Enterprise Resource Planning Tool for University Teaching

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Abstract

Workload for academic personnel has been a concern over the last years in Aalto University, due to this; the Mechanical Engineering Department of Aalto University has the necessity of a tool for teaching planning. This thesis focuses on the development of such tool. Starting from a literature review of ERP (Enterprise Resource Planning) systems, their evolution and implementation in educational systems. Interviews with faculty personnel regarding their concerns, and the tools used in the past in order to balance the workload in each group of the department.

The literature review yields that the application of ERP systems in the educational area, is focused in adding courses to the curriculum in order to prepare students for the industry, but there is not literature in which the ERP methodology were used for teaching (as main objective) purposes. This research has as a goal to implement, a system that helps to improve teaching administration (workload balancing).

After gathering information from all the faculty personnel of the Mechanical Engineering Department a database was created with links between professors, courses, theses and all the hours used for teaching purposes. From this database the ERP tool for university teaching was created, in this one all the information of the currently courses that are teach is displayed, starting from the responsible professor/lecturer/staff, visiting lecturers, assistants, teaching hours, etc. Also all the information of each faculty personnel is shown, courses in which he/her is responsible, courses as visiting lecturer, theses supervised and amount of hours predicted for supervising and for teaching.

At the end this thesis project has as result two KPIs (Key performance indicators). The first one shows workload condition of each faculty personnel (underload, balanced or overload) and the second one is the relation between the total amount of hours used for teaching a specific course and the credits per student. This KPI works as a reference to compare the hours per student distribution between courses.

Finally with the KPIs and all the information shown in a well-structure way the head of the department has an improve outlook of the teaching planning of the department helping him to make decisions for the following academic year and help the department personnel to have a balance workload. This thesis contents all the procedure done in order to achieve an ERP tool for University Teaching.

Keywords Enterprise Resource Planning, ERP, Project management, university teaching, load balancing.
Preface

This thesis was written for the needs of the department of Mechanical Engineering in Aalto University. The Mechanical Engineering Department needed a tool in order to achieve a tool to balance individual workloads of faculty and staff members. Through an open call, the head of the department selected a student to work in this project having as a result the tool and a master thesis. The department of mechanical engineering funded and made possible the entire project.

I want to thank Aalto University for investing in this project. Thanks to the head of the department Jouni Partanen for his patience and his trust, without his guidance this thesis could not had been possible. Thanks to all the faculty personnel of the Mechanical Engineering department for their support and cheerful words every time we meet in the corridor, and for their answers to all the emails that I sent during this process. Special thanks to Markku Kuuva, Heikki Remes and Tuomas Paloposki for helping me to consolidate all the existing teaching resource tools in which they had participated.

Thanks to my family and friends in Mexico, that no matter the distance they were all the way here with me, supporting and helping me through this abroad adventure. Thanks Andrea for all your love and support.

Finally yet importantly, I want to thank Pekka Kyrenius, my advisor, for your trust, your advice, our discussions and your endless support at all the times that I needed during my stay here in Aalto.

To all of you, gracias…totales.

Espoo, Oct 02, 2018

Carlos Chávez
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<tr>
<td>BI</td>
<td>Business Intelligence</td>
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<tr>
<td>BOM</td>
<td>Bill of materials</td>
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<tr>
<td>ECTS</td>
<td>European Credit Transfer and Accumulation System</td>
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<tr>
<td>ENG</td>
<td>School of Engineering in Aalto University</td>
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<td>ERP</td>
<td>Enterprise Resource Planning</td>
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<td>ERPUT</td>
<td>Enterprise Resource Planning tool for University Teaching</td>
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<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
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<tr>
<td>IBM</td>
<td>International Business Machines</td>
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<td>IS</td>
<td>Information System</td>
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<td>KPI</td>
<td>Key Performance Indicator</td>
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<td>HR</td>
<td>Human Resources</td>
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<td>HRMS</td>
<td>Human Resources Management System</td>
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<td>ME</td>
<td>Mechanical Engineering Department in School of Engineering</td>
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<td>MEC</td>
<td>Mechanical Engineering Common</td>
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<td>MinEdu</td>
<td>Ministry of Education</td>
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<td>MRP</td>
<td>Material Requirement Planning</td>
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<td>SCM</td>
<td>Supply Chain Management</td>
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<tr>
<td>SAP</td>
<td>Systems, Applications and Products</td>
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<td>SOA</td>
<td>Service Oriented Architecture</td>
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<tr>
<td>TCO</td>
<td>Total Cost of Ownership</td>
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1. Introduction

Enterprise Resource Planning tool for University Teaching (ERPUT) started with an open call to cover a master thesis project (Appendix 1) at the Mechanical Engineering Department (ME) in Aalto University. The aim of this project was to produce a tool that helps to improve teaching planning in ME. Teaching planning is strongly related to the time allocation stated in by Aalto tenure track working profiles. Faculty’s work profile is discussed every year in order to agree in a balanced time allocation for several activities. Activities such as research, artistic and professional work, teaching, scientific or artistic community activities, etc. Within those activities, teaching has a significant weight and is one of the main activities for every faculty member. Regarding the percentage agreed for teaching purpose every year, faculty personnel in ME is still facing an uneven individual distribution of teaching activities, for example, some professors have overload of theses supervision activities together with a heavy load of courses and number of students. The purpose of this project is to develop a tool that helps the head of the ME to have a big picture of how the academic tasks of each faculty personnel are being distributed in order to have a better overall balance teaching workload for the following academic years.

1.1. Background

According with the Working Hours Act (605/1996) of the Ministry of Employment and the Economy of Finland, section 6 dictates that the regular working hours shall not exceed eight hours a day or 40 hours a week meaning 2080 hours per year maximum. Following this legislation and according with the unions negotiations, in Aalto for 2018 the working hours with a total of 251 workdays it will be 1844.85 hours (Appendix 2). From the total, each professor/lecturer of the mechanical department staff and the head of the department agrees on the average time allocation guidelines for different duties. These duties in the case of lecturers are teaching, research and/or artistic work and activity in scientific community and pedagogical leadership (Figure 1).

![Figure 1 Generic work time allocation for lecturer career levels (Aalto University, 2016).](image-url)
Moreover, in the case of professors, for whom the teaching activities are reduced due to an increase in the research activities and services, the duties are divided as follows: Research, artistic and professional work, Teaching and Service (Figure 2).

<table>
<thead>
<tr>
<th>Fixed term</th>
<th>Permanent</th>
<th>Assistant Professor (1)</th>
<th>Assistant Professor (2)</th>
<th>Associate Professor</th>
<th>Full Professor</th>
<th>Aalto Distinguished Professor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>65% +/-10%</td>
<td>60% +/-10%</td>
<td>50% +/-10%</td>
<td>40% +/-15%</td>
<td>Negotiable</td>
</tr>
<tr>
<td>Research/ artistic/ professional work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching</td>
<td>30% +/-10%</td>
<td>30% +/-10%</td>
<td>30% +/-10%</td>
<td>30% +/-15%</td>
<td>30% +/-15%</td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>5% +5%</td>
<td>10% +/-5%</td>
<td>20% +/-10%</td>
<td>30% +/-15%</td>
<td>Negotiable</td>
<td></td>
</tr>
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</table>

*Figure 2 Generic work time allocation for tenure track professors (Aalto University, 2016).*

As is shown in figures 1 and 2 a considerable percentage of the time allocation corresponds to educational duties, which is the main responsibility for a lecturer and remains constant for professors in order to base teaching in research. However, teaching duties sometimes could take more time (or in some occasions even much less) than the percentage established in the work time allocation, meaning a work overload (or a work underload) according to the different personnel profiles. According to the last results of the Aalto’s personnel survey (2017) (*Appendix 3*), a special focus for academic personnel regarding the teaching load should be addressed, suggesting to each member to create or improve a work plan, which is necessary in order to have a balanced workload.

The key for a successful balanced workload lies in the ability to estimate the actual amount of hours that each faculty member (and other staff members with teaching responsibilities) is assigning to education duties. With this estimation of a work plan that, fits the original time allocation, is reachable. To augment this baseline the head of the Mechanical Department of Aalto University (Jouni Partanen) needs a resource planning tool for academic duties. In such tool the actual teaching workload of each professor in the department will be allocated in order to prepare a balanced work plan for the following years.

This thesis contains the work done in order to achieve this tool, starting from a literature review in chapter two focusing in Enterprise Resource Planning (ERP) definition and its application in educational environment. Chapter 3 describes the necessities of the ME department in order to fulfill a balanced working plan and the reason behind it. Chapter 4 explains the method followed to gather all the information for the achievement of this tool. Chapter 5 describes the development of the GUI (Graphic User Interface) and data structure as a tool and the main objective of this thesis. Conclusions and future work are described in chapter 7.
1.2. Objectives and scope

The main objective of this thesis is to identify the key data necessary to have a complete tool. With this tool the head of the department has a big picture of the estimated workload of each academic personnel against the budgeted time allocated, meaning number of courses per professor/teacher and other staff member, number of students, number of student credits (ECTS), amount of hours dedicated to teaching purpose and students guidance. After the key data is collected by email with a custom excel sheet, a graphical user interface (GUI) with the capacity of shown in a friendly-user way. A breakdown of each professor/lecturer workload is necessary. Such tool needs to point out the key performance indicators (KPIs) of each faculty personnel in order to identify overload, balanced or underload.

To achieve this objective, this study will be divided in three stages, the first one consists in a series of interviews with faculty members that have already been working with tools for educational duties time allocation, in order to have a better understanding of so far how each unit has been dealing with the overall workload balance. The second stage is the creation of a personal survey for each faculty member to start the data collection. The third and last stage is the development of the tool in cooperation with the head of the department in which the definition of KPIs needs to be accomplished.

This study will be focused just in the personnel of the Mechanical Engineering department of Aalto University as a request from the head of the department Jouni Partanen.
2. Theory and literature review

This chapter contains a brief introduction to Enterprise Resource Planning (ERP), its origins, evolution, and its importance through the years, starting from simple manufacturing processes to the e-commerce. At educational level, in the last years high education institutions have invested in ERP systems but just as an information system (IS) without results, focusing at an enterprise level without employees preparation to use such software (Antonucci et al., 2004; Abugabah and Sanzogni, 2010). The literature review done in this thesis shows the focus to add the ERP system as a subject on the list of courses in universities, not how to implement this methodology as a teaching administration tool.

2.1. ERP

Enterprise Resource Planning (ERP) has its origins in 1960 but was until the 90’s where this name started to be used in companies all around the world, quite often ERP is mislabeled as “software” when in fact is a tool that has helped for half century to several companies to improve their performance. Thomas F. Wallace and Michael H. Kremzar describe Enterprise Resource Planning as follows:

“An enterprise-wide set of management tools that balances demand and supply, containing the ability to link customers and suppliers into a complete supply chain, employing proven business processes for decision-making, and providing high degrees of cross-functional integration among sales, marketing, manufacturing, operation, logistics, purchasing, finance, new product development, and human resources, thereby enabling people to run their business with high levels of customer service and productivity, and simultaneously lower costs and inventories; and providing the foundation for effective e-commerce.” (Wallace and Kremzar, 2001)

From this definition, and as part of the objective of this thesis, one of the most relevant definition, is decision-making, an ERP helps through information and processes to make the best decision for the enterprise, or in our case to the University. With the most condensed information, well organized and with an easy access, the head of the department will have a complete frame (outlook) with all the links between the main tasks of the academic personnel, making easier to balance any workload.

The monitoring of business processes has been, since the beginning of ERPs the main objective, one of the first industries in need of integration of information systems, in order to track this processes were the manufacturing organizations. The first predecessor of the actual ERP was the material requirement planning, also known as MRP, this tool helped the manufactory industries to solve the manufacturing equation (Wallace and Kremzar, 2001) which consists of four questions:

- What are we going to make?
- What does it take to make it?
- What do we have?
- What do we have to get?
The answer involves the most important elements of the manufacturing industry: final product, bill of materials (BOM), raw materials, and inventory. With this tool, organization had in a centralized system all the information regarding a specific product so decisions could be taken before stock-out situations.

MRP worked well with simple manufacturing processes but growing companies started to have at the same time more complex processes. Bought-in items and sub-assemblies were involved in these processes. Requiring sometimes products from other companies that at the same time have a different BOM, or even the same company but in a different and far away location has to supply the raw materials, meaning a different inventory or another centralized system. MRP-II appeared in the 80s which was an improvement of the original MRP, in this improvement other modules were added to the previous version, manufacturing, scheduling, operational planning, financial planning and distribution management started a new era where the management of different departments at the same time was possible.

MRP-II worked just fine with manufacturing industries, but starting the 1990s more industries were added and it was necessary to find a tool to help all of these industries. For example in food industries or pharmaceuticals where there is also a warehouse with inventory but not strictly a production of a component. Also within industries the integration of different areas such as human resources, finance, administration, etc. started to become the standard for medium and large companies. This new areas then became internal customers (departments) working as well with their own processes but as part of a same industry. An improvement of MRP-II but now enterprise oriented, with flow of information among different areas needed to be born. Along with the new necessities of industries and the boom of the software development, enterprise resource planning (ERP) was created. Now with this tool, any company can predict what is needed and forecast in order to have better planning and a well-organized schedule, Figure 3 shows an example of how the supply chain management exchanges data with different areas thanks to an ERP system.

![Figure 3 Supply chain management (SCM) interaction with suppliers (S), human resources (HR), Accounting and finances (AF) and marketing and sales (MS) (Monk and Wagner, 2009)](image-url)
2.2. ERP Products

There are several ERP products used in the enterprise market with minimal differences among them. The selection is most of the time base in costs of the application and functionality; the three more common are SAP, PeopleSoft and Oracle. The most widely use is SAP, founded in 1972 by IBM ex-employees. The last version of SAP uses service oriented architecture (SOA). With this architecture the interface can be done with other ERP systems without having to buy new hardware or software reducing the total cost of ownership (TCO) and making SAP a cross functional ERP system (Ganesh et al., 2013).

PeopleSoft is another ERP system widely used, even though it is no longer available to purchase (Oracle acquired it). The software it is well known for its client-server architecture based in human resources management system (HRMS) and their financial packages. This software was quite famous because it was the first ERP that had the option to run as a web client, meaning that all the functions are available from anywhere (Ganesh et al., 2013).

Oracle is one of the most known companies around the world, and its advantage in the ERP systems is that they offer packages to all its clients. They have E-business suite, financial suite, supply chain management (SCM) suite, HRMS suite, etc. in the supply management suite they have the following modules: procurement, planning, logistics, manufacturing, order management and supply (Ganesh et al., 2013).

2.3. Literature Review

The use of business-management software started around 1960 in the manufacturing industry. In such software, the objective was to have an inventory control in order to automate production planning. This kind of software evolved in several occasions adding different kinds of modules to improve the resource planning part but was until 1990 where this kind of software ‘jumped’ from the manufacturing industry to all kind of industries. Since that date, several papers have been written about ERP’s systems. According to Young B. Moon in his article “Enterprise Resource Planning (ERP): a review of literature” there are six categories to classified each article written from 2000 to 2006 which are:

- Implementation,
- Using ERP,
- Extension,
- Value,
- Trends an prespectives, and/or
- Education.

The category in which this thesis is focused is “Education”, while going further with Moon, in this category are allocated those articles in which (as consequence of the wide world use of ERP in industries) several universities tried to incorporate the subject in their courses. The inclusion of courses where ERP education was the main objective, the focus was on teaching: how to use ERP systems and how ERP works, this as a strategy to prepare students for their working life using a software that is industry wide accepted (Moon, 2007).
With this “Education” category suggested by Moon we can notice that the purpose of each article written during those years were to focus on how to teach this software instead of how to use ERP in an educational level as a teaching tools. ERP systems are used all around the world in different industries, including Universities but, as a process management software.

An university ERP example is Oodi, such systems enables to have automate admissions, where a student can register for an academic year, pay his/her tuition fee, enroll in different courses etc. At the same time this system has his/her personal data, grades, courses, exams; simplifying records management for the student helping him/her to take better decisions about him/her studies, showing also all the courses availables in the University. Faculty also gets benefits from this systems where they can update grades, give information to the students enrolled in their courses, and have access to all the data related to their courses. Figure 4 shows the most common modules used in Universities ERP systems.

Since the implementation of ERP systems in universities several benefits are the result:

- Easy access to information,
- Increase of efficiency and productivity,
- Easy to make reports,
- Web and user friendly interfaces,
- Easy to add more modules,
- All the information in just one place,
- Interaction between staff, faculty and students through the system.

*Figure 4 University ERP Modules (Sumner, 2014)*
In summary, ERP systems have been used in universities as a tool to integrate departments, to improve administrative processes, to consolidate a database and share the information between all the modules of the system making it easier for management purposes. Moreover, all the previous research is focused on how to improve the benefits obtained by using ERP systems. The conclusion made by several authors is to teach ERP as part of the IS curriculum, in order to prepare the students for the working life and the use of such systems (Becerra-Fernandez, Murphy and Simon, 2000; G. Stewart, 2001; Hawking Paul, Ramp Adrian, 2001; George and George, 2002; Boykin and Wm. Benjamin Martz, 2004; Cannon et al., 2004; H. Davis and Comeau, 2004). There is also a guide of how to integrate ERP successfully across a high education curriculum. The main points are: *curriculum issues* (how to select the software according to the kind of studies), *training* (approach, what to teach, outside support), *students and faculty* (expectation from the students, learn by mistakes, faculty training, etc). At the end, the author concludes that even is a long process, is worth the effort due to all the benefits from ERP systems (Fedorowicz et al., 2004).

Another issue that concerns this thesis is quality teaching, as is suggested by Henard and Leprince-Ringuet in their article “The path to quality teaching in higher education”, this has become of high importance due to all the changes that education has been facing through the years. So far all the initiatives for quality teaching lacks of definition (or ambiguity) starting from the role of the professors, lecturers and staff, the role of the department, etc (Fabrice Henard and Leprince-Ringuet, 2008). This issue could be address from the teaching balanced perspective; a well-balanced teaching plan can improve teaching quality.

With this, we can conclude that the implementation of ERP systems as a management tool has been a complete success at enterprise level, leading to even changes in the courses curriculum at high education so now the question is the following: Could be this methodology applied in universities having as a result a tool that helps to improve teaching planning?
3. Time allocation

In this chapter the currently situation of the ME faculty personnel is examined. How the lecturers, professors and different personnel with academic duties split their activities, in order to achieve the time allocation. However, there are cases where the personnel has a heavy working load and in the other hand an underload, making the distribution of hours uneven. This chapter explains the importance of have a plan to make a balanced working load.

3.1. Academic work

As mentioned in figures 1 and 2, each faculty personnel has several tasks to perform, in the case of professors and lecturers these tasks are divided in teaching, research and activities in scientific community. In addition, in the case of professors, pedagogical leadership and services.

Figure 5 shows an example of how professors and lecturers divide their budgeted time as is mentioned in the framework set by Aalto University. The blue part represents the teaching activities that in the case of lecturers goes around 70% of their total budgeted hours and for professors is around 30%, same case for different staff members (services, laboratory managers, technicians, etc.) where among other responsibilities they have also to dedicated a percentage of their duties to teaching.

![Figure 5 Tasks allocation example.](image)
The previous example is the optimal one, and is the guideline set by Aalto University, where each professor or lecturer has a proper allocation of his/her academic duties, within the percentages described in the tenure track. However, this is not always achievable, according with the last survey made (Appendix 2) professors and lecturers have problems to balance their time allocation. Sometimes a professor/lecturer is spending more of his/her time in teaching duties than in the others meaning a ‘burst’ due to overload, also there is the opposite case where a professor/lecturer spends less time for teaching purposes having a underload regarding the tenure track guideline. Figure 6 shows a couple of examples of professors and lecturers with over and underload allocations.

![Figure 6 Under and overload teaching allocation.](image)

From the figure, it can be noticed that with an unbalanced teaching allocation the total academic duties of each professor/lecturer/personnel could end in an overload. This means that the person is using more time to fulfill all the requirements from the tenure track, this at the end could trigger personal stress, and on the other hand, there is the possibility to have underload from some personnel making the situation unfair for the rest.

The purpose of this thesis is to build an ERP tool to help to solve this issue, a tool that helps to make decisions about time allocations and how each professor should distribute their teaching hours.

### 3.2. Resources

The importance of a well-balanced workload is not just to make the time allocation easier for each lecturer, professor or personnel with academic duties. At the same time, a well-balanced workload works to optimize the distribution of funding given to the university. The money given each year by the ministry of education is based on the performance of the university on the previous year, but not always this time is well estimated.
Figure 7 shows the aspects that are parts of each teaching hour; there are three main components: funding (money), faculty (personnel with academic duties) and load balancing (this works as an interaction between funding and personnel given as a result the work plan in which each teaching hour is applied).

- **Funding.** This input represent the funding given every year to Aalto University.
  - Minedu Formula. This represents the budget planned by the Finland’s ministry of education; the amount of money given is the result of a budget formulation and Finland’s parliament that every four years decides the core funding for high educational levels (Ministry of Education and Culture of Finland 2018).
  - Aalto U-level. Once the Ministry of education has given the budget to Aalto University, an internal formulation is used to distribute the funding to the schools in Aalto and then to different departments.
  - Eng & dept. As well, the ME has its own formulation to administer the funding given in the previous step, a budget is made according to the plan elaborated previously, and in this, each group of the department gives the estimated hours that it will be used for the academic year.
  - Funded and subsidized projects. Generally, professors in collaboration with the industry obtains this budget use for specific projects.

- **Faculty and staff.** All internal and external personnel that receives an income for services given to the department.

- **Load balancing.** There are three main components regarding load balancing, *the budgeted hours* planned before the beginning of the academic year. *The workload* of each personnel with academic duties, this workload framework stated by the university,
does not represent the actual effort that they are doing for this purposes, most of the time an unbalance workload could end in stress, and in the other hand an underload make it unfair for all the faculty.

All these resources applied in teaching hours at the end will have as result an improvement of the correlation between teaching hours and study credits, making from this a KPI (key performance indicator) to study. How many hours is each faculty personnel using for just one credit? This thesis will show that the main objective for the head of the department is to try to find an optimal minimum value of the KPI (smaller the better) for every faculty personnel, prioritizing quality over quantity.

3.3. Planning and scheduling

The most difficult part is next, how to make an accurate working plan just based on the previous academic year? How to plan the hours used in a new course? How to make the estimation? What about new lecturers, how many hours does they need? In addition, there are cases where a professor acts as a visit lecturer, how to track those hours. Figure 8 shows an example of how the professor divide their schedule between three different courses.

![Figure 8 Teaching hours-courses distribution](image)
From the previous figure, it can be noticed that professor 2 is responsible for two courses, MEC-E1008 and E1001 (even though for the second he/she shares the responsibility with another professor, based on the number of students just one professor is not enough). As can be noticed, the amount of hours changed from one professor to another, there are cases were one professor is responsible of just one course or even more and cases where just part time of the professor hours is assigned to teaching hours (upon this to an agreement with the head of the department sometimes).

From the previous example another point to be consider is, that even the three courses have the same amount of credits, there are differences as the number of students and the hours used to teaching. So, how these courses can be compared and weighed between each other in order to have a better understanding on how each professor/lecturer is using his/her time. The KPI mentioned in the previous part is shown then in figure 8 (at the bottom of each course), the formula used for this is the following:

$$KPI = \frac{\text{Total Hours}}{(\text{Credits}) \times (\text{Students})}$$

This indicator (hours / credits per student) shows how the estimated teaching hours are used per one credit, a lower number (below 1) indicates a good input/output ratio (smaller the better) of the course meanwhile a high number indicates that more than one hour is used to teach just one credit per student. An ideal KPI should be selected as average per discussion within the ME department to compare the amount of hours used for each professor/lecturer.
4. Data gathering

This chapter presents the previous work done by each group within the ME department in order to have an estimation of the teaching hours. This information was used as a time budget, to have an estimated work plan for the following academic year.

The tools previously used were excel files done by each responsible person from different groups, each of them with different structures, notes and results. For this thesis 3 responsible persons were interviewed in order to gather information about what has been done, what is the expectation of this tool and how can help the faculty and staff to improve the estimation of their workload.

4.1. Markku Kuuva interview (Engineering design group)

Meeting held on September 7 of 2017. Markku Kuuva is a University Lecturer working in the Engineering Design and History of Industrialization group. For this group he made an excel file (Uudkandikurs ja koodit-kustannusarvio-versio-15.xlsx), which was focused in the bachelor program. Figure 9 shows an example of how he designed this excel file.

![Teaching hours allocation](Kuuva Marku, 2017)

From Figure 9 is observed that each course is divided by main activities and the hours that each faculty personnel uses for it, it can be a professor, a lecturer or an assistant. The activities for each course are divided as follows:

- Course management
- Participates in joint development of major subject / minor subject. (Pääaineen / sivuaineen yhteiseen kehittämiseen osallist.)
- Evaluation and development of the course's teaching and activity
- Contact teaching with students (lectures, training groups)
- Design and coordination of teaching, preparation of materials
- Grading of student, Grading List Management
- Course human resource management, course feedback and more.

From this first interview, it was clear that each group needed to have information regarding each course. In the case of the engineering design, the total teaching hours was the objective, regarding the name of the responsible of the course, lecturers or assistants. The adjusted total
was obtained by multiplying a “cost estimated hour factor” which in the case of professors was 3, for lecturers 2 and in the case of assistants 1.

From this interview the discussion was about how to make a fair time allocation. It is difficult for each faculty member to make an estimation of his or her time; one course is totally different from another. In addition, the number of students that enroll every period varies and this affects the time of each faculty member and staff. Another difference comes when it is a new course than when it is an existing course. This is reflected in the use of the same material updated as the previous academic year.

Another main issue regarding time allocation are the theses supervision, some professors supervise several theses (sometimes more than 20), and meanwhile another have just two or three. This has become an issue due to some professor have more popular topics than others, so they expect that this tool also helps to solve this issue, that a rule for load balancing comes up to have a fair amount of thesis among supervisors.

For more information about Markku’s excel file please contact him at markku.kuuva@aalto.fi

4.2. Heikki Remes interview (Marine technology group)

Meeting held on September 13 of 2017. Heikki Remes is an Assistant Professor working in the Marine Technology group. Same case as with Markku Kuuva, he was the professor responsible courses. He has an excel file with the teaching hours estimation for the group (00_Teaching distribution – Applied Mechanics 13-10-2016.xlsx). This excel file was focused in the marine technology group as is shown in Figure 10.

![Figure 10 Teaching load (Heikki Remes, 2017)](image)
As is shown in Figure 10, this tool does not have the amount of teaching hours per faculty personnel, instead has the name of all the professors and lecturers in the department and assigns a numerical factor in the case that they participate in a specific course. For example if the professor/lecturer is responsible of a certain course the weighting will be 1, if he is a visiting lecturer or in the case of tutoring and supervising thesis the weighting it will be 0.1. At the end the sum of everything (theses and administration tasks as well) will give a number to which each member of this group can review and they may observe who is the professor/lecturer with the higher workload and who has the less so they can distribute the teaching tasks evenly.

The problem with this kind of tool is that there is no estimation of the hours that each faculty member uses for teaching purposes. Instead it is just a way to compare between the staff members, neither this excel file has the number of supervising theses that each member has. As is noticeable from Figure 10, the average of courses that each professor/lecturer has is three, trying to make the distribution even. It does not matters what kind of course it is, so there are cases where a professor needs more time to prepare a course and teach that course than for another. This tool considers each course as equal (with respect to teaching hours).

For more information about Heikki’s excel file please contact him at heikki.remes@aalto.fi.

4.3. Tuomas Paloposki interview (Thermodynamics group)

Meeting held on September 20 of 2017. Tuomas Paloposki is a Senior University Lecturer in the Thermodynamics group. At the beginning of 2017 Tuomas had the responsibility to follow up of the teaching hours in 2017. For this all hours spent to teaching should be included in an excel file from each faculty personnel and staff (involve in teaching tasks) in order to plan in advance. Figure 11 shows an example of how the teaching hours where used in an excel file (Opetuskuormalaskelma_2016_v14.xlsx).

This excel file has similarities compared with the previous ones but also significant differences. As in the one made by Heikki, this also has the name of each faculty member that has teaching tasks in the course but in this case with assigned hours instead of a percentage. This makes a starting point to compare the amount of hours used per course with other courses or even with future academic years.

In order to obtain all this information an email was sent to each member of the thermodynamic group in which they were asked for a teaching plan for the year 2017. In this email, the courses
given by this group were added in a list, so if a member of the staff had teaching hours for a
certain course they should add it there. Besides this the following teaching tasks where asked:

- Academic advising at master level,
- Master theses instruction and supervision,
- Study administration and program level planning,
- Orientation for new students.

This tool was the most complete because it has a rough estimation of teaching tasks given in
hours per each faculty and staff members of the thermodynamics group. The problem was, that
not all the staff gave their information.

For more information about Tuomas’s file please contact him at tuomas.paloposki@aalto.fi.

4.4. Summary of all interviews

Besides all these three tools have a different way to gather information. At the end, the main
objective is to have a plan, compare how much effort (hours) a course needs and how the
professors manage to balance their academic duties. So from these previous three tools an excel
file was merged for the entire department with these main objectives:

- Teaching hours per course,
- Personnel involved in each course,
- New or old course,
- Theses supervised (bachelor and masters level).

4.5. Survey of entire department

After the interviews and with all the feedback, it was the moment to start gathering information
from the entire department. In order to do this, certain information was necessary:

- First, a search for all the courses (bachelor and masters) was done, finding all the
courses and their data that a student can select from Oodi system.
- List of employees currently working in the Mechanical Engineer department.
- List of theses (bachelor and masters) with the responsible supervisor (unfortunately
the list of theses does not have the instructors of the respective theses, who sometimes
uses even more time than the instructor does).

Once all the information was available an excel file was created with all the information.
Figures 12…14 show the kind of lists made for this purpose.
Table 1: Master Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Teacher</th>
<th>Level</th>
<th>Period</th>
<th>Lectures</th>
<th>Exercises</th>
<th>Credits</th>
<th>Status</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAE-E100</td>
<td>Introduction to Advanced Energy Systems</td>
<td></td>
<td>Master I-II</td>
<td>24</td>
<td>22</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEN-E101</td>
<td>Power Plants and Processes</td>
<td></td>
<td>Master I-II</td>
<td>24</td>
<td>24</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEN-E1010</td>
<td>Heat Transfer</td>
<td></td>
<td>Master II</td>
<td>24</td>
<td>12</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEN-E1030</td>
<td>Thermodynamics in Energy Techno Systems</td>
<td></td>
<td>Master I-II</td>
<td>24</td>
<td>22</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEE-E1040</td>
<td>Measurement and Control of Energy Systems</td>
<td></td>
<td>Master I-II</td>
<td>16</td>
<td>NA</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEN-E1050</td>
<td>Renewable Energy for Communities</td>
<td></td>
<td>Master I-II</td>
<td>24</td>
<td>22</td>
<td></td>
<td>5</td>
<td>No Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEN-E201T</td>
<td>Computational Fluid Dynamics L</td>
<td></td>
<td>Master III-IV</td>
<td>24</td>
<td>24</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEE-E2002</td>
<td>Combustion Technology</td>
<td></td>
<td>Master III-IV</td>
<td>14</td>
<td>14</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEE-E2006</td>
<td>Combustion L</td>
<td></td>
<td>Master III-IV</td>
<td>24</td>
<td>12</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEE-E2007</td>
<td>Energy, Environment and Emission</td>
<td></td>
<td>Master IV-V</td>
<td>16</td>
<td>8</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEE-E3001</td>
<td>Fundamentals of Industrial Energy</td>
<td></td>
<td>Master IV-V</td>
<td>24</td>
<td>22</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEE-E3002</td>
<td>Power Process Simulation</td>
<td></td>
<td>Master IV-V</td>
<td>14</td>
<td>14</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEE-E3003</td>
<td>Industrial Drying and Evaporation</td>
<td></td>
<td>Master IV-V</td>
<td>24</td>
<td>12</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
<tr>
<td>EEE-E3004</td>
<td>District Heating and Cooling</td>
<td></td>
<td>Master III</td>
<td>28</td>
<td>4</td>
<td></td>
<td>5</td>
<td>Teaching</td>
<td>2017-2018</td>
</tr>
</tbody>
</table>

Figure 12 Master Courses

Table 2: Faculty and Staff

<table>
<thead>
<tr>
<th>Group</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Production and Aalto Digital Design Laboratory</td>
<td>Full Professor</td>
<td>Doctoral Candidate</td>
</tr>
<tr>
<td>Energy efficiency and systems</td>
<td>Doctoral Candidate</td>
<td></td>
</tr>
<tr>
<td>Engineering Design and History of Industrialization</td>
<td>Research assistant</td>
<td></td>
</tr>
<tr>
<td>ENG Technical support services and ME Technical support</td>
<td>Special Laboratory Technician</td>
<td></td>
</tr>
<tr>
<td>Thermodynamics</td>
<td>Project Employee</td>
<td></td>
</tr>
<tr>
<td>Energy efficiency and systems</td>
<td>Full Professor</td>
<td></td>
</tr>
<tr>
<td>Thermodynamics</td>
<td>Research assistant</td>
<td></td>
</tr>
<tr>
<td>Engineering Production and Aalto Digital Design Laboratory</td>
<td>Research assistant</td>
<td></td>
</tr>
<tr>
<td>Energy efficiency and systems</td>
<td>Research assistant</td>
<td></td>
</tr>
<tr>
<td>Marine Technology</td>
<td>Research assistant</td>
<td></td>
</tr>
<tr>
<td>Engineering Materials</td>
<td>Senior University Lecturer</td>
<td></td>
</tr>
<tr>
<td>Energy efficiency and systems</td>
<td>Doctoral Candidate</td>
<td></td>
</tr>
<tr>
<td>Engineering Design and History of Industrialization</td>
<td>Doctoral Candidate</td>
<td></td>
</tr>
<tr>
<td>Thermodynamics</td>
<td>Doctoral Candidate</td>
<td></td>
</tr>
<tr>
<td>Engineering Design and History of Industrialization</td>
<td>Doctoral Candidate</td>
<td></td>
</tr>
<tr>
<td>Marine Technology</td>
<td>Doctoral Candidate</td>
<td></td>
</tr>
<tr>
<td>Engineering Production and Aalto Digital Design Laboratory</td>
<td>Doctoral Candidate</td>
<td></td>
</tr>
<tr>
<td>Engineering Design and History of Industrialization</td>
<td>Postdoctoral Research-cher</td>
<td></td>
</tr>
<tr>
<td>Thermodynamics</td>
<td>Research assistant</td>
<td></td>
</tr>
<tr>
<td>Engineering Design and History of Industrialization</td>
<td>Research assistant</td>
<td></td>
</tr>
<tr>
<td>Marine Technology</td>
<td>Teaching Assistant</td>
<td></td>
</tr>
<tr>
<td>Engineering Production and Aalto Digital Design Laboratory</td>
<td>Postdoctoral Research-cher</td>
<td></td>
</tr>
<tr>
<td>Engineering Design and History of Industrialization</td>
<td>Research assistant</td>
<td></td>
</tr>
</tbody>
</table>

Figure 13: Faculty and Staff

Table 3: Theses List

<table>
<thead>
<tr>
<th>Student</th>
<th>Subject</th>
<th>Professor</th>
<th>Year</th>
<th>Month</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strength and failure mechanisms in 3D printed parts</td>
<td>2016 March</td>
<td>Evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A Hybrid Distributed Control for Production Scheduling in a Stochastic Environment</td>
<td>2016 February</td>
<td>Evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tools, methods and processes in product development concept design</td>
<td>2016 March</td>
<td>Evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3D Solid Modeling for Composite Pressure Vessels</td>
<td>2016 September</td>
<td>Topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Menetelmä ja lähettömitataanbraajien pölytestauskoehen</td>
<td>2016 April</td>
<td>Topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Menetelmä ja lähettömitataanbraajien pölytestauskoehen</td>
<td>2016 June</td>
<td>Evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncertainty in electric bus driving cycles</td>
<td>2016 August</td>
<td>Topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design and manufacturing of locking system for a medical device,</td>
<td>2016 September</td>
<td>Topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hissijarrun kilamateriaalin vahinta</td>
<td>2016 March</td>
<td>Topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Establishing the cost of mechanical components using artificial neural networks</td>
<td>2016 April</td>
<td>Evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Cost of Ownership modeling for mechanical parts and assemblies</td>
<td>2016 October</td>
<td>Topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jäähyväisyysjärjestelmän rakenteen optimointi: telekaapelin valmistuslinjassa</td>
<td>2016 October</td>
<td>Topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adhesion testing of cellulose fibres with polymer matrices</td>
<td>2016 August</td>
<td>Topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adhesion testing of cellulose fibres with polymer matrices</td>
<td>2016 November</td>
<td>Evaluation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 14: Theses List
After gathering all the information, it was time for a survey where each responsible of a course send all the information regarding the teaching hours and also a list with the faculty, staff and external personnel that also have some educational tasks in each course, hours use it for advising theses. An email was sent to the entire department on December 18th 2017:

Dear Engineering Materials Staff

I’m Carlos Chavez and I’m working with Jouni Partanen and Pekka Kyrenius in a ERPUT Tool (Enterprise resource planning for university teaching) such tool will help to have a better workload balancing, and in order for this to works we need your help.

Attach you will find a Survey meant for you regarding the courses for which you are responsible (2016-2017) and for the theses in which you are or were supervisor.

In the case of the Master and Bachelor’s courses please fill the blanks with the hours spent to teaching (planning, administration, evaluations, grading, teaching, preparation, etc) made by yourself, other staff members (visiting lecturers), assistants, external staff or other. In the case of the teaching hours for the following periods, this will be a kind of planning.

In addition, for the Theses please send the hours spent in average per student (meetings, preparation, reading, etc.)

Please if the information that I am sending is incorrect or incomplete please let me know.

You can send back either the excel or pdf file.

Anny comments or suggestions are more than welcome.

Please feel free to contact me if more information is needed.

Thanks in advance

Regards
Carlos Chavez
Aalto University
Puumiehenkuja 5 room 207
02150 Espoo
FINLAND
tel. +358 44 959 1785

The survey was then sent to each faculty and staff member, the requirement was to fill the survey with the hours used by the responsible teacher. If other staff member was also collaborating for such course, they should put their name and the number of hours, the same for assistants, external staff and other. They had also to indicate if the course was a new or an old one. For the theses, a summary was printed out in the survey but for the responsible it was necessary just to put there how many average hours they used for supervising.
A high response was obtained, from a total of 46 faculty members that received this survey, 80% answered with their estimation of time used for each course. With this information it now was possible to develop a tool to show the workload of each professor and to give information about how many personnel is working in each course, which courses have most students, which courses require more hours for preparation, etc.

In the case of missing data of those faculty members that did not reply the survey, an average was estimated. This average was taken from the group and used to show in the tool with a red warning meaning that the data for the professor/lecturer was missing.

Figure 15 shows an example of the survey sent to each professor/lecturer. The information is then divided in four parts, the first one general data of the faculty member, the second refers to the bachelor courses instructed by the professor/lecturer (in case that he/she has courses at this level). Third part corresponds to the master level (in case that he/she has courses at this level), and finally the theses section, here a summary of all the theses supervised during the previous year and at the end a box to fill with the average hours use for advising.
Figure 15 Survey
5. Implementation

The next step after gathering all the information from the different groups in the ME department was to build the ERPUT tool. This chapter explains how the information was collected in a big excel file and then the creation of a GUI in order to have easy access to the information.

5.1. Structure

After the survey, all the information was collected in an excel file with the following datasheet distribution:

- Master/Bachelor courses. Datasheet with all the information regarding the master courses: name and code of the course, teacher responsible, periods in which the course is taught, lectures hours, exercise hours, credits per course, status of the course, academic year of the information collected, amount of students, number of students that approved, responsible teacher hours used for this course, as well as other staff members that collaborates in this courses, assistants and external staff as well (Figure 16).

![Master Course datasheet](image)

Figure 16 Master Course datasheet
• Professors. This datasheet contains all the information regarding the faculty and staff member, group in which they work, full name and title. All this information is used then in the GUI for descriptions (Figure 17).

![Figure 17 Professors datasheet](image)

• Master/Bachelor Theses. This datasheet contains all the information regarding the list of theses given by ENG engineering department (Appendix 4), the information is divided by Student name, subject (topic), supervisor, year, month and type (topic or evaluation), Figure 18.
Figure 18 Master Theses

- Thesis List. List generated through filters done in the GUI (more information in following chapters). This list shows in ascendant order the total number of theses supervised in a specific period of time (Figure 19).
Teaching Hours Q. This is the survey auto generated through a macro, Figure 20 shows the button used to run the macro, after a new window appears in which the user has to introduce the employee id of the respective professor/lecturer to generate the survey.
Dashboard. This datasheet contains the button that runs the macro GUI, which is explained in more detail in the following pages.

The purpose is to have several datasheets with a common code number (course and employee ID, this last one classified as confidential information) is to have a well-structure entity relationship (Figure 21) to have a fully functional database from which all the information is extracted and shown in the GUI.
- Code. Id of the course, example MEC-E1001.
- Name. Name of the course.
- Responsible Professor ID. Numeric value given to identify each professor and a key element to make relationships with other tables.
- Professor Name.
- Level. Bachelor or Master (courses with L prefix -PhD courses- were omitted due to the scope of this project).
- Period. Field that correspond to the academic period in which the course is taught.
- Lectures. Amount of lecture hours, this number came from Oodi system.
- Exercises. Amount of exercise hours, this number is filled from Oodi system.
- Credits. Amount of study credits for this course.
- Status. This field shows if the course is currently active or not.
- Year. This field shows the last academic year in which was taught.
- Number of students. Number of students enrolled for that course.
- Approved. Number of students that passed the course in the given period/year.
- Responsible Professor Hours. Field filled with the information obtained in the survey, this data is the main field in order to run the tool.
- Staff Member. Field use for personnel that also teach in the course but are not responsible of such course.
- Assistant. Student or PhD student which assists the course.
- External Staff. Lecturers from outside the university that sometimes helps with the course giving lectures or field trips.
- Total Hours. Total hours used for teaching purpose in the course.
For the Faculty plus Staff excel list the data is as follows:

- **ID.** Professor Number used to make relationship with other tables, for example in the case of the courses excel, this cell has a direct relation with the responsible of the course and staff members that works as invited lecturers.
- **Group.** Group to which the faculty member belongs:
  - Energy efficiency and systems
  - ENG and ME Technical support services
  - Engineering design and history of industrialization
  - Engineering materials
  - Engineering production and Aalto digital design laboratory
  - Marine technology
  - ME Common (staff group)
  - Solid Mechanics
  - Thermodynamics.
- **Name.** Name of the faculty or staff member.
- **Title.** Role of the personnel:
  - Professor
  - Lecturer
  - Assistant
  - PhD Student
  - Researcher
  - Laboratory Staff.

Last, for the theses excel sheet, the following fields are available:

- **ID.** Student number, this is just a reference to have a key field in the datasheet.
- **Student.** Student name.
- **Topic.** Topic registered in the last approving meeting, this topic is a topic that the student already submitted and has been accepted by the approval board.
- **Supervisor ID.** Supervisor number, this field is use to make a relation between the faculty plus staff datasheet and this field.
- **Supervisor Name.** Name of the faculty plus staff whom is supervising this thesis.
- **Year.** This is the year in which the topic was either approved or evaluated
- **Month.** Month in which the thesis was approved (topic or evaluation).
- **Type.** This field is use to specified if just the topic has been approved or if the thesis has been evaluated already.

With all the information in several datasheets, it is difficult to have a good outlook of how the workload is distributed in each department. A tool is needed to have a better understanding of how each course is distributed or/and to see each teaching load for every professor/lecturer of the ME department.

5.2.ERPUT

ERPUT (Enterprise Resource Planning for University Teaching) was then created as an analysis tool with a GUI to handle all the information gathered from the previous step. In order
to access the tool, the user has to select the “Dashboard” sheet and click the “ERPUT” button, as is shown in the following Figure 22.

After selecting the tool a new window will display (Figure 23) in which are six buttons with the following information:

- **Faculty and Staff by group.** In this section the user will find all the Mechanical department personnel divided by the 9 groups that there are in the department:
  - Engineering Design and History of Industrialization
  - Engineering Production and Aalto Digital Design Laboratory
  - Engineering Materials
  - Solid Mechanics
  - Marine Technology
  - Energy efficiency and systems
  - Thermodynamics.

- **Personnel by title.** In this section the user will find all the mechanical department personnel divide by 5 main roles, these roles where selected due to their high teaching participation, roles as researchers or assistants were discarded due to the low participation in courses, the main roles are the followings:
  - Professors
  - Lecturers
  - Doctoral Candidates
  - Laboratory and Technical Staff
  - Other.

- **Master Courses.** Section that will open a window with all the courses in the Mechanical Engineering department, basic information about the course and all the personnel that is currently collaborating in such course.
- Bachelor Courses. Same as previous but for bachelor level
- Thesis List. This section is used to make reports with thesis information of every faculty personnel
- Close. This section closes the “ERPUT” tool.

![Figure 23 ERPUT User form]

5.2.1. Staff by group

In this new window, the user will have 12 fields with all the information regarding the personnel staff selected. Figure 24 shows the staff form.

![Figure 24 Staff form]

1. Combo box filled with all the faculty and staff groups.
2. List box populated with all the members of the group selected in field 1.
3. Number of personnel in the group selected.
4. Name of the person selected in field 2.
5. Title of the person selected
6. Statics. Button that opens a new form with statistic from all the courses teaching by the person selected in field 2.
7. Courses (In charge). Second list box with information regarding the courses in which the selected personnel is responsible. This list box contains the following information:
   a. Code of the course
b. Name of the course  
c. Level of the course (master, bachelor)  
d. Hours spent by the responsible teacher in such course (data that comes from the survey).

8. Courses (Visiting lecturer/Assistant). List box with information of the courses in which the selected personnel participates as visiting lecturer or assistant. Same information as in the previous list box.


10. Number of theses supervised by the selected person. The hours shown using the following formula:
   a. In the case of bachelor the total hours are given by:
      \[ \text{Total hours} = (\text{Number of thesis}) \times 18 \]
   b. And for master the total hours are given by:
      \[ \text{Total hours} = (\text{Number of thesis}) \times 25 \]

   Where 18 and 25 correspond to the average hours used for supervising purposes according to a previous agreement with the ME Department.

11. Total hours. Total hours that the selected person uses for teaching purpose, hours from the courses in which the person is responsible, courses in which is visiting lecturer or assistant and the hours used for supervising theses.

12. Teaching load. This field shows the workload of the selected person. The values are taken from the work allocation (figure 2) and it depends on the title of the selected person (professor or lecturer). And the color scale is classified as follows:
   a. Professor
      i. UNDERLOAD. When the total hours are less than 20% (color: orange)
      ii. BALANCED. When total hours are within the 30% +/- 10% (color: green)
      iii. OVERLOAD. When the total hours are above 40% (color: red)
   b. Lecturer
      i. UNDERLOAD. When the total hours are less than 70% (color: orange)
      ii. BALANCED. When total hours are within the 75% +/- 5% (color: green)
      iii. OVERLOAD. When the total hours are above 80% (color: red)

5.2.1.1. Statistics

The statistics form (Figure 25), is divided in 2 parts, the first part shows the courses taught in an academic year previously selected, and the second part the theses supervised in the same year but with the option to select a range of periods.
1. Academic Year. Here the user selects the academic years from which wants to see the numbers.

2. List box with the following data:
   a) Code of the course.
   b) Name of the course.
   c) Level (BSc / MSc).
   d) Number of credits.
   e) Amount of students enrolled in that course that year.
   f) Number of students that passed.
   g) Efficiency. This number gives the rate of students that approved the course against total students (Pass ratio). \textit{Note: this field is not related to resources used.}
   h) Hours. Hours that the responsible teacher (in this case the person selected) uses for teaching purpose in this course.
   i) Total hours. This number includes visiting lecturers times and/or assistants hours.
   j) KPI. Key Performance Indicator, this indicator follows the formula mentioned in chapter 3.

3. Average numbers for each data previously mentioned.

4. Thesis. In this section the user, selects a range of periods to show the number of theses supervised by the selected person within that period, in the year previously selected.

\textbf{5.2.2. Staff by title}

This form is similar to the one shown in the section 4.1.1 with the difference that the staff members are divided by title, Figure 26 shows an example.
5.2.3. Master Courses

This form shows all the master courses and the data regarding a course selected. Figure 27 shows this form.

1. Courses list box. All the courses taught in the mechanical department.
2. Information of the course.
   a. Name of the teacher in charge
   b. Hours used for the responsible for teaching purposes

Figure 26 Staff by title form

Figure 27 Master courses form
3. Status of the course (currently teaching or new)

4. Period in which the course is taught

5. Lecture. This field is filled with the number of hours used for lectures (information gathering from Oodi)

6. Credits. Number of credits for the course

7. Exercises. Number of hours for exercises sessions (information from Oodi).

3. In this section, the user will find the last year in which the course was taught. Number of students enrolled in that year. Approved students in that year and the efficiency of the course, percentage of students that passed the course.

4. Other staff members. Visiting lecturers that participates during the course with their respective hours.

5. Assistants. Assistants that helped to prepare the course in the year previously mentioned, and the amount of hours used for them.

6. External Staff. In the case that external staff participates giving lectures or field trips, the amount of hours used for them should be in this list box.

7. Total teaching hours for the selected course.

8. KPI. As mentioned in the previous section, this number is a key indicator for the hours used per credit per student in the course.

5.2.4. Bachelor Courses

Similar to the previous section but with the courses at bachelor’s level, all the fields are the same as previously mentioned on Figure 28 shows an example.

![Bachelor Courses form](image)

Figure 28 Bachelor courses form
5.2.5. Thesis list

Figure 29 shows the windows that appears once the user select thesis list, this new windows shows a regular filter with the academic years recording in the ERPUT excel file, and the user has to select a year and the periods in which is the information requested. Once the user selects the “Report” button a pdf file is opened with the information requested (Figure 30)

![Figure 29 Thesis List form](image)

![Figure 30 Thesis Report](image)

5.2.6. Code

All the code made for this thesis was using visual basic macros in excel, for more details or the exact code please send an email to Carlos Chávez (carlos.chavezvillegas@aalto.fi, egungo@gmail.com).
6. Conclusions and future work

Before the conclusions of this thesis is important to add emphasis to the main concerns that arose after the literature review and at the interview with several professors and lecturers.

The first issue is that according to the literature review even though the ERPs systems are focused on enterprise administration of resources as was shown in chapter 2, is possible to bring this approach to the academic field. Not only by adding this subject to the courses list of the department but also applying its methodology to the entire department itself, this thesis is just the spearhead of how the administration of time, resources, tasks, etc. can be improve with the implementations of ERP tools.

The second and most important issue is the necessity of have a balanced workload, as was explained in the first chapter and in the third appendix. One of the main concerns of the professors/lecturers is the creation of working plans and the allocation of resources to accomplish it, meaning to have a balance working load. In addition, during the interviews, another point of concern was the number of thesis supervised. Meanwhile some professors have a lot of theses to supervise (more than 20 sometimes), there are professors without any thesis to supervise. This is not just because the professor does not want to supervise, most of the time is related to the own selection of the students. Some professors have topics more of the interest of the students, but how can this situation be addressed, if is hiding from the general outlook.

It is important to make it clear that the solution of all this concerns is not the objective of this thesis project. The contribution of this work is a tool, which gives to the head of the department, Jouni Partanen, a condensed outlook of all the courses and theses given within the department and shown by professor/lecturer/staff or by course.

If a professor/lecturer is selected, this tool will give full information regarding the courses in which he/she is responsible, those courses in which he is a visiting lecturer as well as the amount of theses and hours used to supervising such theses.

In other hand if instead of select each professor, a course is selected, all the information regarding such course is then displayed. A new window with all the name of the personnel that collaborates in the course, as well as the amount of hours use per each person for this course, a total and a KPI, explained in the above chapters.

The KPIs shown by this tool are the main objectives of this thesis project. First the estimated teaching load that is displayed in the professor window (Figure 26). With this, the head of the department has a green, yellow or red flag that shows how the distribution of workload of the personnel according with his/her job role and in accordance to the time allocation is explained in chapter one.

The second KPI is the one shown in the courses window (Figure 27) this number is the relationship between hours and number of credits, gives a big picture of how the teaching hours are being used in the course, the lowest the number shows domain of the course which indicates a balanced working plan. On the other hand, a high number indicates that the amount of hours overpasses the amount of credits per students, meaning an overload in such course.
There is still work to do in order to have a well-balanced working plan; the following suggestions are made in order to continue the work here initiated.

1. Improvement of professors/lecturers/staff collaboration. Even though 80% of the staff answered the survey done for this research, there is still hesitation about giving information about the time that each person uses for teaching purposes. Sometime this leads to an overestimation of the hours per course. A good way to improve this is to show to the full faculty and staff members this tool as a first approach to solve workload issues within the department. With a full picture of the work that has been done and the intention of the survey, it is possible to have a response improvement.

2. A standalone app/program instead of an excel file that the faculty and staff members can fill at any time online, without the necessity of a ‘come and go’ list of mails that get lost in the queue.

3. Development of a database for thesis topics and evaluation meetings. During the execution of this thesis a thorough research had to been done, consolidating data from separate systems as Oodi, my courses, aaltodoc, etc. However, in the case of the theses, information simple as just the name and the title of the thesis was difficult to obtain. Aaltodoc is a database with all the theses complete until today’s date, but does not contains the theses in process so the way to obtain that information was through the engineering department. The information consisted of long lists of theses topics, which are divided by department, these lists are filled as minutes during the committee meetings. It’s possible to extract the information necessary through xml filtration rules, but an improvement could be done if in each meeting all this data is introduce to an excel file or better yet to a database, or as a metadata in Aalto-docs.

4. Systems integration. There are a couple of systems that have all the courses information as well (as before mentioned) theses information. Those systems are Oodi and MyCourses, Oodi with the database of the courses (code, name, professors, lecturers, information, etc) and MyCourses works as well as a database of such courses (lectures, assignments, links, important dates, etc.). Combining these two for a complete frame of information could be found, if this two systems are used to fill the ERP tool there is not necessity to have a person filling an excel file every year, the information will be displayed once introduced to both systems, making the ERP tool an automat system easy to read.

5. Use of cloud systems. The use of systems such as Power BI (business intelligence) by Microsoft makes the information more accessible to everybody and easier to handle. Such systems are access through the web and have layouts ready to be filled with the information given by Oodi or my courses, generating automatic reports and dashboards with just a couple of clicks. The use of such systems helps to decrease the existence of several files (versions) and the use of space in a personal computer. In addition, improves the automatization of the system as mentioned in the previous suggestion.
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Figure 1.

Aalto-Yliöpistö, (2018), *Generic work time allocation for lecturer career levels* [ONLINE]. Available at: http://www.aalto.fi/fi/midcom-serveattachmentguid-1e7df19d526222d2df1911e7b39ba5062ae3cd3f0d3f0/aalto_lehtorien_urajarjestelma_fi.pdf [Accessed 14 July 2018].

Figure 2.

Aalto-Yliöpistö, (2018), *Generic work time allocation for professor career levels* [ONLINE]. Available at: http://www.aalto.fi/fi/midcom-serveattachmentguid-1e7df19d526222d2df1911e7b39ba5062ae3cd3f0d3f0/aalto_lehtorien_urajarjestelma_fi.pdf [Accessed 14 July 2018].

Figure 3.


Figure 9


Figure 10


Figure 11


All other figures

Appendix 1. ERPUT Master’s thesis topic 2017

Hello all former MEC-E7003 students,
we have a Master's thesis project position open here at our own ME dept, please read attachment.
BR Pekka
cc: Juha, Jouni

PS project name is ERP for University Teaching :) 

-----------------------------
Pekka Kyrenius (Mr.) office +358 50 354 8962
Laboratory Manager mobile +358 40 573 1626
Production Engineering fax +358 9 855 4006
Aalto University School of Engineering Finland, Europe

ERPUT-master-thesis-topic-20017.pdf

2017-08-16
Master's thesis project available
Mechanical Engineering Dept. of Aalto ENG is looking for one Master's thesis worker for ERPUT-project.

Topic: Resource planning tool for academic teaching.

Topic description: Academic teaching resources (time of professors, lecturers, etc.) are allocated according Aalto tenure track work profiles. ME dept. is developing a tool for *teaching* resources planning, including:

- teaching resource allocation & planning
- work load balancing & monitoring
- input (hours) vs output (study credits & degrees) monitoring
- generation of productivity KPI's
- report generation
- consolidation of existing teaching resource tools.
Supervisor: prof. Jouni Partanen (ME dept. director)
Instructor: Pekka Kyrenius.

Estimated timetable: 2+6 months full time:
- excel prototyping & first interviews (2 m)
- thesis work & implementation & remaining interviews (6 m)
- preferred start Sept 1st 2017, end Apr 30th 2018.

Salary: according Aalto/ENG thesis worker guideline.

Location: Aalto campus/Espoo

Requirements:
- minimum of 70 study credits of Aalto ENG Master’s degree passed
- coursework in Personal Study Plan should be finalized in 2017
- estimated graduating is May 2018.

Skill-set needed:
- MS Excel skills (pivot tables, macros/VBA, Data Tools/Consolidate)
- English language skills (interviews).

Selection is based on course grades & study credits and interview.

Documents needed:
- electronic transcript of records from WebOodi (pdf)
- copy of Personal Study Plan (pdf)
- motivation letter, max 1 one page A4 (pdf).

Best 3 applicants are invited separately to an evaluation interview by email.

Additional info by email: Pekka.Kyrenius@aalto.fi

*** Application deadline 28th Aug 2017 at 12:00 sharp. ***

Application only by email: Pekka.Kyrenius@aalto.fi

Please include all 3 documents needed as pdf-attachments, insert in email header: [ERPUT] application, FAMILYNAME FirstName, student number (e.g. “[ERPUT] application, DOE Jonathan, 123459”)

Please feel free to forward this to any suitable Aalto ENG student.

BR Pekka & Jouni
Appendix 2. Working days and hours in 2018

[Accessed 14 April 2018].
Available at:
https://inside.aalto.fi/download/attachments/8065932/Working%20days%20and%20hours%20in%202018.docx?version=1&modificationDate=1515142320298&api=v2

**Working days and hours in 2018**

January, 22 workdays = 161,70 hours
February, 20 workdays = 147,00 hours
March, 21 workdays = 154,35 hours
April, 20 workdays = 147,00 hours
May, 21 workdays = 154,35 hours
June, 20 workdays = 147,00 hours

**January-June total of 124 workdays = 911,40 hours**

July, 22 workdays = 161,70 hours
August, 23 workdays = 169,05 hours
September, 20 workdays = 147,00 hours
October, 23 workdays = 169,05 hours
November, 22 workdays = 161,70 hours
December, 17 workdays = 124,95 hours

**July-December total of 127 workdays = 933,45 hours**

**January-December of total 251 workdays = 1844,85 hours**
Appendix 3. Several measures to prevent inappropriate conduct and balancing workloads.

[Accessed 16 April 2018].

Available at:
https://inside.aalto.fi/display/CurrentAffairs/Several+measures+to+prevent+inappropriate+conduct+and+balancing+workloads

Several measures to prevent inappropriate conduct and balancing workloads

Based on the results of the personnel survey, Aalto University Board has confirmed that preventing inappropriate conduct and balancing workloads are the university's common development areas. This decision was reached at the December meeting of the Board.

Inappropriate conduct may manifest itself in many ways. In addition to sexual harassment, it can include verbal or non-verbal abuse and intimidation, inappropriate electronic messaging, and simply hindering work or studies.

‘We want to reinforce an atmosphere in which every Aalto person can trust that they will be treated in an appropriate and respectful manner. Inappropriate conduct should always be reported and it must also be addressed without delay,’ says President Ilkka Niemelä.

‘I would like everyone at Aalto to read and follow the Aalto Code of Conduct, which will help us all make the right choices. I challenge Aalto community members to develop our organization together, and to engage in constructive discussion, even on difficult issues, because each one of us is responsible for improving the operating environment that we share.’

Aalto’s existing procedures and instructions for dealing with inappropriate conduct have been renewed. In February, the updated operating instructions for how to intervene in and resolve situations will be communicated to personnel and students in a clearer manner than previously. The instructions will apply to the entire community.

A workshop model related to preventing inappropriate conduct is being prepared in co-operation with occupational health care, and it will be reviewed in the management teams of all departments and service units. Workshops targeting the entire personnel will begin in February. Training is also available for people who, due to their work role or position of trust, are involved in resolving situations of inappropriate conduct.

Online learning material about implementing the Aalto Code of Conduct will also be published in February, and training on this topic will be arranged for various personnel groups during the spring.

Workloads to be addressed in the spring objective discussions

As before, the focus in the spring objective discussions will be specifically on reaching agreement concerning objectives for the upcoming period. The objectives should be in line with common targets and clearly defined in order to estimate the workload and resources required to implement them. The objective discussion provides a good opportunity for building a shared understanding of role and expectations, planning work time allocation together and discussing workload.
A special focus for academic personnel will involve reviewing the teaching loads.

'It is important to compile the agreed tasks into a work plan in which the next academic year is planned through key areas: teaching and student guidance, research and artistic activities, and societal impact. We need to be able to estimate how much working time is needed for each of these fields/tasks,' says Provost Kristiina Mäkelä.

‘A work plan is a useful tool for prioritizing and allocating working time. It will also allow the management to follow up on the workloads.’

Another important element in balancing workload is the skill of self-leadership, and this is why Aalto has supplemented the training offered to the whole staff. Coaching related to holding objective discussions will be arranged for supervisors and, for example, groups will have access to training on using a reflective work approach to manage personal work.

Further information:
Results of the 2017 personnel survey
2017 news
Preparing for the objective discussion
Personnel training
Code of Conduct (edit/linked 8.2.)
Harassment and inappropriate conduct
Inside / Current Affairs / ...
2018-02 February / Several measures to prevent inappropriate conduct and balancing workloads
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Appendix 4. Theses lists

The theses lists were obtained through the minutes recorded by the ENG department in each thesis meeting; the contact person for this purpose was the coordinator Sanni Valkeapää (sanni.valkeappa@aalto.fi). Here is an example of an evaluation master thesis meeting minute.

<table>
<thead>
<tr>
<th>OPISKELIJAN NIMI, DIPLOMITYON AIHE PÄÄAINE/SIVUAINE</th>
<th>VALVOJA, OHJAJA/TYÖPAIKKA</th>
<th>ARVOSANA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energia- ja LVI-teknikka / Energy Engineering and HVAC</strong></td>
<td>professori Risto Kosonen, DI Jan Tapper, Wise Group Finland Oy</td>
<td>3</td>
</tr>
<tr>
<td><strong>Pohjalainen, Ville</strong> Yhteistoiminta hajautetussa organisaatiossa talotekniikan suunnittelualalla -LVI-teknikka</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Koneetekniikka / Mechanical Engineering</strong></td>
<td>professori Kalevi Ekman, DI Pertti Saviranta, Outotec</td>
<td>4</td>
</tr>
<tr>
<td><strong>Laakso, Aki</strong> Development of the Mechanical Subsystems for an On-line 3D Optical Granulometry System -koneensuunnittelu</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rökkä, Taneli</strong> Kenttädata nostimen luotettavuusmallinnuksessa -tuotantotekniikka</td>
<td>professori Kalevi Aaltonen, DI Juha Sunio, Konecranes Oyj</td>
<td>4</td>
</tr>
<tr>
<td><strong>Seppänen, Tommi</strong> Environmental Effect of Reactor Coolant on Fatigue of Stainless Steel -koneenrakennuksen materiaaliteknikka</td>
<td>professori Hannu Hänninen, DI Jussi Solin, Teknologian tutkimuskeskus VTT Oy</td>
<td>5</td>
</tr>
<tr>
<td><strong>Söderlund, Jasmine</strong> Biopolttoaineiden käytön kannattavuuden tarkastelu lammostuotannossa -tuotantotekniikka</td>
<td>professori Pekka Ahtila, DI Markku Mäkilä, Fortum</td>
<td>4</td>
</tr>
</tbody>
</table>