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LIFECYCLE STUDY FOR INFORMATION TECHNOLOGY SYSTEMS IN THE COLD ROLLING PLANT 1

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ABSTRACT

Oulu University of Applied Sciences
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Supervisors:	Kari Laitinen, Tuomo Aro	
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The purpose of this Master's thesis was to identify the status of the lifecycle for the IT components used in the production in Cold Rolling Plant, Outokumpu Tornio Site. Other purposes were to clarify the availability of support and spare parts, and to analyze if the components can be upgraded or replaced with newer ones.

One purpose was also to get a view of the used equipment in production lines and to study methods for lifecycle management.

This study covers the basics provided by ITIL and the global manufacturers, ABB and Siemens. The study included field surveys and spreadsheets were created based on the surveys. During the field surveys, all IT components were photographed and finally over 700 photos were analyzed with a system documentation.

This study and the result from the field surveys can be used as a base for the IT system development and for developing daily routines. It gives views for the lifecycles and used equipment in the IT systems in the production and acts as a successful approach for collecting data from the field. The results are company confidential information and separated from the published version.

Keywords:

Lifecycle, Information Technology, Cold Rolling

FOREWORD

This Master’s thesis was done at Outokumpu Tornio Site. The supervisors of the thesis were Kari Laitinen, Principal Lecturer - Oulu University of Applied Sciences and Tuomo Aro, Director - Production and R&D, Outokumpu.

The purpose of the study was to clarify and identify components used in the production and to define the status for them from lifecycle point of view. Also, review methods used for lifecycle management, best practices and tools provided by global manufacturers were handled.

The study was successful from the project point of view but also with the results. The area was large and the project plan made in the beginning gave a good view for the activities and it worked well as a schedule for the whole project. The study was made within the timeframe and the results for further purposes are now available.

During the planning phase came the idea to take a camera with the surveys. All components were localized and photographed in the shop floor. From the results of the surveys a good snapshot of the situation was received. The material can also be used for several other studies in future.

I would like to thank my supervisors and colleagues for the support.

The biggest thank goes to Anne who made it possible to be away from daily routines at home during the studies, thanks for the understanding and flexibility. Thanks also to Eetu for understanding my absence from the hobbies.

In Tornio 13.05.2014

Tommi Pennanen

CONTENTS

ABBREVIATIONS AND TERMS

AG	LTD (in German: Aktiengesellschaft)
AGV	Automated guided vehicle
ALP	Automatic sheet packaging line
AP	Annealing and pickling line
APAC	Asia Pacific
ARP	Automatic reel packaging line
ASCII	American Standard Code for Information Interchange, character-encoding scheme
AUI/TP	Convert Attachment Unit Interface (a 15 pin connection) to Twisted pair (10 Base T RJ-45)
CFC editor	Software for SIMATIC Controllers
CI	Configuration Item
CMS	Configuration Management System
COM	Communication port, serial port interface
Coros LS-B	Siemens automation visualization system for operating stations
CPM	ABB Collaborative Production Management
CPM4Metals	ABB Collaborative Production Management for Metals
CRM	Cold Rolling Mill
CRP	Cold Rolling Plant
Cway	Operator interface for AGV system
DC	Direct current, the unidirectional flow of electric charge

EMEA	Europe, the Middle East and Africa,
EOL	End Of Life, a term used with respect to terminating the sale or support of goods and services
FeCr	FerroChrome, an alloy of chromium and iron containing between 50% and 70% chromium
GM	Grinding Mill
HA	Slitting line
HIKU	Production planning application
HIO	Coil grinding line
HMI	Human Machine Interface
HP/UX	Hewlett-Packard UniX
HP	AP, Annealing and Pickling line
HW Config	Software for SIMATIC hardware
IBA PDA	IBA AG manufactured process data acquisition system
ibid.	ibidem (Latin) in the same place, repeated reference
IMS	IMS GmbH, develops and produces isotope, x-ray and optical measuring system
IP	Internet Protocol
Simatic IPC	Siemens Industrial PC portfolio
ISA-95	International standard for the integration of enterprise and control systems
IT	Information Technology
ITIL	Information Technology Infrastructure Library

ITSM	Information Technology Service Management
KA	Cut-to-length line
KVM	Keyboard, video and mouse
L2	Level 2, based on ISA-95
MES	Manufacturing Execution System
MS DOS	Microsoft Disk Operating System
OPC-protocol	Object Linking and Embedding for Process Control, an industry standard created with the collaboration of a number a leading worldwide automation and hardware software suppliers working in cooperation with Microsoft.
OpenVMS	Open Virtual Memory System, a computer server operating system that runs on VAX, Alpha and Itanium-based families of computers
OS	Operating system
OTW	Outokumpu Tornio Works
PC	Personal Computer
PCS	Process Control System
PDD	Performance and Development Dialogue
PEC	ABB Power electronics controller for power converters, AC 800PEC
PG	Siemens programming device
PIHA	Surface data management system
PLC	A Programmable Logic Controller
PMS	Plant Management Software
R&D	Research and development

RETU	Manufacturing Execution System
RMS	Roll shop management system
RP1	Manual coil packaging line
RTDB	A relational database
SCADA	Supervisory Control And Data Acquisition, a system operating with coded signals over communication channels
SFC editor	Sequential Function Chart editor, Graphical configure and commission tool for Siemens PCS7
SiiX	Siemens industrie-integrierte Unix System
SPM	Skin Pass Mill
Std	Standard
SUS	Software Update Service
SZ	Sendzimir mill
TIA	Totally Integrated Automation Portal, Siemens automation software
tpa	Tonnes per annum (tonnes per year)
UNIX	A multitasking, multi-user computer operating system
VA1	Coil build-up line 1
WinCC	A supervisory control and data acquisition (SCADA) and human-machine interface (HMI) system from Siemens for Windows Operating systems
VLAN	Virtual local area network, a single layer-2 network may be partitioned to create multiple distinct broadcast domains. Mutually isolated that packets can only pass between them via one or more routers.

VO	Tension levelling line
VTK	High bay storage
VV	Skin Pass Mill
x86	A family of backward compatible instruction set architectures based on the Intel 8086 central processing unit
XML	Extensible Markup Language, a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.

1 INTRODUCTION

1.1 Overview

This study was made for the IT department of Outokumpu Tornio steel factory. IT infrastructure, IT application and operation and maintenance groups from production participated in this study. Also equipment supplier's thoughts of the lifecycle were studied. The subject was limited to the Cold Rolling Plant 1 because for the Cold Rolling Plant 2 has planned a modernization project in near future.

The purpose of this study was to identify the status of the lifecycle for the IT components used in the production, to clarify the availability of support and spare parts, and to analyze if the components can be upgraded or replaced with newer ones. IT components consist of applications, networks, servers, and workstations.

IT systems have become part of the production in early 1980's in Tornio. The lifecycles of the automation systems are much longer than the ones of the IT systems. The target was to find out the lifecycle of each IT system and at what phase they are in Tornio. Also, it was interesting to study if there are any best practices available for modernizing the IT systems. Would it be just better to continue manually the lifecycle with "tape and glue" or let the IT system live its own life regardless of other related systems?

The topic was selected under study because the asset management has been mainly inadequate. Some of the lines have been modernized during decades, but lot of automation and IT systems built in 1990's are still in use. As the support personnel and methods have changed many times during the system lifecycle, the knowledge has been lost from many areas. This study will work as a base for the IT system development and also support daily routines.

1.2 Outokumpu

Nowadays Outokumpu is the global leader in stainless steel and high performance alloys and Tornio Site's facility is the most integrated stainless steel plant in the world.

The roots of Outokumpu lead to a town called Kuusijärvi where it was discovered a large copper ore deposit in 1910. The production started in the following few years and within decades the mine was transformed to a modern mass production facility. Later in year 1968 Kuusijärvi transformed its name to Outokumpu.

Outokumpu was one of the major copper producers in Europe and in the middle of the century it had also mines like nickel, zinc and cobalt.

The history of the Tornio Site and Kemi mine started from the happening where a Finnish diver found a piece of chromium from a channel in Kemi in 1959. It turned out to be a success, and Outokumpu started to mine chromium from Kemi in 1960.

Later Outokumpu built a smelter in Tornio and the first steel was smelted in year 1976. At the beginning Tornio produced 50,000 tonnes of stainless steel per year. Later Outokumpu built hot and cold rolling facilities in Tornio Site which made it possible to expand the product portfolio (Legacy of 100 years, Outokumpu, Date of retrieval 3.11.2013).

1.3 Cold Rolling Plant

The Cold Rolling Plant in Tornio Site has two locations, CRP 1 and CRP 2. The production started in 1976 with a capacity of 50,000 tonnes/ year in CRP 1. CRP 2 also called as RAP 5 started the production in 2003. The current capacity of the Cold Rolling Plant is 1.2 million tonnes/year, 750,000 tpa of cold rolled products and 450,000 tpa of hot rolled products.

CRP 1 consists of 25 production lines from a Build-up-line to a High bay storage. CRP 2 is an integrated cold rolling line, including annealing and pickling, cold rolling, skin pass and tension levelling processes. A closely related and common process for both plants is regeneration and neutralization, which handles and recycles all liquids needed in the pickling process. Regeneration and neutralization plant is located between CRP plants.

2 OUTOKUMPU

Outokumpu is an integration of companies which have a long history in mining and metallurgy and which are focusing on stainless steel production. The headguarters is located in Espoo, Finland. The revenue in 2013 was €6.8 billion and it has about 12,500 employees. Stainless EMEA has the largest share of the revenue, 55% (Annual Report 2013, Outokumpu, date of retrieval 23.4.2014).

In year 2012 Outokumpu informed that it will purchase a stainless steel division Inoxum from ThyssenKrupp. On December 29, 2012 a new Outokumpu started operations with four business areas, Stainless Coil EMEA, Stainless Coil Americas, Stainless APAC and High Performance Stainless & Alloys (Stock Exchange Release, Outokumpu OYJ, date of retrieval 23.4.2014).

Outokumpu has the most significant production sites in Finland, Germany, Sweden, United Kingdom, Unites States, Mexico and China (Vuosikertomus 2013, Outokumpu, date of retrieval 23.4.2014).

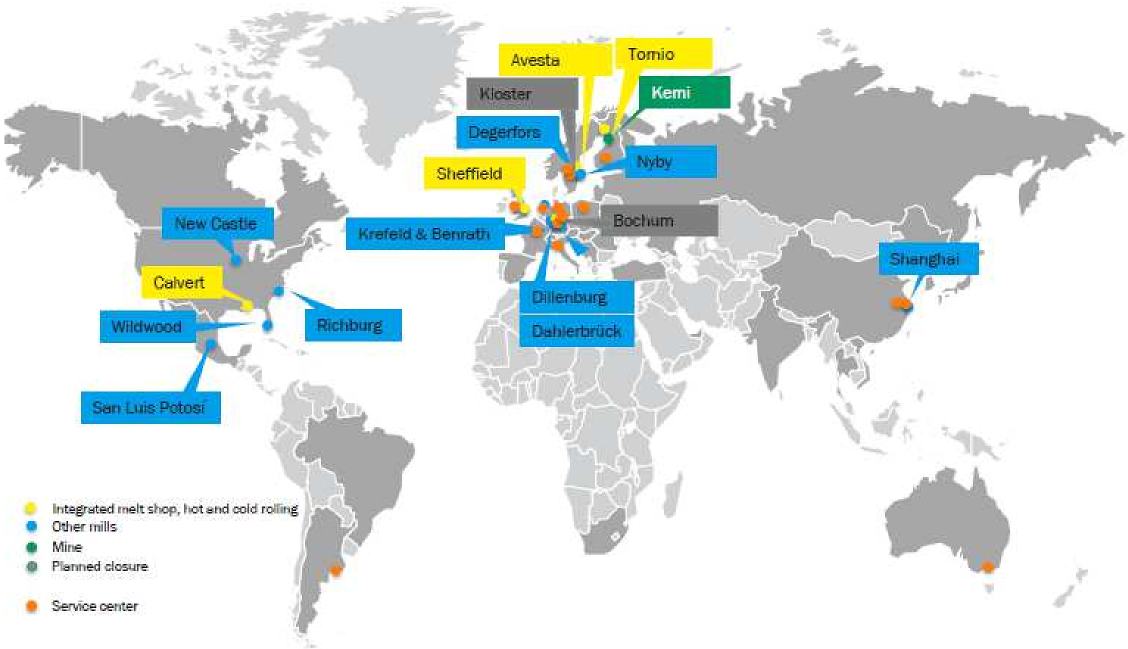

FIGURE 1. Outokumpu operates around the world (This is Outokumpu, Hannu Hautala, date of retrieval 23.4.2014).

2.1 Tornio Site and Kemi Mine

Safety is the number one in all activities in Outokumpu and its priority takes over everywhere, also in the production.

Tornio is the most integrated stainless steel plant in the world. Its own chrome ore guarantees supplies and ferrochrome quality stays at a stable level. An integration brings savings in primary energy as the liquid ferrochrome and carbon monoxide can be get from its own process. Processing times can be kept short with lower logistic costs. Part of Tornio Site is the finishing plant in Terneuzen and it is located close to main markets.

Kemi Mine is the only mine in European markets. The production started in 1968 and the first minings were done from an open pit. Currently the production is underground. At the mill ore is concentrated into upgraded lumpy ore and fine concentrate. It is used as raw materials for the Tornio Ferrochrome Works. (Outokumpu Tornio Site and Kemi Mine, Outokumpu, date of retrieval 23.4.2014).

2.1.1 Production Chain

The raw material from Kemi mine is transferred to Tornio by trucks. In Tornio Ferrochrome Works the concentrates are refined to ferrochrome (FeCr). Ferrochrome Works consists of a sintering plant, two smelting furnaces and product handling. In 2013 the third smelting furnace has doubled ferrochrome production to 530 000 tpa and with its support Ferrochrome Works will supply raw material for the whole Outokumpu Group in near future.

The next work phase is in Steel Melting Shop. The liquid ferrochrome and recycled steel are melted according to the customer specified grade and cast into slabs. Slabs are 14 m long and 167 – 185 mm thick. The width can be from 1000 to 1620 mm. The slab can weight the maximum of 26 tonnes.

After melting the slabs are hot rolled into black coils in Hot Rolling Mill. After processing the material is in coils and the strip thicknesses are from 2.5 to 12.7 mm.

At the next phase the coils are transferred with the terminal tractors to the Cold Rolling Plant 1 or 2, where the black hot coils are annealed and pickled to white hot bands and further processed to cold rolled products.

From the CRP the materials are transferred to the harbor, The Port of Tornio, or directly via train or trucks to the end-users or distributors. From harbor the products are exported into the markets or to the finishing plant in Terneuzen, Netherlands, where are slitting and cut-to-length lines for further processing. (Outokumpu Tornio Site and Kemi Mine, Outokumpu, date of retrieval 23.4.2014).

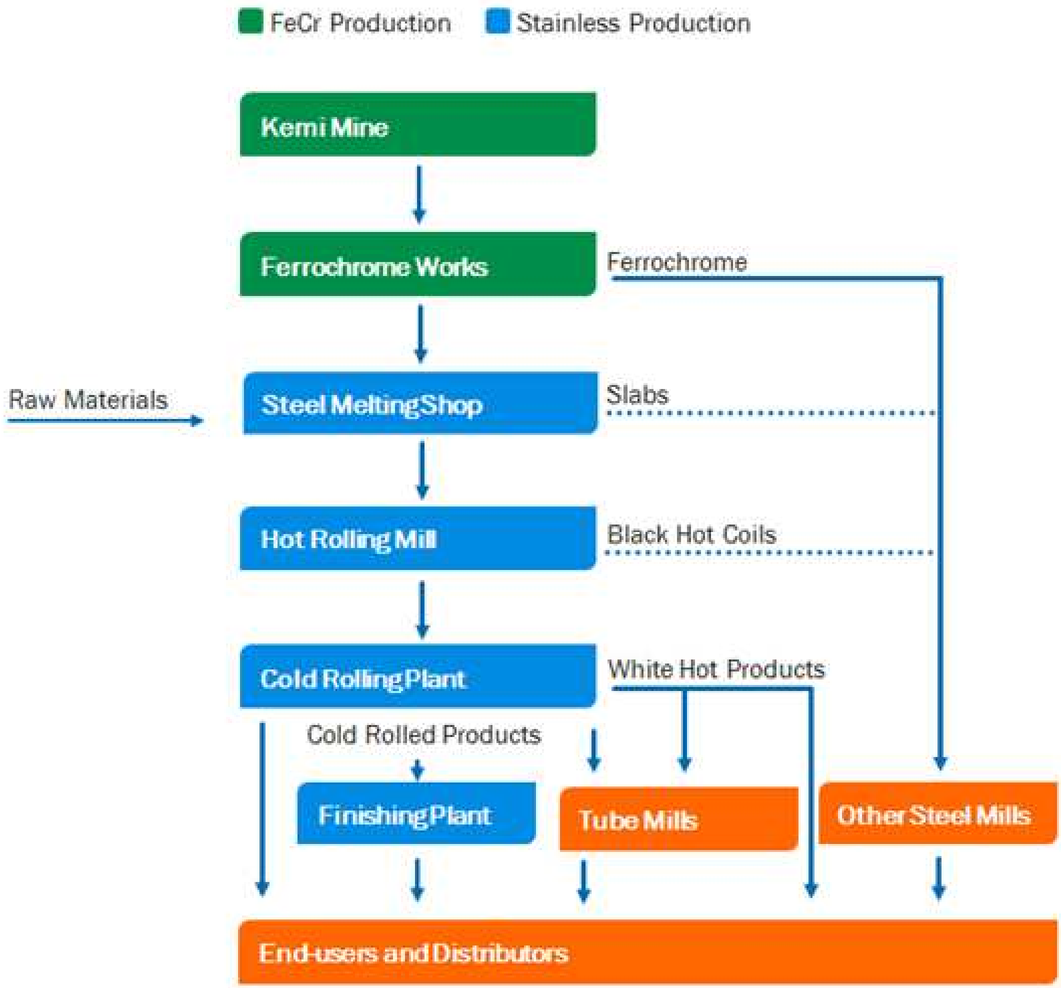

FIGURE 2. Kemi Mine and Tornio Site Production chain (Outokumpu Tornio Site and Kemi Mine, Outokumpu, date of retrieval 23.4.2014)

2.2 Cold Rolling Plant 1

The Cold Rolling Plant 1 consists of 25 production lines. The black hot strips produced in Hot Rolling Mill are covered with a black scale. In the Cold Rolling Plant, coils are unrolled and passed through an annealing and pickling line 3 which recovers the mechanical properties of the steel and removes the scale. After annealing and pickling process the strip can be called as white hot strip.

At the next work phase the coil is rolled to its desired thickness. The maximum reduction could be over 80%. As cold rolling hardens the steel, the strip must be treated in the annealing and pickling line again before further processing.

After final annealing and pickling, the material is transferred to a polishing treatment in the skin pass mill to improve its surface finish.

From the skin pass mill the stainless steel coil continues to the slitting and cut-to-length lines, where the steel is finished to the customer required dimensions, as coils or as individual sheets. After the products are finished, they are packed in automatic packaging lines and moved via conveyors to the high bay storage.

From storage the material can be transported forward by a truck and trains. Also the material can be transported to the harbor with terminal tractors or a forklift and shipped forward with ocean liners (Tornion tehtaiden ja Kemin kaivoksen esittelymateriaali, Niina Kostiander, date of retrieval 23.4.2014).

The material transportation and warehousing in the Cold Rolling Plat is handled with automated guided vehicles (AGV) and automatic cranes. The material information and flows are handled by a Manufacturing Execution System (MES) called RETU.

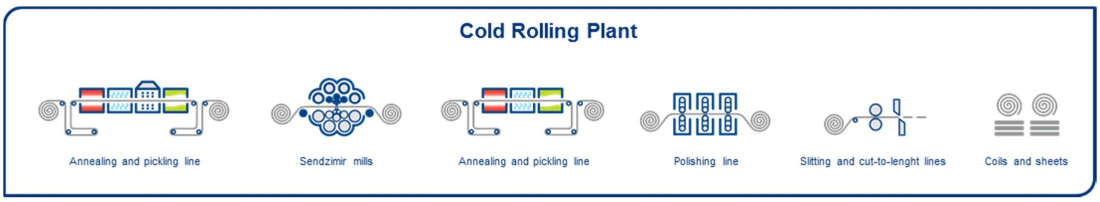

FIGURE 3. Cold Rolling Plant processes (Tornion tehtaiden ja Kemin kaivoksen esittelymateriaali, Niina Kostiander, date of retrieval 23.4.2014).

3 LIFECYCLE MANAGEMENT

Lifecycle is part of the operations that need to be maintained carefully, even it is not present in every days routines. Every component in the production has a different lifecycle. Mechanical and automation components are widely in use and lifecycles for them are well known. The manufacturers can provide a recommendation for these components and their consumption can be quite easily estimated.

For IT components the situation is a bit more challenging. The hardware is deeply joined together with the operating system and drivers. Spare parts are also ageing together with the running system and they also need the same routines even they are not in daily use, like patching and virus protection. As the development in information technology is fast, it causes pressure and also opportunities for service providers. They can offer service for management but are also pushing customers to upgrade the systems more often than the other automation.

Lifecycle management is one of the key elements when providing service for customers. The lifecycle management needs to be started already during the planning phase and before implementing a new system into use. During the implementation component lists for the installed systems need to be created and all necessary data has to be collected. It can be used in future for managing the service.

The Service Transition is part of the Information Technology Infrastructure Library (ITIL) and it gives advices for implementing the management systems. ITIL is a collection of best practice guidance on the management of IT services.

Lacy, S. & Macfarlane, I. (2007, 3) state in their book that an effective service transition is not possible if the organization does not recognize the need for it and the benefits it could bring to them.

3.1.1 Configuration management

The support organization needs to understand the items which are critical for running of the customer's business. The items need to be recorded to the configuration management system (CMS) as the configuration items (CI) and activities for them are handled with the configuration management.

The relationships between the items are described in the configuration management. It provides information about the impacts what changes can cause. It also informs what implemented actions made to the items. It also ensures that the used components are identified and maintained and that the changes to them are controlled.

The handling of the configuration item is the base for the whole configuration management. A configuration item could be hardware, a service component or another item, like software or a documentation or even a part of them. The list of the assets works also as complete inventory for the plant. List could include also information for example of the responsible persons and maintenance routines.

Without the configuration and asset management, the service cannot be provided effectively. The activities and resources cannot be coordinated well when all time goes for “firefighting”. One target of the configuration management is to transform from reactive to proactive operations. When the field is well known, activities can be planned and failures can be notified and even avoided before they occur.

Configuration items are possible to group and manage together. A set of components may be grouped into a release or to one line or area. Configuration items should be selected by using established selection criteria, grouped, classified and identified in such a way that they are manageable and traceable throughout the service lifecycle. One good example is the maintenance groups to the servers. Non-critical ones could be handled first as a test group. The second group can be taken servers which are not in use outside office hours etc. (Lacy, S. & Macfarlane, I., 2007, 65 - 80).

3.1.2 Asset Management

The routine for collecting and maintaining the asset data needs to be well established to all parties. Support personnel may consider collecting the data just as an extra load and the customer only as an extra cost. Also the collected data becomes easily out of date, if routines can be slipped.

The benefits need to be clearly highlighted and communicated with good examples to the support team and also to business customers. One good way is to add tasks to personal targets in the annual Performance and Development Dialogues (PDD) and follow the activities carefully.

When building new facilities, all information needs to be collected among the project. The lifecycle management routines must be already planned during the planning phase and the costs and cycles for the upgrades must be estimated in the very beginning of the project (ibid., 84).

3.1.3 Service management

ITIL provides a guidance to make it possible to reach the standards. The standards are made for the Information Technology Service Management (ITSM), which specifies the areas that need to be covered to meet the targets. Best practices give guidance on how to do it and during the implementation activities it can be customized to the local needs.

The service and lifecycle management is also provided by automation suppliers. They provide management tools and support only for the systems they have delivered, so in any case a local configuration management system is necessary for managing the service.

3.2 Siemens AG

Siemens AG is a German multi-industry company. The main sectors are engineering and electronics and it is organized into four main divisions: Industry, Energy, Healthcare, and Infrastructure & Cities. Energy sector is the biggest one with revenue of 35% and industry comes second with revenue of 24% of total €75.9 billion. The number of employees was in year 2013 globally 363,000 which is around 20 percent less than in beginning of the century (The Company Siemens 2014, Siemens AG, date of retrieval 21.4.2014).

Siemens is both an automation and automation software supplier. It supplies products from separate components to tailored automation systems. The most common automation software group is called SIMATIC and it provides solutions for a wide variety of production. (Automation Software, Siemens, date of retrieval 21.4.2014).

3.2.1 Process Control systems

SIMATIC WinCC is a common product for visualization and HMI (Human – Machine interface) operations. SIMATIC PCS 7 is a process control environment, which is based on modular architecture.

Siemens provides own hardware for the systems for an easier lifecycle management and also for avoiding conflicts with non-standard components. When the components and software are known, the environment is better controlled and a root cause for possible system failures can be easier analyzed (SIMATIC PCS 7 Tutorial, Siemens, date of retrieval 21.4.2014).

The SIMATIC Manager is the core of every SIMATIC PCS 7 project. It includes an Engineering Toolset and a project basis for the whole system management. The system consists usually of the Engineering station, where all the changes are made to the application, HMI- and L2-servers and HMI -operating stations.

The SIMATIC Manager -application works as a gateway to all the other applications used to create a PCS 7 project. Related applications are PCS 7 OS for executing Operating stations configurations, CFC editor and SFC editor for creating cyclic automation logic and sequential control systems and HW Config, for configuring all the hardware. All applications have graphical interfaces, which makes it easier to operate and understand the system. (Engineering System, Siemens, date of retrieval 21.4.2014).

Siemens keeps tightly the ropes in its hands. All PC hardware is based on industrial workstations which are designed and dedicated to locations; a server, a client or an operating station (Operator stations, Siemens, date of retrieval 21.4.2014).

3.2.2 PCS 7 Evolution

The SIMATIC PCS 7 was established in 1990's. The SIMATIC PCS 7 V4.0 was established in 1998 and it is still widely used in the production even if the estimated 10 years lifecycle has already ended almost seven years ago. The reasons for the slow upgrade in the automation systems are the upgrade complexity needed for the long shutdown and practically new ramp-up for the system.

The next version of PCS 7 V5 was established in 2000 and the version 6 in 2003. After PCS7 V6 went several years before V7 was launched in 2006. The latest version of SIMATIC PCS 7 is a version 8.0. It provides a universal data management system to set up and also an integrated planning workflow from the process description to the automation program. PCS7 V8 has been available since 2011 as described in figure 4 (SIMATIC PCS 7, Siemens, date of retrieval 21.4.2014).

As Microsoft is also related to the lifecycle of the products, it has not made the situation and upgrade planning any easier. There have been eleven operating systems with numbers of service packs during the PCS7 lifecycles (see figure 4). The PSC7 compatibilities with the Windows operating systems are (Compatibility tool, Siemens, date of retrieval 21.4.2014):

- PCS7 V4 compatible with Windows NT4 and Windows Server NT4
- PCS7 V5 compatible with Windows NT4 and Windows Server NT4
- PCS7 V6 compatible with Windows 2000, XP, Server 2003 / 2003 R2
- PCS7 V7 compatible with Windows XP and Server 2003 / 2003 R2
- PCS7 V8 compatible with Windows 7 and Server 2008, 2008 R2

Microsoft offers support for the operating system at two (2) phases, the mainstream support for the first five (5) years and it continues two (2) years after the next version of the product is released. The second phase is the extended support which continues product's lifecycle five (5) years after the mainstream period has ended and it continues two (2) years after the second version of the product is released. (Windows lifecycle fact sheet, Microsoft, date of retrieval 21.4.2014).

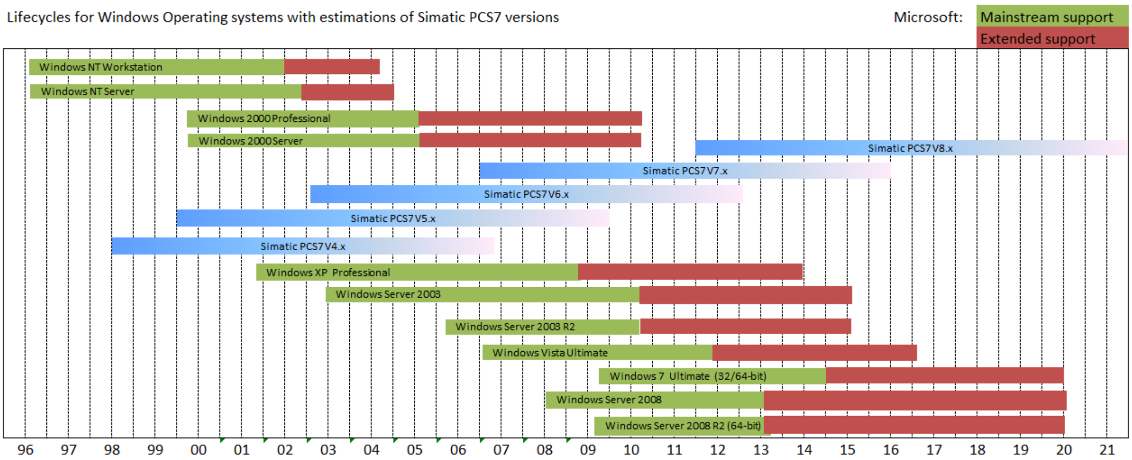

FIGURE 4. Lifecycles for Windows Operating systems with estimations of Simatic PCS7 versions

As Siemens is keeping the ropes in its own hands, it can provide rough schedules for the components lifecycles. The schedule makes it easier to a customer to see when the components need to be replaced or when to purchase replacements for the systems before the product end of life (EOL) announcement. Siemens informs that hardware long-term availability is 4 - 6 years and with spare parts the total service and support period could be the maximum of 9 – 11 years.

After that period the availability of compatible hardware is very limited (see figure 5) but Siemens offers a minimum of 6-month overlapping period with the new device generations. (SIMATIC IPC, Siemens, date of retrieval 21.4.2014).

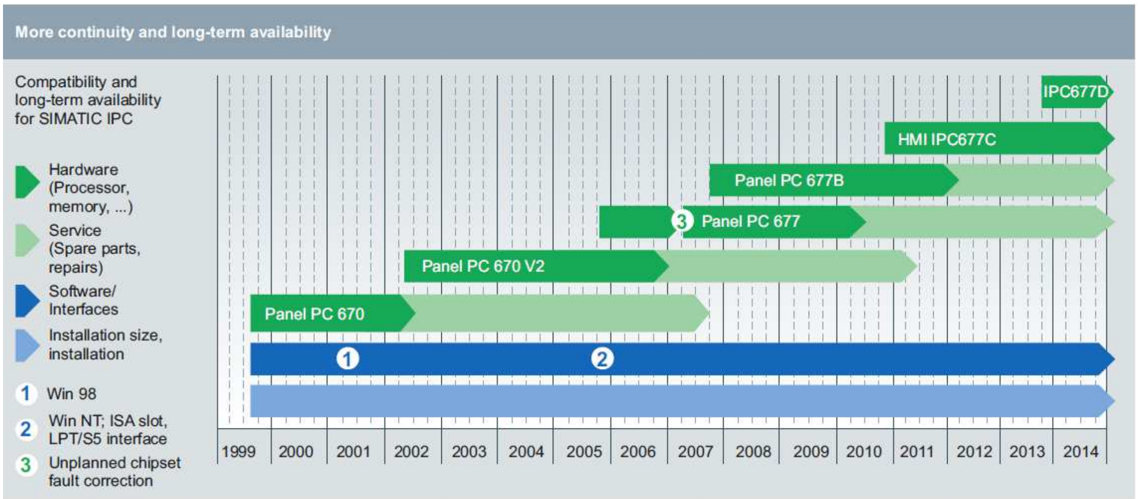

FIGURE 5. (SIMATIC IPC, Siemens, date of retrieval 21.4.2014).

3.2.3 Upgrade planning for Siemens systems

When planning an upgrade for a system, it is necessary to make sure that all components are compatible with each other. For the analysis, Siemens provides a compatibility tool, which is designed to support in questions about the compatibility of various hardware and software products (appendix 2). However, Siemens instructs always to observe the notes of the respective system from the file “PCS 7 readme”. It defines information about the correct version of the installed system. (Compatibility tool, Siemens, date of retrieval 21.4.2014).

Also, when preparing the upgrade of the new SIMATIC PCS7 system, adjustments could be necessary in the basic automation, process automation and in the drive system, too. So it is not only an IT system upgrade, also the automation part need to be considered.

Siemens is providing upgrade packets for the systems and upgrades can be done step by step. SIMATIC PCS7 licenses are provided for the whole system or just for the upgrades. It is more cost efficient to purchase licenses just for the upgrade as the licenses from the old system becomes obsolete. In that case all old PCS 7 licenses must be returned to the license disks and these disks need to be handed over to Siemens.

One possibility is to sign a service contract with Siemens. Software Update Service (SUS) includes upgrades for the system and the yearly fee includes updates for the applications. Installation can be freely scheduled even for yearly maintenance breaks (SIMATIC PCS 7 Process Control System, Siemens, date of retrieval 21.4.2014).

3.3 ABB

ABB is a global manufacturer in power and automation technologies. The main office is located in Zurich, Switzerland and ABB has 150,000 employees globally in about 100 countries. The business units are Power Products, Power Systems, Discrete Automation and Motion, Low Voltage Products and Process Automation. The revenue in year 2013 was € 41.9 billion. The growth for last year was about 6%. All the divisions are at the same level from revenue point of view with 17 - 24% shares. The largest division based on revenue was Power Products with 24% share and the second largest was Discrete Automation and Motion with 22% share. The Process Automation was third and its share was 19% of the revenue (The ABB Group Annual Report 2013, ABB, date of retrieval 23.4.2014).

The company was established in 1988, but the roots lead far back to 1880’s. ABB is delivering complete automation systems and it is focused on research and development activities and innovations (ABB IN BRIEF, ABB, date of retrieval 22.4.2014).

3.3.1 Customer evolution planning process

ABB has been concentrated on customers and the evolution planning a lot in last years. The target is to provide a model to a customer, where the lifecycle can be handled as a program. The customer participates in the process and as a result there will be a model on how the system can be upgraded part by part.

The plan can be used as a base for the annual budgeting and it also minimizes the production impacts. The plan will be created for 3-5 years and will be reviewed periodically (Customer Evolution Planning Process, ABB, date of retrieval 22.4.2014). The target is to provide a possibility to maintain the systems without large investments and long maintenance breaks as one investment can be divided into several ones to be realized within several years.

3.3.2 System Lifecycle Programs

Proactive approaches to hardware and software upgrades are the key approach that ABB recommends to a customer. The target is to plan activities so that the system can be upgraded in small steps. The most secure way is to keep the old system in the background for a while after a new one has switched over to the operational use.

A partially upgraded system makes it easier to plan the production and long maintenance breaks can be avoided. This philosophy suits well for customers as the systems can be kept up-to-date and the productivity can be improved along the production.

ABB evolution programs are also giving the financial flexibility by revamping the existing automation systems one by one. (System Lifecycle Programs, ABB, date of retrieval 22.4.2014).

3.3.3 Automation Sentinel

Automation Sentinel is ABB's lifecycle management support program that provides services to maintain and continually improve the ABB control system installation. With the license a customer gets support for the installed systems and software can be kept up-to-date. ABB has tried to design the service so that it is easy to maintain and extend the lifetime of the system (Automation Sentinel, ABB, date of retrieval 22.4.2014). Still, the marketing of the service has not fully met the customer needs. In many cases the Sentinel is provided just for the warranty period and the customer has not been notified of the importance of the program until the first trial has ended.

Sentinel provides three subscription types and allows customers to choose the level of support and the upgrade schedule that suits best for the customers. The Maintain-level provides services and deliverables for the installed version. This suits well for the systems, where development activities are not needed and the target is to keep the system stable when it is designed. The Maintain Plus -level also includes an access to new software license versions and updates of installed products. This service provides a possibility to keep the installed control system up-to-date as long as it suits the customer's purposes. The highest level of the service is called Maintain and Evolve. It includes all the previous level services but also a capability of evolving ABB control system products. For sure it gives the best flexibility improve productivity but also needs a huge effort from designers that the benefits can be reached.

ABB provides a 3-month trial period for Automation Sentinel with the new control system purchases (Automation Sentinel Program details, ABB, date of retrieval 22.4.2014). Their target is to provide a possibility to become familiar with the program. But three months is a short time during the ramp-up. Mostly the customer has hands full of work in getting familiar with the new system so the service stays in the background and is easily forgotten after the test period. In many cases the customer does not even have time to concentrate to the program at all.

With the Automation Sentinel agreement also an access to the ABB SolutionsBank is obtained. SolutionsBank provides the latest information for the system, like daily verification reports for the antivirus scanners, validated Microsoft patches and documentations and the latest information of the Microsoft security updates which are vital for handling the continual service. (Automation Sentinel Program and Cyber Security, Malek Chebaro, date of retrieval 22.4.2014).

3.4 Overview for the lifecycle management

Both Siemens and ABB are providing tools and support for lifecycle management with a yearly fee. Internally from the customer side it is important to agree who is the correct contact for the tools and how the best effort can be reached, is it the automation team who is responsible for the line automation or should the access be arranged for the IT department?

From IT point of view ABB is not so tightly controlling the system and components used in it as Siemens. ABB has made huge steps with the virtualization in recent years, which seems to be the mainstream in the platform development. Hopefully also from Siemens side the virtualization can be seen as an opportunity and the development will continue to that direction.

Virtualization releases the operating system from the physical hardware and makes the lifecycle management more interesting. In a virtual environment changes are safer to do as the original equipment can be cloned easily and a step back is much easier to take in case of system failure. On the other hand the risk is that the system might be aging more easily in virtual environment than in physical hardware, as the old operating systems could be running and supported by the virtual platforms. So there might raise thoughts that a system is ageless, but that is just an illustration. The virtual platform itself is ageing and so do the software and the rounding systems like PLCs.

Both large suppliers have worthy methods for lifecycle management. At least parts of the services are a good combine with the methods provided by ITIL. However, it is important to start from the beginning, to identify the components and create a reliable database for the assets and also the methods for maintaining the information. With the information the planning for lifecycle management can be started. The most important thing is to keep an eye on the goal and take activities as a part of the continual service.

4 LIFECYCLE STUDY IN THE CRP 1

The target of the lifecycle study for IT systems in the Cold Rolling Plant 1 was to identify the components and status of their lifecycle. The methods for implementing the survey were also one of the tasks, as similar surveys previously done were not fully successful.

In the beginning it was decided to leave out the common components with other plants, the level 3 manufacturing execution system RETU, the production planning system HIKU, the surface inspection management system PIHA and the vehicle computers. Also the Regeneration and Neutralization plant was left out as it is a common process with the CRP 2 and the movement in the area is strictly controlled from the safety point of view.

4.1 Process phases

The study started with a planning phase. First, a project plan was created. Activities were divided into seven (7) phases from the preparation to the final reporting. The schedule of the project was planned for the given timeframe.

At the next phase 1 the field surveys were done. The surveys were the made first to the automation rooms, line by line. All components were notified, photographed and recorded in the spreadsheets. Next, surveys to the control rooms and fields with the same methods used in the automation room were made.

The phase 2 had target to identify the components. The photographs were analyzed one by one, the components from them were described and the results were documented in the spreadsheet. The components were categorized to five groups, server, workstation, network, application and other component.

After all components were listed, phase 3 was started, where the target was to clarify the status of the identified components. System documentations were used as a base for clarifying the role of the item.

At this phase it was also planned practices on how and what information should be collected from the items for future purposes. The team from automation and production were invited to the review and the practices were performed to the rolling area. For the components it was defined seven (7) attributes:

- Impact, defines criticality to the production
  - Low, no affect to the production
  - Medium, causes slowness to the production
  - High, a critical component, high impact on the production
- Maintenance group, defines maintenance window for a component
  - 1 – MG1 – Office Hours, 8:00-16:00 EET
  - 2 – MG2 - Out Of Office Hours, 16:00–06:00 EET
  - 3 – MG3 - Weekends, 12:00-20:30 EET
  - 4 – MG4 – Separately agreed time
- Routine for backup, defines the routines for the component
- Description, defines a role for the component
- Operating system
- Stand alone, are the components connected to the network or not
- Spare available, is there spare equipment available

The details were collected in the spreadsheet manually. The review was a good experience so the practices can be continued for other areas, too.

From the result of the phase 3 it was started to analyze the lifecycles for the systems. At phase 4 tables for each line were created (table 1). The components were classified and the lifecycle for them was defined. The lifecycle was described with categories: active, classic, limited and obsolete. The status is based on the operating system lifecycles.

Also, the hardware status was described with similar categories:

- Active = Active product or virtualized
- Classic = Old fashioned product, lifecycle can be extended (+ 3 years) by replacing the hardware
- Limited = Limited availability, needs to be reviewed case by case
- Obsolete = No hardware available from markets

Information about the IT component was collected systematically. Table 1 shows a template that was used to describe each IT component.

TABLE 1. Example of the lifecycle template for IT components.

Lifecycle management - Production Line 1		A=Active	C=Classic	L=Limited	O=Obsolete	
Line	Product class	2013	2014	2015	HW*)	**Remarks**
Line 1	System nn (Application)	C	C	C		
	Server	A	A	A	A	Virtual Server
	HMI	C	L	O	C	OS Windows XP
	Related Systems	L	L	L	L	OS Win 2000, NT, 95
	Printer	A	A	A	A	
	Networks	A	A	A	A	

*) Hardware based status:
Active = Active product or virtualized
Classic = Old fashioned product, lifecycle can be extended (+3 years) by replacing the hardware
Limited = Limited availability, need to be reviewed case by case
Obsolete = No hardware available from markets

The rest of phases were activities for reporting. The last phases were Conclusions & proposals and Final reporting & feedback. They were related to the reporting where the results of the study were analyzed and conclusions made.

5 CONCLUSIONS

The study began first with planning how to do the survey with success. Previously these kinds of asset surveys were made with pen and paper, and they were not so successful because surveys take long time and notes from the field are varying. In the beginning decided to take a camera to the tours and later it turned out to be a successful decision.

From the study it was made the first project plan for keeping up the activities and following closely the schedule for the study. The plan was divided into steps to better handle the issue.

After planning the first action was to make field surveys to the production. The target was to collect details from the field and locations for the IT components. During the surveys all IT components were photographed and saved in files dedicated into the area and location. Also, notes from the field were taken for further purposes.

When the field surveys were completed, the components were identified and the status of them was clarified with the photos, notes and the documentation of the lines. Finally, from the results lifecycle for each component group in the line was defined.

During the study it was clarified how the largest and common used manufacturers, ABB and Siemens are providing support for lifecycle management. ABB’s lifecycle management support program is Automation Sentinel and Siemens is providing for example Software Update Service (SUS), which includes upgrades for the system components.

The result of the study was decided to be published only internally as it contains company confidential data. The study was made according to the agreed scope and the results can be found in Outokumpu internal library.

5.1 Proposed steps for future

To keep the system up and running we need to create a plan for the lifecycle management. There are two options, purchase the service from the suppliers or create the plan and routines with own personnel. ITIL supports and gives good advice and practices for operations.

A good way along the planning is to start acting in the field, pick up line by line, agree an action needed to be done in the maintenance break and start implementing.

Preparation actions before the maintenance break could be for example:

- Asset information check and availability of markings
- Is the component visible to the factory network (does it need remote or onsite activities)
- Check backup status and if not available agree routines and frequency
- What patches and updates can be installed
- Does update need some special actions, like on call support after a line starts up again

During the maintenance break:

- Agree schedule with responsible persons
- Configuration identifier corrections to components
- Backup the system
- Load and update the Configuration Management database, automate if possible, otherwise manually
- Install the agreed updates
- Test the operation of the system
- Inform parties about the updates and possible on-call service

These could be the first steps for the lifecycle managing in the plant. The steps need to be just taken.

Overall the lifecycle of the IT systems seems to be a quite simple thing; from automation point of view the lifecycle is about 20 years, but for PC hardware it is a too long period. So it is reasonable to consider safer methods during the implementation project and plan the upgrade to 5 – 10 years cycles by upgrading hardware, operating systems and applications. With this method the IT systems live their own life and last until the next modernization or at least 15 years from the latest upgrade.

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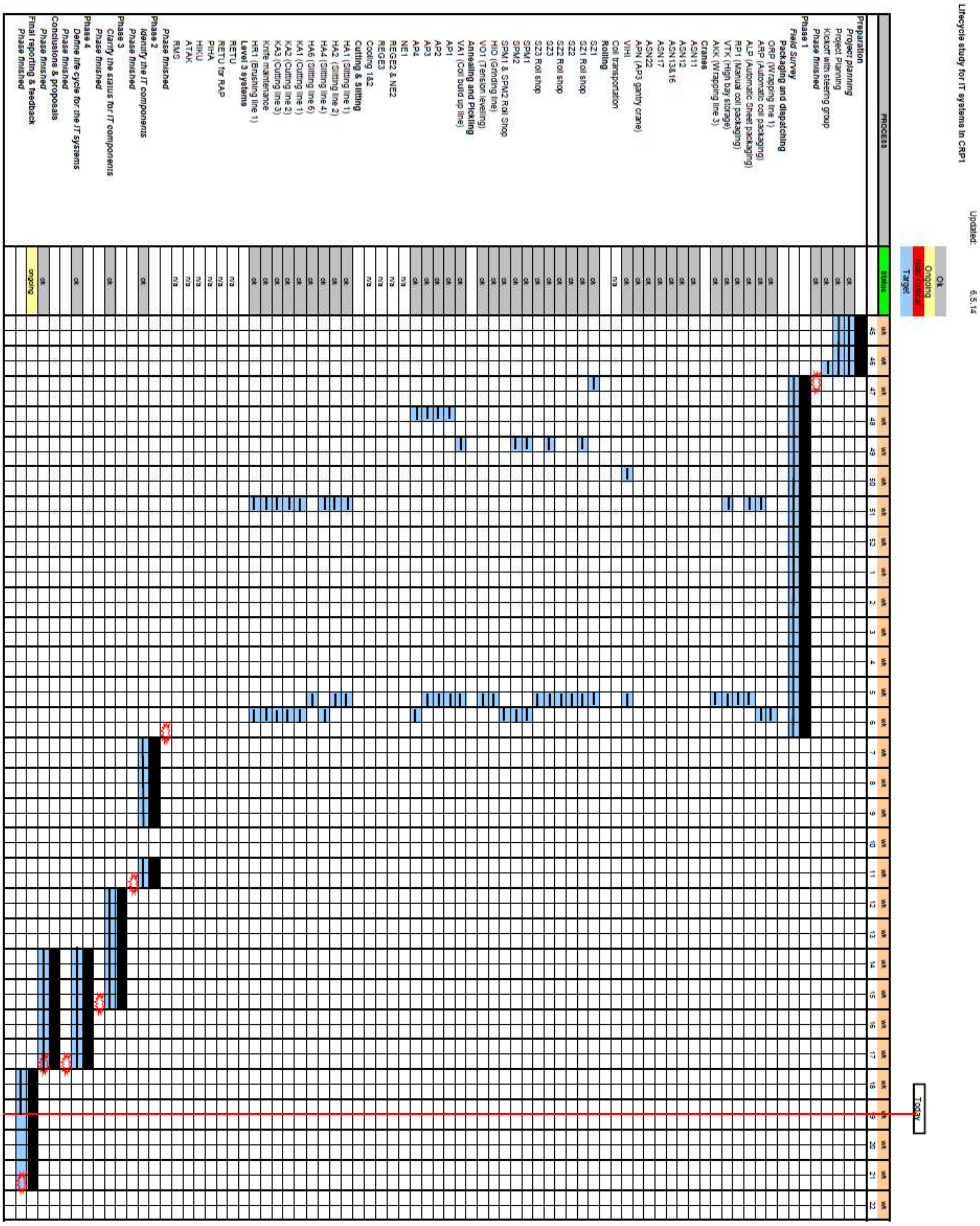
PROJECT PLAN FOR LIFECYCLE STUDY APPENDIX 1



COMPATIBILITY LIST FOR PCS 7 V4.02 APPENDIX 2

(Siemens AG. Compatibility tool. Date of retrieval 21.4.2014)

Compatibility list for PCS 7 V4.02 (Data status 2014-03-12)

		PCS 7					
		V4.02 SP1	V4.02 SP1 HF1	V4.02 SP1 HF2	V4.02 SP1 HF3	V4.02 SP2	V4.02 SP3
Microsoft Windows NT Server	4.0 SP5	√	√	√	√	√	√
Microsoft Windows NT Workstation	4.0 SP5	√	√	√	√	√	√
AS/OS Engineering	V4.02.1	√	√	√	√	√	√
AuthorsW	V2.4					√	√
CFC	V4.01 K4.01.4	√	√	√	√		
	V4.01 K4.01.6					√	√
DataWareHouse	V4.02	√	√	√	√	√	√
DOCPRO	V3.02	√	√	√	√	√	√
IEA-PO	V4.01 K4.01.4	√	√	√	√	√	
	V4.01 K4.01.5						√
Microsoft Internet Explorer	V5.0	√	√	√	√	√	√
NCM S7 Industrial Ethernet NT V4.0	V4.02	√	√	√	√	√	√
NCM S7 PROFIBUS NT V4.0	V4.02	√	√	√	√	√	√
PCS 7 Basis Blocks	V4.02	√	√	√	√		
	V4.02 SP1					√	√
PCS 7 Driver Blocks	V4.02	√	√	√	√		
	V4.02 SP1					√	√
PCS 7 Field Device Blocks	V4.02 HF1	√	√	√			
	V4.02 HF2				√		
	V4.02 SP1					√	√
PCS 7 Getting Started	V1.0	√	√	√	√	√	√
PCS 7 Technological Blocks	V4.02 HF1	√	√	√			
	V4.02 HF2				√		
	V4.02 SP1					√	√
PKZIP	V2.50	√	√	√	√		
	V2.60					√	√
S7-1413/Windows NT V4.0	V5.1	√	√	√	√	√	√
S7-1613/Windows NT V4.0	V2.1					√	
	V2.1 SP2						√
S7-5412/Windows NT V4.0	V5.1	√	√	√	√	√	√
S7-5613/Windows NT V4.0	V2.1					√	√
S7-PLCSIM	V4.0	√	√	√	√		
	V4.0.1					√	√
S7-SCL	V4.0 SP2	√	√	√	√	√	√
SFC	V4.01 K4.01.4	√	√	√	√	√	
	V4.01 K4.01.5						√
SIMATIC BATCH flexible	V4.02 HF1	√	√				
	V4.02 HF4			√			
	V4.02 SP1 HF1				√	√	√
SIMOCODE-DP	V1.0	√	√	√	√	√	√
STEP 7	V4.02.1 K4.02.6	√	√	√	√	√	√
Symantec pcAnywhere	V8.0	√	√	√	√		
	V9.2					√	√
TH	V4.01 K4.01.4	√	√	√	√	√	
	V4.01 K4.01.5						√
WinCC 1)	V4.01 SP2	√	√				
	V4.01 SP3			√	√	√	√
	V4.02 SP1	√	√				
	V4.02 SP1 HF2.1 2)			√			
	V4.02 SP1 HF3 2)				√		
	V4.02 SP2					√	
	V4.02 SP3						√