ABSTRACT
Construction projects are complex systems where knowledge is extensively used. Particularly, in preconstruction, innovative knowledge is critical success factor. In traditional construction contracts, preparation overlaps with bidding and continues with definition of: performance, methodology, quality, supply, site preparation and works introduction. Integrated contracts are more complicated due to economic, social and design issues that must be taken in account. Above all, this issue is more critical in the developing countries like Kosovo, where basic management principles are not applied as needed. This paper presents a study that designs a Knowledge Management Framework (KMF) that supports knowledge utilization in the preconstruction phases. The models of the KMF are made with Soft Systems Methodology (SSM) based on the cases of “Hidroterm” Construction Company. The proposed Framework shows that knowledge is not managed purposefully if the overall system of the supportive activities related to knowledge use is missing. The study contributes for the development of construction projects in the developing countries by creating opportunities to better use knowledge assets and thus increase overall performance of the construction industry.

KEY WORDS
Preconstruction phase, knowledge management, Soft System Methodology, system analysis, developing countries.

INTRODUCTION
This study analyses a problem of managing knowledge during the preconstruction phases of the construction project. Having in mind that preconstruction phases are knowledge extensive, the assumption relying in this study is that appropriate framework is necessary to support knowledge use and its management. Search for this framework was oriented toward human activities and not toward structural processes. It has been supposed that peoples behaviour and attitudes are main factor to utilize knowledge management (KM) functions. The framework has been foreseen as specific human activity system which supports project team to implement KM functions during the preconstruction phase (purposeful interventions of project team to enable KM principles). The second condition for the development of the framework was that it should cover holistically all issues that are controlling knowledge flows in a preconstruction phase. To develop this framework, soft system methodology was used as appropriate method. This problem was developed and analysed within a particular case of “Hidroterm” one of the biggest construction companies in Kosovo. In this company knowledge was used on ad-hoc basis without any systematic approach and even without having awareness about needs and necessities. The proposed framework consists general principles and can be adopted in different projects as well as different working environments, depending on the scope of the work, IT infrastructure and on KM capacities.
STUDY BACKGROUND
Construction projects are complex systems that require extensive preparations. In general, these projects are covering the phases of: conceptual studies; engineering and design; procurement and construction; and commissioning and start-up (Corrie et al. 1991; Barrie & Paulson 1992). First phases are characterised with: investigation, feasibility and preparation of technical and administrative documentation. This period of activity in the construction project that continues from the project initiation until the start of execution has been identified as Preconstruction.

Preconstruction phases are important to ensure quality of works, financial effectiveness (Gidado 2004) and reduce delays in the beginning that can be accelerated later during the construction (Lyneis et al. 2001). However, contractors are reluctant to concentrate their efforts in these phases as Gidado (2004) states: “Often contractors defer the commencement of any detailed planning until after the contract has been won and before work commences on site (post-contract planning). Again, the time between winning the contract and work commencing on site is often too short to fully plan the whole project in detail.”

The preconstruction phases are knowledge intensive and are based on application of expertise to enable construction planning and design. Under these circumstances, utilization of knowledge is one of the prerequisites for efficient construction. Any missing knowledgeable asset is increasing the risks for delays and financial loses. Therefore, the way how knowledge is treated and ensured is critical for the start-up of construction and use of Knowledge Management (KM) functions are becoming necessity in every project. The figure 1 depicts only part of the elements that are covered in a preconstruction, and links them with necessary KM requirements. The activities related to KM are based on the SECI model (Nonaka & Takeuchi 1995). The figure shows importance of knowledge requirements for overall project management of construction works. This problem was identified in this study as important professional as well as cultural issue. Therefore it has been investigated as “soft” or human activity system rather than as “hard” or technological one.

METHODOLOGICAL APPROACH - SOFT SYSTEMS IN PROJECT MANAGEMENT ENVIRONMENT
The Research problem of this study is to find out: what are human actions that enable utilization of knowledge resources during the preconstruction phase? The purpose of the research is to define a supportive framework that can help managers to organize flows of knowledge and experiences. To define this comprehensive framework, a system analysis was used as most appropriate methodology.

The system analysis was done with SSM (Soft Systems Methodology) as systems approach that describe human activity systems (Checkland & Scholes 1999). SSM belongs to so called “soft” system modelling, as appropriate method for defining non-structured systems of social behaviour which are characterised as messy situations (Winter 2006). SSM follows several methodological steps to draw a picture of human activities within a particular environment (Checkland & Scholes 1999). The core of the method is to define, based on the preliminary problem analysis, models for each of the identified set of actions that relate to human activities purposefully undertaken to complete particular real world issue. For instance, to enable knowledge sharing in a preconstruction phase, the team should define a system to encourage openness and trust among the team members. In general SSM was not used very much in studying project management problems (Winters 2006) and especially practical application of the method is lacking (Crawford et al. 2003). In the construction projects application of SSM is rarely used in relation with KM applications.
The SSM models of the KM Framework (KMF) are based on the case of “Hidroterm” Construction Company where the author of this paper is working as an external consultant. The models are used to create an idealized picture how knowledge should be managed in a preconstruction. The scope of preconstruction in this analysis covers only period from signing the contract until starting the construction works. Design and build case as well as tendering and pre-contract periods have been omitted for practical reasons. However, the developed systems are general and can be used with modifications in any phase before and during the construction.
SUPPORTING FRAMEWORK FOR KNOWLEDGE MANAGEMENT IN THE PRECONSTRUCTION PHASES

Based on the experiences from construction projects, appropriate framework was modeled to depict the activities that should relate to knowledge management deployment. Three layers of modeling have been identified: appreciation (“0” level), processes (levels “1” and “2”) and activity (level “3”). In this paper we have presented only few models from this inquiry.

Two basic models are identifying appreciation layer. First model (figure 2.) is an issue based system that supports KM activities in construction projects. Issue based model is term which was defined from Checkland and Scholes (1999) and covers models that are not related to formal processes but rather with issues that are important for decision makers. This first model shows importance of support, awareness, readiness and knowledge about the benefits that KM can bring for the project. With this model initiative can be developed and champions can be enabled to start KM application. The level of improvement of KM activity is very much related to the overall capacities, IT architecture, and readiness to finance different KM technologies.

Figure 2: An issue based system to support KM deployment

Another model (figure 3.), also part of an appreciation layer, presents a primary based system (according to SSM theory, these are systems related directly to formal activities) that enables start-up of KM activities in construction projects. This system encourages a supportive KM Framework in a Preconstruction phase by defining principal human activities that will enable beginning and initiation of KM deployment!
The last element in the previous system shows the general picture of the Framework which is layered in the lower level “1”. This is a system to set-up KM functions through preparation, activating, and control mechanisms to support permanently knowledge utilization in a Preconstruction phase (see figure 4.).

This model is then divided in the next level into different models which precisely define the initiatives that are necessary to enable functioning of the framework. For instance, in the figure 5, the system to ensure necessary knowledge has been presented. In the beginning of preconstruction phases it is important to identify knowledge needs which we named as Critical Knowledge Needs (CKN). Explicit identification of these needs helps to concentrate on the content and the sources that will support project team to ensure required knowledge.

**PRACTICAL CASE**

Hidroterm is one of the biggest construction companies in Kosovo, although in global terms it has small size of around 300 employees. After 1999, in the period of post-conflict situation the company ensured its part of the market with qualitative and effective work. Their operational units are very reliable with qualitative, independent and cooperative workers. Due to the permanent drop in the construction sector since 2002, and because of the insolvent local clients, Hidroterm developed a policy to compete only for reliable clients who pay regularly like donors or foreign investors. Since, the requests from these foreign clients were to comply with international standards for contract and performance, the Company was in situation to ensure knowledgeable people who can communicate in English, who know international contract procedures, who understand the whole project cycle. Furthermore, each new project was new endeavour where specific knowledge was necessary to enable problem-solving. The author of this paper was part of this supportive expert team and the approach modelled in previous section was applied to ensure better flows of knowledge in the Company. At the same time this analysis enabled comparison of the KM requirements and internal capacities or processes. Furthermore, the analysis identified very important weakness in the organization related to its organizational culture. This problem is discussed in the final stage of the SSM analysis.
Comparison of models with actual situation

Investigated experiences from the case of Hidroterm are compared with proposed models. Comparison was aimed to identify lack of policies and activities related to KM deployment in the preconstruction phase and find a gaps related to overall approach toward knowledge utilization. The results of the comparison are presented in the table 1.
Table 1: Comparing ideal with real world models

<table>
<thead>
<tr>
<th>Important issue</th>
<th>Proposed model</th>
<th>Actual situation</th>
<th>Proposed Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>KM Awareness and necessity</td>
<td>High level of commitment to use KM</td>
<td>Knowledge and awareness about KM are missing</td>
<td>Build up awareness program and support KM champions</td>
</tr>
<tr>
<td>Identified needs for Knowledge in the beginning of the project</td>
<td>Precise notification and identification of knowledge needs</td>
<td>Ad hoc - intuitive identification and their superficial treatment</td>
<td>Systematic identification of knowledge needs through setting-up formal procedures and practices</td>
</tr>
<tr>
<td>Meetings and social activities - Socializing knowledge</td>
<td>Purposefully established systems of meetings and social activities</td>
<td>Lack of team facilitation and lack of regular meetings</td>
<td>Develop appropriate plan how to socialize team members and establish precise schedule for the meetings</td>
</tr>
<tr>
<td>Externalizing Knowledge</td>
<td>A system to convert experiences in explicit knowledge</td>
<td>Converting system installed but is not accepted in the company level</td>
<td>Define standard procedures how to transfer experiences into standard forms and applications</td>
</tr>
</tbody>
</table>
## Knowledge and Experiences

Knowledge and experiences are accumulated from different projects into better solutions. Gathered experiences and knowledge are lost. On the company level, develop procedures to permanently combine gathered knowledge into a central knowledge warehouse.

<table>
<thead>
<tr>
<th>Combining knowledge</th>
<th>Knowledge and experiences are accumulated from different projects into better solutions</th>
<th>Gathered experiences and knowledge are lost</th>
<th>On the company level develop a procedure to permanently combine gathered knowledge into a central knowledge warehouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internalizing knowledge</td>
<td>Regular transfer of knowledge and experiences through the company</td>
<td>Lack of awareness about the opportunities that internationalization of knowledge brings</td>
<td>Find a way to show how achieved results and created knowledge should be presented and discussed with other members of the company</td>
</tr>
<tr>
<td>Knowledge Base</td>
<td>Permanent accumulation and refinement of knowledge</td>
<td>Doc collected on individual basis, not collected and not transferred</td>
<td>Develop an IT system to enable easy accumulation and distribution of knowledge</td>
</tr>
<tr>
<td>Learning system</td>
<td>Sustainable learning system in function</td>
<td>Reluctant to learn permanently due to the lack of self-confidence</td>
<td>Establish a supportive system to enable learning of the issues that can ease the application of KM in the preconstruction phase</td>
</tr>
</tbody>
</table>

### Stream of Cultural Analysis

When the models are developed and compared, SSM continues with a stream of cultural analysis. This part covers three different implications in the system: intervention, social, and political analysis. According to Checkland & Scholes (1999), analysis of intervention primarily identifies three important stakeholders in the project: the client, the problem solver, and the problem owner. In this study, the client is the Hydroterm Construction Company. Would be the problem solver is the author of this paper or consultant. Problem owner is the staff in the company. Social analysis investigates links between Roles-Norms-Values. The roles in Hydroterm are identified but are not explicitly maintained in terms of reflection and interventions or changes. Roles as well as norms are dominantly implicit, created during the establishment of the company and rooted in the family or/friendship relationships. They have created a specific culture which is very reluctant to managerial interventions. When having in mind that the overall management is not oriented towards efficiency but rather toward operational goals, the innovations related to KM use are very difficult to be implemented. Although, the values in Hydroterm enabled creation of respectful company image, they are not cultivated and in several cases, they have been neglected. This culture of the Company created a situation where changes are happening only in the projects which are managed from knowledge champions and in most of the cases, good practices are not becoming part of the company procedures. The results of the study showed that until the power is distributed between the family members who are at the same time reluctant to utilize modern managerial principles, the company risks stagnation.

### Conclusions

The preconstruction phases are depending on appropriate and innovative knowledge. To ensure knowledge needs and to manage appropriately this knowledge, construction companies need to establish some kind of human activity framework. Results of the study shows that knowledge is not managed purposefully if the overall system of the supportive
activities related to knowledge use is missing. Furthermore, project team need to have awareness and appropriate knowledge about the opportunities that KM is offering. As a background, the company should have basic management principles, initiative or KM champions, and permanent support form the top.

From the methodological point of view of using SSM, through the definition of desired models and their comparison with existing situation, important gaps are identified and this can be very useful for finding the necessary interventions. However, this approach can contribute also for the development of construction processes in the developing countries by creating opportunities to better use knowledge assets and thus increase overall performance of the construction industry.

REFERENCES