Uncovering hidden process assets: A case study

Maria-Isabel Sánchez-Segura[1] · Alejandro Ruiz-Robles[2] ·
Fuensanta Medina-Dominguez[1]

Abstract The information technology (IT) industry is not
making the best possible use of its intangible process assets.
The proposed process assets classification is grounded on the
experience existing in the intellectual capital field. IT compa-
nies can use this classification to better identify and classify
their process assets, thereby gaining an overview of the ele-
ments on which their processes depend and incrementing their
intellectual capital. Two IT companies participated in a case
study in which company chief executive and chief operations
officers used the proposed classification, which they consid-
ered very useful, to identify a set of important process assets
not previously taken into account.

Keywords Knowledge management · Intellectual capital ·
Process improvement · Process assets · Intangible process
assets

1 Introduction

A cornerstone of the long-term survival and sustainability of
any organization is the status of its intellectual capital (Tsai et
al. 2012; Khan 2014). Data correlations confirm the linear
relationship between a country's intellectual capital and gross
domestic product (Ståhle and Ståhle 2012), which is increas-
ingly recognized as a factor of production (Abhayawansa and
Guthrie 2014). Nevertheless, while the strategic role played by
intellectual capital in value creation is well established in ac-
ademia, it is not widely exploited in the corporate world
(Demartini and Paoloni, 2013).

Intellectual capital targets the valuation of intangible assets,
which are all the non-tangible resources contributing to the
delivery of a company's value proposition (Stewart and
Ruckdeschel 1998; Marr 2008).

Axtle-Ortiz (Axtle-Ortiz 2013) offers an excellent compen-
dium of intellectual capital definitions from 1971 to the pres-
ent. Angel and Ortiz (Angel and Ortiz 2006) suggest that the
concept of intellectual capital should be equivalent to intangi-
ble assets. On the other hand, intellectual capital is defined by
Edvinsson (Edvinsson, 1997) as the knowledge that resides in
people, organizations, technology, procedures, customer
relationships and professional skills that give a competitive
advantage. Ross et al. (1998) Edvinsson, 1997) provide an-
other important perspective of intellectual capital. They define
intellectual capital as the processes and assets that do not usu-
ally appear in the balance sheet, on which they do, however,
have an indirect effect.

Taking into account these definitions and the different per-
spectives that they provide, we can appreciate the connection
between intellectual capital, intangible assets, knowledge and
process assets. So, it is necessary to manage intangible assets
or process assets, which are essentially knowledge sourced
from different parts of any organization, in order to address
and take advantage of intellectual capital.

A company will be unable to capitalize upon its knowl-
edge, no matter how much it may have, unless it is accessible
in the form of intangible process assets of proven use to the
organization. On this ground, it is very important to identify

✉ Maria-Isabel Sánchez-Segura
   misanche@inf.uc3m.es

   Alejandro Ruiz-Robles
   alejandro.ruiz@udep.pe

   Fuensanta Medina-Dominguez
   fmedina@inf.uc3m.es

1   Carlos III University, Madrid, Spain

2   University of Piura, Piura, Peru

which intangible process assets should be used and maintained in order to keep the company in good shape.

Process assets describe, implement and improve processes. Some examples of process assets are policies, defined processes, checklists, lessons learned, documents, templates, standards, procedures, plans and training materials. These assets are developed or acquired by organizations in order to meet their business goals and represent investments that provide business value (Software Engineering Institute 2010).

Process assets allow the deployment or improvement of company processes, and their performance determines how well the processes work and projects are executed (Project Management Institute 2013; Software Engineering Institute 2010).

The need to manage process assets, and especially their storage and reuse, has been discussed in the literature (Buco et al. 2010; Caralli et al. 2010; Roberts 2002; García et al. 2011; Heredia et al. 2013; Software Engineering Institute 2010). Industry has not, however, advanced far enough in their practical implementation to identify and classify process assets and boost company business value (Demartini and Paoloni 2013), even though the need was recognized back in 2007 (Dutta 2007). The importance of identifying and classifying intangible process assets is critical for knowledge-intensive fields like IT, where knowledge is seen as a key intangible process asset (Kaltio 2001; Beruk 2010; Kpmg 2009; Verdun et al. 2011; OECD 2011; Ramona-Diana 2011). It is important not to confuse software assets management (SAM) with software process assets identification and classification. There are some commercial applications for SAM, including Flexera Software®, InvGate Assets®, Spiceworks IT Desktop®, Microsoft SAM®, etc. However, these applications focus exclusively on software assets as programs running on the organization's systems, which represent only a few of the intangible assets possibly influencing an IT organization's intellectual capital. Software process assets are much more than that; this is why we focus on process asset identification and classification and not just on what is popularly known as SAM.

Several process asset classifications have been proposed in the literature. Some are based on the most recognized branches of intellectual capital (Kogu and Zander 1992; Hall 1993; Blackler 1995; Stewart and Ruckdeschel 1998; Nonaka et al. 2000; Housel and Nelson 2005; Marr 2008). Other works (Li and Tsai 2009; Li et al. 2010) adopt a dynamic classification of intangible assets throughout their life cycle rather than a static view of the classification built when the asset was classified for the first time. Finally, other works focus on the importance of intangible process assets in the software field (Aboody and Lev Source 1998), assess the impact of human capital intangible assets in Egyptian software companies (Seleim et al. 2007), specifically highlight the cultural classification of intangible assets governance in IT (Verdun et al. 2011).

Any of the above-mentioned classifications could be of use in IT organizations, but the fact is that they have not been deployed in real cases. This paper seeks to improve the identification of process assets by classifying them as intangible assets in the information technology (IT) industry. IT is a knowledge-based industry which is extremely sensitive to the value of its intangible process assets, but not openly aware of their value. A more comprehensive understanding of such assets will enable an organization to improve their management in order to increase its intellectual capital and take a first step towards making better informed strategic decisions. We manage process assets according to the principles that intellectual capital management applies to intangible assets.

There are many intellectual capital models. These models have a key handicap in the process of identifying and classifying intangible assets (Li et al. 2010): perceptions of the intangible assets of worldwide organizations vary according to context (Axtle-Ortiz 2013). For this reason, we believe that intangible assets must be identified and classified for each company ad hoc, although this process should be structured to ensure efficiency.

We believe that the possible consequences of organizations not paying proper attention to process assets are as follows:

- The benefits of implementing and improving processes are limited because organizations do not identify all their process assets. Therefore, they do not see the full picture regarding all the assets that could help to implement and improve their processes, and meet their business goals.
- Organizations miss out on part of their intellectual capital because they do not classify process assets as intangible assets.

The remainder of this paper is structured as follows. Section 2 reports the experience of two IT companies that participated in a case study developed to investigate whether it is possible to identify and classify process assets in a more comprehensive way. This is highly beneficial in order to avoid the shortcomings described above. Finally, Section 3 describes the future lines of work and outlines the conclusions.

2 Helping organizations to improve the identification and classification of their process assets as part of their intellectual capital

Our proposal is based on the classification suggested by Marr (Marr 2008) and described in Table 1. It is founded on the major classifications of intangible assets from the intellectual capital field into the structural, human and relational categories (Edvinsson 1997; Marr 2008; Stewart and Ruckdeschel 1998), which are used to identify and classify all sorts of intangible company assets. These categories are further

Table 1 Proposed process assets taxonomy

Structural Assets Category (Company assets belonging to the organization)	
Knowledge Documents	The knowledge captured in any kind of physical or digital document.
Tools	Tools used to manage process assets or processes.
Knowledge Management Culture	How the company manages, i.e., creates, transfers, and uses, knowledge.
Human Assets Category (the living and thinking part of the company)	
Knowledge	The knowledge of the members of the company regarding the processes or any company processes assets.
Experience	The experience of company members at performing company activities or regarding any process assets.
Competences and Skills	The competences and skills required by people to do their job.
Relational Assets Category (the relationships between the company and any external person or company)	
Relationships with clients and users	The formal and informal relationships with clients and users.
Relationships with suppliers	The formal and informal relationships with suppliers.

divided into several subcategories that we propose according to which intangible assets from IT companies can be easily classified. Marr's is a broad and general proposal, while our approach specializes in IT and has been tested on this field. The identification and classification of intangible assets is new and valuable in the field of IT.

The classification enabled us to expand the identification of process assets at different IT companies, identifying process assets that had never been taken into account as such before. They were then classified as part of the companies' intellectual capital.

In this paper we report the results of a case study developed at two small and medium-sized IT enterprises with no more than 25 employees. We worked with the chief executive officers (CEOs), chief technology officers (CTOs) and chief operations officers (COOs) of both companies because they have a more comprehensive view of their company's processes. Each case study was divided into two phases. In the first phase the companies were asked to identify process assets related to no more than five of their main processes according to the CMMI definition and explanation of process assets (Software Engineering Institute 2010). This took about four hours. In the second phase the proposed process asset classification was presented to the same participants, who were asked to use the classification as a guide to perform the same activity. During this phase, we were on hand in order to answer questions regarding classification categories and subcategories. This phase took the companies about 10 h. The companies worked on the same processes in both phases.

To illustrate the benefits of using the proposal to improve the identification and classification of process assets, the results of its application at two companies are explained in detail below.

2.1 Case study 1: Company a

Company A (etips.cl) is a software development company specialized in mobile and web applications. It is located in Chile and has a distributed team based in Chile, Peru and Venezuela. It is expanding quickly due to customer satisfaction and the good economic conditions in the region. Consequently, one of its main challenges is the rapid induction of new developers, who require training in the processes and technologies used within the company, without compromising product quality.

Company A was aware of the importance of processes. However, it did not know what role process assets play in training new employees. With the aim of encouraging new developers to use company processes, the organization started to identify all the elements that it considered to be related to the description, implementation and improvement of its processes. This first round was performed by the CEO and COO, who identified twelve tools that they considered crucial for performing five of its most critical processes: estimation and planning, new developer training, requirements elicitation, programming and server maintenance.

After this first round the process asset classification was presented to one of the company's founders and its COO, who re-identified process assets using the classification as a guide. This new round took about 10 h and resulted in the identification of 36 new process assets that had not been identified in the first round, as shown in Fig. 1. Table 2 shows all the process assets identified at Company A.

Within the Structural Assets category, seven documents were identified and placed in the Knowledge Documents subcategory. These documents were used to perform processes like estimation and planning and requirements elicitation. However, the documents had not been considered as process assets until then because of the knowledge gap regarding process assets. These process assets are now recognized as such, and their relationship with process enactment has been specified.

The COO did not manage to identify any more tools than had already been classified in the Tools subcategory. However, he did identify four important process assets in the Knowledge Management Culture subcategory. One of these was the Knowledge Formalization Process, a process performed by project managers at the end of each project in order to capture experiences or lessons learned to improve the knowledge documents or tools. This process asset was important because the quality of the knowledge documents and tools, and therefore the quality of the development processes,
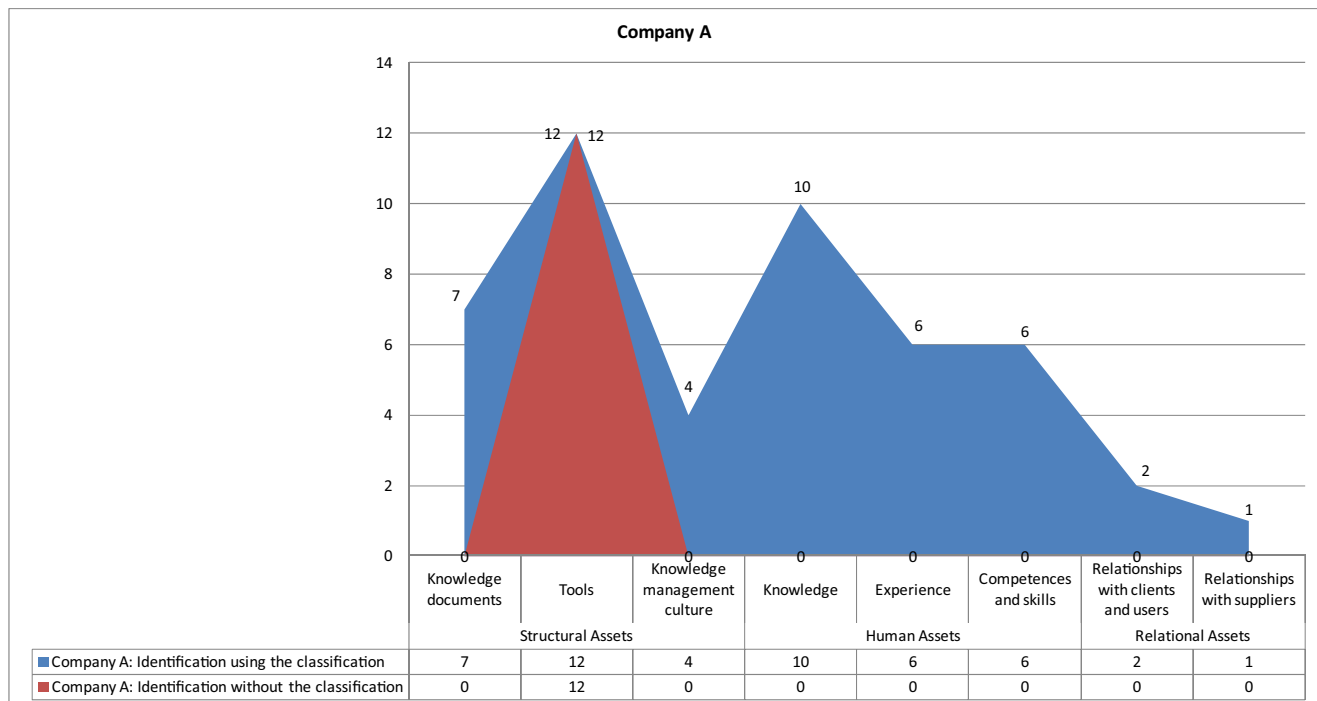
Fig. 1 Summary of process assets identified at Company A

could be undermined over time without the Knowledge Formalization Process. Another asset was Informal Knowledge Transfer, a sort of informal practice where developers interact with each other in order to answer questions. This process asset was important because it rounds out the training process of new developers and fosters the implementation of development processes. Thanks to the identification of these new process assets, the company now pays more attention to rigorous knowledge formalization, and seeks to foster a work environment where there is fluent informal knowledge transfer.

In the Human Assets category, 22 new process assets were identified. In the Knowledge subcategory, the COO identified Knowledge of the Company's Proprietary Components and Knowledge of Web Technologies as process assets: software development projects are based on these technologies, knowledge of which was considered to be an important process asset in order to properly perform the development processes. If new developers do not become proficient in such technologies, development process enactment could be undermined.

In the Experience subcategory, the COO identified Project Planning Experience as an important process asset for satisfactory project estimation. This asset is related to the process asset called Project Cost Projection Document in the Knowledge Documents subcategory, and it is now clearer that both process assets should be taken into account in the project estimation process: the quality of the Project Cost Projection Document and the level of Project Planning Experience are important and necessary to make a good project estimation.

Another process asset in this subcategory was Linux Bash Programming Experience, an important asset for the deployment of Linux servers and the development of certain web applications. This asset was considered important because most new developers do not have the necessary experience and need to be trained and evaluated periodically in order to measure their progress before they can participate in these specific projects. These development processes can only be performed by the most experienced company developers, which is a limitation for the company.

In the Competences and Skills subcategory, the COO identified Communication Skills with Clients as a process asset. This was considered an important process asset because only the people with this skill could be assigned to the requirements elicitation process activity. Failure to pay attention to this issue had resulted in weaknesses in the past. Another identified process asset was Teaching Ability, an important process asset for training new developers. This last process asset caught the COO's attention because he felt that the training process was too slow and took up too much of the trainer's time, causing him to neglect his primary responsibilities. When this process asset was identified, it was found that the problem was that the person in charge had no patience for teaching and did not feel comfortable with the job.

At this point, the COO acknowledged that they had sensed that most of these process assets were important, but had been unable to structure them. Thanks to the classification, they were able to organize the process assets and gain a clear understanding of their importance and relationship to company processes.

Table 2 Process assets identified at Company A

	Identified process assets at Company A	
	Phase 1 (without the taxonomy)	Phase 2 (with taxonomy)
Structural Assets Category		
Knowledge documents		- Client credentials document
		- Project charter document
		- Project cost projection document
		- Project look and feel templates
		- Meeting minutes
		- Amazon utilization report template
		- Requirements capture template
Tools	- Mavelink	- Mavelink
	- Gantter	- Gantter
	- Google Drive	- Google Drive
	- Gmail	- Gmail
	- Cacoo	- Cacoo
	- Skype	- Skype
	- Gtalk	- Gtalk
	- Firefox plugin Web- Developer	- Firefox plugin Web- Developer
	- Zend Studio 9	- Zend Studio 9
	- Google Chrome	- Google Chrome
	- Virtual Box with Windows XP	- Virtual Box with Windows XP
	- Mysql Workbench Mavelink	- Mysql Workbench Mavelink
Knowledge Management Culture		- Knowledge formalization processes
		- Reusable software components development processes
		- Knowledge transfer in testing processes
		- Informal transference knowledge
Human Assets Category		
Knowledge		- Knowledge of company's proprietary components
		- Knowledge of web technologies
		- Knowledge of Linux servers
		- Knowledge of servers architecture
		- Knowledge of UML
		- Knowledge of Mysql
		- Koweldge of. NET MVC Framework
		- Knowledge of Amazon AWS
		- Knowledge of project management areas like accounting
Experience		- Zend Framework 1.2 experience
		- Project planning experience
		- Linux bash programming experience
		- JQuery and Twitter bootstrap experience
		- PHP experience
		- Windows servers administration experience
Competences and Skills		- Communication skills and clients
		- Teaching ability
		- Self-learning
		- Aptitude for documenting code
		- Good writing skills
		- Facility for following programming standards and processes
Relational Assets Category		
Relationships with clients and users		- Formal communication processes with clients
		- Informal communication with clients
Relationships with suppliers		- Amazon Web Services communication channels

In the Relational Assets category, the company identified three assets. In the Relationships with Clients and Users subcategory, they identified Formal Communication Processes with Clients as a process asset because they were helpful for methodically enacting development processes. They had experienced some problems with an important client due to informal

communications in the past. In the Relationships with Suppliers subcategory, the COO identified Amazon Web Services Communication Channels as a process asset because they were important for enacting server maintenance processes and guaranteed the maximum server uptime for clients.

According to the Chief Operations Officer at Company A:

Before using the classification I had no idea just how many process assets there were at our company. They were there subconsciously, but there was no instinctive way of specifying and classifying them… Through the use of the classification, we were able to discover many process assets that had been hidden…

We believe this new way of organizing process assets will help us to conduct a better induction program in order to introduce new programmers to the company and its processes, which is a critical issue due to our current growth… We can now focus on those assets that help us to improve our products and services… We will create new materials such as videos and tutorials to improve the induction of our programmers.

2.2 Case study 2: Company B

Company B (exa.pe) is an IT company specializing in the provision of a learning management system (LMS) to large and medium-sized companies in the form of software as a service and in the development of online learning contents. It operates in Chile and Peru. The development team is located in Chile, Peru and Spain, and the support team is distributed between Chile and Peru. The company's CEO was interested in formalizing some processes that were being enacted based only on the expertise of some company members and in improving other processes that he thought were inefficient.

In a first round the company's CEO started to identify its process assets. As a result he came up with nine tools that were considered important for performing four of the learning management system (LMS) processes: project kick-off, control, LMS development and maintenance, and online learning content development. The process asset classification was then presented to the company's CEO. He was very receptive and enthusiastic because, while reviewing the subcategories of the classification, he identified elements that he thought were important within the company and which had not been dealt with systematically until then. A second round to identify the process assets using the classification took the CEO about 10 h to complete. As a result, he identified 21 new process assets, as shown in Fig. 2. All the process assets identified at Company B are shown in Table 3.

In the Structural Assets category, the CEO identified four documents in the Knowledge Documents subcategory. These documents were used to perform processes such as the project kick-off process, and, as at Company A, had not been considered as process assets until then.

In the case of the Tools subcategory, another process asset, the File Transfer Protocol (FTP) server, was identified. This, along with the previously identified Project Management System process asset, was used to enact the control process, a process carried out to interact with clients during the adaptation and deployment of the LMS and the development of online learning content. Company B was looking to improve interaction with its clients: it recognized that the Project Management System was a constraint because it was not functional and, although it was an easy way to share large files with clients, the FTP server was not an elegant solution. In the Knowledge Management Culture subcategory, the CEO was unable to identify any process asset and recognized that this was a deficiency because the company relied too heavily on staff knowledge and had not done anything to formalize, transfer and reuse this knowledge.

In the Human Assets category, nine new process assets were identified. In the Knowledge subcategory, the CEO identified Development Process Knowledge and Course Development Process Knowledge. These assets were considered critical because the modifications of the learning management system and the development of online learning content relied too heavily on the knowledge of the developers that had served longest at the company; if, for any reason, these assets were not available, the development process slowed down.

In the Experience subcategory, the CEO identified Help Desk Experience as an important process asset for providing adequate support for clients. Again the company recognized that it did not have a good enough support process and depended too heavily on the experience of the help desk people. Another process asset in this subcategory was Development Process Experience. This asset is related to the process asset called Development Process Knowledge. Although the company thought that developers had more than enough knowledge and experience, which is valuable asset within the company, it felt that it was too heavily reliant on individuals for this knowledge.

In the Competences and Skills subcategory, the CEO identified Communication Skills with Clients. This was considered an important process asset because one of the company's key qualifications for becoming the sector leader was its focus on providing excellent customer service. This was a crucial asset for guaranteeing the quality of any process involving interaction with clients, and its specification and relationship to such processes was important in order to maintain process quality and convey the importance of this process asset within the company.

In the Relational Assets category, the company identified seven process assets. In the Relationships with Clients and Users subcategory, it identified Informal Relationships with Clients as a process asset related to the processes involving
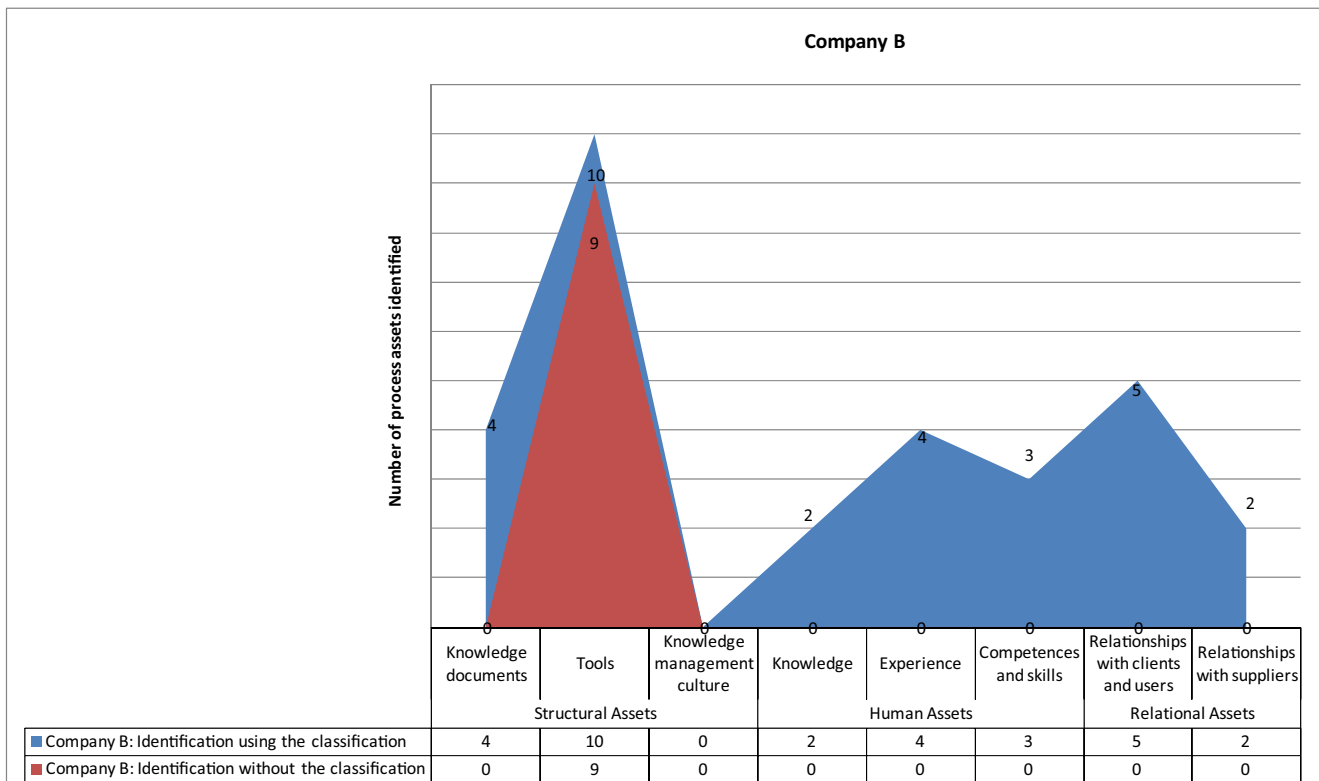
Fig. 2 Summary of process assets identified at Company B

interaction with clients. This process asset was important for maintaining fluent communication with clients. Although the company's CEO wanted to formalize some processes, he recognized that informal communication should continue to complement any formal communication process. In the Relationships with Suppliers subcategory, the CEO identified Telebanking Systems as a process asset. The company relies on these systems to perform the monthly billing processes. Although these processes are not directly related to software development processes, the company wanted to take the related assets into account because they play a critical role in charging customers, and some of the systems were not as good as the company had originally thought.

After identifying the process assets, the company's CEO decided to develop a new LMS. He had been toying with this idea for a while due to some functional and technical system constraints. After it became clear that the development processes relied too heavily on staff knowledge and experience, he decided to start the new development.

According to the Chief Executive Officer at Company B:

Initially we were able to identify only a few general and unstructured process assets within our company. Using the classification, however, we were able to identify really valuable assets, such as human assets, which are not usually taken into account or recognized as being important to the company…

As our company specializes in the management of the organizational knowledge of several companies, our main process assets are experience and relationships with clients built up over the years… Using the classification we were able to formalize and give all company members access to these process assets and thereby put them into their true perspective…

3 Conclusions and future work

Properly identifying and classifying process assets is the stepping stone to achieving business goals. However, the two reported case studies revealed that process assets are taken for granted and their ascribed benefits will not be realized spontaneously unless special care is taken of process asset performance. Even enterprises that have well-defined processes use and manage their process assets without completely understanding their importance and function, and those that do are unable to completely identify all of their process assets and focus on just a subset, mainly documents and tools.

By defining process assets as intangible assets, IT companies can use the proposed process asset classification to identify process assets that usually remain hidden within organizations. And by expanding the number of process assets identified using the proposed classification and classified as part of

Table 3 Process assets identified at Company B

	Identified process assets at Company B	
	Phase 1 (without the taxonomy)	Phase 2 (with taxonomy)
Structural Assets Category		
Knowledge documents		- Kick off meeting document
		- Course content template
		- Service proposal template
		- Service Level document
Tools	- Microsoft Project	- Microsoft Project
	- Skype	- Skype
	- Multimedia design and development tools	- Multimedia design and development tools
	- Microsoft Office	- Microsoft Office
	- Proprietary web project management system	- Proprietary web project management system
	- Email	- Email
	- Learning Management System	- Learning Management System
	- MS SQL Server	- MS SQL Server
	- Microsoft Excel data users templates	- Microsoft Excel data users templates
		- FTP server
Knowledge Management Culture		
Human Assets Category		
Knowledge		- Development process knowledge
		- Courses development process knowledge
Experience		- Help desk processes experience
		- Development process experience
		- Experience in making suitable business proposals
		- Course development process experience
Competences and Skills		- Communication skills with clients at a technical and managerial level
		- Empathy with clients
		- Telephone communication skills with prospective clients
Relational Assets Category		
Relationships with clients users		- Informal relationships with clients
		- Responsibilities of clients in each project
		- Courses development progress reports
		- Minutes of meeting with clients
		- Amazon Simple Email Service (SES)
Relationships with suppliers		- Telebanking systems
		- Detailed providers service information

their intellectual capital, IT companies will have a more comprehensive view of their process assets, increasing the understanding of which assets could affect operations and process improvement and add value to the organization's intellectual capital.

The next step, on which we are now working, is the alignment of process assets with company business goals, as well as process asset assessment in order to help companies make decisions about how to increase the value of their assets.

An expected future benefit for companies is the recognition of their process assets as part of their intellectual capital, which will result in the immediate increase in the value of their intellectual capital. The very next question facing IT companies that have recognized the importance of intellectual capital is: What is your

intellectual capital? After identifying the previously hidden process assets, companies will be able to answer this question, increasing the number of their intangible assets and therefore the value of their intellectual capital.

Although companies recognize the importance of identifying and classifying their process assets as part of their intellectual capital, a proper assessment of the value of company intellectual capital will be required in order to provide quantitative proof of this improvement.

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Dr. Maria-Isabel Sanchez-Segura has been a faculty member at the Carlos III University of Madrid Computer Science Department since 1999. Maria-Isabel holds a PhD in Computer Science (2001), an MS in Software Engineering (1999) and a BS in Computer Science (1997) from the Technical University of Madrid. Maria-Isabel is a Knowledge Management Institute Certified Knowledge Manager and IEEE Senior Member. She leads the research line on Processes and Information Technologies for the Governance of Intelligent Organizations (promise.sel.inf.uc3m.es). At present she is the technical coordinator of the Spanish point of contact of the European Center for Women and Technology and is a member of the CEPIS (Council of European Professional Informatics Society) Women in ICT Task Force.

Alejandro Ruiz-Robles holds an MS in Computer Science from Carlos III University of Madrid and is faculty member at the University of Piura. His research interests include software engineering and knowledge management. He is a member of the IEEE Computer Society.

Dr. Fuensanta Medina-Domínguez holds a PhD in Computer Science and a BS in Computer Science from the Carlos III University of Madrid, Spain. Fuensanta is Knowledge Management Institute Certified Knowledge Manager. She has been working in the software engineering field since 2000 and has been a faculty member of the Computer Science Department at the Carlos III University of Madrid since 2004, where she is an associate professor. She has authored several papers published in journals such as IEEE Transactions on Education, IEEE Software, Journal of Systems and Software, Information Sciences, etc. Also, she has authored papers presented at international conferences specializing in her research fields. Her research interests include: knowledge management, knowledge reuse, intellectual capital, software engineering focusing on processes, methodologies, software process improvement and education and training, global software development, computer supported collaborative work.