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Swisslog's Field Service Engineers' productivity analysis across different countries within the Greater Europe region.

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In-Company submitted as partial requirement for the conferral of

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Supervisor:
Prof. João Carlos Menezes, ISCTE Business School

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Executive Summary

Swisslog has identified inconsistencies in the productivity estimates across the Greater Europe region countries and differences between the budgeted and actual figures presented in the financial reports. This report outlines the Swisslog's way of calculating productivity across seven countries and attempts to explain deviations between the countries, as well as the reported figures based on the information gathered. This study is also significant, as it gives an insight into the calculations in the real service organisation, which gives another chance to compare and contrast the literature theories against the practicality in the business settings. This piece of work was undertaken to form the In-Company Project as part of the authors master's degree, as well it was part of the writer's job to complete the analysis for the company.

Research identified the differences in calculations are related to the calculation method. First the total hours calculations are based (depending on the country), on 360 days, 260 working days or available working days in a month, summed up to get the yearly number of available working days. The working hours in the countries varies from 7.5 to 9 hours per day. In Country 1, 3, 6 and 7 holidays plus Bank Holidays or shortening of work hours lays between 32 and 34.5 days. In Country 4 holiday and permissions equal to 25 days, while in Country 2 and 5 25 days is deducted for holiday. Sickness ranged from 1% to 3% of the total hours. After the above deductions, available hours are calculated, which form the starting point in calculating productivity at Swisslog. 85% productive is expected from the Field Service Engineers except one, where the training and admin accounted for 4% of the available hours comparing to 15% in the other countries.

Calculations seem to be like the ones presented by **Fleishman (1982)**, who proposed the concept of group productivity and calculations were based on actual productive hours over total available hours worked. However, this method does not consider other factors presented in the existing studies, which are highlighted as important when evaluating productivity in the service companies. Nevertheless, as the research was only focusing on one division, it cannot be concluded that these factors are not taken into account when assessing productivity based on all departments in any given country.

Recommendation was proposed to standardise sickness to 2% of the total hours, training to 5% of the available hours and admin to 10% of the available hours. It is assumed that the suggested

changes are going to affect the calculations and result in the productivity percentage being at the same level in all countries. The general recommendation for the company was to exclude the overtime from the budgeted figure, but keep it in the actual one, however for more accurate comparison, it was suggested that the overtime hours should be specified in the productivity reports. The last proposal was to include the Field Service Managers in the calculations, as it allows for the assessment of the field service team. For the same reason Head of Customer Support hours should be included in the calculations, but as a percentage of time spend on the field service activities in a given country.

The restricted time frame was the main limitation of the study as it did not allow to analyse the figures in more detail. For example, analysing the individual employee's performance, which could potentially enhance the research or reveal any factors, which were not considered. In addition, the simulation of the proposed changes was not conducted. Consequently, it was suggested that the above along with discussions at the managerial level about the feasibility of the changes, monthly reviews of the productivity figures and benchmarking with KUKA would form the further actions.

1. Introduction

1.1 Motives

The purpose of this research is to examine Swisslog's service engineers' productivity across different countries within Greater Europe region. The idea for the title arose because author was offered a new role in the company. The new opportunity was to assist the Vice President Customer Service and Head of Global System Operations and help with the business and operations analyses. Therefore, it was sensible to combine the master dissertation with the new role, as it allowed to work on a topic that satisfies the university's requirements and has an international aspect, which relates to the author's degree. In addition, this approach main advantage was to work on an issue that was not theory based but responded to a real business issue, that needed explanation and provision of the potential solutions. These aspects made this piece of work more valuable as at the same time it benefited the writer and the company, as well as made it more interesting to research.

1.2 Background

This research focuses on Swisslog, which is a Swiss company, providing warehouses, distribution centres and hospitals with the automation solutions in 50 countries, with the workforce of 2,700, employed in 25 countries. In 2015 Swisslog merged with KUKA and is the member of the KUKA Group now.

Field Service Engineers role is to provide the preventative maintenance of the equipment installed on the customer's premises and conduct any necessary repairs, services and modifications. In addition to the engineering skills, the engineers are expected to behave professionally and demonstrate good communication skills, as they are spending most of the time at customers' sites.

1.3 Problem

It has been highlighted by the Vice President Customer Support Greater Europe, that across different countries within the region, there are variances in the productivity rates. As well as there were variances between the budgeted and actual figures. This lead to a question: 'where the differences are coming from?'. Engineers are performing the same job, no matter of where they are based, so in theory productivity rates should be the same. So why are they not? This is the base for the need of the analysis in different countries within the region to better understand

how the productivity is calculated in the investigated area. The research purpose is to find what these calculations are in seven countries and to understand where the differences are coming from. The research did not aim to criticise anyone, but to understand what are the variances dependent on.

1.4 Expectations

It was expected that each country calculates the productivity rate slightly different. Either by including or excluding factors which increase or decrease the figures. It was also anticipated that there might be factors that are country specific, which will be included in the formulas, but would not be applicable or considered by other nations. Lastly it was envisioned that through the research and analysis the results would lead to recommendations and initiate discussions on how to move forward.

1.5 Audience

This piece of work is mainly directed towards the Swisslog's Vice President Customer Service and Global System Operations, who requested the research, and assessors who will mark this work as a part of authors master's degree. However, it could benefit Swisslog in general, as it would allow Financial Controllers, Heads of Customer Support and other employees interested in the topic and/or understanding how productivity is calculated across the Greater Europe region.

1.6 Structure

The subsequent part of this paper summarises the existing definitions of productivity in general and then more specific definition relating to service productivity, assessment methods and challenges relating to the measurement, its importance and improvement techniques. The literature review section is followed by the explanation of the research method used and the reasoning behind the chosen scheme. Next, the results are presented in the graphical format (for the ease of the comparison) and supplemented by description of important features linked to calculations in different countries. This is followed by the discussion of the results, conclusion, recommendations, limitation of the work and suggestion for the further actions to be taken.

2. Literature Review

The starting point for writing the literature review was to find the key words that would help to assess the research topic. Search for articles and books was around the concepts of: productivity, service productivity, service engineers' productivity, productivity measurement and ways of improvement. The summary of the selected work relevant to this research is portrayed below.

2.1 Definition

Productivity in manufacturing is well established topic **(Biege et al., 2013)** and according to **OECD (2001: 12**) it is defined as 'ratio of a volume measure of output to a volume measure of input use'. Similar explanation was offered by **Diewert and Nakamura (2005)**. In addition, Paul Engle **(2004: 22)** a Senior Manager defined productivity as 'the number of dollars of goods and service produced by a unit of labor'. Others associate productivity with performance assessment **(Djellal & Gallouj, 2013)** and effectiveness in the resource use which helps in achieving the company's objectives **(Pritchard, 1992)**. However due to intangibility **(Johnson and Jones, 2014; Sekhon et al., 2016)** or peculiarity **(Biege et al., 2013)** of the service, the manufacturing productivity calculations could not be applied to the service.

2.2 Service productivity definition

Service system have been described as a combination of resources, staff, companies, distribution of information and technology internally and externally which contribute to value creation **(Sopher, Vargo and Maglio, 2008)**. Whereas service productivity explained by **Grönroos and Ojasalo (2004)** is the collaboration of cost efficiency, revenue efficiency and capacity utilisation. Another meaning has been offered by **Ostrom et al.** '… service productivity is about measuring the value of the return on investment' **(see Sekhon et al., 2016: 224**). A definition proposed by **Janeschek et al. (2013: 1)** is 'as the ratio of output factors and input factors. These input factors are transformed throughout a service process'. This thought has also been supported by **Coelli et al. (2005).** Furthermore, **Vitamo and Toivonen (2013)** mentioned service process in their research highlighting the customer role in the input and output, which makes it difficult to control by the company. It has been detailed that factors affecting service productivity can differ. This has been called multiplicity of output in Djellal and Gallouj research (see **Janeschek et al., 2013)**. This means that output could be observed in

the financial terms or volume, but on the other hand the customer-company relation could be similarly valuable measure of productivity in the service sector.

Relevant to this research is to highlight the difference between efficiency and productivity in relation to engineers' measures of productivity **(Norman and Bahiri, 1972).** The first one refers to measuring how the energy provided in a work transforms to a valuable work. The second one mentions the output expressed over an aspect of production like assets, investment or stock. This in turn means that the cost of input cannot be higher than rate of the output, if company wants to be profitable.

Vuorinen, Järvinen and Lehtinen (1998) stressed out an important point of the difference between productivity and effectiveness. The first one relates to input/output ratio, while the other one focuses on the capability to reach company's goals. Therefore, the improved productivity is not the only factor that would contribute to the improvement of effectiveness.

Literature also recognises the role of customer in the creation of the service productivity **(Spohrer et al., 2008)**. Research conducted by **Randall, Gravier and Prybutok (2011)** stated that customers who take part in the process, are more satisfied, which in turn as suggested in other articles has a positive effect on productivity. On top of that there is identified customer productivity expressed 'as the ratio of the service output experience by customer to the inputs provided by that customer as a participant in service production' **(Parasuraman, 2002: 7)**.

The above definitions show complexity of the service productivity. Yet **Banerjee (2015: 3592)** had an attempt to propose the summed-up meaning as 'a complex combination of quantitative and qualitative terms'.

2.3 Measurement

The attempts of applying the manufacturing productive measure in service industries resulted in the ratio being much lower than manufacturing and the difference was associated with the service features **(see Biege et al, 2013).** Service characteristics have been summarised by **Fisk, Brown and Bitner (1993)** and this include: 'intangibility' which relates to unknown outcome before obtaining; 'heterogeneity' reflecting the inconsistency of the outcome; 'inseparability' explained as seeing the provision and consumption of the service at the same time (this was also supported by **Parasuraman (2002**) and finally, 'perishability' which links with service being constantly available. These criteria may not be applicable to every service business, but

can be useful for engineering, which is classified as knowledge based **(Lovelock and Gummesson, 2004)**.

Intangibility of the service was also mentioned by **(Jäskeläinen and Lönnqvist, 2011; Klinger, Pravemann and Becker, 2013; Sekhon et al., 2016)** as a factor making it difficult to quantify the units of input and output. On the other hand, **Lovelock and Gummesson (2004)** seen that the aspect of intangibility also applies to products, as sometimes customers cannot view the product before purchase as it is already packaged.

This distinction provided by **Johnston and Jones (2004)** to measure service productivity as an operational productivity or customer productivity. First being the relation between contribution of material, tools, employees, clients and yield of customers, income and resources used, while the second comprises customer output including result and experience, over worth to customer involvement based on price, time and effort, which also supports the view that manufacturing productivity is not transferable to service.

Mark (1982) highlighted that the common measure of output to labour input is broadly used, as labour allows for the easy measure and economic analysis. In the research by **Bienge et al. (2013)**, it has been summarised what should be included in the input and output. Hence, input includes service provider and customer's input in terms of period and cost associated with the interaction during the service process, as well as the knowledge. Whereas the output incorporates quantity, quality, innovativeness, 'internal output' and knowledge same as in the case of input.

Vuorinen, Järvinen and Lehtinen (1998: 380) illustrated the explanation of the term in an equation format, which covers most of the factors described above:

$$\text{Service Productivity} = \frac{\text{Quantity of output and Quality of the output}}{\text{Quantity of input and Quality of the input}} \quad 1$$

Output was also seen as challenging to measure by **(Mark, 1982: 3)**, as it 'must be quantifiable and independent of the input measure'. In addition to this, another challenge in measuring output have been associated with technologies, as this causes the changes in the service activities (**Maroto and Rubalcaba, 2008)**, which lead to the requirement of the changes in measurement being applied more frequently. However, if the activities included in the

productivity calculations are monitored on a regular basis, this should not form a huge problem, as the adjustments could be applied in a timely manner.

Similarly, quality may mean different things in different industries and for different individuals, which make the calculations difficult to standardise across the company departments and locations. In agreement with this measuring quality in a service companies can result in difficulties 'since physical ways of measuring cannot be applied**' (see Biege et al., 2013**). Nevertheless, Li and Prescott (2009) noted that quality is linked with customer satisfaction.

Another formula refers to the group productivity and is expressed as the actual productive work hours over total work hours available. This calculation requires clarification of the available work hours and establishing the time needed to complete the task. If the relation is at 1.0 it can be assumed that all hours were productive **(Fleishman, 1982**).

The above explanations show the complexity of the topic. Therefore, it was reasonable for **Parasuraman (2002)** to support the **Bienge et al. (2013)** view, that broader explanation of the output which include sales, profits, markets share etc., from the company's perspective and service performance, satisfaction etc. from the customer's perspective should be used. For the organisational input: labour, equipment and technology are looked at, whereas the clients input includes time, effort and emotional energy. The level of customer involvement in the process will depend on how well was the labour allocated, or in which area the cuts are implemented.

The resource play an important role in the service sector, therefore its control and utilisation will be essential for the firm's competitiveness **(Guchait and Cho, 2010)**. It is argued that return on resources is correlated with the resource commitment **(Hunt, 2000)**. Furthermore, **Sekhon et al. (2016)** study, based on the higher education service, discovered that employee readiness impacts productivity in the service sector. This was also supported by **Biege et al. (2013).** Despite this, **Sekhon et al. (2016)** found that resource commitment was not significant in Australia and New Zealand, which need to be considered when conducting further researches, examining companies in different countries.

Another aspect mentioned in the research was motivation. It was indicated that motivated staff is productive. This is an advantage to the business, as it allows to increase returns through efficiency and effectiveness **(Banerjee, 2015)**. The motivation could be related to financial benefits, which was explained by Taylor's Scientific Management theory **(see Furlotti, 2017)**. Similarly, the book by **Sutermeister (1976)** quoted another writer who suggested that 20-50% improvement in productivity could be achieved with direct incentives. However, this approach

does not consider the complexity of the human mind, which is explained to be affected by factors like work conditions, individual needs, knowledge, training etc., which could form other possibilities which relate to employee's performance **(Sutermeister, 1976**).

It has been suggested, that there is no consistency across countries in the working hours **(Bick, Brüggemann and Fuchs-Schündeln, 2016),** but it affects the management of a company, so it should be clear how hours worked influence productivity of the workforce, because it helps to estimate the required labour numbers **(Collewet and Sauermann, 2017)**. They have also concluded that with the increased working hours the productivity slightly decreases, in contrast to quality, which slightly increases at the same time. They have also found out that fatigue has greater effect on employees who just started in their profession. However, this research was based on call centres, which does not necessary mean that it is applicable for other services. Furthermore, exhaustion can be reduced by provision training and the increase of employee experience **(Norman and Bahiri, 1972)**.

Another research linked to employees found that the costliest productivity loss was due to absenteeism, followed by problems caused by the work environment and lastly presenteeism **(Strömber et al., 2017)**. This was explained by managers questioned in their examination, who highlighted that frequently it is difficult to move the scheduled work, which result in using the substitute that would not be as productive as the employee who was unfit to complete the work.

The industrial productivity indicates that customer and company benefit when the relation between output and input is low. However, this is not necessarily true in the service sector, since organisation may benefit from the improved productivity, but customer may not **(Beinge et al., 2013)**. The same article highlights that the factors like: greater variety, faster flow or increased spectrum of tasks, which negatively affect manufacturing productivity, when applied to service productivity have a positive effect instead. This supports the view that there are different types of productivity and therefore different measurements are required **(Walsh, et al., 2016; Vuorinen, Järvinen and Lehtinen, 1998)** to represent the true reflection of any given service.

Despite growing importance of the service sector, around 33% of companies examined by **Klinger, Pravemann and Becker (2013)** were not analysing productivity. They found out that the methods used were the key performance indicators (81.3%). This shows an improvement compared to the Fraunhofer's (see **Janeschek et al. (2013)** analysis from 2010, which highlighted that over fifty percent of firms are using key performance indicators as measure of

service productivity**. S**tandard calculation used in manufacturing (ratio of the input and output) was the second most used method (51.4%). Other tools like balanced score cards or data envelopment analysis, which are tailored to measure the service productivity were not often used. This was explained by the unfamiliarity, lack of awareness of these methods, lack of skills and the associated expenses. Similarly, **Li and Prescott (2009**), pointed out that measuring and keeping a track of the productivity in the service sector is challenging for executives due to absence of precision in the measurement methods. Still the competition caused by growth of the market is the factor that should drive the productivity management and measurement **(Walsh et al., 2016)**, if businesses wish to stay competitive.

2.4 Improvements

It has been emphasised by **Becker et al. (2011)** and **Parasuraman (2002)** that methods used to improve productivity should differ between the product and customer's view. The conclusion was that there would not be any conflicts between improving service excellence and enhancing productivity when the wider definition of productivity is used.

In addition, according to **The ONS Productivity Handbook (2007)** there are five factors that support the growth of the productivity. These include: investment, innovation, skills, enterprise and competition. All of these stimulate companies to do better if they want to remain competitive.

One of the suggestions for improvement was to work with customers in similar industries as it requires less amendments and therefore improving the internal efficiency (**Zolnowski et al., 2013).** They have also found that capacity efficiency can be increased when there is a price variation available, which may attract certain customers at times, when staff may be less occupied.

Furthermore, **Pritchard et al. (2008)** analysed productivity measurement and enhancement system projects and determined that in most cases feedback increases productivity. Although, the feedback is beneficial for the effectiveness only when it is made clear **(Kluger and DeNisi, 1996)** and when it adds value to receiver's knowledge **(see Pritchard et al., 2008)**. The impact of the system can be also affected, when staff changes, and new employees are not engaged in the process. Nevertheless, once improvements are implemented it is suggested that they last **(Pritchard et al., 2008)**.

Moreover **Engle (2004)** mentioned that technology helped companies to increase the productivity significantly without a huge investment. Likewise, scheduling software was also seen as a way of enhancing Field Service Engineers' productivity **(Anonymous, 2005)**. Despite this, there is still potential for improvements in: 'administration functions; manual operations; and errors, mistakes, and waste' **(Engle, 2004: 22)**. The first one includes the customer service which links with this research. His suggestion was that organisation needs to 'design and implementation of a measurement system to identify output, cycle time, error rate, productivity, and if possible, customer service level' **(Engle, 2004: 22).** However, this should be followed by the monthly analysis by the top managers, to perceive any patterns that would allow to eliminate or reduce the unproductive time.

2.5 Importance

It is interesting to note that **Mark (1982)** noticed that from 1960's the service industries have been enlarging its position and provoked the researchers to identify the measures applicable to this sector. Though, looking at **McLaughlin and Coffey (1990)**, it seems like no actions have been taken, because they stated that service companies are not big enough, as well as they lack capability do to so, therefore they do not show an interest in measuring productivity. Other researchers found that larger organisation may be more willing to take actions, as they are more exposed to do so **(see Walsh et al., 2016)**.

However as highlighted by **Engle (2004) and Wacker et al. (2014)** service industries play more important role in the economy nowadays, however there is not sufficient research that would help companies increase the understanding of the service productivity and indicate how to assess the resources throughput, which in turn would increase company's competitiveness. This could be a possible reason for the service productivity theme being comprehensively researched in 2012 **(Biege et al., 2013)**.

Increased competition (**Klinger, Pravemann and Becker (2013)** and role of services in the market should be the motive for the companies to measure and strive for improvements, especially that the role of service providers is likely expressed in financial terms, therefore maximising profits and increasing shareholders value (**Parker et al., 2013)** are linked with productivity. However, it is not only important for companies, but also for the Office of National Statistics (ONS). The growing productivity is the 'determinant of economic growth' (**Dawn, 2007: 20**) and combined with lower unemployment suggest the living standard have

gone up **(Camus and Watson, 2007**). Moreover, productivity of services affects other economic segments **(Maroto and Rubalcaba, 2008)**, which demonstrates the importance of the topic.

3. Methodology

The starting point for the research was to understand the company's issue, why the concern arose, why is it important and what is the expected outcome of the research. This information was gathered during the initial meeting with the Vice President Customer Service and Head of Global System Operations, who was the initiator of the research topic. Second step involved meetings with the Head of Finance and Head of Customer Service departments in Region 4 to provide the basis knowledge about the productivity topic in relation to the Field Service Engineers at Swisslog. These meetings allowed to understand some of the terminology and get the general idea of how productivity is calculated in Region 4.

3.1 Secondary data

This is the data that already exists and have been collected by others and is accessible by others **(Saunders et al. 2009).** This was an easy way of gathering the data which provided an overview of the topic including background information about the productivity in general, service productivity, ways of measuring including challenges in doing so, ways of improvement and its importance. However, the data was not directly relating to the company, which cause the lack of the comprehensive explanations that researcher aimed to gain **(Buglear 2012)**. Therefore, there need for collection of the data relevant to the Swisslog was identified. The starting point was to gather Swisslog's productivity reports, which would provide the recognition of what contributes to measurement of the Field Service Engineers' productivity, which again was an example of the secondary data, as it was available for the researcher use. The highlighted cell titles (Appendix 1) show numbers relevant for answering this research questions.

At this stage the relevant data was transferred to a spreadsheet (Appendix 2) prepared by author and the Vice President Customer Service and Head of Global System Operations. This was prepared for a clearer presentation of the data, as it excluded irrelevant information and allowed for an easier comparison between budgeted and actual figures, as well as cross-country evaluation.

3.2 Primary data

The secondary data collected through reports was quantitative, so it allowed for the statistical analysis **(Pitcher 2016)**. However, it did not provide the explanation where the numbers are coming from and why there are differences. This supported the need of the primary data, which is the one that researcher collects first hand **(Burns and Burns 2008)**. This type of data allows for the collection of the most up to date information, which directly relates to the questions of the study. However, it takes time to gather the evidence and depending on the scale may be expensive **(Buglear 2012).** Nevertheless, in order to increase the understanding **(Hair et al. 2011)** of what contributes to the figures presented in the productivity reports the qualitative data was required, as it allows to explain the meaning behind the numbers **(Zikmund, 2012)**.

In order to collect the primary data, the interviews were chosen as the most suitable way, because it allowed to ask questions that arise during the conversations, but interviewer did not anticipate **(Bell, 2014)**. The semi-structured interviews were the best option, because they give the flexibility in the flow of the discussion and gives the opportunity to ask questions that will expand the in-dept of the data collected **(Fisher et al., 2010)**.

3.3 Interviews

The first phase of the primary research was to interview Heads of Customer Support in four regions. Region 1 covering Country 1 and 3; Region 2 covering Country 2, 5 and 6, but excluding one of the countries were the team is only made of one person; Region 3 covering Country 4 and excluding country where the team is not yet well established and finally Region 4 covering Country 7. The interviews for regions 1, 2 and 3 were Skype interviews and for Region 4 interviews were face to face.

Based on the analysis of the data from the productivity reports. Open questions were prepared, to gather the reliable data, which was not influenced by any leading questions of the interviewer, as well as these tend to provide descriptive information **(Maylor et al., 2017)**. The main point was to find out how the productivity is calculated in all of the countries; other questions were based around the differences between the budgeted and actual figures and aimed to find the explanations.

Although some explanations were provided regarding the data and how the productivity is calculated, there were still some gaps in the calculations. In addition, after collecting and comparing the information gathered through the interviews with the Heads of Customer Support other questions arose. After the discussion with the company supervisor it has been decided that interviews with the Financial Controllers would fill the gaps in the calculations and answer remaining questions. This formed the phase 2 interviews.

Interview for the Region 4 was already covered at the beginning of the research, when the author was introduced to the topic. Therefore, the remaining 3 were required. Similarly, as with the phase one, interviews were Skype based. Except Region 3, where due to the lack of availability the questions were send by email, to be answered at a convenient time. In that case the research method can be classified as self-administered questionnaire, as researcher was not with the participant at the time of answering questions **(Saunter et al., 2016)**. Moreover, any other clarifications were gained through emails exchange.

3.4 Analysis

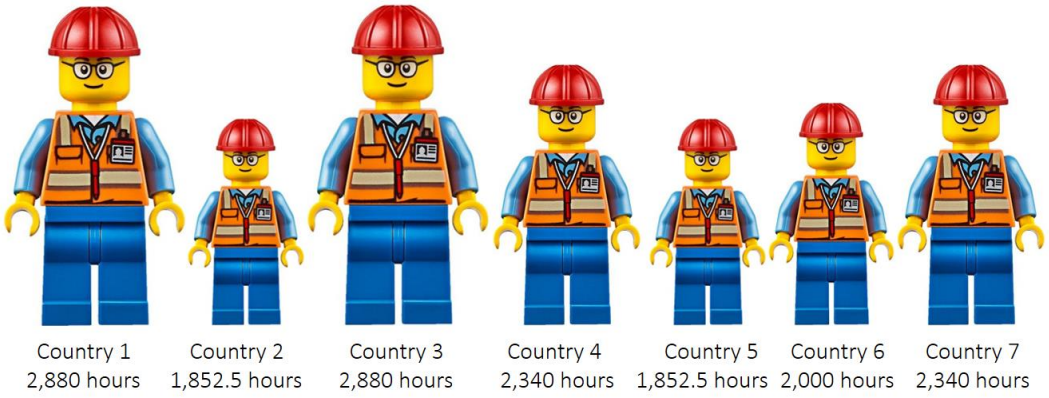
As mentioned before, based on the productivity reports the spreadsheet was created to capture relevant data. Another tab was designed to calculate the hours per employee per month (Appendix 3) and hours per employee year to date (Appendix 4). Based on the figures derived from interviews, the average annual available hours were divided by 12, to get the hours per month per FTE. This was done to check if the budgeted figures match the hours expected by the interviewed employees as well as to compare them with the actual ones (see figure 12 in the results section). An attempt was made to explain the differences, based on the qualitative data gained.

4. Results

The findings are based on the information provided by four Head of Customer Support and four Financial Controllers. It was managed to conduct seven interviews, two of them were in person (Region 4) and five were Skype based. One interview (Region 3) was not a Skype call due to the lack of availability of the Financial Controller. Instead author received responses to the question through email. The response rate of 100% was achieved due to the support of the Vice President Customer Support by introducing the author to the people interviewed and emphasising the aims of the research and introducing no blame culture. The summary of the phase 1 interviews can be seen in Appendix 5 and phase 2 in Appendix 6. The general results have been summarized in the graphical format, to visualise the results, as they allow to quickly spot differences and similarities between the figures and countries.

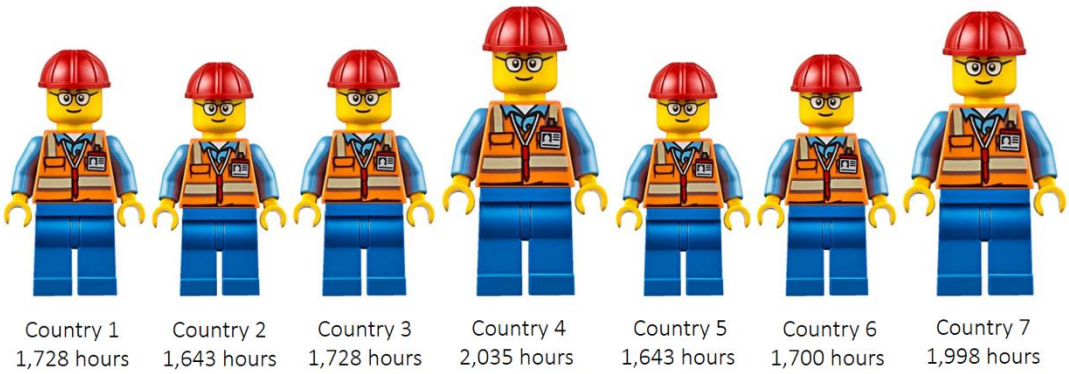
The first picture represents the average total hours per Field Service Engineer per country. Total hours refer to total yearly hours. This is the starting point to calculate the productivity at Swisslog. The difference between the lower and the highest number equals to 1027.5 hours, which gives a significant difference. The reasons behind it, will be explained later in this paper.

Figure 1 - Average total hours per Field Service Engineer per country.



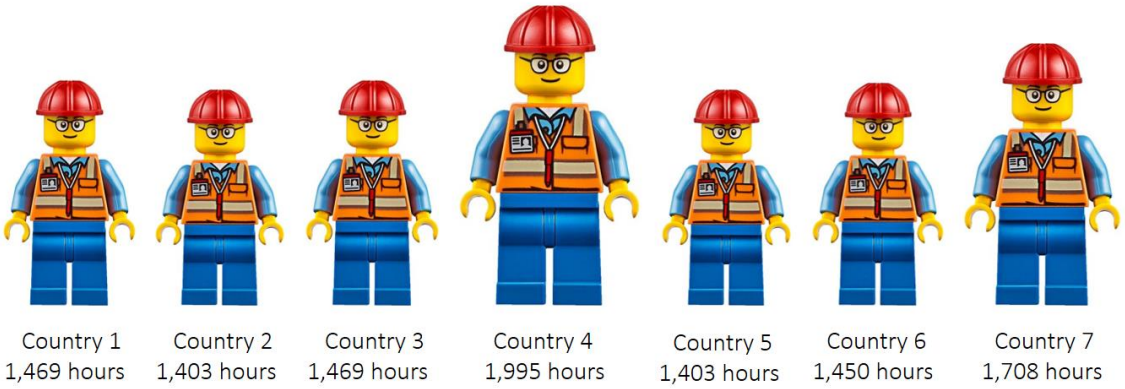
Picture 2 shows the average available hours per Field Service Engineer per country, which according to Swisslog's Accounting Manual (2014: 35) refers to 'total yearly hours less holidays, sick leave and military absence etc.'. At Swisslog this is the starting figure for calculating the productivity. It can be noticed that 5 out of 7 countries have quite similar number of available hours.

Figure 2 - Average available hours per Field Service Engineer per country.



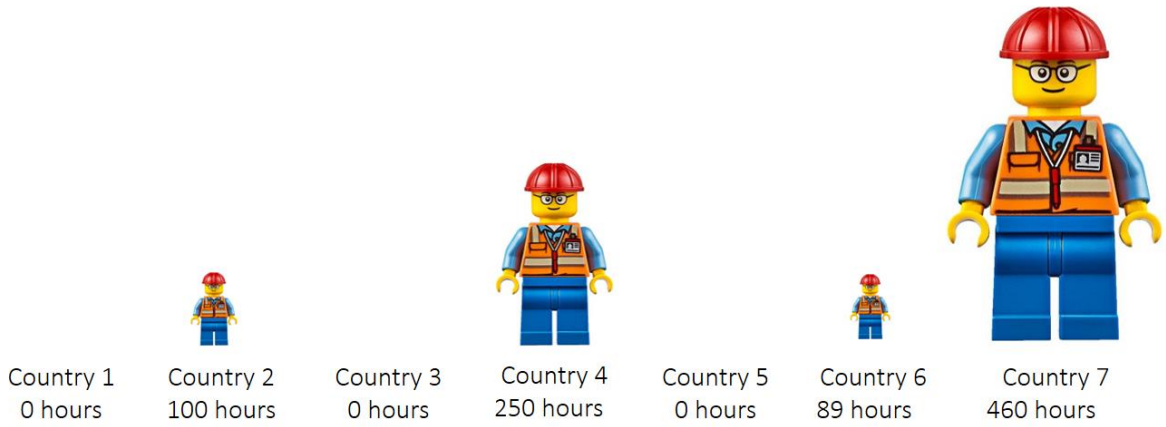
Third picture illustrates the average productive hours per Field Service Engineer per country. At Swisslog this hours refer to 'hours paid by a customer (or other Swisslog unit) / chargeable to a customer (or other Swisslog unit) such as manufacturing hours, project work, customer support work etc.' **(Swisslog Accounting Manual Update Oct 2014: 35).** Similarly, to the previous graphic, five of the countries show similar number of productive hours.

Figure 3 - Average productive hours per Field Service Engineer per country.



The last comparative graphic shows average budgeted overtime per Field Service Engineer per country. Overtime is added on top of the available hours. It can be clearly seen that there is huge variance between the results. Country 1 and 3 do not include the overtime hours in the budgeted figures because it is hard to estimate. For Country 5 there was no overtime assumed for 2018. In addition, it is important to mention that overtime hours presented in the figures below are based on the average.

Figure 4 - Average budgeted overtime per Field Service Engineer per country.

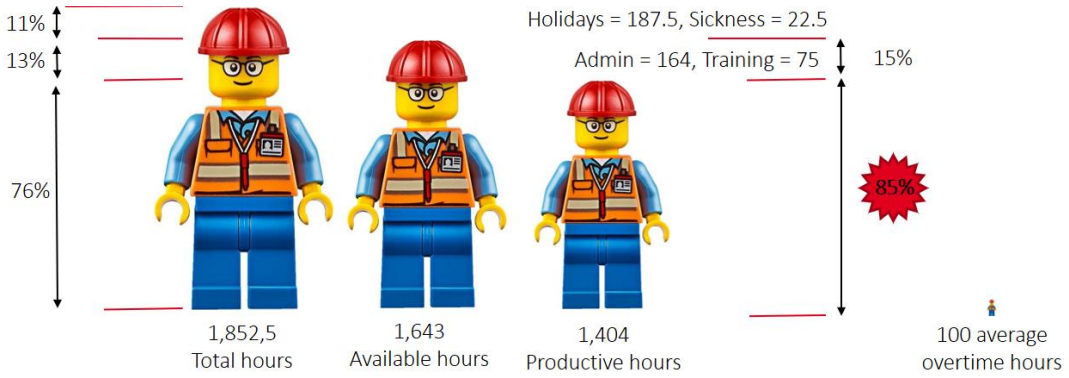


Figures 1 to 4 show the differences in the numbers across countries, but they do not explain where the differences are coming from. Therefore, an illustration for each of the seven countries was prepared to demonstrate the factors and hours deducted from the total hours in order to get the available hours and productive hours. Percentages on the left-hand side of the figure, from the top to the bottom represent the deductions from the total hours to get the available hours, deductions for unproductive time and productive hours. On the right-hand side, the top figure represents the anticipated unproductive hours as a percentage of the available hours. The figure in the red star shows the expected productivity level from the Field Service Engineer. The box shows budgeted and actual productivity figures November year to date (YTD).

Figure 5 – Productivity calculations per Field Service Engineer in Country 1

In Country 1, the total hours are based on 360 days and 8 hours day. 32 days is assigned for holidays plus Bank Holidays and 8 days for sickness. They budgeted for 5 full time equivalents (FTEs) in 2018, one of them is the Head of the Customer Support and one is a Field Service Manager, who are classified as unproductive, the remaining three are Field Service Engineers, from whom the 85% productivity is expected. Overtime is not budgeted, as it is difficult to estimate.

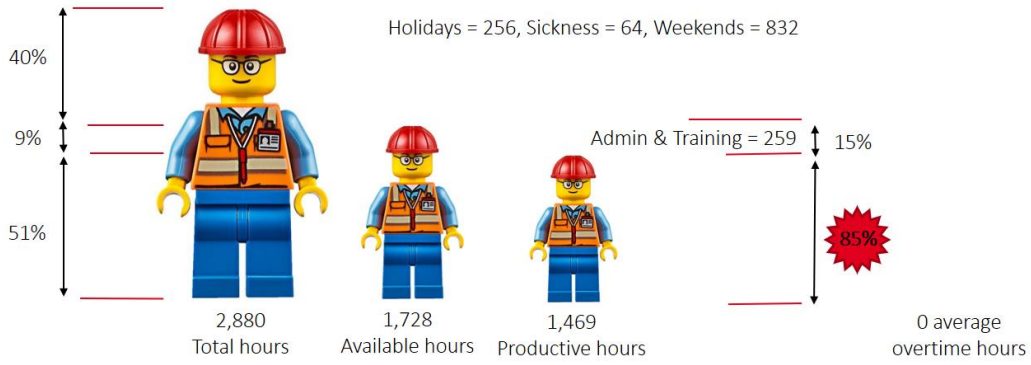
Figure 6 – Productivity calculations per Field Service Engineer in Country 2



Budget YTD (Nov)	Actual YTD (Nov)
81%	88%

Country 2 base the total hours on the available working days in a given month, which adds up to 247 days for 2019 and multiplied by 7.5 hours day. 25 days is allowed for holiday and 3 days for sickness. The budgeted FTE number for 2018 was 3 with the expectation of 85% productivity based on the average calculations. 300 overtime hours was budgeted for overtime, which on average gives 100 per engineer for 2018.

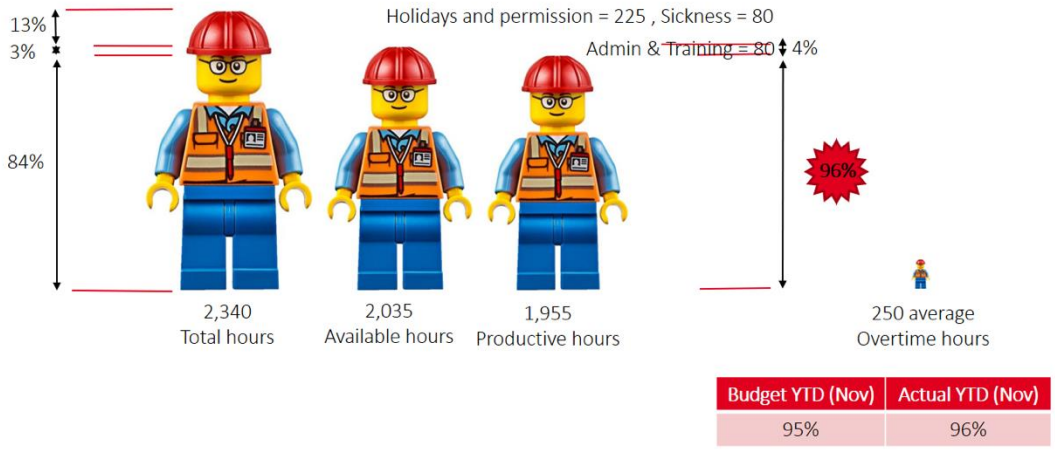
Figure 7 – Productivity calculations per Field Service Engineer in Country 3



Budget YTD (Nov)	Actual YTD (Nov)
75%	97%

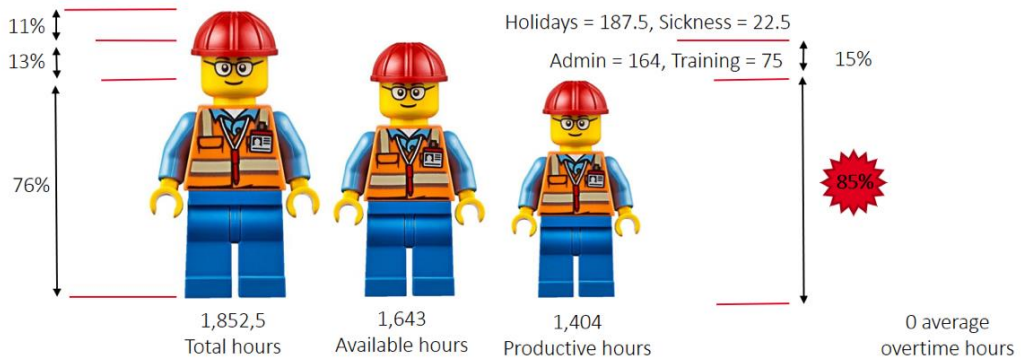
Country 3 is in the same region as Country 1, so the total hours are calculated based on 360 days and 8 hours day. 32 days is assigned for holidays plus Bank Holidays and 8 days for sickness. They budget for 3.8 FTEs, who are all counted as productive. 0.8 FTE is due to the fact, that one of the engineers works 4 days a week. Again 85% productivity is expected. Overtime is not budgeted, as it is difficult to estimate.

Figure 8 – Productivity calculations per Field Service Engineer in Country 4



Country 4 calculates the total hours by multiplying 5 working days by 9 hours day and 52 weeks. 5 weeks is allocated for holiday and permissions (shortening in the working hours due to private appointments) and 80 hours is administered for sickness. The FTE number is 7, this includes service manager, who is counted as productive, because customers are paying for this hours as well. All heads expected to be 96% productive. 250 hours overtime per head was budgeted.

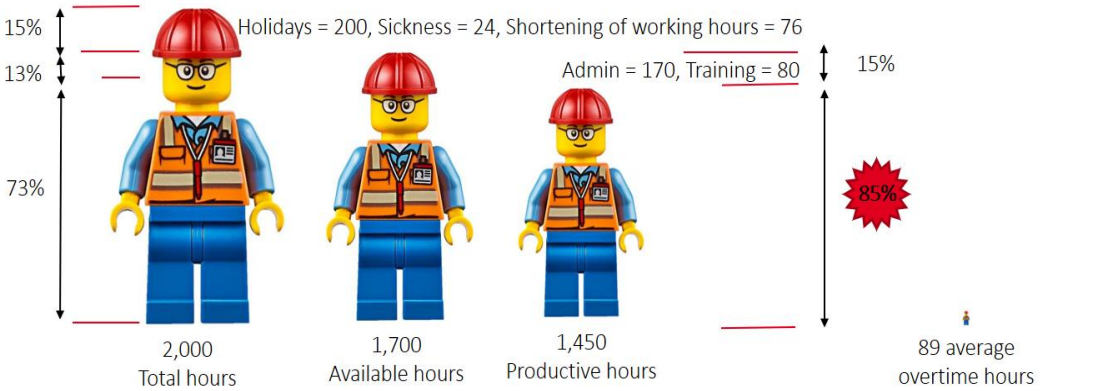
Figure 9 – Productivity calculations per Field Service Engineer in Country 5



Budget YTD (Nov)	Actual YTD (Nov)
82%	85%

Total hours in Country 5 are based on the available working days in a given month, which add up to 247 days for 2019 and multiplied by 7.5 hours day. 25 days is allowed for holiday and 3 days for sickness. The budgeted FTE number for 2018 was 9, this includes Field Service Manager, who is classified as unproductive. The remaining 8 engineers is expected to achieve 85% productivity. There were no overtime hours estimated for 2018.

Figure 10 – Productivity calculations per Field Service Engineer in Country 6

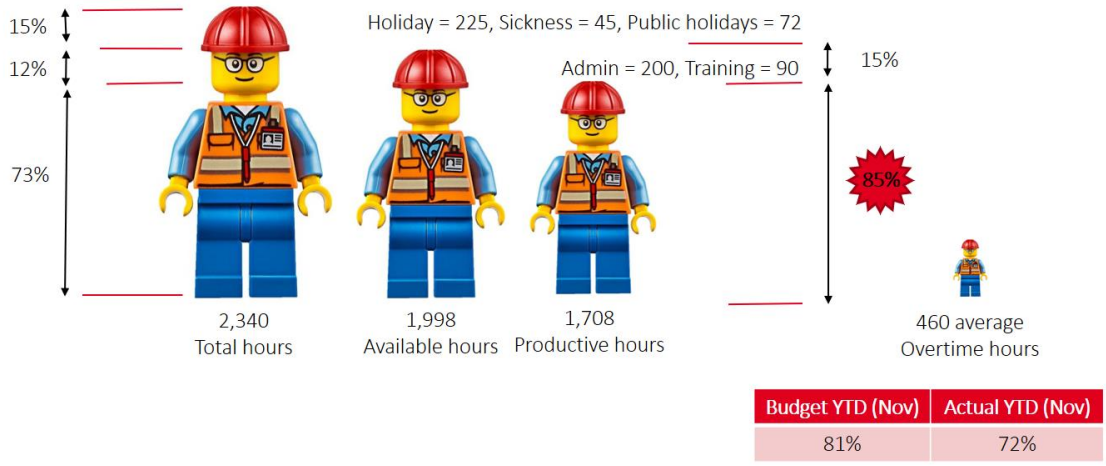


Budget YTD (Nov)	Actual YTD (Nov)
80%	74%

Total hours in Country 6 are based on the available working days in a given month, which add up to 250 days for 2019 to be multiplied by 8 hours day. 25 days is deducted for vacation, 9.5

days is for the shortening in the working hours and 3 days for sickness. The budgeted FTE number for 2018 was 19, this comprises of 7 FTEs in Team 1 and 12 in Team 2. Both teams are supervised by the Field Service Manager, but he is not included in the FTE numbers mentioned. Alike most of the above countries 85% productivity was foreseen. There was 1,700 overtime hours assumed for 2018, 800 for Team 1 and 900 for Team 2. The total overtime hours for both teams were divided by 19 FTEs to get the average overtime hours per Field Service Engineer.

Figure 11 – Productivity calculations per Field Service Engineer in Country 7



Country 7 calculates total hours by multiplying 5 working days by 9 hours a day and 52 weeks. 25 days is deducted for holiday, 8 days for Bank Holidays and 5 days for illness. The budgeted FTE number for 2018 was 22, this comprises of 10 FTEs for Team 1 and 10 FTEs for Team 2, while 3rd team comprises of 2 employees. Team 1 and 2, includes the Field Service Managers, who are counted as unproductive, Team 3 embraces Commissioning Engineer counted as productive and Operations Manager who is not. Engineers should achieve 85% productivity. There were 8,745 overtime hours budgeted for 2018, which divided by 19 productive heads give 460 hours.

Figure 12 – Comparison of the hours per employee per month, based on budgeted and actual figures November 2018 and average calculated based on the interviews' data gathered.

Country	Budgeted	Interview Based	Actual
Country 1	130	144	146
Country 2	145	145	212
Country 3	163	144	143
Country 4	149	190	185
Country 5	122	134	137
Country 6	164	174	148
Country 7	189	205	154

Figure 12 clearly shows that there are variances between the figures. Although the differences between budgeted and actual can be expected, it is surprising that the budgeted figures do not match the calculations that the writer have completed based on the information gained during the interviews, as these in theory should match as the same people set the budgeted target. This could however be explained by the fact that engineers' contracted hours do vary and can be between 39 and 45 hours a week.

The most significant difference is noticed in Country 6. The explanation for the lower number of hours could be due to the shortage of heads. There were 19 FTEs budgeted for November, however the actual number for November was 16. The missing three were the engineers, who are productive staff. The same explanation could apply to Country 7 where there was a shortage of 3 productive workers, therefore the team performance could be reduced. Another underperforming team is in Country 3. This is hard to explain what the cause could be, as the FTE number only includes productive heads. The actual figure suggests that there was no overtime booked in November as well as the team spend more time than expected on unproductive activities.

Table also shows that in Country 2, the budgeted figure exactly matches the figure calculated based on the collected data through interviews. Nevertheless, there is anomaly in the actual figure. It suggests that in November each employee have done 67 overtime hours, which is 67% of what was budgeted for the whole year. So how is it possible that they have done so many in one month?

The last data that was looked at involved the year to date figures, which can be seen in the right bottom corner of the figures 5-11. According to the year to date November figures Country 2, 3, 4 and 5 are above the budgeted productivity level, which again could be due to a lot of overtimes done.

Country 1, 6 and 7, are below the set target by 6% to 11%. In case of Country 1, the team is small, and it includes two unproductive heads, therefore as the actual FTE number was 4, it proposes that there is a productive head missing, which reduced already low productivity figure set. In the other two countries as explained with the November figures, the underachievement is probably caused by the deficiency of employees, who were originally budgeted for.

The above comments are based on the information gathered during the interviews, therefore it does not provide definite answers regarding the reasons behind overachieving or underachieving. Therefore, to make the comments more accurate, more detailed analysis would be required.

5. Discussion

The criteria mentioned by **Fisk, Brown and Bitner (1993)**, like intangibility or perishability relate to what Swisslog offers to its customers. Therefore, as they specified that these criteria can be useful for engineering, it is clear, that the analysed sample is included in the service sector. Suggesting that the traditional way of measuring would not be applicable to the examined company therefore the closer look should focus on the literature covering the service productivity definitions, measurements and improvements.

This means that the manufacturing definition of output over input, expressed in financial terms (**Parker et al., 2013)** as revenue per employee does not reflect the way it is expressed at Swisslog. Even though there is no financial aspect involved in the calculations of productivity per field service engineer, and the output does not relate to the number of services performed, it can be seen in a way that the output/input ratio is still used, by interpreting that the productive hours are the output and the available hours act as an input.

Another definition associated productivity with performance assessment (**Djella & Gallouj, 2013**) and effectiveness in resource utilisation, which in turn help to achieve company's objectives **(Pitchard, 1992)**. The importance of resources is recognised at **Swisslog**, and especially engineers, as the more productive they are the higher margins can be achieved or the prices reduced, which consequently could increase the number of customers as company would be more competitive. Which suggests the potential increase of the profits and growth, which increase the need for employees, which in turn makes company contributing to the economic growth (**Camus and Watson, 2007).** However, it does not mean that competitiveness is dependent solely on the productivity. Other factors like quality of the equipment, effective marketing, word of mouth or relation building also play an important role in winning contracts.

Likewise, performance have been mentioned in this research. At the time when the issue and the expected task was presented by the company supervisor, the distinction between performance and productivity was made quite clearly. With the meaning that performance relates to the time spend at work, but productivity is the time spend on completing the designed tasks. The other time, which is spend on activities that do not link to the role are unproductive and reduce the productivity percentage. This dependence is also explained in Swisslog Accounting Manual Update Oct 2014 where productive hours are the ones for which customer

pay. This showed the importance of distinguishing the differences of terms which may be commonly used to express the same thing, but in fact when the clear understanding of the meaning is gained, it is possible to examine the problem more accurately.

Clear distinction between definitions, identified that the manufacturing ratio is more applicable to Swisslog's customers in measuring the units produced/proceeded per period. However, for the study's company, the service productivity seems to be more applicable due to the field service engineer team being looked at. Yet, the company does not include the factors mentioned in the literature like customer involvement, technology, capacity utilisation, quality, profits, staff motivation, system culture and country context to calculate the productivity of the field service. This does not necessarily mean that Swisslog do not take these factors into an account when evaluating the productivity of the company based on all departments. For example, the managers and other admin staff, who are counted as unproductive (as customer is not paying for their hours) are responsible for resource allocation based on location, customer and individual's capabilities. These are the activities who help to organise the work, and therefore as engineers do not have to do any of the planning activities their productivity goes up. It is understood that the supporting roles (office based), although non-productive, are important as they increase the availability of the staff that is the key to generate the revenue.

Based on the overview of the measures in the existing researches, the most applicable one seems to be presented in **Fleishman's (1982)** book where the actual productive hours are represented over the total available hours worked. This is called a group productivity, which seems to be reasonable to be used by Swisslog as the reports aim to show the budgeted and actual team productivity. Although the budgeted figure is set at a certain level, the actual figure can be a higher. This can happen if less time was spent on admin or training. Moreover, overtime hours could increase that figure above the expectations. Also 100% figure is potentially possible to be seen in the actual figure, if there would be a lot of overtimes done, which would compensate for the estimated unproductive time.

In addition, one of the studies, which found that the absenteeism is causing the costliest productivity loss (**Strömber et al., 2017)**, does not seem to be true at Swisslog at least from the budgeted point of view. This is because sickness is not included in the available hours, which would not affect the productivity. In regard, to the reasons given as an explanation for the loss in productivity, this could be in theory applicable to the researched company, as engineers'

work is scheduled based on their knowledge and experience. Therefore, sending less experienced engineer, could reduce the productivity if it took them longer to complete the job than it was expected from the other engineer, who was not able to attend the scheduled service visit. However, to make any conclusion on this argument, more detailed analysis of the individual engineer's productivity would be required.

The research findings showed that at Swisslog there is no consistency in the working hours across countries, which proved what was already stated by **(Bick, Brüggemann and Fuchs-Schündeln, 2016)**. The awareness of these differences is important as it helps with approximating the required labour numbers **(Collewet and Sauermann, 2017)**. This was to some extend proved during collecting the primary data, when Head of Customer Support in Region 4 explained how the required number of engineers is calculated, when the expected demand increases due to the new projects. This of course was related to the available working days, however for more precise calculations the productivity percentage was taken into an account. Interestingly in these calculations the percentage productivity was slightly less than 85%, nevertheless it was explained that it was to recognise that during the 8 hours day, some time is lost due to lack of expertise, breaks etc., which seems to be omitted from the budgeted productivity calculations. Although it seems reasonable to include this as unproductive time, author did not get enough insight into the reasons why this is not anticipated in calculations.

Swisslog assumes that overtime is 100% productive. However, research based on ththe call centred, indicated that increased working hours cause a slight reduction in the productivity (**Collewet and Sauermann, 2017)**. So, it would be interesting to investigate this aspect in more detail and check if the same results would be collected in dissimilar service sector. If this would find to be true, the productivity figures would possibly need to be revised, as this could suggest that reduction of the set productivity figure could be required in countries that include overtime to calculate the budgeted percentage. The reduction in turn could result in a need for the additional engineers to meet the demand and/or the need to increase the rates charged to customer.

In the same research it was mentioned that fatigue has a negative effect on productivity, however it is most likely to be applicable to new starters. Nevertheless, to reduce the effect of this issue, training and increased experience was suggested as a solution **(Norman and Bahiri, 1972)**. At Swisslog engineers are trained on a regular basis, which potentially reduces the

chances of its employees' exhaustion. Moreover, experienced engineers (at least in Country 7) do more overtime, therefore the fatigue factor that could decrease their productivity is cut.

As Swisslog is the service company, it is important to address the customer role in influencing productivity. Previous studies suggested that customers who are included in the service process are more satisfied (Randall, Gravier and Prybutok, 2011). Although in the examined company customer influence on the Field Service Engineers' productivity is not anticipated in the calculations, there is a potential that it could be the factor affecting it. For example, if the customer does not prepare the site for the engineers' visit, the time spend by Swisslog employee waiting for the warehouse readiness, is non-productive, however staff is still paid for these hours. Therefore, it causes losses, as to catch up with the work it is likely that the overtime will be needed, which was not predicted in the first place. Although Swisslog cannot control the customer actions, they can include the contingency in the hours sold to customer, which would minimise the risk of loss, however this would still not improve the engineers' productivity. The aspect of satisfaction relating to customer involvement in the service cannot be concluded based on the data gathered through the primary research.

6. Recommendations

The conducted research lead to authors' recommendations for Swisslog, followed by the further actions to be taken if they wish to standardise the calculations and improve productivity. Two types of recommendations were identified including standardisation and general, which will be explained in more detail below.

6.1 Standardisation

- **Training -** It has been suggested to set the training as 5% of the available hours, as this seemed to be standard approach taken by most of the countries.

- **Admin** – The standard application of 10% of the available hours seemed to be a pattern in most countries, therefore it was suggested to keep it the same in all countries.

- **Sickness** – There was not consistency in the sickness estimates. It varied from 1 to 3% of the total hours. According to European Foundation for the Improvement of Living and Working Conditions research (2010), the absence across Europe was between 3% and 6% of working time. However, as Swisslog expects to do better than the average, as well as it was shown in the calculations that in most countries less than 3% was possible to achieve, it is realistic to keep it lower. Therefore, the suggestion is to standardize across the Greater Europe region as 2% of the total hours.

- **Total hours calculation** – It is recommended that in Country 1 and 3, weekends should be excluded from the calculation of the total hours, as it gives a misleading assumption that contracted engineers' hours are significantly higher than in other countries. One of the other two approaches of calculating could be applied, as they derive to quite similar results.

- **Productivity percentage** – This budgeted figure should also be the same for all countries, because engineers are completing the same job no matter of the location. Currently, this would be 85%, however when the above changes would be applied that percentage could be affected.

6.2 General

- **Overtime** – The overtime hours should not be included the budgeted hours, as it is hard to estimate how many extra hours will be needed in a year. It is reasonable to include the overtime hours in the actual figure, however to make it clear for the people analysing, these should be specified in a separate cell in the productivity reports. The proposed approach is also used as a control method at Pohjola insurance company, to control the input (see Vuorinen, Järvinen and Lehtinen, 1998).

- **Field Service Manager** – Their hours should be included in the calculations presented in the productivity report, even though they are classified as non-productive heads, because it allows for the assessment of the team. If the manager is responsible for more than one country team, their hours should be split as a percentage of the time spend on field service activities in a given country/team.

- **Head of Customer Support** – As with the above, their hours should be included in the budgeted figure as a percentage of the time spend on field service activities in a given country.

7. Conclusions

The research aimed to investigate how the Swisslog's field service engineer productivity is calculated in different countries across the Greater Europe region and why there are variances between the budgeted and actual figures. Skype or in person interviews, as well as the emails exchange with the Heads of Customer Support and Financial Controllers, provided quantitative data that presented in a graphical form allowed for a quick assessment of where the differences lay. In addition, the data collected through the primary research allowed to gain the qualitative data which helped to understand why these differences occur.

This examination provided the explanations to Vice President of Customer Service and Global System Operations how each country is deriving to the productivity figures. The total hours are based either on the available working days, or 360 days multiplied by the number of working hours per day from which the deductions depending on the country include: holidays, Bank Holidays, shortening of working hours, sickness and weekends. This equation gives the available hours, from which 85% productivity is expected in most of the countries expect one, where 95% is foreseen. The remaining percentage covers training and admin, and as these are the hours that customer do not pay for, they count as unproductive. Overtime is added on top of the available hours and are expected to be 100% productive.

All these calculations lead to the budgeted figures being generated and compared on a monthly and year to date basis with the actual ones to measure the productivity of the field service engineers' teams. The FTE number in one of the countries include the Field Service Managers and Heads of Customer Support. However, they are classified as non-productive, therefore the budgeted productivity figure in that case is lower than the generally expected 85%.

The most similar explanation of the productivity calculation to the one at Swisslog was presented by **Fleishman (1982)** and referred to group productivity and calculations were based on actual productive hours over total available hours worked. However, this method does not consider other factors presented in the existing studies, which are highlighted as important for calculating the productivity in the service companies. Nevertheless, as the research was only focusing on one division, it cannot be concluded that these factors are not taken into account when assessing productivity based on all departments in any country.

8. Limitations

The sample size was enough to answer the research questions and conduct the required analysis. However, it was only conducted for the Greater Europe region countries, so it is impossible to say that the results would be applicable and generalisable for the whole company. Therefore, similar analysis for the other company's regions would be useful. Nevertheless, even if it would be based on the whole company, it would not mean that this is the general approach in calculating the productivity for the field service engineers/teams in similar companies or that the same approach is applied in the service sector in general.

The timing of the study was also a limitation. Because the deadline of submitting this paper was December, the financial reports available at that time were up to November. This did not allow to complete a yearly analysis. If the deadline was set for January, it would be possible to see the yearly results and analyse the reasons for achieving, underachieving or overachieving the expected productivity.

Another limitation relates to the methodology. If the research would be conducted again, more time would be spent to analyse the existing research and financial reports, before the primary data collection. As this would provide more insight into the topic and therefore help to formulate the supporting interview questions and possibly allow to cover all the information during the interviews, without the need to ask the supplementary questions in due course.

9. Further research

In order to add value to the existing literature, by providing the link between the theory and practice, the topic of the Swisslog's field service engineer productivity would need to be explored in more detail. Therefore, the following actions are proposed to enhance the company knowledge as well as to enhance the present studies:

- Analyse in more details where the differences between the budgeted and actual figures are coming from.
- Analyse the effect of the recommended changes on the expected productivity for field service engineer.
- Discuss at the managerial level if it is feasible to implement the proposed changes.
- Monthly analysis of the productivity reports by Heads of CS to note anything that affected productivity in a given month and could result in reduction of unproductive activities as seen in **Engle's (2004**) article. This could help to:

- spot any trends or ongoing issues, which could then be discussed during the CS Greater Europe meetings to seek solutions.
- understand why the productivity was/was not the same as expected.

- Benchmarking with KUKA.

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Appendix 1 - Relevant information from productivity reports

Productivity Overview

Month:	November																							
				FTE			Productivity Monthly view																	
							Budget									Actual								
Cost Center	Description	Responsible	31.12. 2016	Act. FTE	Bud. FTE	Avail. Hours	Offer hours	Project hours	Dev/Supp hours	Proj. only %	Off. only %	Dev. only %	Proj./ Off./Dev. %	Avail. Hours	Offer hours	Project hours	Dev/Supp hours	Proj. only %	Off. only %	Dev. only %	Proj./ Off./Dev. %

Appendix 2 – Calculations Breakdown

	Belgium		Holland		UK		ITALY	
Total hours	2880		2880		2340		2340	
Holiday					225	10%		
Public Holiday					72	3%		
Sickness	64	2%	64	2%	45	2%	80	3%
Weekends	832	29%	832	29%				
Bank and Public Holidays	256	9%	256	9%				
Holiday and Permissions							225	10%
Shortening working hrs								
Total Available Hours	1728	60%	1728	60%	1998	85%	2035	87%
Overtime		89%		89%				
(Total available hrs)								
Training					90	5%		
Admin					199.8	10%		
Training & Admin	259.2	15%	259.2	15%			80	**4%**
Productive hours	1468.8		1468.8		1708.2		1955	
Productivity %	0.85		0.85		85%		96%	

	Sweden East		**Sweden West**		**Denmark**		**Noraway**	
Total hours	2000		2000		1852.5		1852.5	
Holiday	200	**10%**	200	**10%**	187.5	**10%**	187.5	**10%**
Public Holiday								
Sickness	24	**1%**	24	**1%**	22.5	**1%**	22.5	**1%**
Weekends								
Bank and Public Holidays								
Holiday and Permissions								
Shortening working hrs	76	**4%**	76	**4%**				
Total Available Hours	1700	**85%**	1700	**85%**	1643	**89%**	1643	**89%**
Overtime	x	800	x	900	x	300	x	0
(Total available hrs)	1700+x	2500	1700+x	2600	1643+x	1943	1643+x	1643
Training	80	**5%**	80	**5%**	75	**5%**	75	**5%**
Admin	170	**10%**	170	**10%**	164	**10%**	164	**10%**
Training & Admin								
Productive hours	1450		1450		1403		1403	
Productivity %	85%		85%		85%		85%	

Appendix 3– November's productivity report data analysis

NOVEMBER 2018	Region 1			Country 1			Country 3	
	Budget	Actual		Budget	Actual		Budget	Actual
Contract hours per FTE								
Hours per FTE	**144**	**144**		**130**	**146**		**163**	**143**
Bud FTE	8.8	7.8		**5**	**4**		3.8	3.8
Avail hours / month	1,267	1,126		**648**	**582**		619	544
Offer hours	0	82		0	82		0	0
Proj hours	832	723		367	233		465	490
Productivity %	**66%**	**71%**		**57%**	**54%**		**75%**	**90%**

NOVEMBER 2018	Region 2		Country 6		Country 6 - Team 1		Country 6 - Team 2		Country 6		Country 2		Country 5	
	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Contract hours per FTE														
Hours per FTE	**150**	**152**	**164**	**148**	**192**	**136**	**148**	**156**	**140**	**150**	**145**	**212**	**122**	**137**
Bud FTE	31	28	19	16	7	6	12	10	1	1	3	3	9	9
Avail hours / month	4648	4245	3117	2375	1342	816	1775	1559	140	150	436	635	1095	1235
Offer hours	100	0	59	0	22	0	37	0	0	0	13	0	28	0
Proj hours	3653	3503	2439	1835	1051	672	1388	1163	0	0	340	589	874	1079
Productivity %	**81%**	**83%**	**80%**	**77%**	**80%**	**82%**	**80%**	**75%**	**0%**	**0%**	**81%**	**93%**	**82%**	**87%**

NOVEMBER 2018	Region 3 - Country 4	
	Budget	Actual
Contract hours per FTE		
Hours per FTE	**149**	**185**
Bud FTE	7	7
Avail hours / month	1,041	1,297
Offer hours	0	0
Proj hours	988	1,281
Productivity %	**95%**	**99%**

NOVEMBER 2018	Region 4		Country 7 - team 1		Country 7 - team 2		Contry 7 - team 3	
	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Contract hours per FTE								
Hours per FTE	**189**	**154**	**188**	**156**	**190**	**146**	**191**	**172**
Bud FTE	22	19	10	9	10	8	2	2
Avail hours / month	4160	2919	1883	1406	1895	1170	382	343
Offer hours	24	0	8	0	8	0	8	0
Proj hours	3332	2117	1560	1076	1589	897	183	144
Productivity %	**81%**	**73%**	**83%**	**77%**	84%	77%	50%	42%

NOVEMBER 2018	GrEur		Region 1		Region 2		Region 3		Region 4	
	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Contract hours per FTE										
Hours per FTE	**162**	**155**	**144**	**144**	**150**	**152**	**149**	**185**	**189**	**154**
Bud FTE	68.8	61.8	8.8	7.8	31	28	7	7	22	19
Avail hours / month	11116	9587	1,267	1,126	4648	4245	1,041	1,297	4160	2919
Offer hours	124	82	0	82	100	0	0	0	24	0
Proj hours	8805	7624	832	723	3653	3503	988	1,281	3332	2117
Productivity %	**80%**	**80%**	**66%**	**71%**	**81%**	**83%**	**95%**	**99%**	**81%**	**73%**

Appendix 4 – November's year to date productivity report data analysis

November YTD 2018	Region 1			Country 1			Country 3	
	Budget	Actual		Budget	Actual		Budget	Actual
Contract hours per FTE								
Hours per FTE	**1584**	**1727**		**1426**	**1772**		**1792**	**1679**
Bud FTE	8.8	7.8		**5**	**4**		3.8	3.8
Avail hours / month	13,939	13,470		**7128**	**7088**		6811	6382
Offer hours	0	370		0	370		0	0
Proj hours	9,155	9,081		4039	2893		5116	6188
Productivity %	**66%**	**70%**		**57%**	**46%**		**75%**	**97%**

November YTD 2018	Region 2		Country 6		Country 6 - Team 1		Country 6 - Team 2		Country 6		Country 2		Country 5	
	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Contract hours per FTE														
Hours per FTE	**1649**	**1775**	**1804**	**1798**	**2108**	**2037**	**1627**	**1654**	**1536**	**1584**	**1598**	**2094**	**1339**	**1628**
Bud FTE	31	28	19	16	7	6	12	10	1	1	3	3	9	9
Avail hours / month	51125	49697	34283	28762	14758	12219	19525	16543	1536	1584	4793	6282	12049	14653
Offer hours	1100	38	641	0	238	0	403	0	0	0	147	18	312	20
Proj hours	40177	39342	26822	21358	11559	9492	15263	11866	0	0	3739	5526	9616	12458
Productivity %	**81%**	**79%**	**80%**	**74%**	**80%**	**78%**	**80%**	**72%**	**0%**	**0%**	**81%**	**88%**	**82%**	**85%**

November YTD 2018	Region 3 - Country 4	
	Budget	Actual
Contract hours per FTE		
Hours per FTE	**1636**	**1674**
Bud FTE	7	7
Avail hours / month	11,450	11,716
Offer hours	0	0
Proj hours	10873	11,218
Productivity %	**95%**	**96%**

November YTD 2018	Region 4			Country 7 - team 1			Country 7 - team 2			Contry 7 - team 3	
	Budget	Actual		Budget	Actual		Budget	Actual		Budget	Actual
Contract hours per FTE											
Hours per FTE	**2080**	**2124**		**2072**	**1986**		**2084**	**2278**		**2100**	**2128**
Bud FTE	22	19		10	9		10	8		2	2
Avail hours / month	45756	40355		20716	17874		20840	18226		4200	4255
Offer hours	276	48		92	8		92	40		92	0
Proj hours	36657	29029		17161	12763		17481	14103		2015	2163
Productivity %	**81%**	**72%**		**83%**	**71%**		84%	78%		50%	51%

November YTD 2018	GrEur		Region 1		Region 2		Region 3		Region 4	
	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
Contract hours per FTE										
Hours per FTE	**1777**	**1865**	**1584**	**1727**	**1649**	**1775**	**1636**	**1674**	**2080**	**2124**
Bud FTE	68.8	61.8	8.8	7.8	31	28	7	7	22	19
Avail hours / month	122270	115238	13,939	13,470	51125	49697	11,450	11,716	45756	40355
Offer hours	1376	456	0	370	1100	38	0	0	276	48
Proj hours	96862	88670	9,155	9,081	40177	39342	10873	11,218	36657	29029
Productivity %	**80%**	**77%**	**66%**	**70%**	**81%**	**79%**	**95%**	**96%**	**81%**	**72%**

Appendix 5 – Phase 1 interviews' summary

Summary of the data gathered from Heads of Customer Service across four regions within the Greater Europe region.

Region 1

Country 1

No of FTE's equals to four, however include one field service engineer manager and Head of Customer Service who reduce the productivity.

No of FTE – 4; two field service engineers, one team leader and Head of Customer Service

Total hours = 38*52 = 1976hrs

Holidays = 20*8 = 160hrs

Bank holidays – roughly 10 days x 8hrs = 80hrs

Country 3

3.8 FTE including one working 4 dates a week, explaining where 0.8 FTE is coming from.

25 days holiday x 8hrs = 200hrs

Applicable to both countries
15% allowed for training and admin.

The calculations are not applicable and advised to speak with the Financial Controllers.

Region 2

Country 6 – Team 1 and 2

FTE number based on previous years.

Budgeted calculations for 2019.

Total hours 250*8=2000 hours (available hours for every worker)

Holiday 5 weeks 25*8=200 hours

Shortening working hours 9.5*8=76 hours

Sick days 3*8=24 hours

Available hours 2000-200-76-24=1700 hours

Overtime (paid overtime; not overtime hours used for compensation leave) = x

Total available hours =1700+x

Country 2 and 5

Total hours 247*7.5= 1853 hours

Holiday 25*7.5= 187.5 hours

Sick days 3*7.5= 22.5 hours

Available hours 1853-187-22.5= 1643 hours

Overtime (paid overtime; not overtime hours used for compensation leave) = x

Total available hours =1643+x

Applicable to both countries - Admin is calculated as 10% of the available hours and training usually accounts for 10 days, unless there is a new starter then more training is anticipated.

Region 3

Country 4

FTE number includes field service manager hours who is working mostly from the office and prepares a lot of documents and do some admin for field service engineers.

45/50 hrs a week x 52 week = 2340/2600

20 days holiday plus permissions = 5 weeks = 225/250 hours

Administration and meetings non-productive. If work at weekend it is all overtime.

Region 4

Country 7

Unsure how the budgeted hours are calculated and who sets them up.

Believe the available hours should exclude admin and training.

However, when calculating number of FTE's required, 202 usable days were used. This was based on the below calculations:

5 days x 52 weeks = 260 days

Holiday – 28 days (for most of engineers due to the length of service)

Bank holidays – 8 days

Training 8 days

Sickness – 4 days

Admin - 10 days

@ 83% productivity which was to recognise that within 8 working hours, some time will be lost due to breaks, lack of knowledge/expertise etc.

Appendix 6 – Phase 2 interviews' summary

Summary of the data gathered from the Financial Controllers across four regions within the Greater Europe region.

Region 1

Country 1

Total hours = 360days * 8hrs = 2,880 hours

Weekends = 52weeks * 2days * 8hrs = 832 hours

Bank holidays and Public Holidays = 32 days * 8hrs = 256 hours

Note: Number of BH and PH the same for Country 1 and 3, although the split is different.

In Country 2 have more legal holidays but less Bank Holidays.

Sickness = 8days * 8hrs = 64hours

Available hours = 2,880-832-256-64 = 1,728hours

Training and Admin – 15% of the available hours

- 85% of the field service engineers should be productive. Service engineers in Country 1 also need to cover up the Head of CS and Field Service manager costs, so percentage wise they would not reach 85%.

Country 3

Total hours = 360days * 8hrs = 2,880 hours

Weekends = 52weeks * 2days * 8hrs = 832 hours

Bank holidays and Public Holidays = 32 days * 8hrs = 256 hours

Sickness = 8days * 8hrs = 64hours

Available hours = 2,880-832-256-64 = 1,728hours

Training and Admin – 15% of the available hours

85% of the field service engineers should be productive

- Overtime is not included in the available budgeted hours, because you don not know if there will be any. However, they are included in the actual.
- Project hours are the productive hours – hours sold and is or will be paid by customer. Travel also included in these hours.

Region 2

Country 6 – Team 1 and 2

Number of available working hours 250days * 8hrs = 2000hrs

250 days based on:

Jan	22	Jul	23
Feb	20	Aug	22
Mar	21	Sep	21
Apr	20	Oct	23
May	21	Nov	21
Jun	18	Dec	18

Deduction vacation 5 weeks 25days * 8hrs = 200hrs

Deduction shortening working hours 9.5 days * 8hrs = 76hrs

Deduction sick days 3days * 8 = 24hrs

Available normal working hours 1700hrs

Admin – 10% on available hours

Training – 2 weeks

Additional paid overtime hours (not overtime hours used for compensation leave) = X

Team 1 - 800hrs overtime

Team 2 - 900hrs overtime

Team 1 and 2 have different cost centres, that's why the figures are presented in two lines in the productivity reports. The budgeted overtime hours may cause the difference. Service manager is predicting the overtimes for individual engineers based on previous years and experience.

Country 2 and 5

247days * 7.5hrs = 1853hours

Jan	22	Jul	23
Feb	20	Aug	22
Mar	21	Sep	21
Apr	17	Oct	23
May	20	Nov	21
Jun	19	Dec	18

Deduction vacation 5 weeks 25days * 7.5hrs = 187.5hrs

Deduction sick days 3days * 7.5 = 22.5hrs

Available normal working hours 1643hrs

Admin – 10% on available hours

Training – 2 weeks

Additional paid overtime hours (not overtime hours used for compensation leave) = X

Country 2 - 300 hours overtime.

Country 5 - No overtime hours anticipated in 2018.

- Head of CS and CS Service Manager have different cost centres and not included in the productivity, as they don not book their hours.

Region 3

Country 4

Total hours 9 x 5 x 52 = 2340hrs

Holiday and permissions 45 hrs a week x 5 week = 225hrs

Sickness = 80hrs

Available hours 2340 - 225 - 80 = 2035

Training and admin = 80hrs

Productive Hours 2035 – 80 =1955

Productivity % = 1955 / 2035 = 96%

- 250 hours per year is anticipated per FTE.
- Travel hours are not considered overtime.
- Overtime hours included in the budgeted figure.
- Overtime is expected to be 100% productive.
- 5% is unproductive and that it admin and training. 80 hours assigned for admin and training which is based on the experience – as the service engineers are always on site, they do the admin during spare time in hotel, which results in no hours booked onto SAP.

Region 4

Country 7

Total hours depend on the contract type 39-45 hours. New contracts are based on any 5 out of 7.

Total hours 45hrs * 52 = 2340hrs

Holiday 25days * 9hrs = 225hrs

Public Holiday 8days * 9hrs = 72hrs

Sickness 5days * 9hrs = 45hours

*6 (2.5%) days is an industry average, but it is predicted that will do better

Available hours 2340-225-72-45 = 1998hrs

Training 10 days * 9 = 90hrs

Admin 10% of available hours 10% * 1998hrs = 200hrs

Productive hours 1998-90-200 = 1708hrs

Productivity = 1708/1998 = 85%

- An assumed overtime is included in the budgeted hours and actual overtime goes into the actual.
- Overtime in theory should be 100% productive.
- Financial controller completed the budgeted figures for 2019.
- The FTE number for both teams in UK include the managers so their productivity would be zero.
- Head of Customer Service is not included in the calculations because is not in the service engineering cost centre.
- Budgeted calculations are calculated per employee.
- The average hours per year should take into consideration two managers who book hours to a separate cost centre but are part of the team. One of them is non-productive, one is productive to some extent.
- 8745 overtime hours was budgeted for 2018 for the field service team, which has 22 employees. 3 of them are non-productive (managers), one is expected to do no overtime, 18 will do overtime, but it isn't an equal spread.