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TECHNICAL SUPPORT IMPROVEMENT

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TIIVISTELMÄ

Tampereen ammattikorkeakoulu
Ylempi ammattikorkeakoulututkinto
Teknologiaosaamisen johtaminen

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Teknisen tuen kehittäminen

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Tässä opinnäytetyössä oli tarkoituksena selvittää mahdolliset kehityskohteet Glaston Oyj:n suomen teknisen tuen tukiprosessista, toimintatavoista sekä käytössä olevista työkaluista ja tutkimuksen jälkeen antaa esiin nousseihin ongelmakohtiin ratkaisuehdotuksia ja työkaluja. Tukiprosessi on osa Glastonin konetoimitusten, päivitysprojektin ja huoltojen tukea. Teknisen tuen asiakkaina on ensisijaisesti yhtiön omat työntekijät ja välillisesti myös loppuasiakkaat. Tukiprosessi alkaa, kun Glastonin henkilökuntaan kuuluva asennusvalvoja tai huoltomies ottaa yhteyttä tekniseen tukeen ja päättyy siihen, kun tukipyyntö ratkaistaan korjaamalla ongelma tai tarjoamalla väliaikainen ratkaisu. Prosessin lopputuotteina voi olla myös korjauspyyntö ohjelmistokehittäjille tai uusi vaatimuspyyntö muutoksenhallintaan.

Tutkimusongelmana oli selvittää, miten teknisen tuen toimintaa voidaan kehittää sekä selvittää mitkä ovat keskeisimpiä teknisen tuen tehokkaan toiminnan ominaisuuksia. Tutkimusmenetelmäksi valikoitui toimintatutkimus, jonka tietojen kerääminen toteutettiin haastatteluna sekä havainnointina. Haastattelulinkki lähetettiin kaikille Glastonin asennusvalvojille, huoltomiehille ja huoltopäälliköille. Haastattelun rakenne muodostui kysymyksistä liittyen teknisen tuen tukiprosessin toimivuuteen ja toiminnan kehitysehdotuksiin. Havainnoinnissa tietoa kerättiin olemassa olevista prosesseista sekä toimintatavoista, mitä ei oltu dokumentoitu aikaisemmin.

Haastattelu toimitettiin 70 henkilölle, joista 20 vastasi kysymyksiin. Tutkimuksen tulokset jaettiin kahteen eri pääkategoriaan ja niiden sisällä vielä useamman alikategorian alle. Vastauksien toistuvuutta painotettiin valitsemalla jokaisesta alikategoriasta suurin ongelma, mihin ratkaisua lähdettiin hakemaan.

Tutkimuksen perusteella suurimpia ongelmia teknisen tuen tukiprosessissa oli tuen huono tavoitettavuus ja sekä tukipyyntöjen hallintaan tarvittavien työkalujen, prosessien ja toimintatapojen puutteellinen käyttö.

Teknisen tuen toiminnan ongelmiin esitellään ja annetaan erilaisia ratkaisuja työn viimeisessä osiossa.

Asiasanat: häiriönhallinta, ongelmanhallinta, tekninen tuki

ABSTRACT

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TECHNICAL SUPPORT IMPROVEMENT

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The goal in this thesis was to find out possible improvement areas in Glaston Oy technical support incident management process, working practices, used tools and after research to give suggestions to highlighted problems. Support process is part of the Glaston delivery process for new machine sales, upgrades ja services. Customers of technical support are primarily company's internal employees, but also indirectly the end customers. Support process start when Glaston employee contacts to technical support and ends when incident is resolved, or a workaround is present. Outputs from that process can be bug report to software developers or change request to change management.

The research problem was to find out how technical support can be improved and also to find out what are the key factors of efficient technical support. Research strategy in this thesis was action research, which data collection was implemented by interview and observation. Interview link was sent to all Glaston installation supervisors, service engineers and service managers. The frame of the interview was formed by questions related to the support process functionality and to possible improvements areas. Data from the observation was collected of the current process model and ways of working, which were not yet documented.

Interview was sent total of 70 people, from which 20 replied. The results of the interview were separated to two main categories. Inside those two categories were few sub-categories. The recurrence of the answers was highlighted and answer that got most hits were selected for improvement targets.

Based on the research the most critical problem was support poor availability and lack of structured request handling system and non-working ways of working.

Technical support problems are presented in the chapter four and the suggestion for improvement are presented in the chapter five.

Key words: incident management, problem management, technical support

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Appendix 3. The Service Support Process Model (ITIL Service Support 2005).
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ABBREVIATIONS AND TERMS

CI	Configured Items
CMDB	Configuration Management Database
GS	Glaston Support
Incident	Incoming report or request of a detected problem in Glaston machine
Known Error	A problem that is successfully diagnosed and for which a work-around is present
KPI	Key Performance Indicator
PLC	Programmable Logic Control
RFC	Request For Change
SLA	Service Level Agreement
SLI	Service Level Indicator
SLM	Service Level Management
SLO	Service Level Objective

1 INTRODUCTION

Glaston has a position as a global market leader in glass heat treatment. This is a result of innovative product development and high quality of the products. To maintain the current position, all aspects of internal work need constant revaluation and developing. Glaston support (GS) has a critical role in customer satisfaction. GS could have the most accurate information what kind of incidents customers have with their machines during machine lifecycle. That information it's not collected, and support performance efficiency is not metered.

In this thesis the main goal is to point out the ways to improve GS performance in every possible way, but also to investigate support internal ways of working and improve the incident process itself. Research starts from the determination of the current level of performance. GS customers, the global field service engineers are interviewed to get wider perspective for the evaluation.

The thesis starts with Glaston's company presentation and goes through Glaston's support process, theory and problems in service desks. The method of the executed research and the way of collecting and analyzing the data is described in this thesis. The results are compared to the literature recommendations.

The final part of the thesis presents the ideas and tools that can be used to improve the support performance. All the most critical problems, what noticed in the interview are evaluated and corrective action suggestions are presented.

2 SUPPORT PROCESS

2.1 Company presentation

Kyro company was originally founded 1870. Glass heat treatment history starts in 1981, when Kyro bought glass tempering machine manufacturer Tamglass at 1981. Tamglass was founded earlier at 1970. After few furnace models and acquisitions the name of the company is changed to Glaston at 2007. Glaston business area is divided to two areas, machines and services. The glass technology is fragmented and Glaston has many competitors. In the machines business Glaston is one of the world's leading operators and a market leader in the flat tempering technology (Glaston About us and Investors 2018).

Glaston has manufacturing in Tampere Finland and Tianjin, China. Glaston has machines for heat treatment (Picture 1):

- Flat glass tempering
- Flat glass laminating
- Glass bending & tempering
- Glass bending & laminating

Other business areas of Glaston are:

- Upgrades for old machines
- Services
- Spare parts
- Tools
- Training and consultation

Picture 1. Glaston flat tempering FC-Series machine.

2.2 Glaston Support

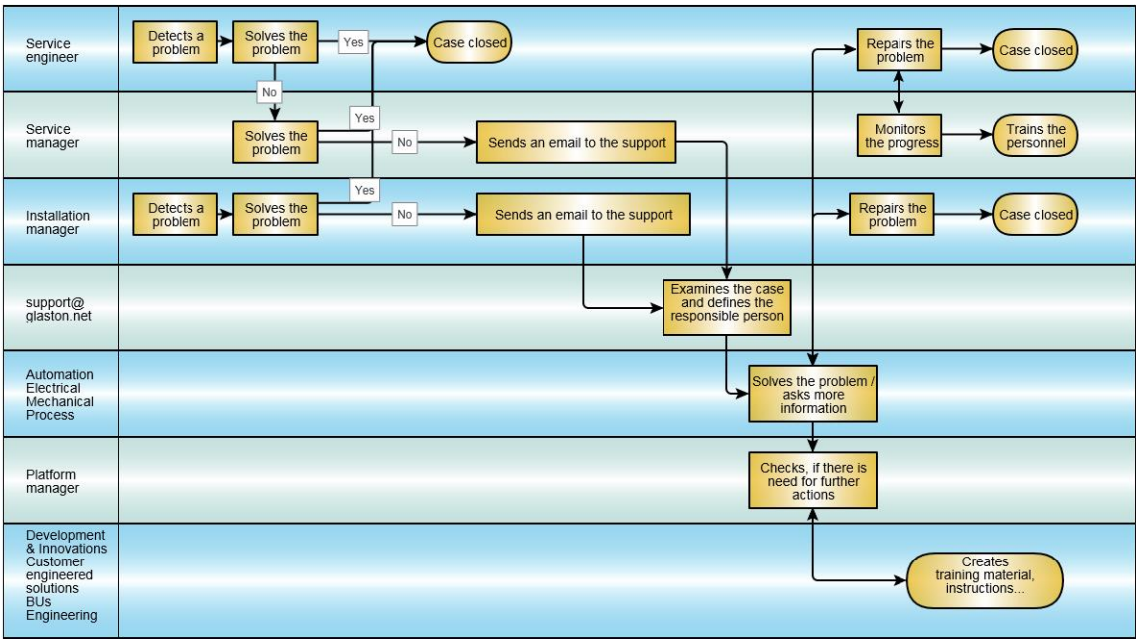
GS is serving Glaston internal customers. All regional service offices and their employees are included to support customers. Also, every Glaston installation supervisor and hired sub-contractors are GS customers. Glaston has 13 service offices around the world at every continent, where end-customers have Glaston machines. Offices are located at Finland, Russia, Germany, UK, Italy, Dubai, U.S.A., Brazil, Mexico, China (2), Singapore and Australia.

Picture 2. Europe and middle east service offices.

2.3 Glaston Support process

Glaston incident chain begins from the end user facilities, either from the end-customer or from Glaston employee. In case of end-customer finds an incident they first contact to the regional service office. If that service office can solve the incident, the incident never comes to GS. In case of the reginal support can't solve this incident, they send support request to GS in Finland. That request is now sent from various channels, officially by email to support mailbox or by calling to support engineer. Unofficial ways are sms, lync or WhatsApp.

Technical support point of view the process is presented in the picture 3. The process first input comes from the service engineer or installation manager. If service engineer solves the incident, process ends. If the incident can't be solved by service-engineer, he reports to service manager. If regional service manager solves the incident, process ends. If service manager can't solve the incident, he contacts GS. GS examines the incident and solves it or defines the most suitable department to solve it. GS gives instruction directly to service engineer or installation manager. In some cases, solving the incident can create input for improvement, instructions or training material, which the platform manager evaluates. Then process ends.



Picture 3. Technical support process diagram (Glaston internal process model).

2.4 Support staff

Like presented in chapter 2.2, GS is involved in international business. Therefore, good communication and language skills are a must. Support staff need to have experience in many levels. Overall understanding of the control system, glass process, machine mechanics and components, fieldbus and other network technologies and PC, and its hardware is needed to debug the incoming incidents and understand the connections between events. Also, good problem-solving skills and techniques must be familiar to the support staff. Support needs not only knowledge of the current systems in use, but also knowledge of the whole machinery. The machinery consists many other control systems than the current one.

3 RESEARCH

3.1 Research background

Glaston has increasing number of machines around the world. Company puts effort to improve machines all the time. To be able to support the expanding machinery, also support needs to improve its performance. Support plays a significant role in a term of customer satisfaction, which is only achieved with properly handled incident cases. The need for this research has been noted from the verbal feedback from the support customers and from the company strategy agreements.

Formal feedback from support performance has not been gathered and support efficiency haven't been measured. Support working practices has not been evaluated and compared to the company strategy, current process models and needs from real life situation. Collecting feedback from support customers and analyzing the working practices, it's possible to understand what kind of information is available in current situation and what would have to be changed, in case some other information is needed for better analyzing.

This thesis is focusing for two processes inside the complete service support process. The whole process is presented in the appendix 3. Connection between processes are visible the model. Glaston has parts of the process already in use and now plan is to improve two processes inside the model as they are the ones that belong to GS. Glaston current processes and literature recommendations are later presented in this thesis.

Lack of efficiency can be seen many ways in daily basis. ITIL Service Support book describes common problems in Service departments. Many support departments are under pressure to improve service and reduce costs. They tend to work in reactive mode, as a loose collection of disparate groups, spending vast amounts of time fire-fighting and generally keeping their heads above the water. The current situation in many companies include:

- no structured customer support mechanism in place
- low customer confidence/perception
- an outgrown customer support system
- support resource undermanaged
- continually fire-fighting

- the same problems being resolved repeatedly rather than eliminated
- continually interrupt-driven
- an overdependency on key staff
- a lack of focus
- uncoordinated and unrecorded change takes place
- an inability to cope with changes in the business
- staff resource/cost requirements being unclear
- an inconsistent quality of call response and response times
- no management information available, decisions being based on "I think' rather than 'I know"

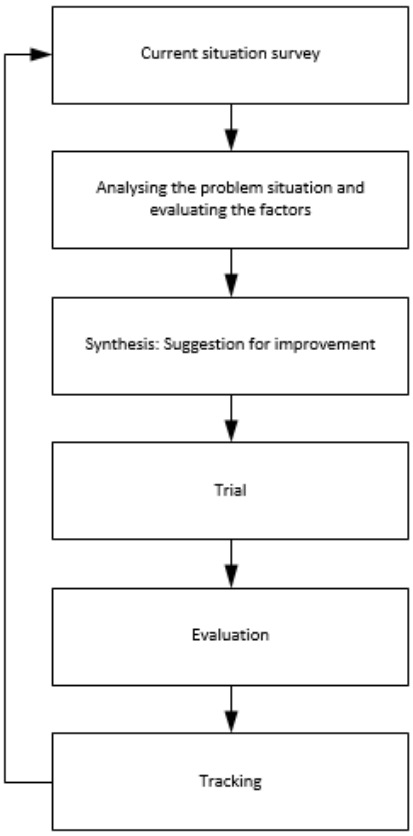
To improve matters, a consolidated and team approach is required. More time is needed to plan, train, review, investigate, and work closer with customers and users – in short, to adopt proactive and structured working practices. (ITIL 2005, 28).

3.2 Research targets

One of the most important reasons for research are to produce quality information of the surrounding world and modeling the reality (Lempiäinen, Löytty & Kinnunen 2008, 234). Goal for this research is to study how the support process and working practices can be improved. Another point is study what are the know key factors for successful service work. Research result will be used to point out deficiencies and suggest possible alternatives for corrective actions. Goal is to suggest improvements as much as possible, but primarily for the ones that are the most critical in each sub-category.

3.3 Research strategy

Action research is mix of other research strategies – qualitative and quantitative (Kananen 2009, 11). The aim of action research is to improve target practices, people's understanding of that practice and situation where they are (Syrjälä, Ahonen, Syrjäläinen & Saari 1994, 35). Action research starts from a real-life problem. That's why action research is situation- and environmentally-driven, many times solving problems in a group (Syrjälä, Ahonen, Syrjäläinen & Saari 1994, 31). Action research works well in cases, where goal is to influence one way or another to the subject of research and to make practical intervention by using research methods. (Eskola & Suoranta 1998, 128). One of the factors that separates action research from other qualitative strategies, is that researcher itself is part of the studied phenomenon's group and it actions (Kananen 2009, 23).



Picture 4. Different phases of action research (Kananen 2009, 28).

Action research phases (picture 4) can variate, but the basic concept is always the same. Problem determination, presenting corrective action, trial and evaluation (Kananen 2009, 28).

3.4 Research credibility

In qualitative research for criteria reliability criteria is used term credibility (Kananen 2009, 96). Qualitative research credibility might be difficult to show, but in thesis the it's been approached by triangulation. Query answers that only appeared once were ruled out to eliminate the randomness in results. This doesn't mean that the problem is not real, but it means that is has smaller priority among the other results. Answers that appeared more than once are compared to the current situation process models and working practices. If missing process or working practice can produce resolution to the problem, then suggestion is made, and the customized actions and integration to the process or working practices are presented.

3.5 Collecting data

Like earlier presented actions research start from the current situation survey. To be able to determine the current situation, data needs to collect in many ways.

One of the most common ways to collect qualitative data is most likely performing an interview. The interview aims to figure out, what someone has on their mind. The principal is simple. If we want to know what the person thinks and what kind of motives the person has, why not ask straight from that person (Eskola & Suoranta 1998, 85). Survey can be executed in structured-, semi-structured-, themed- or open survey-style. Semi-structured style means strict questions, but without ready answer options. The interviewed person can reply freely to the question (Eskola & Suoranta, 1998, 87).

An interview was carried out to collect data from the customers. Interview form for the customer was built in semi-structured style. To analyze the support process and work practices, an action research was selected as a research strategy. Later these to results are compared to the official processes, ways of working and literature to understand the reasons behind the interview results and point out the possible improvements.

Interview form link was sent to total of a 70 person. 20 of them replied to the interview. Replied persons are working as a service engineer, installation supervisor or as a service manager. Those people are concerned as a customer to the GS. Questions are presented in a non-dichotomy way.

Questions for the customers were:

- How the Glaston support process works from your point of view?
- What kind of communication method you prefer when contacting to Glaston support and why?
- What problems you have faced when contacting/doing business with Glaston support?
- What kind of feedback would you like to have from Glaston support for your support requests?
- What part of Glaston support is working well?
- How would you improve the Glaston support?
- What kind of a recurring problems you must deal with?
- What's holding you back from accomplishing your tasks?
- Anything in your work world that's causing frustration or delays?
- What kind of training would you like to have?
- Can you find instruction and guides easily and are they useful?
- How would you improve the instructions?

All the responders got this same message:

I am doing my master's thesis for Glaston and I am researching ways to develop and increase efficiency of the technical support. The purpose of this interview will be to develop the Glaston technical support for more efficient use for everyone involved. At this stage of the research we are collecting data, which helps us to improve our operation. I ask you to spend some time with the answers, because you are doing this for yourself. There's no such thing as wrong answers. All your answers will be valuable for the development. I ask you to be honest and give criticism if needed.

More information is needed to be able to compare the results of the survey to a real-life situation. Therefore, literature analyze must be done. First need to understand the basic concept of a service desk and it functions. Recommended process descriptions and current situation comparison will reveal the deficiencies and potential development targets. The current support process and working practices were presented in chapter 2.3. Smaller

working practices that are not visible in the process charts need to be collected by different methods of observation. According to Jorma Kananen different methods for observation are:

- Hidden observation
- Direct observation
- Participatory observation
- Inclusive observation

(Kananen 2009, 61)

In this thesis the researcher is participating to the support daily actions the most suitable observation way will be participatory observation. Kananen describes participatory observation by following statement in the book called Action research in business development. "Participatory observation happens when researcher is physically present at the research situation". Observation results are later presented in the chapter 4.6.

3.6 Incident Management Process

In appendix 3 can be seen that incident management is a process inside the service support process model. This process is presented in this chapter. In ITIL terminology, an" incident" is defined as: *Any event, which is not part of the standard operation of a service, and which causes, or may cause, an interruption to, or a reduction in, the quality of that service.*

The primary goal of incident management process is to restore normal service operation as quickly as possible and minimize the adverse on business operations, thus ensuring that the best possible levels of service quality and availability are maintained. "Normal service operation" is defined here as service operation within Service Level Agreement limits. Inputs for the process are:

- Incident details
- Configuration details
- Response from incident matching against problems and known errors
- Resolution details
- Response on request of change

Outputs of that process are:

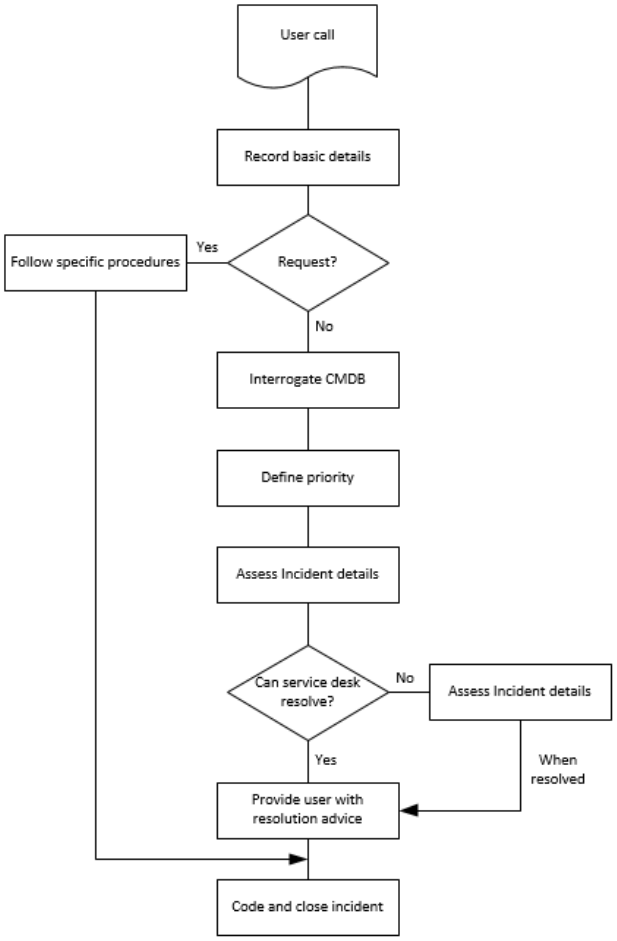
- Request of change for incident resolution
- Resolved and closed incidents
- Communication to customer
- Management information
  (ITIL 2005, 73).

Common Service Desk include following functions:

- receiving incidents, first-line customer liaison
- recording and tracking incidents and complaints
- keeping customer informed on request status and progress
- managing the request life-cycle, including closure and verification
- identifying problems
- highlighting customer training and education needs
- closing incidents and confirmation with the customer
- contributing to problem identification
  (ITIL 2005, 48-49).

The service desk is responsible for the monitoring of the resolution process of all registered incidents – in effect the service desk is the owner of all incidents. This process is mostly reactive. To react efficiently and effectively therefore demands a formal method of working that can be supported by software tools. (ITIL 2005, 73).

Incident that cannot be resolved immediately by the service desk may be assigned to specialist groups. A resolution or work-around should be established as quickly as possible in order to restore the service to users with minimum disruption to their work. After resolution of the cause of the incident and restoration of the agreed service, the incident is closed. (ITIL 2005, 73).

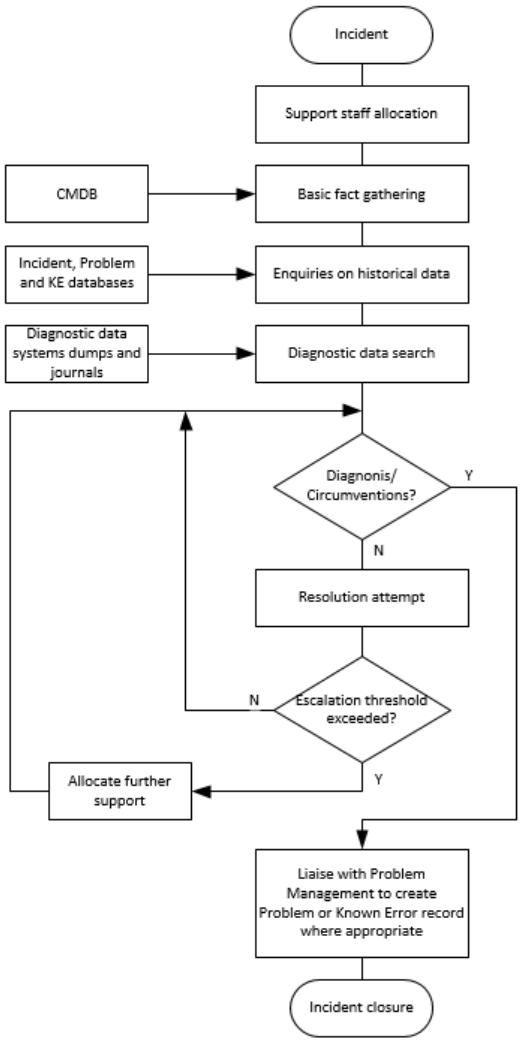


Picture 5. Incident life cycle (ITIL 2005, s.94).

The status of an incident reflects its current position in its life-cycle, sometimes known as its "workflow position". Everyone should be aware of each status and its meaning. Throughout the incident life-cycle it is important that the incident record is maintained. This allows any member of the service team to provide a customer with an up-to-date progress report. These actions could be update history details, modify status and monitor escalation status. Following updates to the incident record should be registered during the incident life-cycle:

- name of the person who made the modification
- date and time of modification
- what the person modified
- time spent

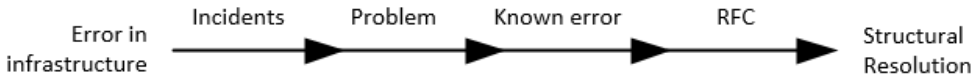
(ITIL 2005, 74).



Picture 6. The process of incident investigation (ITIL 2005, 93).

In picture 6 is presented the recommended process for incident investigation. The priority of an incident is primarily determined by the impact on the business and the urgency with which a resolution or work-around is needed. Targets for resolving incidents or handling requests are generally embodied in an SLA. In practice resolution targets for incidents are often related to categories (ITIL 2005, 76).

Where the underlying cause of the incident is not identifiable, then it may be appropriate to raise a problem record. A problem in thus, in effect, indicative of an unknown error within the infrastructure. Successful processing of a problem record will result in the identification of the underlying error, and the record can then be converted in to known error once a work-around has been developed, and/or a request of change. The logical flow, from an initial report to the resolution of an underlying problem, is shown in picture 7 (ITIL 2005, 77).



Picture 7. Relationship between incidents, problems, Known errors and Request for change (ITIL 2005, 77).

A problem can result in multiple incidents and it is possible that the problem will not be diagnosed until several incidents have occurred, over a period of time. Handling problems is covered by the problem management process (ITIL 2005, 77).

Successful incident management requires a sound basis, as highlighted by the following points:

- An up-to-date CMDB is prerequisite for an efficiently working incident management process. If a CMDB is not available, information about configuration items related to incidents should be obtained manually and determining impact and urgency will be much more difficult and time-consuming.
- A knowledge base in the form of an up-to-date problem/error database should be developed to provide for resolutions and work-arounds. This will greatly speed up the process of resolving incidents. Third-party known error database should be also available to assist in this process.
- An effectively automated system for incident management is fundamental to the success of a service desk.
- Forge a link with the SLM process to obtain necessary incident response targets. Timely incident resolution will satisfy customers and users.
  (ITIL 2005, 79).

3.7 Problem Management Process

Like in incident management, also the problem management is a process inside the service support process model. This process is presented in this chapter. In ITIL terminology, a "problem" and "known error" are defined: "*Problem is an unknown underlying cause of one or more incidents, and a "known error" is a problem that is successfully diagnosed and for which a work-around is present."*

Incident management process produces inputs to the problem management process. Other input to this process is coming from the CMDB, like configuration details. Problem management process position in the service support process model can be seen in the appendix 3. The actual problem solving can be reactive or proactive. Reactive problem solving can be seen as a response to one or two incidents and pro-active is more identifying problems and known errors before the incident even occur.

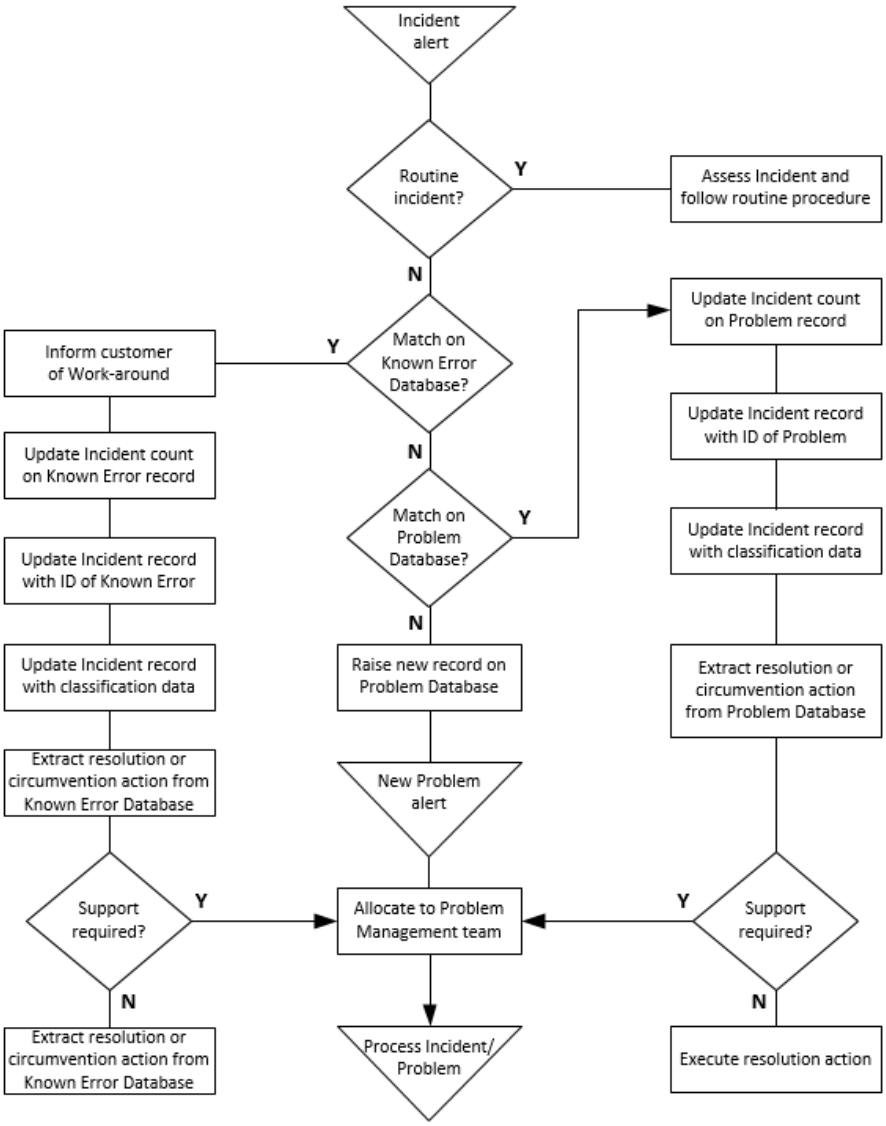
The goal of problem management is to minimize the adverse impact of incidents and problems on the business that are caused by errors within the infrastructure, and to prevent recurrence of incidents related to these errors. In order to achieve this goal, problem management seeks to get to the root cause of incidents and then initiate actions to improve or correct the situation. The major activities for problem management are:

- Problem control
- Error control
- The proactive prevention of problems
- Identifying trends
- Obtaining management information for problem management data
- The completion of major problem reviews
  (ITIL 2005, 95)

Problem control aims to identify the root cause, such as the CIs that are at fault, and to provide service desk with information and advice on work-arounds when available. When incident control focuses handling individual incident or temporary work-around, those actions are recorded to problem control to identify problem and suitable workarounds. Error control includes processes involved in progressing known errors until they are eliminated by the successful implementation of a change under the control of change management. Proactive problem management aims to solve problems before they occur, by trend

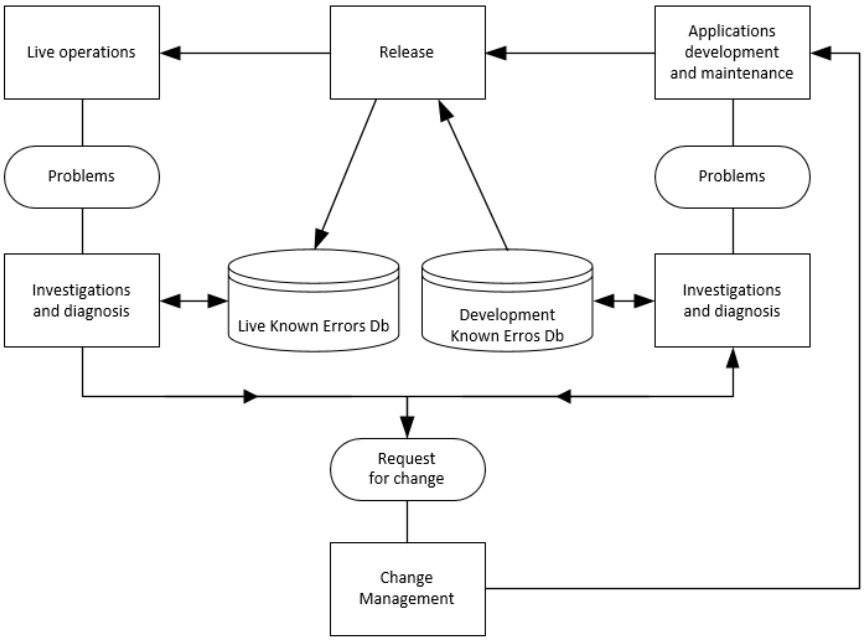
analysis and thereby targeting support actions and providing information to the organization (ITIL 2005, 99-101).

Incident matching process flow is presented in the picture 8. Critical functions in this process are the Known Error and Problem databases. Those databases are updated in this process.



Picture 8. Incident-matching process flow (ITIL 2005, 102).

Problem control process starts when there is no match to existing problems and known errors, occurring incident, or in case of major or significant incident. Problem control outputs are inputs to error control. Error control system gets known error data from two sources, live environment and from the development environment (ITIL 2005, 106).



Picture 9. The error cycle in the live and development environments (ITIL 2005, 107).

Outputs of this process are like earlier mentioned, requests for change, an updated problem record, the known errors, response from incident matching to problems and known errors and management information. Problem management responsibly is to ensure that previous information is documented in a such way that it is readily available to first-line and other second-line staff. Requirements for that documentation are:

- The information need to be indexed so that it is easily referenced from new incidents
- Regular inspection to ensure the continued relevance of the documentation.
- Process should be subject to a detailed view.
- Staff who are using the to be trained to understand the depth and the power of the information available.
  (ITIL 2005, 96)

The benefits from problem management are at least incident volume reduction, permanent solutions like problems and known errors that are resolved stay resolved. Organization itself can benefit from the process as it produces concept of learning from the past. This can be formed from the historical data to identify trends. Incident management produces detailed information of incidents. More detailed information is available, the more detailed consequences can be made from data analysis.

4 RESEARCH ANALYSIS

4.1 Collecting data

The goal of qualitative analysis is to create clarity and produce new information about the research subject. Analysis aims to compress the data without losing any information. In other words, to increase the information value by making shattered material to a clear and a meaningful form (Eskola & Suoranta 1998, 138).

This research questions can be separated to multiple type groups. Main categories are the following:

- Process
- Improvements

Those two categories form's the structure. Each of them contains positive and negative alternative and sub-categories. Sub-categories are the following:

Process: 4 questions.

- Contacting, P/C
- Incident progress, P/IP
- Feedback, P/F

Improvement: 8 questions.

- Overall, I/O
- Information sharing, I/IS
- Training, I/T
- Availability, I/A

Question are coded to match the sub categories. Questions for the customers were:

P/C	What kind of communication method you prefer when contacting to Glaston support and why?
P/C	What problems you have faced when contacting/doing business with Glaston support?

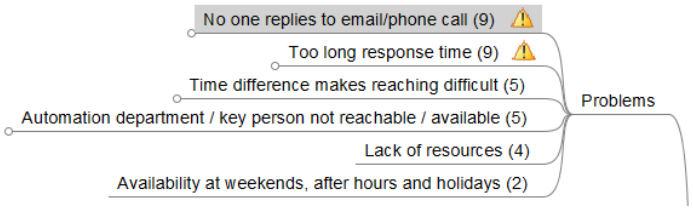
P/IP	How the Glaston support process works from your point of view?
P/F	What kind of feedback would you like to have from Glaston support for your support requests?
I/O	What part of Glaston support is working well?
I/O	How would you improve the Glaston support?
I/O	What's holding you back from accomplishing your tasks?
I/O	Anything in your work world that's causing frustration or delays?
I/IS	Can you find instruction and guides easily and are they useful?
I/T	What kind of a recurring problems you must deal with?
I/T	What kind of training would you like to have?
I/T	How would you improve the instructions?

4.2 Interview results

Measuring the result is happening by performing frequency- or volume-measurement. How many times certain subject is answered or how many times some specific word is used. The main idea is to compare qualitative data and make internally valid generalizations (Eskola & Suoranta 1998, 185-186). Results of the interview was collected together and filtered. Every answer was transferred to mind map (Appendix 1) to the most suitable categories. Some answers made more sense under different category than they were answering to in the interview form. Those answers were transferred to more suitable subcategory. Calculating similar answer together it is possible to see what the most common problems are that they are facing and what are the most wanted improvements. This will help to determine, which of the problems should be resolved first. Also need to be considered, that some of the problems might be easier to solve than others. Meaning that minor priority problems can be also solved in the first round of corrective actions, if they don't require expensive and time-consuming actions. Also, the impact of the problem need to evaluate, which might raise that problem to top of the list. Some of the problems might be solved together with other problems or correcting one problem might lead to a situation that one of the problem is not relevant anymore. These things will be presented later after data analysis.

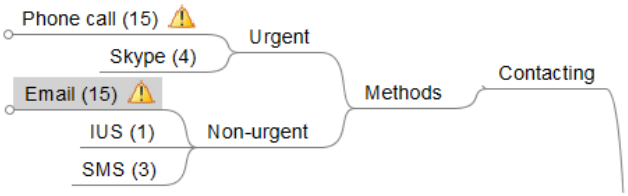
4.3 Interview results for process category

Contacting related problem's, the most common issue was "No one replies to email/phone call". It collected 9 hits. With same number of hits, was "Too long response time". Second most common problem with 5 hits, was "Time difference makes reaching difficult" and "Automation department / key person not reachable / available". "Lack of resources" on third place with four hits and "Availability at weekends, after hours and holidays" as last with 2 hits.



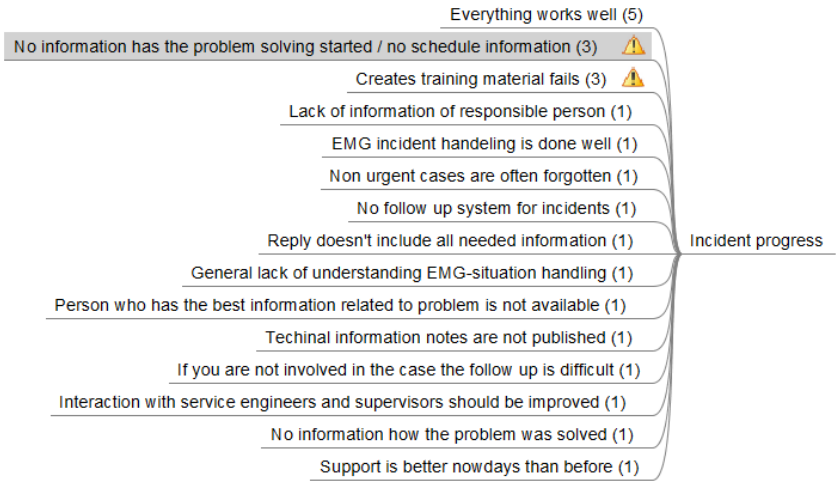
Picture 10. Contacting problems results.

When asking people, the preferred way of contacting, the result was clear. Answers divided to two cases. Urgent and non-urgent. In urgent cases phone call with 15 hits was the wanted choice. The most common reasons were quick response time and that sometimes the lack of internet connection at the factory which leads to no possibility to write emails. For non-urgent case the choice was clearly email. As a benefit for email, mentioned that it leaves a record and makes easier to deal with the time difference.



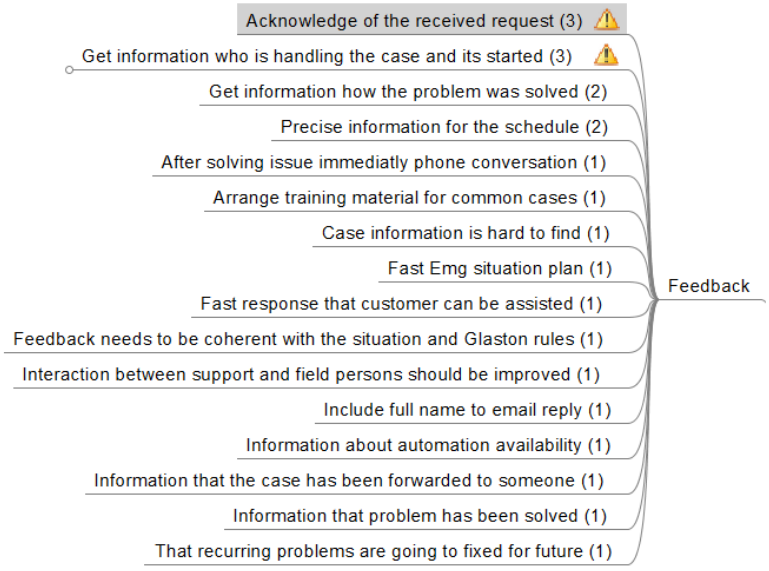
Picture 11. Contacting method results.

Question about support process performance, gave lots of different views and less agreement. Most of the hits was collected by "Everything works well". Exactly same results with 3 hits were "No information has the problem started / no schedule information" and "Creates training material fails" had 3 hits. Rest of the answers were mentioned only once.



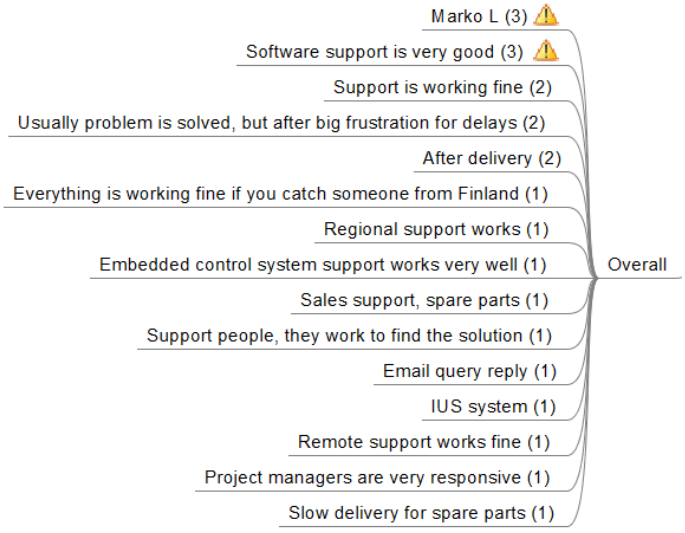
Picture 12. Incident progress results.

Problems with feedback had also lots of variation in the results. Information that support request has arrived collected the most hits together with the information wanted who is taking care of the case.



Picture 13. Feedback results.

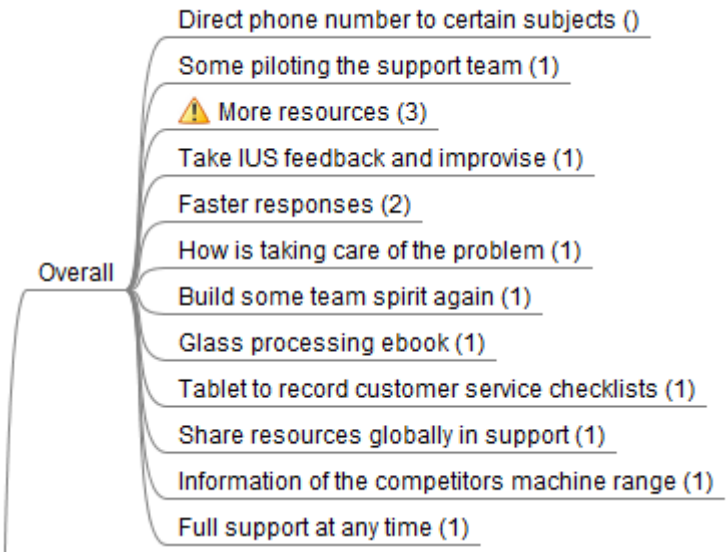
In overall performance the results are shattered. Most of the hits goes to single person performance and to software support performance.



Picture 14. Overall performance of the support process results.

4.4 Interview results for improvement category

Overall improvement result showed that, more resources to support is wanted. Second most wanted overall improvement is faster response to support requests. Then rest of the answers got only one hit.



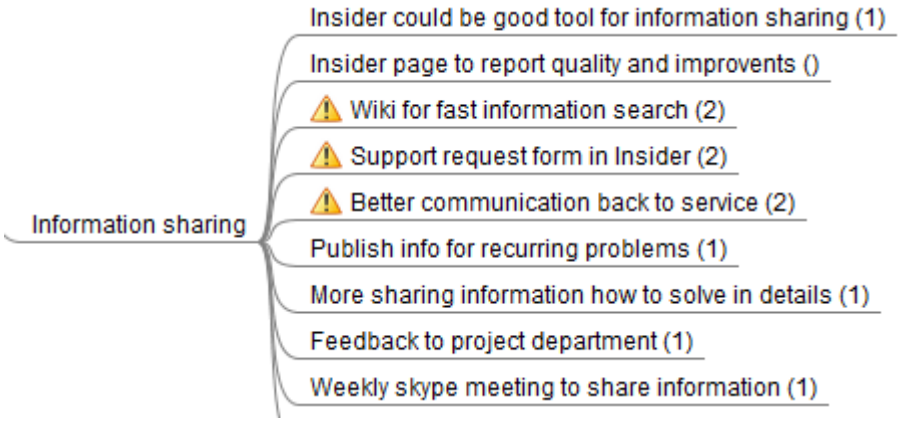
Picture 15. Overall improvement answers.

In the answers for improvements to availability, the most hits went to extend availability to after hours, holidays and weekends (3 hits). Second most wanted improvement is

"guaranteed response time" and "List of responsible persons to contact, depending of the nature of problem" with two hits per each. Rest of the answers got only one hit per each.

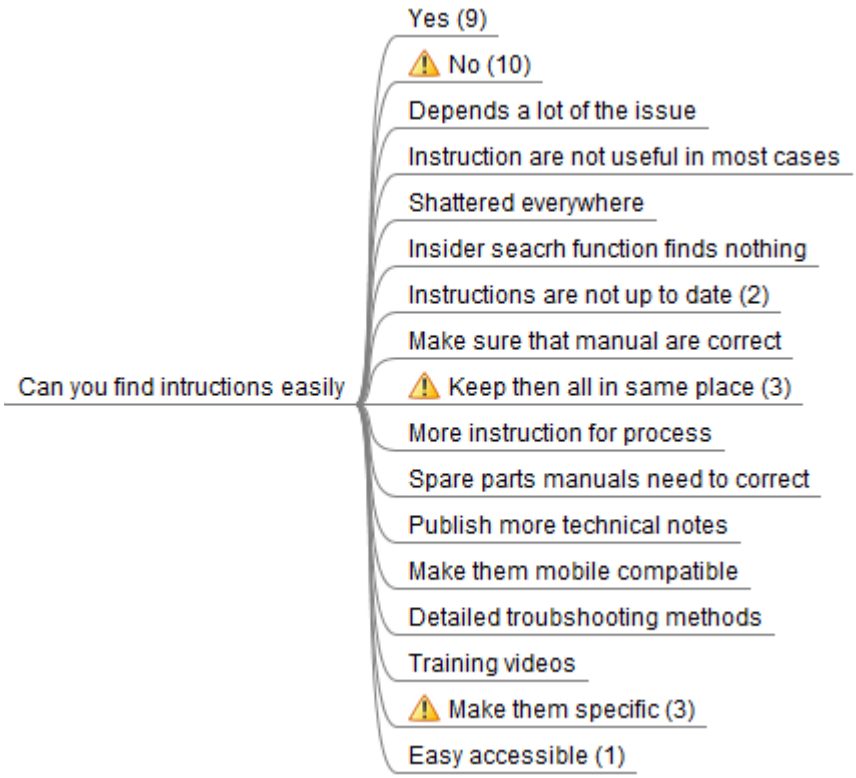
Picture 16. Availability improvement answers.

Results for information sharing improvements highlighted three things. "Wiki for fast information search", "Support request form in insider" and "Better communication to service".



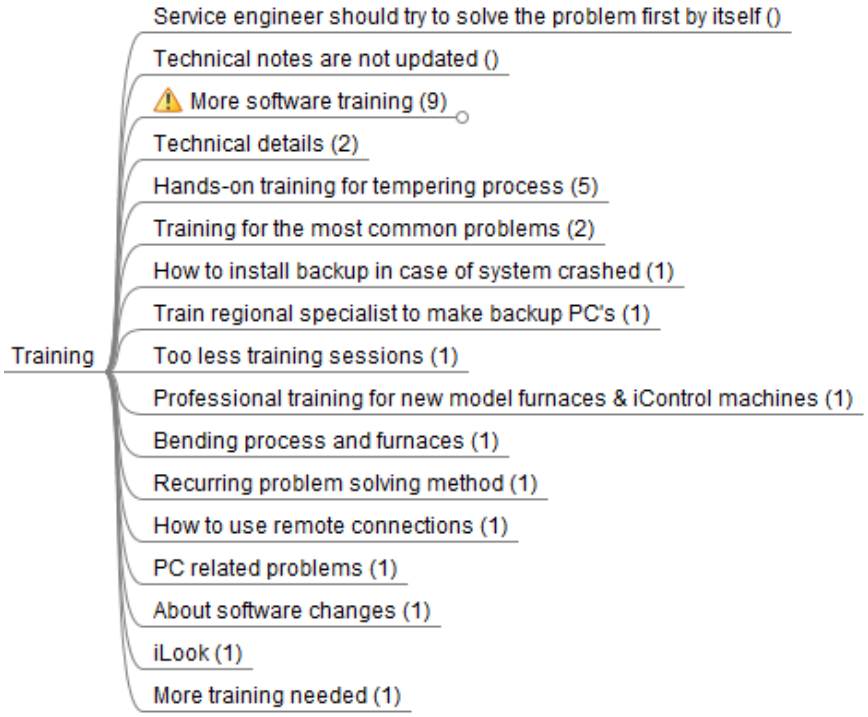
Picture 17. Information sharing improvements.

As a sub question to information sharing was "Can you find instruction easily?". Answer "No" got, 10 hits and "Yes" got, 9 hits. Wanted improvements to instructions was to keep them all in the same place and make them more specific.



Picture 18. Answers for question: Can you find instructions easily?

When asking "What kind of training would you like to have?", the results showed clearly that more software related training is wanted with 9 hits. Second most wanted training is "Hands-on training for tempering process" with 5 hits.



Picture 19. Answers for Training improvement.

4.5 Interview conclusions

The most critical answers are gathered together. Suggestions for improvements will be focusing for these problems.

Process

Contacting	No one replies to email/phone call	9
	Too long response time	9
	Preferred contacting method: Equal results for email/phone	15
Incident progress	No information has the problem solving started / no schedule information	3
	Creates training material fails	3
Feedback	Acknowledge of the received request	3
	Get information who is handling the case	3

Improvements		**Hits**
Overall	More resources	3
Availability	After hours, holidays, weekends	3
Information sharing	Wiki for fast information sharing	2
	Support request form in insider	2
	Better communication back to service	2
	Can you find instructions easily; No	10
Training	More software training	9

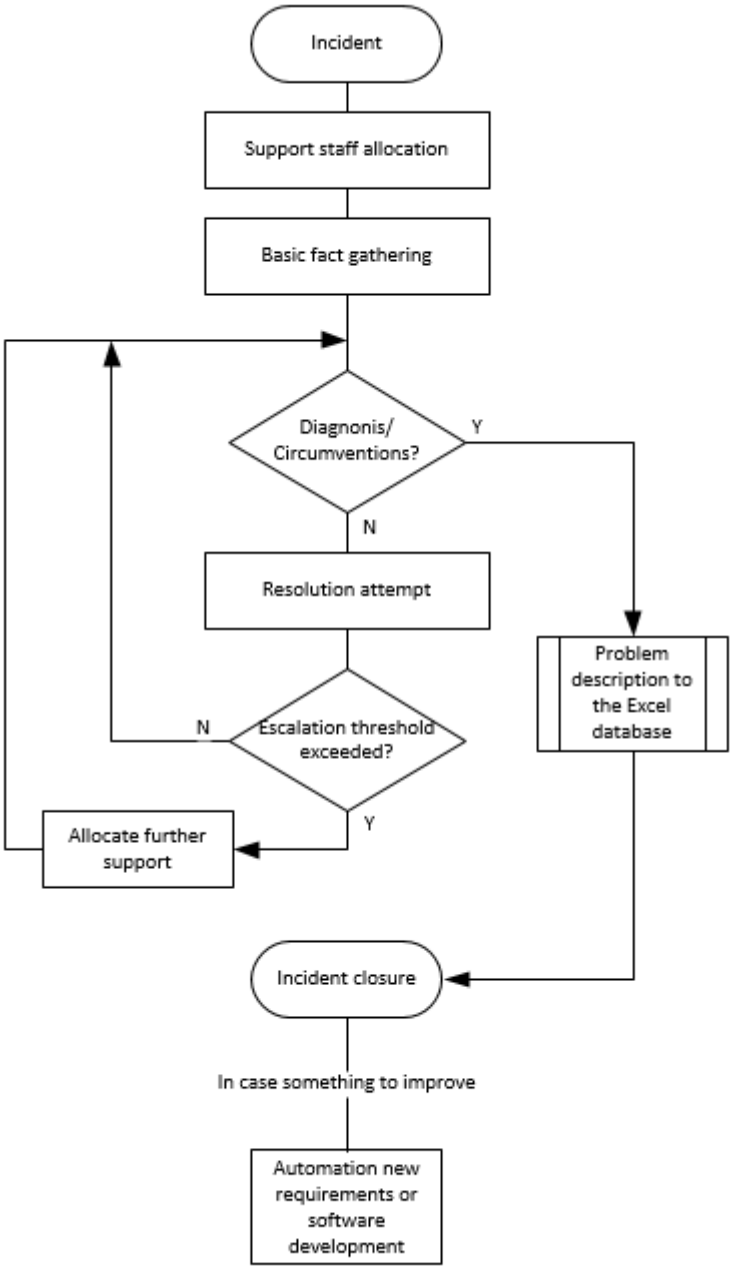
Picture 20. Most hits per each category.

The results are clearly pointing out some lack of actions and failing some of existing processes. Support has too long response time or no one is even available for the first contact. Customer don't receive any information has the incident solving started or who is investigating the incident. Creating training material fails. No process or tools in use to point out training needs. Biggest issue in feedback to request senders was that no information who is handling the case.

More resources for support is wanted. Weekends, after hours and holidays should be also covered. Self-service knowledge base is wanted for independent incident solving tool. Support request form is wanted into insider. Communication between support and service should be improved. All the instructions and other helpful information are not easily available. Glaston has multiple locations for instructions in use. Training should focus on software.

4.6 Observations results

Observations about the process of incident investigation is presented in picture 21. This diagram shows the GS internal flow during the incident solving. No documented information of the investigation process was available. The process is formed by observation of daily work.



Picture 21. Glaston support internal flowchart of incident investigation.

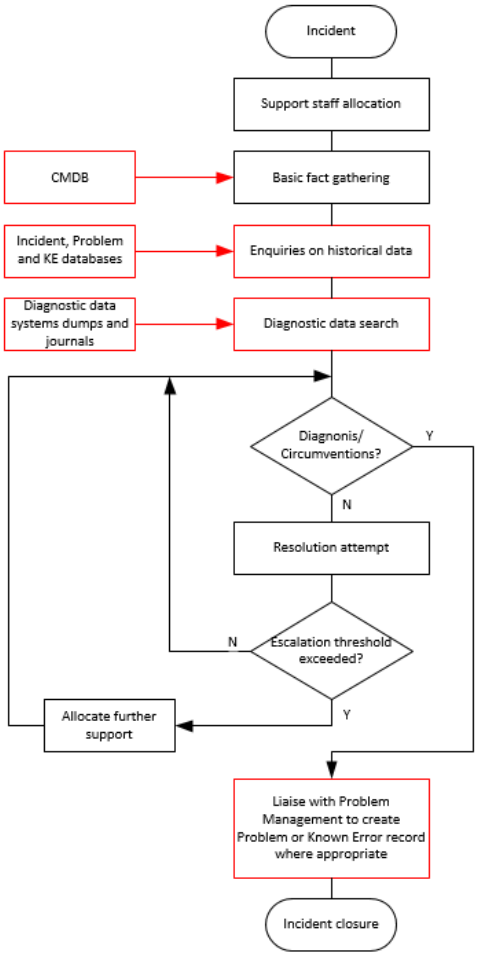
Every incoming incident goes through following flowchart. Incident will go to an evaluation for support member that has the most knowledge of the control system, which is used in the project for this request is related to. An incident is evaluated using the available information in the request. Support decides can it solve the incident and is more information needed, or does it need to be escalated to another department. When diagnosis or circumvention is confirmed the actions and resolution need to be written to the support log -excel file (picture 22). Date, incident handled person, project name, machine type, PLC version and short description of the incident are filled to the document. In case some software bug or new requirement is found, a new Jira case is raised to suitable project. In all cases the incident recipients should be informed, whether there is ready solution to the problem or that the incident is going to be solved later. In case the incident solving is not possible remotely, support or other department gives instruction to service engineer who resolves the problem or schedules a service visit to the customer.

Connection D	Perso	Project Cod	Name	Machine	Explanation	Version	Custom(not in SVN)
14.9.2017	MNY	8309	SGBAMBERG	FC-Series	AirKnife was not working. Controllers were swapped and problem continued on same side. Motor+cylinder was replaced.		

Picture 22. Example from the support-log Excel file.

Overall Glaston does not have a service support process model (appendix 3) in use. Although Glaston has parts of that process in use, but the connections between processes are not planned. Only process that is working well inside the service support process model is release management. Other existing process is change management, which has already its own improvements going on. Then existing incident management is lacking badly. Available ways of working are only covering the fire-fighting. Problem management doesn't exist in any formal way and records to error and problem control databases are not made, which makes liaise with problem management not possible to execute.

Based on the observation of working practices differences are presented. ITIL recommendations for incident management process were earlier presented in chapter 3.5 and Glaston process for incident investigation above in this chapter. When comparing the Glaston incident management process to ITIL recommendations, it is possible to see some differences. Missing tasks are highlighted as red in picture 23.



Picture 23. Missing tasks in Glaston incident investigation process.

Project configured items (CI's) must be checked from the project info document. Enquiries to the historical data is not available, except that information which has logged to the excel sheet. Meaning that complete incident, problem and known error database does not exist. Before closing the incident, support has only marked case resolution to the excel document. Because the problem management process and plan doesn't exist, all the related sub-processes are missing too.

Other observations what is lacking are:

- Workload information is not collected and analyzed. Individual incident calculation is not possible.
- Fix-rate in support is not metered. No tools to collect data.
- Escalation data is not collected.
- Not possible to give estimated schedule to the customer. Not possible to follow any other time related meters, like to time to first response.

- No OLA’s or KPI’s are determent for support. Reporting and review of support performance is not available.
- No rules have been agreed, which information and incident status changes must be shared between customer and support.
- Support does not have any effective way to highlight the current training needs.
- Data of the incoming incidents are not filtered anyway, and recurring problems are not registered. Known error and problem databases are not available for matching the incidents together.
- Rules for instructions updates haven’t been agreed. Platform and locations has not decided.
- All information and instruction are truly shattered.

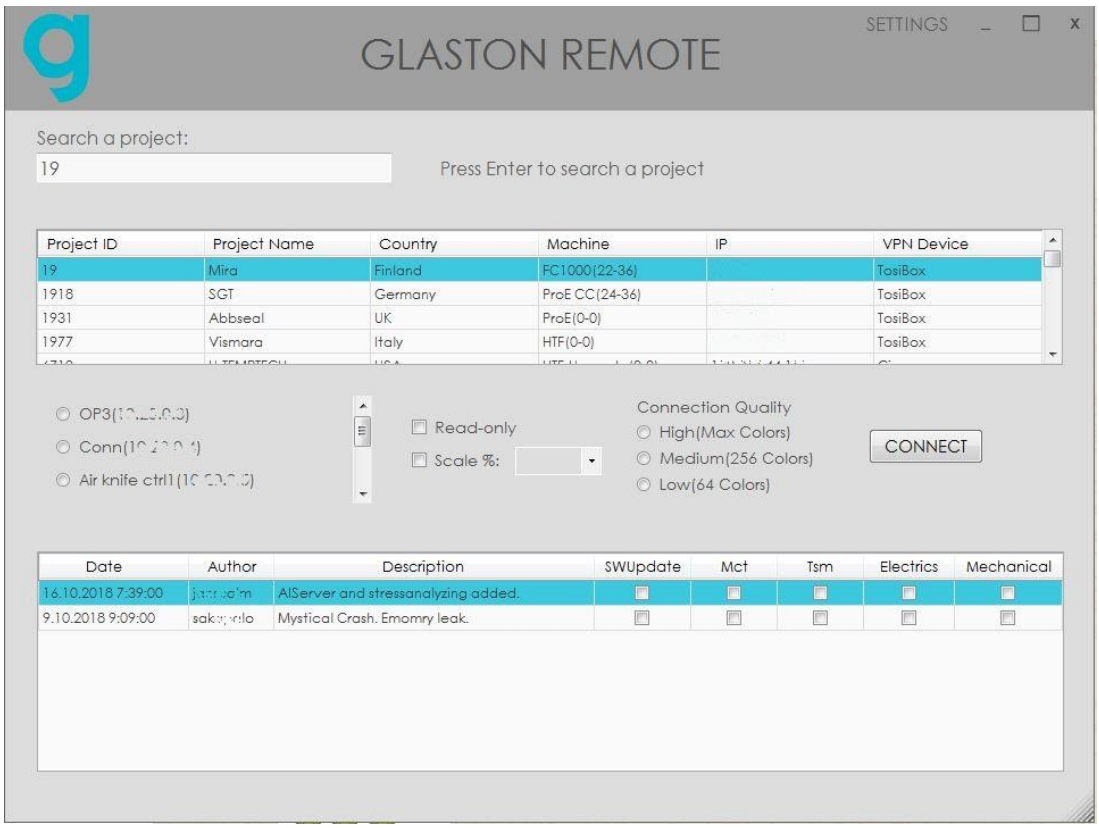
5 IMPROVEMENTS

Many of the support problems which were previously presented in chapter 3.1 can be confirmed. Interview results are showing lacking in performance and observations of the support ways of working is revealing possible improvement targets. Following chapter will cover suggestions to all the most critical problems based on the interview.

5.1 Remote connections

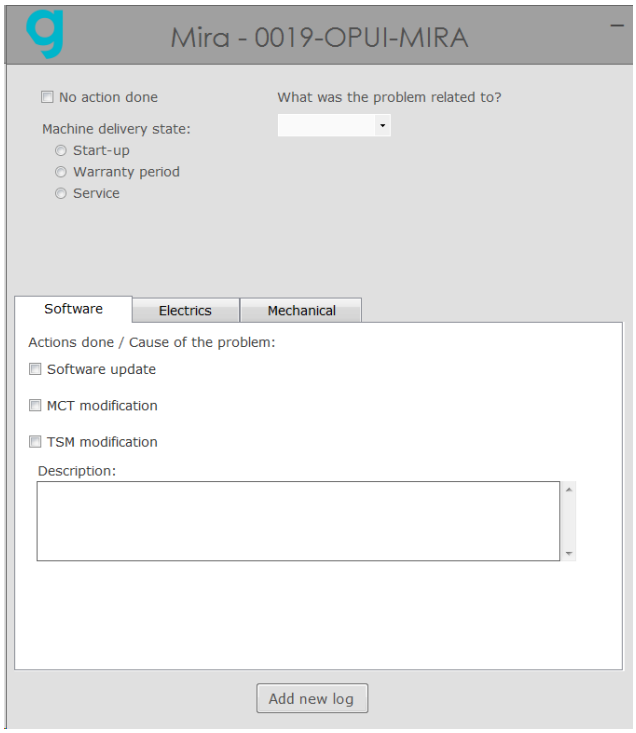
To be able make support faster, fully functioning remote connections is the key. Therefore, all remote connections should be tested every time performing a service visit. All remote information should be in one location and responsible person to keep them up to date must be pointed. Unfortunately, sometimes the scheduled remote connection could not be established, and incident could not be solved because of non-working remote actions.

To keep the all remote connection information in one place a remote tool was created. Project information is available in the search field just typing project name or number. Then all the history of remote actions is available for this project to view. This tool makes remote connection opening simpler and faster. Remote tool has also list where software developers can easily mark pending software update. The pending project is then highlighted as red when project is searched. The whole list is always also visible at the remote tool. Information inserted to the remote tool will be later used to analyze remote connections.



Picture 24. Glaston remote tool dashboard view.

After remote connection user will have to write a description and select labels for what has been done and for what device actions has taken place.

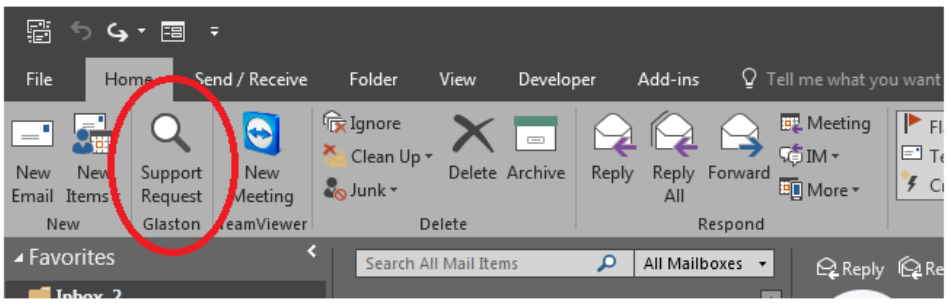


Picture 25. Remote actions report for the remote database.

5.2 Contacting problems

Biggest issues people reported when contacting support is that the response time is too long and that no one replies to email/phone call. One of the support main role is to be available as much as possible for first contact. Efficient request evaluation requires enough basic information of the incident and project details. Incident investigation process consists connection between basic fact gathering and CMDB.

Project details are configurations details, which should be provided automatically to the process and that information should be always up-to-date and valid. In incoming email-requests, that information is many times incomplete. To make the incident handling faster, one solution is to create form which has field for all the basic information. Now all the requests are sent in free form by email. At his point, avoiding too many new software's, the best solution would be, include the support form in the Outlook email. Outlook allows to use pre-determent macros. Also based on the interview, email was the first choice of contacting method together with phone call.

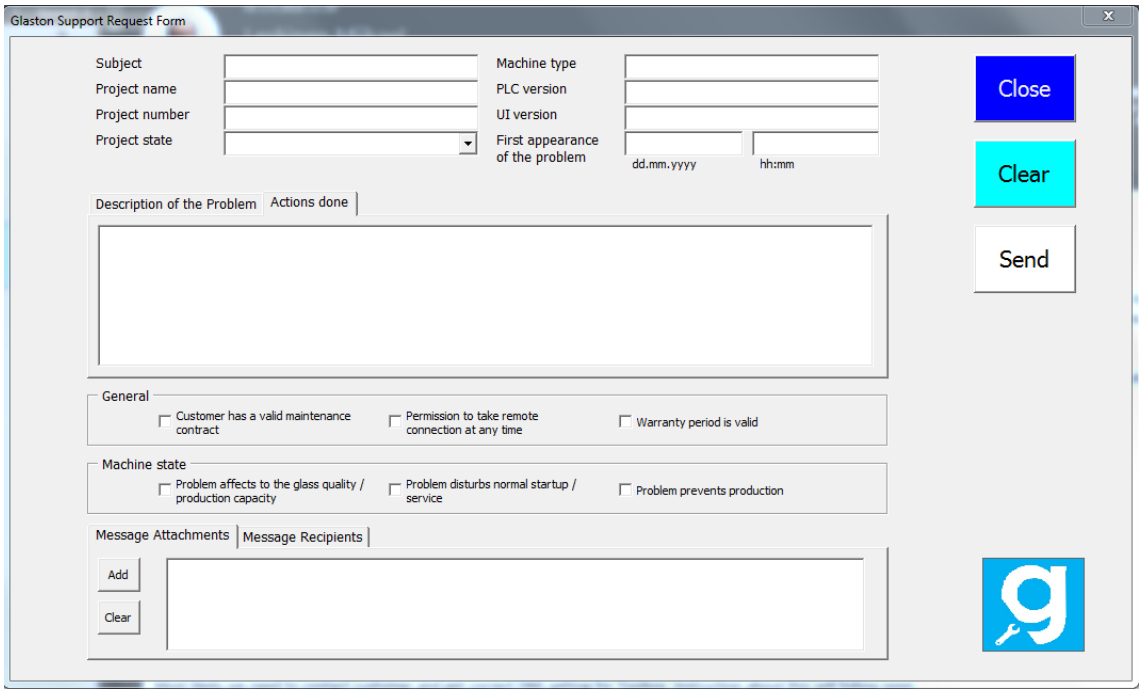


Picture 26. Support request macro in Outlook.

From support point of view for faster ticket handling the needed basic information are:

- Project name
- Project number
- Project state
- Machine type
- PLC version
- User interface version

- Subject
- First appearance of the problem
- Description of the problem
- Actions done
- Does the customer have valid maintenance contract?
- Is the warranty period still valid?
- Does support have permission to take remote connection at any time?
- Machine state; Does the problem prevent production, disturb normal start-up/service or does the problem affect to the capacity or the glass quality



Picture 27. Support request form in Outlook.

Same form for mobile devices allows even faster and easier access to send support requests. All the same field are included to the mobile version. This form is used only for the first contact to GS. In first phase configuration details per project will have to enter manually to the process by typing them to the request. Second-phase solution is to get CI information automatically from CMDB to the form by project name or number. Support response times should be based on incident priorities and incident priorities should be determined in the SLM.

5.3 Incident progress problems

Automatic replies to the request will solve the problem “No information has the problem solving started / no schedule information”. In Outlook, automatic replies can be made, but after that, features are running out. Therefore, incident management software is recommended. Glaston has already Jira software in use for software developers for release management and change management, so adding a Jira Service Desk version would be the smartest choice to integrate incident and problem management to existing release management process. Currently there are no way to follow the status of individual incident. In other words, it means there are no information to outside support, who is handling the case, what is the status of the ticket, estimate time to resolution, what is the resource situation and very limited possibility to collect any data from the incident details for later analyzing or a tool to manage problems. Like presented in previous chapter the incoming information in the support request is in free form. Using the macro, the information will be always in same formal way. That will help to integrate the information automatically to the incident details in Jira.

Like earlier presented an incident management software should be selected for more efficient resource and incident handling. Support macro form helps also for this case. All the incoming requests have specific id in the email subject field. That id can be used to identify requests from other emails in the support mailbox. After basic fact gathering and enquiries on historical data, first-line support evaluates can it handle the incident, or does it need to be escalated. Incident management software has a tool for Service desk use, which will be the first-line support tool and for there, the individual incidents can be escalated to another department or even linked to another project. This feature would be very useful when building a self-service knowledge, managing problems and for change management. Linking the similar individual incidents together with other project matching tickets and knowledge base articles the relations can be seen, and self-service knowledge-base could be possible. Ticket handling system could help to openly follow who is handling the case, inform the reporter for acknowledgement and status changes, estimate time to resolution, manage resource situation and better possibility to meter the support efficiency in many levels. Also collect quality related data to engineering and other departments. Customer training needs can determent based on the incident data. For example, what are the most common problem devices in the machine.

Making priorities between cases we need to determine what is urgent and what is not. Selection is made in the form field machine state selection. Based on ITIL Service Support, priorities are agreed in the SLA. Most high ranked case is that problem prevents production. Second ranked case is that the problem disturbs normal startup / service / production. Smallest priority choice is that problem do not prevent or disturb machine operation. That kind of cases are more likely cosmetic, for example misspelt words or misaligned text or minor loss of function, or other problem where easy workaround is present. Based on the priorities it is possible to give senders more accurate information how long they must wait before their problem will be started and solved. This information is critical information for the sender to be forwarded to the end customer. If customers can openly see the workload and priorities, they will more likely understand the possible delays.

For metering the efficiency of the support, it is important to collect info when the actual problem has appeared for the first time. Then it is possible to track down the actual response time and time to resolution to the end customer. In general field there are three different fields to select. Customers who have active maintenance contract can speed up their solving time when this information is available for support. Remote connections need customer permission and when this permission is asked beforehand, it can speed up the remote access. When machine is under warranty contract may affect for example to the software updates prices.

5.4 Support availability and information sharing

Overall improvement to availability, more manpower was wanted. More manpower can be justified in cases that the first-line support fix-rate is low. Fix-rate means a percentage value how many of the incidents are solved by the first-line support. The fix rate is part of the SLO and should be determent in first place. Fix-rate could possible raise higher in first-line support, by training some special area of knowledge, but the area need to agree based on valid data. Without data for the fix-rate and the reasons behind the low rate is just hiring another fire-fighter.

More manpower could be a solution for many problems like overall availability, but still is important to remember that incoming incidents do not come evenly distributed. They come in different sized pulses, meaning that the workload average could manageable with

available resources. When high number of requests are incoming on a day when all the resources are not available, it can cause longer response times for obviously reasons. From support point of view there are same problems, which are simple to fix, but understandable that, if the problems occur once or twice in a year to a single person, the resolution can be difficult to remember.

Another possibility is that just lack of knowledge. As a solution to the problem when there is no support available, like weekends or because of big time difference, can be easily accessible online knowledge base for solved cases. When the root-cause of the incident is known, every solved incident resolution should be marked as "known reason" and an article should be created. Then recurring incidents can be linked for the same article. This is part of the problem identification where also the recurring "known reason" incidents should be evaluated. There might be wring information in the instructions or the function or device might be redesigned. With current tools it's not possible to build well-functioning knowledge base or link cases. This is when the incident management software becomes needed. Building a knowledge base requires lots of data. At this point it would not be possible to set it up quickly. That's why it would be important to start collecting, as well the incoming information of incidents, but also the resolutions for different incident. Knowledge base would aim to tackle especially out of support availability problem out-of-office hours for non-critical activities. Knowledge base also tackles possible recurring investigation for same problem and thereby raise the first-line support fix-rate.

Support process is supposed to create training material to field service people. Based on the interview this process has failed. Combined with the results that what kind of training material is wanted the results are clear. Support could have the most exact information what kind of problems occur in machines. Training material creation could be separated to different categories: urgent hot-fix material, knowledge base material and hands-on related training.

Support team role in this process should be more like to make sure that they can provide good quality data to available for others, like to software department and service, which can organize trainings or change their way of working if needed. Some instructions are enough only in paper, but some need hands-on training or visible examples to learn. Also, some people learn and remember things better, if they can do it themselves. Separating these kind of problem solutions from the incoming ticket data, will help to build the

hands-on training structure for training events. Based on the answers also hands-on training was wanted.

Software training was one the most wanted trainings. Glaston remote tool and individual incident in Jira requires a label for which devices these actions have taken place. When recording this information, it is possible to see which devices require the most actions. Going through those cases it is possible to recognize trends, what devices need more software training and what kind of problems people have with them. Like in every software development, software bugs are common. Those problems appear suddenly and depending of the case the affect can be wide or limited. In this case information, what software version are installed in the machines is critical information. This information should be easily available. Some of the problems can be resolved without software developer or software update. Critical in this point is to have a fast and easily accessible place for share information. Based on the interview result, can be noticed that the information is shattered in too many locations and it is not easily available. Best situation would be, to collect all information into a specific place and make rules, who is responsible for updating which document. Even more better way is to integrate sales tools to CMDB and get that information from there to processes and people who need that information.

Part of the problem management is problem control. One of the problem control tasks are to provide information to the organization. Then a quick information sharing needs a channel. The people are accustomed to use email in their daily basis. Because of that email group in the office365-environment would be the good solution without adding another software to use. Only urgent and simple matters can be informed by using this channel. This channel can be later superseded by the incident management system knowledge base.

Screen-recorded instruction library is also recommended to certain debugging procedures. Video can be much more simple than written document. Link to the video can be added to the knowledge base information of an incident.

5.5 Backup handling

Automation department has backup database for customer projects. After startup or service visit the backups have been asked to deliver to Finland. There are no clear instructions, which way the they should be delivered. People has used email for smaller files and sent complete backups by CD-ROM or USB-memory stick. Lack of proper plan for backup handling, policy for backup taking and storing it, there is a big risk in case when customer PC fails. This is also a risk what customer need to take care of and for that Glaston provides hard-disk online mirroring and cloud services.

Solution for this is to create clear backup policy. What need to be saved, when backups need to be taken, where they need to be stored and how they should be delivered to Finland. Backup size can variate a lot. Projects that have been running for years could have size up to 10Gb and individual file size can be more than 5Gb. This sets some limits how the backups can be transferred to Finland. One possibility is to take backups online to cloud, but access to internet variates a lot. At this point a cloud-drive would be the best solution. Recommendation is that every time remote connection is taken, the files that has been modified need to be copied to the backup location before taking any action. Also, every time service engineer is visiting customer site, complete backup should be taken and transferred to the drive. Then support is responsible to transfer the files from the cloud-drive to the backup network drive.

5.6 Technical support process in future

Glaston Service Support process model itself is quite similar than the ITIL recommendations are. Although, some processes need to be added to complete the process to match needed requirements and the whole process must be documented in big picture. In appendix 3, it’s possible to understand how fundamental role CMDB has in the service support process. All the other processes are linked to this base. When the inputs to the whole process are entered incidents, business, customers or users, all the processes have its own critical place in the chain.

Incident management process will go through all the suggested improvements and problem management process is planned and integrated. Next step will be to evaluate and

integrate existing change management process to problem- and incident management processes. Then third step is to make sure that also existing release management is matching perfectly to all other processes.

5.7 Performance meters

Setting up KPI's or SLI's for support is related to the Glaston strategy. Determining these levels are part of the Service Level Agreement and responsibly belongs to top management. Support efficiency can be measured in plenty of the ways. Most common KPIs for service desk incident management are:

Key Performance Indicator (KPI)	Definition
Number of repeated Incidents	Number of repeated Incidents, with known resolution methods
Incidents resolved Remotely	Number of Incidents resolved remotely by the Service Desk (i.e.without carrying out work at user's location)
Number of Escalations	Number of escalations for Incidents not resolved in the agreed resolution time
Number of Incidents	Number of incidents registered by the Service Desk * grouped into categories
Average Initial Response Time	Average time taken between the time a user reports an Incident and the time that the Service Desk responds to that Incident
Incident Resolution Time	Average time for resolving an incident * grouped into categories
First Time Resolution Rate	Percentage of Incidents resolved at the Service Desk during the first call * grouped into categories
Resolution within SLA	Rate of incidents resolved during solution times agreed in SLA * grouped into categories
Incident Resolution Effort	Average work effort for resolving Incidents * grouped into categories

Picture 28. KPIs Service Desk and Incident Management

Most common KPIs for service desk problem management are:

Key Performance Indicator (KPI)	Definition
Number of Problems	Number of Problems registered by Problem Management * grouped into categories
Problem Resolution Time	Average time for resolving Problems * grouped into categories
Number of unresolved Problem	Number of Problems where the underlying root cause is not known at a particular time
Number of Incidents per Known Problem	Number of reported Incidents linked to the same Problem after problem identification
Time until Problem Identification	Average time between first occurance of an Incident and identification of the underlying root cause
Problem Resolution Effort	Average work effort for resolving Problems * grouped into categories

Picture 29. ITIL KPIs Problem Management.

Managing the support and software development resources is not possible without understanding how much time remote connections are taking from people's working hours.

Remote tool builds database of the remote connections. Based on the data it is possible to track down the total time of remote connection per region or department or even person. More detailed information can use to help R&D department to point out the most problematic devices on the machine based on the information that how many times that device has caused remote actions and how much time is spent to fix it. For software department it's critical to know, if there are recurring incidents to improve internal quality of the pre-configuration of the projects. Some projects might require custom software's. This custom software effect to the remote connection time can be also track down.

5.8 Other improvements

One of the support roles is to be available as much as possible. Many of the cases need to be escalated to other departments. Developers are normally working with the platform development or with the projects. Then interruptions to work is not wanted. Therefore, weekly-rotating resource for support is recommended. Then developer is ready to assist in case the incident is escalated to software department. Many of the developers have their own special area in the control, which means that they might have the best knowledge only from that field. This suggestion is related to the SLM. What kind of time limits are promised when second-line support is needed.

Information of the scheduled start-ups and service visits should be easily available for support team to be able to manage resources. Then support has possibility to note that during that specific period, less resources is available and corrective actions could be done. Information how the individual projects is progressing is critical information for support team, but also for the software department. Installation supervisors and start-up engineers should have possibility to mark the progress easily. Installation and start-up phases should be divided for small tasks in online checklist, which could be marked as started or done. Then total progress of the installation or start-up would be available for everyone. Weekly report of the problems is too sparse. Reaction time to problems could be speed up. Online checklist could be available in the machine user-interface or new reporting software to replace existing word document.

6 SUMMARY

This research was implemented by actions research. Research starts from current situation survey. Then analyzing the problem situation and evaluating the factors. After that follows synthesis: suggestions for improvements. Suggestions in chapter 5 were partly fundamental and the execution will happen in long period of time. Therefore, it's not possible to include last three phases; trial, evaluation and tracking completely into this thesis. As can be seen in the improvements chapter, some of the suggestions are already in the trial phase. Depending of complexity of the suggestion they will progress in different speed. All the phases will be done in the future and a following rounds will be executed. The financial benefits of these suggestions are measurable only later in the future. Short term improvements from customer point-of-view can be measured by repeating some of the original interview questions in the further rounds of this research. Support efficiency baseline can be determent when exact analysis in incident management is working. Therefore, I suggest that similar query will be held every year. That information can be used when planning next step development plans.

A suggestion to all the major issues in every category was presented. Some suggestions for lower priority issues and wanting's noticed from the ITIL recommendations were also presented. Glaston model were covering most of the suggested processes, although biggest realization was that how little all the processes are integrated together. Quick wins can be easily established from the smaller changes in way of working. Biggest job in the future is to integrate and improve the interface between all processes in a way that is most suitable for Glaston.

The incident and problem management processes need certain inputs to be able to produce outputs that needed for another process. Same inputs are also needed to be able to produce valid reports from those processes. Implementing suggested tools and ways of working that information becomes available. Then reports, information to CMDB and other processes can be produced.

Implementing all the suggestions will lead closer to the "Glaston way", which contains company values and value promises.

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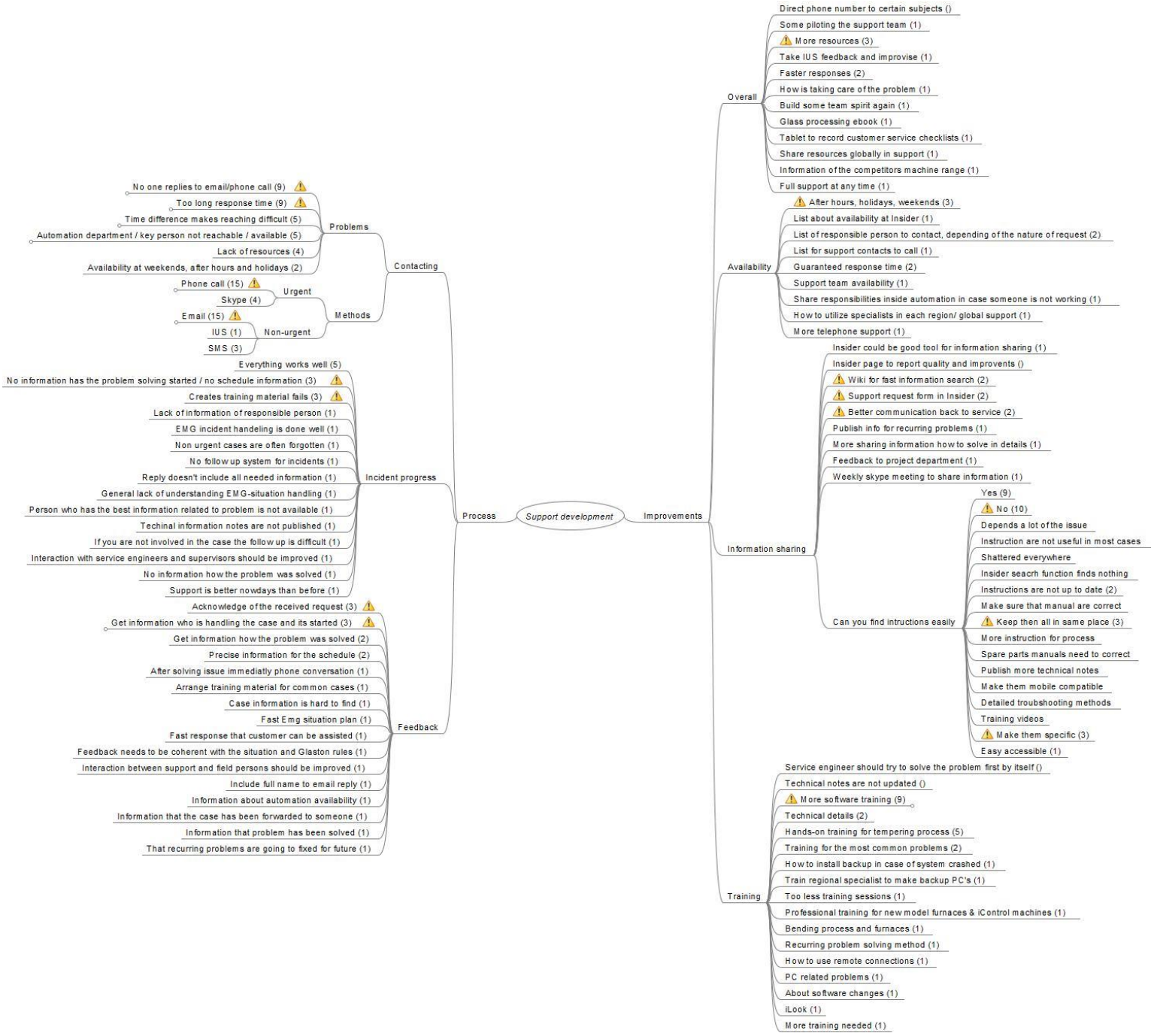
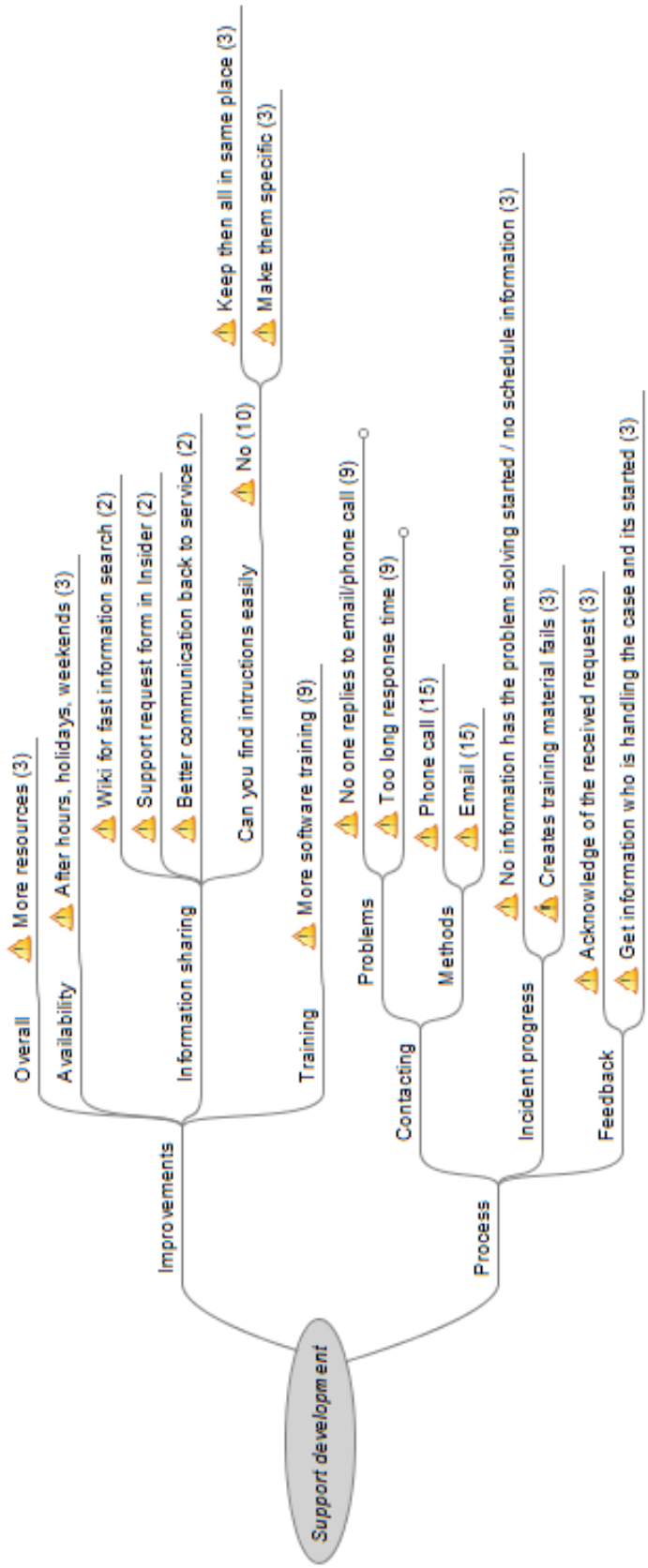
APPENDICES

Appendix 1. Complete MindMap before reduction.



Appendix 2. Interview most hits collected answers.



Appendix 3. The Service Support Process Model (ITIL Service Support)