Use of information systems in professional work practices

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Abstract. Organisations have been more knowledge intensive and professional during the last decades. Professional work generally has certain specific properties related to its working context. Two different case studies have been conducted within two different work disciplines; aircraft maintenance and emergency healthcare. This paper explores different characteristics for the different types of professions in the time and life critical work practices studied. The two different types of professions are called T(hing) and L(ife) professions. The aim of this paper is to highlight the specific characteristics for the two different types of professions, T and L, and their use of the information systems. The aim is also to derive the general challenges met according to the professionals’ use of the information systems.

1 Introduction

Professionalism is a concept that has become increasingly important within society (Evetts, 2006, 2011a, Freidson, 1994). Professions and their knowledge intensive work have increased in importance, and this work differs from more routine basic work. This development has been ongoing in the last century, where society has been organised more and more towards knowledge as a large source for economic development (Castells, 1996, Drucker, 1988). People who work within these intensive knowledge based occupations are relatively authoritative in their work making their own decisions within their area of knowledge expertise. Within professions, knowledge is used both as input and media for performing the work, as well as the result of the activities performed. In relation to the immediate context to the work new knowledge is being created and used (Newell, et al., 2002).

There are increasingly needed requirements for knowledge and competence with more competence development within society. It is clear that work is becoming more knowledgeably intensive and professionally orientated (Alvesson, 1993). Technological innovations imply an increased need of human expertise (Scarborough, 1995). The complexities within the professional work are increasing, where the work within the different professional spheres are both life and time critical. This development of society has of course made an impact on the professional work that is changing in character. Professions use information systems in their intrinsic knowledge work. In order to manage the implementation and use of the information systems within the professional work to support the knowledge intensive work, it will imply changes in the way work will be performed and how the professionals can take advantage using the information systems (Berg, 2001; Burns, et al., 2006). Even though much research has been carried out about how information systems and information technology has been adapted and accepted by different types of users, very little research has been done as to how information systems and information technology have been adapted and accepted by professionals and how the professionals have been influenced by the information systems (Chau, Hu, 2001; Silva, et al., 2007). Different professions are also influenced by their
specific cultures that could complicate the implementation and use of the information systems (Hellberg, 1999; Tansley, 1996).

Organisational knowledge is often embedded in routines and practices, but knowledge is also internal within individuals that have to identify, interpret and internalise knowledge (Baskerville, Dulipovici, 2006). Knowledge is the most difficult resource to manage within organisations, because it resides within the people’s minds and thoughts and is intangible. Information systems often support the knowledge management within these organisations. At the same time there are large opportunities in using information systems in order to support the knowledge processes, information systems can also cause problems within the professional work. Information systems are often seen as bureaucratic and impersonal, and as monitoring and controlling (Newell, et al., 2002). The aim of this paper is to highlight the specific characteristics of two different types of professions, T and L, and their use of the information systems. The aim is also to derive the general challenges found according to the professionals’ use of information systems. The two different types of professions, T(hing) and L(ife) professions are derived from two different professional cultures. These two professional types are both coupled with each of the engineering and the healthcare culture, referred to in this paper.

2 Theoretical framework
The concept of these professions is introduced, together with the characteristics of the professions that are important to this study. Professionals are using information systems in different ways within their work to perform complex, and often time and life critical work. The two different types of professions that have been studied are based on two very different professional cultures, the engineering culture and the healthcare culture. A huge amount of the previous research on professions is related to the state and the society, thus it is related to the macro level (Evetts, 2009). This paper will take into account previous research, but is restricted to the aspects that are considered as important to get an understanding of professions on the micro and meso level.

2.1 Characterising professions
In order for people to be included in a profession education is the foremost pre-requisite. Thus, education is considered a formal jurisdiction for belonging to a profession. With education one can acquire access, position and identity as well as the status included in a specific profession (Archer, 1995). Education and the knowledgeable area within each profession encapsulates the socialising function and thus has an impact on the identity of human beings (Beck & Young, 2005). Thus people obtain a role within their working life that can be related to a profession.

According to Schein (1972) professional knowledge has three components:
• An underlying discipline or science on which the practical work is based.
• An applied science that the daily problem situation can be related to.
• A competence and an attitude to the performance of the work.

Different professions are striving to establish their own status and their own privileges within the profession that exclude other groups or professions, and will be described by the concept
of professionalism (Axelsson 2008; Evetts 2011b). Professions are exposed for the impact and changes they have in the different ways of society. Professionalism is a concept that describes the constant changes professions are exposed to, and have created themselves so that they can be perceived as the professional value a profession needs (Friedson, 2001; Evetts, 2011b).

New technology and new information systems will force new impacts and new challenges for the professions and also implies that the professions have to integrate the information systems in their work in a suitable way (Saks, 2010). Information systems have to support the complex work performed by professions and not impede problem solving and creativity. Efficiency and quickly found solutions to critical and complex problems cannot be disturbed by using information systems.

The concept of profession is used more and more when discussing work in modern society (Evetts, 2006). The meaning and interpretation of the concept has been shifting during the years, from denoting professional collaboration, collegial work, a collective identity and confidence based on competence to emphasising altruism and the service orientated work. The orientation associated with professions is towards the best for the society or the interest of the society in the background of the authority related professions (Pfadenhauer, 2006).

Four key factors have been identified by Burrage and Torstendahl (1990) as important for the development of professions:

- The people performing the professional work
- Users, as people becoming in the need of the professional work
- The state
- The universities

It has been increasingly important to add a fifth key factor, forming an impact on the development of the professions. This implies that organisations that are included in the professional working areas are denoted as a key factor (Evetts, 2011a). The first four key factors are analysing the professions mostly on a macro level, though the fifth key factor, the organisations, are useful in analyzing the professions in more detail on a meso and a micro level. Professions are relatively autonomous and independent in their work. The work is often characterised by creativity and problem solving, this requires that one organises its own work. The professionals make assessments and decide how their work should be planned, organised and co-ordinated based on their experiences (Brivot, 2011). Starbuck (1992) states that a profession has its own collegial authority and a common view. This implies that when one has received a formal education, training and in some cases the license, one has the confidence to use the knowledge and the experiences in different complex contexts within the area of the profession, and to make its own assessment decisions. In this way professionals have control over their own work, and therefore the impact from external rules are minimised (Evetts, 2006). Introduction of information systems is often seen as having an impact on the professionals’ work because it means that rules, control and monitoring of the work are introduced.

Trust is an important concept for professions. This concept is often used for analysing professions and their change and control in the work (Evetts, 2006). Trust is defined in different ways in the literature, even though two questions are central. The first question is about managing risk and uncertainty, while the other question is about accepting vulnerability. Luhmann (1988) views trust as an attitude that allow individuals to subjectively assess if they are exposing themselves to situations where damage can outweigh an
In order to trust somebody there has to have been a situation where uncertainty is prevalent, and where there has been a possible realised risk for the individual having the trust. There are many sources of vulnerability in collaborating situations. The vulnerability can affect the reputation, economic resources, self-esteem and conversations. Trust has, in recent times and to a greater extent been questioned (Evetts, 2006). Not least this will relate to healthcare professions, where the public have greater opportunities to inform themselves about health problems by information systems such as the Internet.

Professions have such characteristics that they motivate special social positions and privileges. Professions have traditionally been interested in forcing their own interests with high salaries, power and authority. This implies that they willingly protect their own knowledgeable areas (Alvesson, 1993). This process of trying to close ranks within their own professions and to have monopolistic control over their own work is called professionalising (Evetts, 2011b). In creating these barriers against other professions it is also a clever strategy to strengthen their own positions in order to limit knowledge transfer and knowledge integration with other collaborating professions (diLuzio, 2006). Competition between professions is another aspect that can emerge within the collaboration between professions. Different collaborating professions are often starting to compete, and in cases where new technologies and new knowledge is obvious, each profession is inclined to adopt the new technologies and the new knowledge (Scott, 2008) Professions with authority are trying to take control over these changes, as new technologies and information systems are introduced (Bourgeault, et al., 2011).

2.2 Professional cultures

Different cultures have historically evolved within different types of professions, where collective experiences constitute a framework. The cultures help people to develop their own different views and to relate to their own work practices, thereby creating a specific identity within the profession. Different cultures within different types of professions imply that boundaries are created, communities are built and separations between people are made. A professional culture represents a shared experience that others do not have (Starbuck, 1992). Alvesson (1993) mentions the special occupational culture within each profession. Professions specific cultures could be interpreted as hindering other people from their right to work within the working area. This in turn can have a negative impact on how knowledge is shared and integrated in other people and within other professions.

This study takes its departure in characterising the professions on the micro and meso levels, and specifically within the two different professional types, so called T(hing and L(ife) professions respectively (Hellberg, et al., 1999). These two professional types can each be coupled with the engineering and the healthcare cultures respectively. Both of these professional types are included in the classic professions, as well as lawyers, psychologists and architects (Salling Olesen, 2006).

Cultures within these different professions can be seen as common rules, which have an impact on the cognitive and the affected aspects pertaining to a profession as well as the ways the cultures are composed and expressed (Kunda, 1992). Cultures also affect the attitudes in the use of information systems as well as how the use of information systems are prioritised. Different cultures can have different meanings in the adoption and use of information systems. In this context the cultures are described and defined as the different types of professions studied, the T and L professions.
2.2.1 Engineering culture – T-professions

A culture can be seen as internalised within the minds and hearts of human beings. A culture consists of learned traditions that guide you in knowing, thinking and feeling in order to belong to a specific culture (Kunda, 1992). This implies that people within a culture share the rules that guide the cognitive and emotional aspects, and how they are formed and expressed. Engineers often have difficulty explaining what they really do in their work, other than describing the environment that the organisation is handling (Van Maanen & Barley, 1982; Langefors, 2007).

The profession for civil engineers was created during the 18th Century, in order to correspond with the military occupation as engineer. Around the year 1800 the engineering professions were developed to be of more homogenous groups (Davis, 1996). Within the engineering culture the people try to personalise their values of technical excellence and claim a high value on the technical knowledge. The technical competence is highly valued because it is expected that engineers can take care of new technological challenges within their work. The engineering culture should be seen as user orientated and it should be passed on to as many people within the society as possible (Tansley, 1996). Tansley (1996) claims that the cultures within the technical professions are trying to offer the best with the highest satisfaction to as many people as possible and that the technical professions are responsible for the welfare, health and security of the society. Traditionally the soft characteristics are not very valuable as for example, the social competence and ability to communicate, even though these characteristics are valued more and more in the prevalent society. Engagement and integrity are other valuable characteristics. Control and quality assurance, specifications and routines are other concepts that are important for engineers (Nguyen, 1998).

Hellberg (1999) is denoting the professions as being in the field of production, organisation and the administration of goods and services as T professions. T stands for the concept of “Thing”. T professions stand for practical utility and usefulness. Education comes on many levels - belonging to, and the occupational roles are built on exams, titles, occupational experiences and self-authorisation. The T-professions can usually be found in an environment characterised by usage and utility. T-professions relate their work practice to producing, organising and administrating goods and services. They provide important services, material goods and critical knowledge for the technological, economical and organisational development for the society. An example can be quoted in the development of more green and fuel efficient cars. T-professions do not have any close handling of individuals. T-professions are based on educations and are not governed by the law (Hellberg, 1999). Other types of occupations that can be included within the T-professions are engineers within the automotive and electronical industry (Axelsson, 2008).

2.2.2 Health care culture – L-professions

Occupations within the healthcare service are one of the oldest occupations in the world. The Swedish regions were established during the 1860s and it turned out to be natural that healthcare should be provided on a regional level (Gustavsson, 1987). In pre-industrial times most of the healthcare was provided by women, as they are experienced in caring for their families and neighbours, on a daily basis. During the industrial revolution, the medical profession established itself with men who were salaried. In reality the women were
prohibited in educating themselves within the medical field as it was uncommon to gain entrance to the universities (Witz, 1992).

What can be found specifically in the professional healthcare cultures is that the work has been built on ethics, morality and responsibility (Leininger & McFarland, 2006). The knowledge within the healthcare profession is built on individual knowledge and competence with a high degree of collegial control. The work is planned and executed relatively free, differing from other professional work divisions (Nilsson, 2007).

Professionalisation consists of the process where the characteristics of the professions are influenced and changed. When information systems are used and developed in different ways, it can cause a sustainable influence on the professions within the healthcare. Patients can for example, be sometimes more knowledgable from information available on the Internet, which in turn causes a decrease in the healthcare’s authority. The professions that can be derived from the healthcare and care about human beings in the society, Hellberg (1999) is characterising as L professions. L stands for the concept of “Life”. The characteristics of the L professions are mainly their involvement with the welfare and the health of people in society. L professions are claiming the right in taking care of basic human welfare within a civilised society. This could for example, be in the form of taking care of each human being’s right to feel secure and have good health. Griew, et al. (1999) emphasises that L professions have an ethical base. They also protect the right for the professions to get specific information in order to conduct their work. The L professions do not have a problem asserting themselves in society. On the contrary, all citizens are in a presumptive need of the L professions. In Sweden the doctors are the first to get their own practice regulated by law. Other professions, such as nurses and dentists also get their practices regulated by law at a later date. There is only one way to become a member within the medical profession and this is by passing exams at university. Educations are approved by the state and are legitimised by an authority of the state. L professions are thought of as altruistic which implies they are altruistic in their nature (Hellberg, 1999).

3 Research Method

This study has been conducted with a qualitative approach, with case studies by ethnological influences. This is an approach well used in studies of the use of information systems within organisations. The cases studies have implied that the organisations and the cultures have been studied within a relatively long time period. The data collection has been focused on different ways in gathering information in order to get a deeper insight into the different human, social and organisational aspects within the context of organisations and their cultures. The primary data sources have been interviews, studies of internal documents, observations, informal discussions and participation in meetings within the organisations. When studying their work in the workplace there have been opportunities to see what people do, to hear them explain their work and to get an insight into their routines, dilemmas, frustrations and relationships within their daily work (Hammersley & Atkinson, 1995; Myers, 1999). Documents as e. g. maintenance handbooks, fault reports and medical treatment descriptions have been read. Questions have been able to be asked by the researcher, if specific questions have occurred during the observations. The social interplay and the social processes have also been able to study (Repstad, 1999). A summary of the data collection can be seen in table 2.1.
### Table 1: Summary data collection

<table>
<thead>
<tr>
<th>Data collection</th>
<th>Aim and description</th>
<th>Aircraft maintenance case Quantity</th>
<th>Emergency health care case Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>Field visits to understand and document activities that took place on site at the air base as well as the emergency unit.</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Document analysis</td>
<td>Readings of organisational documents and work procedures</td>
<td>7 days</td>
<td>2 days</td>
</tr>
<tr>
<td>Meetings</td>
<td>Project meetings and regular meetings with key members from the actual fields</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Interviews</td>
<td>Qualitative interviews mostly focusing on questions relating to apparent themes</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>Follow-ups</td>
<td>Follow-up discussions where empirical results were reported</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

The interviews have been of a semi-structured character, where a number of themes have been prepared before each interview. The interviews have been conducted in the respondents working environment.

Within the aircraft maintenance the interviews have been done with people from different departments and from different professions in the organisation. The respondents consist of flight engineers, control engineers, service engineers, and managers within the aircraft maintenance. Flight engineers are working within the practical maintenance, but there are also flight engineers working as educators and developers at Volvo Aero Corporation (VAC). Developing engineers are working at VAC, and are developing monitoring systems and user interfaces for the flight engineers. Interviews have also been done with the developing engineers. In the beginning the study was explorative in its nature, when the research problem was unformulated. The research project was started at the end of 1997, and has continued with more or less intensity until 2010, when the last follow-up discussions were held.

From the practical healthcare activities within the emergency healthcare, different key persons have been interviewed. Doctors, nurses, IT-personnel as well as assistant nurses have been interviewed. An IT-manager and IT-personnel have been interviewed at the IT department as well as interviews with a manager at the emergency transportation department. The respondents represent both the operative and the managing levels in the organisation. The research project was started in 2000, primarily as a project where studies of information
technologies were important. The last follow-up discussions were held at the beginning of 2010.

The collected material has been reviewed as the study has progressed. The professional cultures’ and the different professional types have been used as a framework for the analysis. Moreover, the use of information systems has been an overall theme for the analysis. The reviews have resulted in relatively regular reflections and reviews that have been documented. At the beginning of the project there was only a vague understanding about the orientation of the study, that information systems should be studied in relation to the studied organisations. By using the case study method it has been possible to formulate the design of the research and the research problems. From these different phenomena within the organisation analysis and documentation have been completed. With time the different concepts and patterns have been derived and categorised from the data material, and more specifically have been directed to a research problem (Myers, 1999). The research problem increasingly turned out to be dealing with the effective use of information systems within professional work practices.

4 Empirical description

4.1 Aircraft maintenance

In the process to start using the JAS 39 Gripen aircraft in 1997, there was a transformation in the maintenance concept, from time-based to condition-based maintenance. The big challenge with this maintenance concept is to strike a balance between cost and risk, ensuring efficient aircraft maintenance when required. Previously maintenance and service work activities were more of a mechanical nature. If any component was damaged it had to be exchanged but to avoid serious breakdowns, the time-scheduled activities were of a large scale. Sensors in the new aircraft gathered signals about the different parameters such as temperature, pressure, height and so on in order to meet the condition-based maintenance concept. Military aircraft maintenance is highly mobile work, very different from the civil aircraft maintenance. The aircraft is often located in different places when it is grounded as the aircraft obviously takes off and lands at different places. There is a need to serve and maintain wherever the aircraft is located. Moreover the landing place is not always known in advance. This can lead to uncertainty if spare parts and relevant information are not available that wing or airbase, or wherever the aircraft has been grounded and located in order to carry out the maintenance work. Some information is located in the aircraft, i.e. information about the actual condition of the equipment. Other information, such as the maintenance handbook and rules for troubleshooting are found at the airbase. Due to security reasons there are restricted opportunities to have easy access to data and information by a network infrastructure. In case of war enemies must not get access to any data or information.

4.2 Emergency health care

The emergency department is divided into two departments; each of them located in different hospitals in different cities. The two departments have one common manager. There are several section managers on each department responsible for scheduling, personnel businesses among other things. The emergency department has a medical department, a surgical department and an emergency department for children, ears and gynecology during the nights
and weekends. In the clinic nurses, assistant nurses, doctors and medical secretaries work. Each department has its own IT co-ordinator that functions as the primary support to the personnel.

There are three people that share the role of IT manager, one of these are also responsible for IT strategy within the NU healthcare and is also a doctor. As an IT strategist he also participates in the regional IT managing group which is supervising the IT director and have the primary responsibility for IT in the region. There is also an IT advisory team that functions as a link between the healthcare management and the IT managers. In this team both practitioner and IT people are taking part.

5 Analysis and discussion

In this section the concept of the profession is discussed together with the influence of information systems. The two different professional practices seemed to be influenced by different cultures. Therefore certain characteristics can be derived from T and L professions respectively, according to the use of information systems. There are also general challenges based on the professionals’ use of information systems.

Professions have different characteristics that influence practical work. Different characteristics can be derived from the theoretical framework, but also from the empirical material that has been collected and analysed. Differences between the different types of professions are clear in the analysed organisations, even though professional work can generally be characterised within unique situations of complexity, with unknown consequences to decisions (Schön, 1991). Hofstede (1984) considers values to be central to cultural differences. Values influence attitudes and behavior helps identify cultural differences and the reasons behind them.

For both the professional types studied, it is important to recognise both history of each aircraft and of each patient, what has been fixed earlier with the aircraft, and which treatments a patient has received. It is also about taking into consideration alternative solutions to fix things at the aircraft and to alternative treatment of patients, before a final decision can be reached. Even if diagnosed faults and diseases are known of beforehand, it is not always obvious that a prescribed action or treatment should be performed, as the best practice. This kind of situation for making decisions includes that there are many influencing factors of uncertainty, risk taking and the consideration of scientific knowledge that can be unique in each situation. The work is dynamic, the professionals have to adapt to new situations and continually changing situations. The differences identified between the T and L professions are shown in table 5.1. These differences are described and discussed further.

<table>
<thead>
<tr>
<th>T-professions</th>
<th>L-professions</th>
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<tbody>
<tr>
<td>Less authoritative and independent</td>
<td>More authoritative and independent</td>
</tr>
<tr>
<td>Stronger barriers both individually and</td>
<td>Weaker barriers individually, but stronger barriers</td>
</tr>
<tr>
<td>collectively</td>
<td>collectively</td>
</tr>
<tr>
<td>Higher competition between professions</td>
<td>Lower competition between professions</td>
</tr>
<tr>
<td>Work is more based on collective</td>
<td>Work is more based on individual</td>
</tr>
<tr>
<td>knowledge</td>
<td>knowledge</td>
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<td>---------------------------------</td>
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</tr>
<tr>
<td>Materialistic attitude to work</td>
<td>Humanitarian attitude to work</td>
</tr>
<tr>
<td>Natural attitude to information systems</td>
<td>Questioning attitude to information systems</td>
</tr>
<tr>
<td>Higher trust in information systems</td>
<td>Lower trust in information systems</td>
</tr>
</tbody>
</table>

Table 5.1. Differences between T and L professions according to the characteristics derived from the professions.

5.1 **Authoritative and independent professions**

Professions are generally characterised as authoritative and independent of other professions and groups (Evetts, 2002). However, the authoritativity and the independence differ between the different professions. In this study the T professions have been found to be less authoritative and independent compared to the L professions. The work performed by the T professions is controlled to a higher degree by other professions in the hierarchy of professions that are prevalent. The decision making is formal, centralised and hierarchical. As an example it can be mentioned that the flight engineers are writing the fault reports when faults are discovered. These fault reports should always be sent thereafter to the control engineers, who register these faults. The control engineers will also use the fault reports when needed to perform more complex trouble-shooting activities.

Within the L professions there exists a stronger collegial control and collaboration between individuals. This can also be confirmed by Bourgeault, et al. (2011). The work is more clearly and explicitly divided between the professions. In this way the work of L professions would be more authoritative and independent. The information each profession has written within the patients records can then also be read by other professions. Though information registered by other professions is hardly relevant for the decisions and performance for the work of each profession. However, there exist some situations where nurses are not as authoritative and independent as they should be in their work, and these situations are therefore related to the discussions about the need and requirement for information systems. In these situations the physicians consider themselves as having the right to influence the design of information systems, even when the information systems would be used mainly by the nurses. The physician’s profession has, with the support of its authority, a higher authority and power to have an impact of the design of the information systems. This is the case even if the nurses have the better knowledge about the activities they perform in their own work. The physicians will be those who first adopt the new technology and in this case they will try to influence the new information systems (Scott, 2008). The nurses are aware that the physicians do not show special consideration to their comments, and therefore the consequences could be that the nurses’ needs and requirements will not be collected by the personnel at the IT department. This situation implies a risk if the information systems are not adapted to the work activities they are intended to support.

5.2 **Barriers between professions**

A characteristic of the professions is that they are creating barriers to other collaborating professions. Professions are therefore developing different strategies in order to de-limit the
transfer and integration of information and knowledge to other professions (diLuzio, 2006). Barriers between different professions differ between the two types of professions (Svensson, 2009). Within the T professions there are not always clear and defined limits between the different activities that are performed in the work. Sometimes it can for example be hard to decide if a fault is too complex, unknown or unusual so that the flight engineers are not allowed to solve the problem, and when it should be handed over to the control engineers or to other professions according to the strict hierarchical division of work. When the boundaries between work activities and knowledge areas are somewhat unclear the relations between professions run the risk to be conflicting and unstable, even if they are not collaborating to a great extent. Control engineers, on their side create barriers against flight engineers and are in this way protecting their own work and their own professions, and they are not eager to share their knowledge and competence.

L professions often have clear rules about which activities should be performed by which professions, and how the work should be divided, even if a relatively high degree of collaboration is prevalent between the L professions on an individual level. In the collaboration there is a knowledge sharing and knowledge integration going on, and they are sharing their own competence. As for example, sometimes a more experienced nurse can be more competent in assessing X-ray pictures than a newly educated physician. In these situations discussions often occur between nurses and physicians, with the nurses sharing their knowledge and competence with the physician. Collaboration between individuals from different professions is usual (Aarts, et al., 2006). Therefore barriers are not occurring between individual L professions in their daily work. Nurses are not considered to have the medical knowledge needed in order to assess the condition of a patient. Only physicians are considered that knowledgeable, and are therefore responsible for any decisions about a patient’s condition. Nurses do not have the authority to comment on the patients’ condition in front of the patient. For example, nurses are not allowed to comment on X-ray pictures even if they, as in most cases can identify the injury or the disease. On the contrary, there exist clear barriers between the L professions on a collective level. For example, this is obvious at meetings where groups of different L professions are included. In these situations the nurses do not feel that the physicians are listening to them seriously (Evetts, 2011b).

5.3 Competition between professions
A higher degree of competition occurs when different collaborating professions would like to have access to the very same information and knowledge. This is especially prevalent when new knowledge is created or has to be created, or when new technology will be introduced (diLuzio, 2006; Scott, 2008). An example of this within the T professions is that the control engineers do not allow the flight engineers to have access to the control engineers’ information systems and databases that contain videos or other information about the type of fault occuring. In this way the control engineers are protecting their knowledge because they have the responsibility to investigate more complex faults occuring. Later on even up to a year later, changes can be made in the maintenance handbook. Instead, the flight engineers would like to take part in the trouble-shooting process to a greater extent, and to have access to all information that the control engineers have, in order to develop their own knowledge and competence within their profession. If the flight engineers could be more active within a new and complex process of trouble-shooting it would probably lead to the faster repair of
faults, as much of the daily work for the flight engineers profession is to look over, repair and trouble-shoot the aircraft.

Actually, competition within L professions does not occur between individuals in their daily work. Instead, competition occurs on a group level, when for example, it will come to planning for the implementation of information systems. In these situations, the physician’s profession would, with the support of their authority try to influence the choice and the design of the information systems even if the physician’s profession was not affected by these information systems to a specific degree. The physician’s profession would willingly like to have the monopoly on the knowledge introduced when new information systems are implemented.

5.4 Collective versus individual knowledge
The work performed by the T professions is to a great extent based on knowledge that is coded into rules. However, the more informal learning and reflections made in the work are not always possible to code and manage by information systems (Bhatt, 2001; Ellström, 2006). Instructions for maintenance and trouble-shooting are collected in a maintenance handbook that is issued by a service engineer. Sometimes the flight engineers believe the instructions to be unnecessary complex and in some cases they can imagine and have ideas and suggestions as to how the maintenance could be performed in an easier and more effective way than described by the maintenance handbook. However, the flight engineers are not allowed to make any exceptions from the maintenance handbook in their practical work.

The work within the L professions is based more on individual knowledge. This implies there is a high degree of reliance put on the knowledge encased in the brain of the individuals (Bhatt, 2001). Individuals within the L professions make decisions by themselves, often after discussions and collaboration with other individuals within the profession or with other professions. In this way the decisions will be more collectively established. Each individual within each profession is allowed to create instructions for treatments within their own competence area, in order to support the work. However, each document has to be approved by a department manager. The documents can then, in their entirety or in part be used with other relevant documents. The document can be used as the original version or be re-written as a new version. This handling of documents could create problems as it would be hard to know which document is the latest up-dated document or if it was the original, and how it could be interpreted and re-written. Each individual within the L professions have ultimately to trust their own knowledge and competence, in different situations, but with the possibility of discussion with other individuals.

5.5 Professional attitudes to the work
For both of the professional types it is the attitudes to, and in the best interest for the society that is in focus (Pfadenhauer, 2006). Even though there exist different approaches, and/or attitudes to the work performed. The professions within the emergency healthcare have a more human approach, as the professions within the aircraft maintenance have a more materialistic and technical approach viewing different technical parts as connected in a system.

The specific knowledge within the professions is important both within the T and L professions. To have the capability to interpret and control critical situations is also a strength within both of the professional types. But there exists a difference between the different types
of professions understanding and analysing problem areas, and their knowledge is managed in different ways. Within the L professions there are verbal communications going on with the patients and they also discuss and collaborate within and between the professions in order to help the patients in the best possible way. There has to be great trust in the professional knowledge in order to interpret the condition of the patients, and there has to be great trust in the human knowledge and experiences (Hellberg, 1999). Individuals within the L professions often make their own decisions and trust their tacit knowledge and each other. At the same time they are interacting with the advanced monitoring systems. The T professions are also using their tacit knowledge in order to interpret the condition of the aircraft. Also within the T professions there are discussions and collaborations going on, but mainly within each profession, in order to find the best solutions to the problems. To a great extent reliance on the professionals’ knowledge, experience, intuition and tacit knowledge is characteristic for the professions (Dreyfus, Dreyfus, 1986). The tacit knowledge is of course more complicated and would not be possible to register and store within the information systems (Mathiassen, et al., 2003; Walsham, 2001).

T professions are more inclined to use supportive technical artifacts and tools than the L professions. This situation can be seen as natural because the T professions already in their education have got the technical knowledge and the technical orientation in the work. This implies that the T professions are more used to using technical artifacts in their work. As information systems are assumed to be based on information technology, information systems are interpreted as technical solutions. Therefore, the T professions have easier understanding in the use of information systems and to integrate the usage of information systems in their work (Hellberg, 1999).

## 5.6 Professionals attitudes to information systems

T professions are more familiar with learning about new technologies and technical equipment and systems than L professions are. Therefore, T professions find it relatively easy getting to know about new information systems, compared to L professions. L professions often relate to information systems and information technology with efficiency and control, concepts that are conflicting with the traditional values within healthcare, where the values are grounded in the care of humanity. L professions often feel unfamiliar knowing when to use the information system and information technology. On the contrary T professions are used to working with efficiency and control and the same conflicting situations are not obvious when they are using information systems. People working within the T professions are used to seeing technical solutions for different problems, and it is natural for them to use the different technologies and information systems in their work. The work is characterised by a more materialistic and technical view, where technologies and systems are seen as supportive in the work.

T professions have a more natural attitude to the use of information systems in the workplace than L professions have. The L professions are more inclined to take care of people, and to help the sick and injured people in the best way possible, with the support of their knowledge and competence.

When use of the information systems is planned for any function within the work of T professions, the flight engineers are often involved. Flight engineers have the knowledge and competence for maintaining, trouble-shooting and repairing faults, and therefore are seen as being as competent as the other T professions in being involved in the development of
information systems. This is a natural attitude of the T professions, and this also follows the intention of the soft approach for information systems development where the users are involved to a high degree (Rose, 2002). This could be a reason why the T professions do not perceive any general problems when implementing and using information systems. During the development process, the T professions are involved, as they consist of people with expert knowledge of the practical work activities. This makes the needs and requirements clear and explicit for the team that are working on the system development process.

When use of information systems is planned within the L professions, the L professions can explain their needs and requirements to a systems development team at the IT department. When people at the IT department later on present the requirements for the information systems, the L professions think that the IT people express the L professions needs and requirements in a more technical way. However, it is often obvious that the IT people have not perceived the needs and requirements related to the L professions work. Moreover the L professions often perceive that the information system processes are very urgent and that the systems should be developed in as short a time scale as possible.

When problems occur in the use of information systems the L professions often perceive that it is awkward having to call a service personnel at the IT department, to raise questions. Service personnel are sometimes hard to get in touch with, and often L professions feel that it is difficult to understand instructions and explanations on the telephone. Often the L professions feel somewhat helpless, when for example, they are searching for some special information about how to use the information systems. The L professions would willingly welcome the opportunity to have an IT co-ordinator in the department, someone who has the knowledge about both the work activities and how to use the information systems. Previously, each department had such an IT co-ordinator, but the IT department took over all user support from the IT co-ordinators, because the health care organisation became more centralised during the last year. Therefore they have tried to make all the IT activities more efficient within the organisation (Lines, 2004). The emergency healthcare department has to a certain extent been able to keep its IT co-ordinator.

5.7 Professionals’ trust in the information systems

Without the use of information systems the activities performed in the professional work could more or less collapse (diLuzio, 2006). Therefore, the information systems are critical in gaining access to all different kind of information and to co-ordinate and communicate the information and knowledge in an efficient way. Professional work is becoming more and more technical in its nature and has to be adapted to the opportunities and limitations that the technologies and the information systems give. When information systems are introduced within professional work the professions need to feel comfortable and competent in using the information systems in different situations. The people’s understanding of the information systems is very important in order to interact with them (Orlikowski, Gash, 1994).

The L professions perceive relatively large problems in the use of information systems, as they feel they don’t have enough knowledge and competence within the design and use of information systems. They see themselves as poorly educated when it comes to information systems and information technology. Therefore they are asking for more education within this area of knowledge. L professions also wish to have a greater influence when choosing and designing information systems. Many people within L professions feel frustrated when problems occur when they are using the current information systems in their work. This
implies that the L professions distrust the information systems. L professions feel that they need to acquire more knowledge and competence in order to manage the use of information systems in their work. This is needed in order to bridge the knowledge gap that is prevalent in the activities that are performed at work, related to the information systems. In a wider perspective the low degree of distrust in information systems can have an impact on the L professions ability to make assessments and decisions in their work. If the L professions do not have the possibility to use information systems in an efficient and effective way, they run the risk of not being able to fulfill their work efficiently. Therefore it is important to try to create complete trust for the professions to use information systems in their work. Human errors can sometimes be the case when wrong assessments have been made, but if the L professions do not trust in the information systems the work can be more risky (Perrow, 1984; Reason, 1990). The L professions need to feel complete trust in the information systems in order to feel that they have control in performing their work. The T professions demonstrate a higher trust to information systems than the L professions do. This situation is of course related to the T professions orientation to technologies and their use in the work. They have also been trained within their education to use technology of different kinds in their future work. This culture within the T professions therefore plays an important role (Kuhlmann, 2006).

To have the opportunity to be included in systems development processes and to have an active engagement in the development of information systems is more or less a pre-requisite in order to gain trust in information systems. This also implies that information systems could be designed better to support the work activities needs and requirements. If individuals within T professions see a new way to manage information, it is not unusual for the specific individual to start to design an information system on his or her own initiative. Different information systems will in this way continually be developed at the airbases. Sometimes the information systems are developed with the very same intentions and functions, but are designed differently. Then the different information systems can be implemented at different airbases, but often the information systems will be sent to a development team in order to be evaluated. During the evaluation process the development team decides on the information system best suited for the function, and this information system will be implemented within the Airforce. The trust in the information system will then be maximized in this way, because different information systems will be evaluated against each other, together with the fact that the evaluation is carried out by the T professions themselves, as they are both involved and engaged in the work practice and at the same time they are involved and engaged in the information systems development.

Normally the T professions do not meet any special problems in integrating information systems in their work but however, they instead feel the barriers and tensions in the information and knowledge transfer between the different professions, even if the potential has increased for collaboration when using information systems.

Previously, at the beginning of this study the L professions within the different departments had the opportunity to develop and design their own information systems to some extent and this could be done from the needs and requirements existing in the practical work. If their own developed information systems are seen as useful for more than a few people within the L professions, the information systems would spread to other departments and even to other hospitals. The healthcare organisation has now changed its strategy, whereby they are no longer allowed to develop and design their own information systems.
6 Conclusions
Different types of professions can be said to have different characteristics. The different professions differ according to the authority and independency. L professions are characterised as having more authority and independence than T professions. Barriers are more obvious on a collective level for the L professions when it comes to the design and use of information systems. Barriers between the T professions are more related to the professional knowledge areas. Collective knowledge is most important within T professions, whereas individual knowledge is considered more important within L professions. The professional types have different attitudes to their work and to information systems. T professions are more technically orientated and perceive information systems as a natural part of their work. L professions are more interested in human caring, where information systems are often perceived as difficult to relate to the work practice. Making sense of information systems is influenced by the involvement and engagement in the information systems development processes, where it is natural for T professions to be involved. L professions do not have the same opportunities to be involved and engaged in the information systems development processes, This situation results in lower level of trust in the information systems for the L professions, compared to the T professions that show a high level of trust in the information systems.

References


Mathiassen, L, Robertson, M, Swan, J, 2003, Cracking the Code: The Dynamics of Professional Knowledge, European Knowledge Management Conference


Orlikowski, W, Gash, D, 1994, Technological Frames: Making Sense of Information Technology in Organisations, ACM


Pfadenhauer, M, 2006, Crisis or Decline?: Problems of Legitimation and Loss of Trust in Modern Professionalism, Current Sociology, Vol 54, No 4, pp 565-578


Repstad, P, 1999, Närhet och distans, Student litteratur


Svensson, A, 2009, *Informations system i professions orienterat arbete*, Licentiate Thesis in Informatics, Department of Applied Information Technology, IT-University, University of Gothenburg


