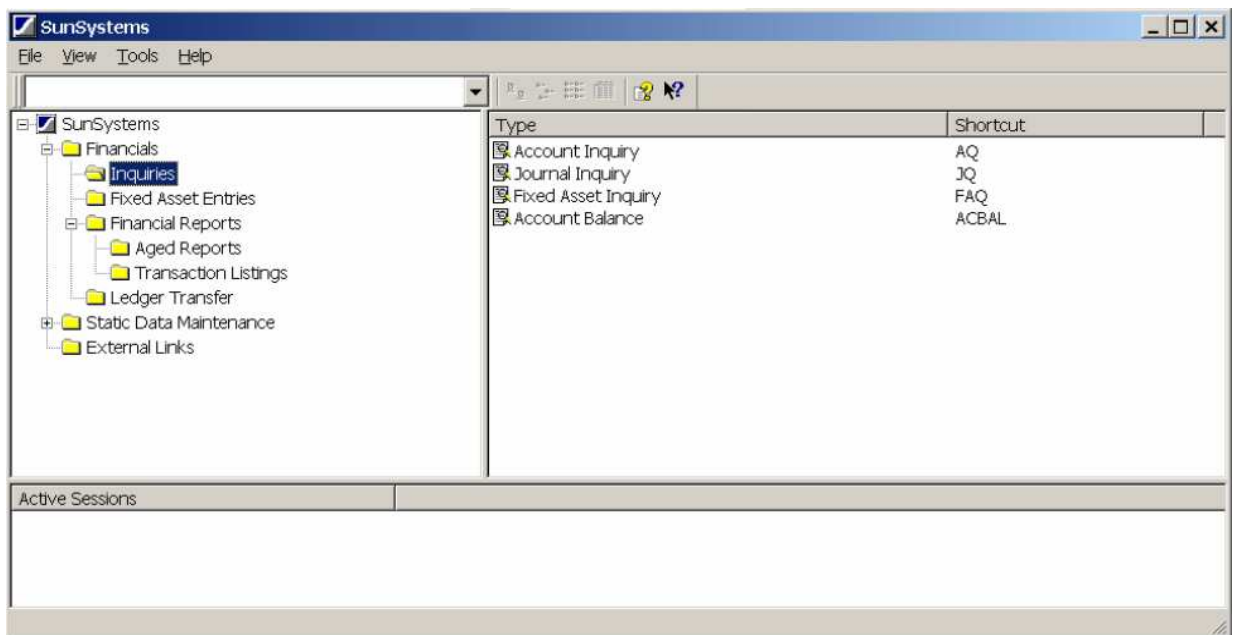
Microsoft Outlook is (as author mentioned in chapter 4.2.) not only used as a mailbox but also as meetings planner, calendar and notes maker. Specially the meetings planner is important feature used in Desk_Table company. There are always at least 7 meetings a day between all departments and it would be very hard for employees to keep track of all meetings if there would not be Outlook application.

The mailbox itself is used for the collection of invoices incoming into company. Accounts payable team saves attachments of these e-mails (mostly scanned originals of invoices in pdf files) into public share-drive (accessible by everyone with corresponding privileges) and then uses these documents for accounting purposes.

SunSystems 5.2.1

Accounting software. Holds data of General Ledger. For example: allocations of accounts, creation of new suppliers cooperating with Desk_Table company, entering accounts of new customers of company, business units, received invoices, purchase invoices, prepayments, fixed assets and their depreciation, intercompany journals, reconciliations of accounts, entering reference data and journals, etc.

SUN is also used for reports. Like financial reports, trial balances, financial analyses, account listings, payment listings, aged reports and reference data reports.



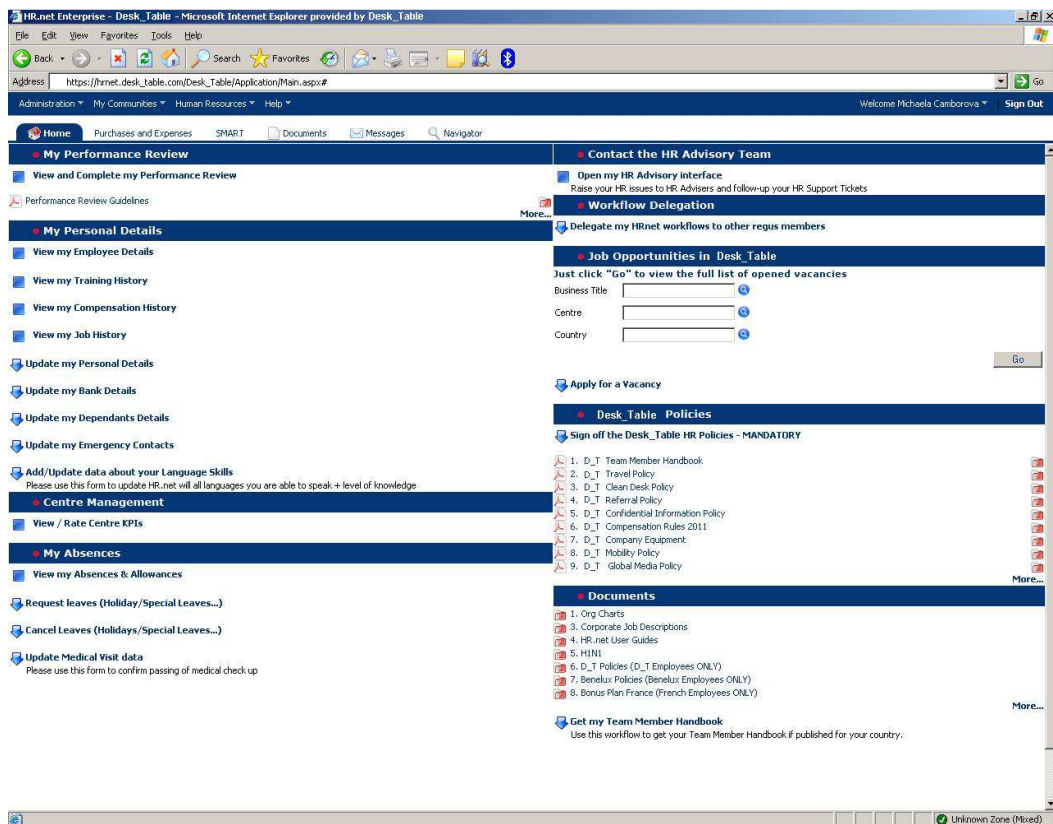
Print screen 1 - SUN opening page

Vision

Vision application is closely “related” to the SunSystems applications. It is an add-in application in Microsoft Excel. It helps to create reports. It downloads all necessary data from Sun to create report. For example, Accounts Payable team wants to create report of all open items on supplier accounts. If there would be no Vision application, they would have to open every supplier account and check it manually. With Vision, they just click about four times and report is created – in Excel. Also KPI (Key Performance Indicator report – explained in chapter 6.4) is created via this application.

HRnet

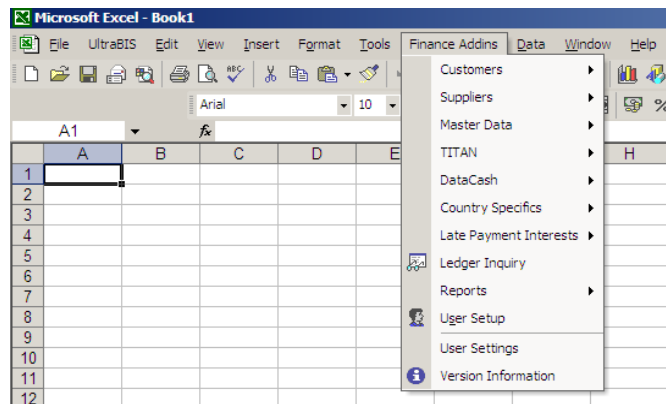
Is Web enabled applications which holds all HR aspects (employee’s data, employee’s KPI (Key Performance Indicators), vacations, company policies (e.g. travel policies, clean desks, referral policies, compensations rules, mobility policies), documents (organizational charts, corporate job descriptions, finance reports, etc.). Employees can also create purchase orders (EPO-Electronic Purchase Order)



Print screen 2 - HRnet main page

Finance Addins

Again add-in application for Excel used by Accounts Payable to see the aging reports from SUN (to show how long have been invoices outstanding).



Print screen 3 - Finance Addins functions

6.3 KEY PERFORMANCE INDICATOR REPORT

Key Performance Indicator Report

It is a report created by the Accounts Payable team. This report displays the amounts of all received invoices and their status (if they are rejected, pending or processed). It also displays number of active suppliers, number of inactive suppliers, new suppliers and number of centres served.

Print screen of this report can be found in supplements (this report will be used further in the case study part of thesis).

6.4 EFFECTIVENESS OF SOFTWARE APPLICATIONS

There are many indicators – error messages, dialog boxes, user rights (how long does it take to have access to the software), how large volumes of data are required for the full usage of the software, what are the security requirements, involvement of end users in the implementation process, how are the input and output data organized. (O'Brien, Marakas; 2011; Stair, Reynolds; 2010)

6.5 CASE STUDY – EFFECTIVENESS OF USED APPLICATION

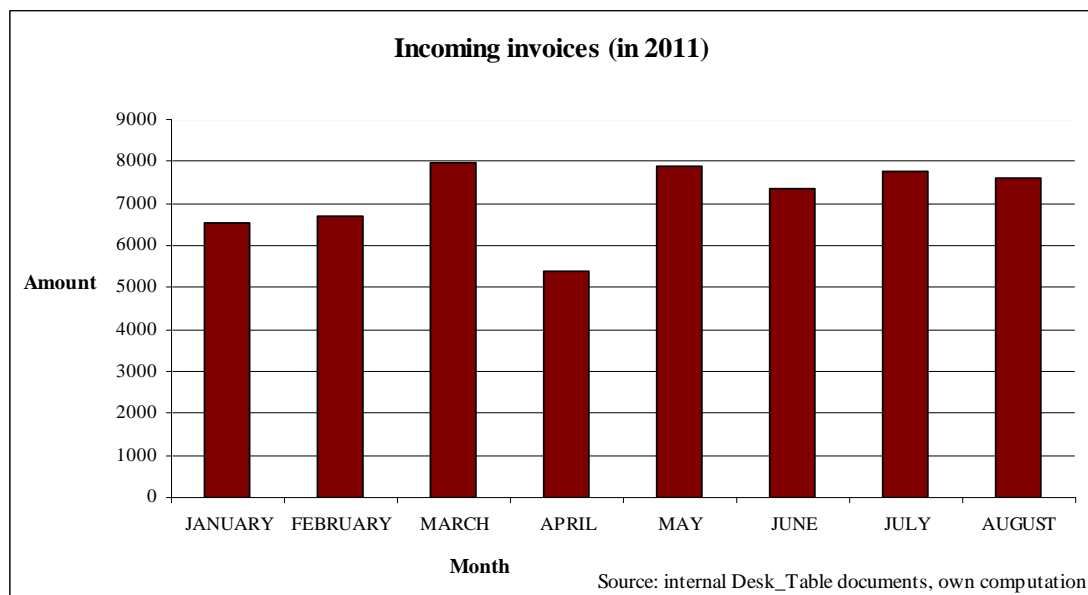
Microeconomic evaluation of cost effectiveness of used application – Cost per one invoice (comparison of purchased SunSystems accounting software with outsourcing of accounting service by Audita Company).

For better comparison of cost per one invoice, author will divide the cost of SUN 5 software by twelve months so that the results are more visible.

Exchange rate used in calculations is 24.50 CZK per Euro.

Number of incoming invoices

Every month the KPI (chapter 6.3) is created. Months for which author was able to collect data were in period January to August. Data are displayed in following graph and table:



Graph 1 - Incoming invoices

JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST
6536	6680	7981	5374	7896	7362	7774	7600

Table 1 - Incoming invoices

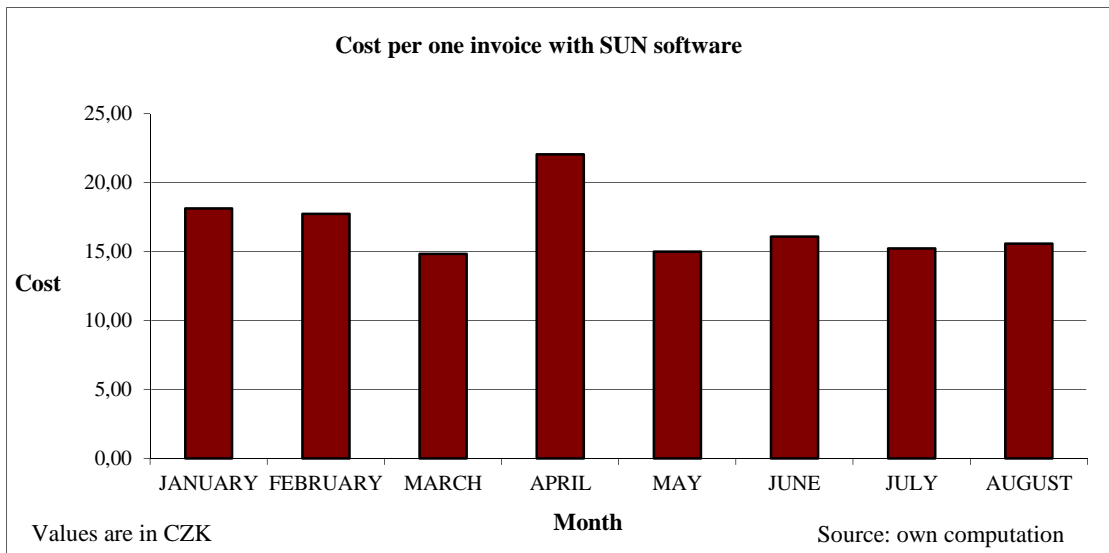
SunSystems 5.2.1

Accounting software used in Desk_Table Company. It was bought directly from the developer and implementation took one year and all employees were involved during this implementation.

Desk_Table Company has not bought this software in a regular sense. Desk_Table bought only the licence to use this software. Licence was paid once and does not have to be paid again. Let's say – “licence for life”. One licence is valid for one user. The cost of a single licence was 1,000 EUR– 24,500 CZK. There are 50 people in company using this software. When we multiply these two variables, we get the “purchasing” cost of 1,225,000 CZK. Another cost connected with SUN 5 software is the implementation cost. This cost was 8,000 EUR – 196,000 CZK.

In total the cost of SUN 5 software was 1,421,000 CZK. Which when divided by 12 (to see the monthly cost) is **118,416.70** CZK per month.

As next step, author computed cost per one invoice – by division of monthly cost of SUN software by the number of received invoices per one month – from the KPI report. Here are graph and table displaying cost per one invoice per month in CZK.



Graph 2 - Cost per on invoice with SUN software

JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST
18.12	17.73	14.84	22.04	15.00	16.08	15.23	15.58

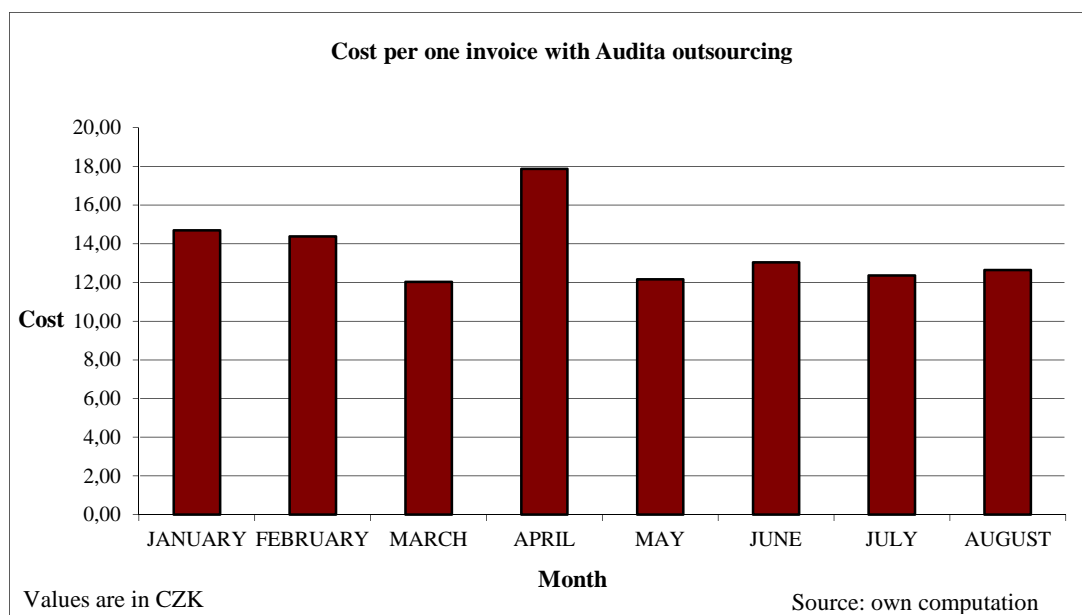
Table 2 - Cost per one invoice with SUN in CZK

Outsourcing of accounting

For data collection author asked several Czech outsourcing companies to kindly supply research data (in authors inquiring e-mail there were specifications which were directly applicable for Desk_Table Company – number of employees, number of received invoices, frequency of documents processing, vat payer confirmation and required monthly reporting) for author’s case study: RSM Tacoma, E-consulting, HOKA Financial group, ComSet, Account Agency, Mazars and Audita. Only two companies replied on these emails – Mazars and Audita. But only one company – Audita – supplied the needed data. To which author hereby must thank.

Author was contacted by an Audita employee and received information about the cost of this service. The cost would be calculated on the basis of monthly fees after the agreement from Desk_Table Company. The cost for this service would be 80,000 crowns plus tax. Which in total gives us **96,000 CZK** per month (or 1,152,000 CZK per year)

Then again, author divided the cost of Audita outsourcing service by the number of invoices received per month from the KPI report. And got this graph and table.



Graph 3 - Cost per one invoice with Audita outsourcing

JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST
14.69	14.37	12.03	17.86	12.16	13.04	12.35	12.63

Table 3 - Cost per one invoice with Audita in CZK

Now when we have the necessary data, comparison can start.

It is very clear that that the cheaper invoice processing tool is Audita outsourcing accounting. Following tables display savings with Audita outsourcing **per invoice, per month** and **per year**.

Savings with Audita outsourcing per invoice per month in CZK:

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST
SUN	18.12	17.73	14.84	22.04	15.00	16.08	15.23	15.58
Audita	14.69	14.37	12.03	17.86	12.16	13.04	12.35	12.63
SAVINGS	3.43	3.36	2.81	4.17	2.84	3.04	2.88	2.95

The Audita outsourcing would **save** Desk_Table Company on average **3.19 CZK** per invoice per month.

Saving with Audita outsourcing per month in CZK:

	Cost per month
SUN	118,416.67
Audita	96,000
SAVINGS	22,416.67

Desk_Table Company would **save 22,416.67 CZK** per month.

Savings with Audita outsourcing per year in CZK:

	Cost per year
SUN	1,421,000
Audita	1,152,000
SAVINGS	269,000

Desk_Table Company would **save 269,000 CZK** per year.

This result does definitely sound exciting. To save almost 270 thousand crowns per year due to outsourcing of accounting service, that is very good!

But that would be **true only in the year 2011**. For next years, there would be **no cost associated with SUN software**, because of the “license for life”. No maintenance costs, no implementation costs, no trainings, no upgrades. Nothing.

	Cost per year in 2012
SUN	0
Audita	1,152,000
SAVINGS	-1,152,000

(values are in CZK)

In the table above you can see that with no costs for SUN software and fixed yearly costs with Audita outsourcing, the Desk_Table Company would actually **lose 1,152,000 CZK** per year if it would **continue using** the service of Audita **for more than one year**.

INTERPRETATION OF RESULTS

On one hand (in short term period) it would be **very interesting** for the Desk_Table Company to use the accounting services of Audita outsourcing. It would **save** the company almost **270 thousand crowns per year**. And this money than could be used for other activities. Upgrading of hardware, improving the working conditions, team-building activities, etc.

But on the other hand (in long term period) Desk_Table Company bought “**license for life**” for the SunSystems software. And no matter the lower cost of Audita outsourcing, this “only once paid license” is much more beneficial for the company. Because there are **no additional SUN costs** in the following years the company does not have to pay anything else. But, with Audita, it would have to pay monthly fees for the services and therefore lose money.

Author’s **recommendation** to Desk_Table Company is **to keep using the SunSystems software**. It will save them a lot of money in the long term period – which is probably the reason why the company purchased this software in the first place. There is no reason for outsourcing of accounting service.

There may be a possibility to save even more money by using an open source accounting software – most probably as a part of an open source ERP system. Unfortunately, there is no space for this kind of research topic in this bachelor thesis.

7. CONCLUSION

Information systems went through big changes in a considerably short period of time. Hundred years ago it was almost science fiction to do business with someone on the other side of planet. Nowadays, companies even hold international job interviews to hire the best and brightest.

Information systems belong to category of goods which cannot be replaced by anything else. Without IS businesses would not be able to operate in any competitive way. It would be impossible for employees to work with any bigger amount of data without getting insane.

There are many approaches when it comes to hardware, software and networks used in business. Companies have very wide field to choose from. They can have two computers connected via LAN network with Internet connection. Or they can have hundreds of computers connected to clouding server with all necessary software applications. They can store their data on internet servers, hard-drives, flash-drives or even papers.

Companies buy software with idea that it will give them competitive advantage. And spend enormous amounts of money to customize software to its needs. Sometimes even employees are asked to help with implementation – since they are the ones who will use the software on daily basis. The more involved employees are, the easier the software is implemented and less money is spend on trainings.

Case study has **proven** the hypothesis. The accounting software SunSystems is a cheaper way of processing invoices in company in comparison with outsourcing of accounting service by Audita Company.

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9. SUPPLEMENTS

Key Performance Indicator Report of received, rejected, pending and processed invoices.

Key Performance Indicator Report 2011											
AUGUST 2011											
Country	Number of Invoices Received		Number of invoices rejected		Number of pending last day of the month. I.e. not booked	Number of invoices Processed		Number of active suppliers	Number of inactive suppliers	Number of new suppliers	Number of Centers Served
	Number	% from total	Number	% of compliance		Number	Number				
BELGIUM	312	4.11%	2	0.64%	2	310	4.37%	280	263	5	9
LUXEMBOURG	121	1.59%	1	0.83%	1	120	1.69%	115	143	2	3
NETHERLANDS	1150	15.13%	213	18.52%	39	937	13.22%	1062	1171	33	43
SPAIN	455	5.99%	45	9.89%	45	410	5.78%	275	199	6	11
PORTUGAL	178	2.34%	2	1.12%	2	176	2.48%	162	96	1	5
ITALY & MALTA	443	5.83%	91	20.54%	24	352	4.96%	305	412	10	11
TURKEY	284	3.74%	0	0.00%	0	284	4.01%	301	33	12	5
HUNGARY	270	3.55%	0	0.00%	0	270	3.81%	169	195	0	4
AUSTRIA	259	3.41%	6	2.32%	0	253	3.57%	202	277	5	6
SWITZERLAND	429	5.64%	12	2.80%	0	417	5.88%	253	268	11	12
CZECH & SLOVAK & RSC	272	3.58%	0	0.00%	0	272	3.84%	210	152	6	8
BULGARIA	49	0.64%	0	0.00%	0	49	0.69%	56	212	1	1
LITHUANIA	39	0.51%	0	0.00%	0	39	0.55%	37	29	0	1
ESTONIA	39	0.51%	0	0.00%	0	39	0.55%	61	7	3	1
POLAND	344	4.53%	0	0.00%	0	344	4.85%	217	282	2	10
ROMANIA	232	3.05%	1	0.43%	0	231	3.26%	139	252	0	3
SERBIA	40	0.53%	6	15.00%	3	34	0.48%	60	0	0	1
LATVIA	42	0.55%	0	0.00%	0	42	0.59%	38	0	0	1
FINLAND	134	1.76%	8	5.97%	8	126	1.78%	138	157	9	2
SWEDEN	449	5.91%	46	10.24%	10	403	5.68%	275	340	11	8
IRELAND	252	3.32%	13	5.16%	0	239	3.37%	156	104	6	4
GERMANY	1807	23.78%	64	3.54%	35	1743	24.58%	930	1602	41	37
TOTAL	24	7600	510	6.71%	169	7090		5449	6214	172	187

Print screen 4 - KPI