
Assessing strategic knowledge assets in e-business

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Abstract: Capabilities and their underlying knowledge assets represent a major competitive resource for knowledge-intensive organisations such as e-businesses. The research presented in this paper utilises a series of case studies to identify the key knowledge assets for e-businesses. The paper suggests the Knowledge Assets Map as a framework to identify and manage key capabilities and key assets in today's economy. The Knowledge Asset Map identifies the following six areas as critical: stakeholder relationships, human resources, physical infrastructure, culture, practices and routines, and intellectual property. Furthermore, the paper provides managerial guidelines to design knowledge assets metrics.

Keywords: Intangible assets; intellectual capital; knowledge management; performance measurement; knowledge-based organisation; e-business.

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1 Introduction

Knowledge assets represent the foundation of a company's capabilities. Capabilities in turn determine the performance of the processes necessary to execute a company's strategy. In today's turbulent business environment, with accelerating business cycles and a steadily increasing rate of innovation sequences, managers need tools and techniques to manage their capabilities and therefore their knowledge assets.

E-businesses rely even more heavily on their capabilities and knowledge assets than more traditional brick-and-mortar companies because they mostly provide services and intangible products. The volatility in their market capitalisation reflects that the assessment and evaluation of knowledge intensive e-businesses represents a very difficult task.

Performance measurement and management systems provide managers with meaningful tools to understand how well their organisation is performing and help them to decide what areas need their attention. A famous homily underlining this statement is that 'you can't manage what you don't measure'. The definition and implementation of measurement systems which allow measurement of a company's knowledge assets, and therefore their capabilities, is of fundamental importance for e-businesses. It is not possible to manage organisational knowledge assets and capabilities if a company does not assess them [1,2].

The matter of knowledge assessment is a topic of growing interest for practitioners and academics. In fact, in recent years considerable attention has been paid to the meaning, the objectives and the approaches towards organisational knowledge measurement. Consequently, in the management literature it is possible to identify different approaches to knowledge assessment. These appear to be mainly focused on the evaluation and external reporting of the company's intellectual capital, trying to explain the growing gap between the traditional book value and the market value [1-4].

Starting from the specific knowledge assessment need of e-businesses, case studies are used to identify a set of key capabilities and the corresponding knowledge assets for knowledge intensive e-economy organisations. The result of the case research together

with the insights of a literature review about the intellectual capital assessment are used to outline a framework, the Knowledge Assets Map, to support managers in identifying and monitoring the key knowledge assets of e-businesses. This framework is accompanied by the identification of a set of managerial guidelines to design knowledge assets metrics.

2 Knowledge assets in today's economy

In today's complex and turbulent business environment companies are required to be flexible, highly innovative and able to develop pro-active strategic approaches. To reach these aims many organisations have realised that knowledge (underlying capabilities) represents the most important factor in creating economic value since it underpins the firm's overall performance [5–13]. Webber writes in his *Harvard Business Review* article 'What's so new about the new economy?' that the revolution in information and communications technologies makes knowledge the new competitive resource [14].

Today's economy is characterised by two main aspects: the fast evolution of ICT and the recognition of knowledge as a fundamental strategic lever for a company's competitiveness. However, organisations are beginning to recognise that technology-based advantages are transient and that knowledge assets represent a much more sustainable competitive advantage. Thus, knowledge assets and their maintenance, are essential resources.

In order to better manage their business performance, organisations need to assess their knowledge. Knowledge shapes the foundation of a company's performance and its assessment provides a picture of the development capabilities of a company. This is a topic of fundamental importance, particularly for e-businesses that often have few physical assets [15]. These companies, considering the nature of their products is mainly intangible or services, are realising that they are knowledge-intensive companies and their performance is deeply affected by their knowledge assets and knowledge processes. Thus, for e-businesses it is becoming important to report and evaluate their knowledge dimensions which underpin their capabilities. In particular, managers need to assess the e-businesses' knowledge dimensions either to value the organisation's knowledge assets, so they can communicate the company's value to the outside world, or to measure knowledge assets in order to internally manage their business performance. Therefore, it is possible to identify two different kinds of knowledge reports with separate functions:

- external reports that aim to communicate the company's value
- internal reports, as internal managerial information, which address the assessment of a company's knowledge stock.

It is important to point out that for external reporting the traditional balance sheet alone is no longer sufficient because it only takes into account the tangible knowledge assets, disregarding the intangible knowledge assets. Recently, many articles and books have been written on intangible assets or intellectual capital that refer to the large difference between a company's conventional balance sheet value (the book value) and its market value [15–18]. To explain these gaps between book value and market value different reasons have been provided. Various rationalisations claim that the gap between book and market value is either due to knowledge, the brand or the ownership of standards, but

in each of these cases it is due to the exploitation of specific knowledge. As knowledge represents a resource that forms the basis of business performance, a new challenge arises: how to evaluate the organisational knowledge assets in order to manage them.

The attempt to operationalise the concept of knowledge has led practitioners, as well as academics, to define new concepts and approaches in order to identify, classify and manage the knowledge resources of organisations. In particular, the concept of intellectual capital (IC) has emerged as a key concept. In recent years different definitions of IC have been provided in the management literature. These mainly consider IC and intangible assets as interchangeable concepts [1–4, 17–22]. It is important to point out that most of the proposed classifications of IC appear to be aimed principally towards a market evaluation of an organisation's knowledge assets. They appear to be intended to help analysts understand the gap between the book value and the market value of companies in the new economy. In fact, the different definitions lead to the following equation: $\text{Market Value} = \text{Book Value (Monetary Capital} + \text{Physical Capital)} + \text{Intellectual Capital}$. This equation explains the differences between the market value and book value of knowledge-intensive companies like the e-businesses for which the IC is even bigger than their tangible assets.

The IC approach appears to be particularly useful for external accounting purposes, since it allows separation of all assets for which it is easy to provide financial evaluation from those that are, due to their intangible nature, inherently difficult to evaluate in monetary terms.

For internal reporting purposes the IC measurement is about knowledge-management activities. In fact intellectual capital represents the company's knowledge assets which enable them to perform their business processes. Knowledge assets can be defined as assets of a company, which embed fundamental knowledge and which lead to future economic benefits for the company. Knowledge assets can be either tangible or intangible. The tangible knowledge asset is an asset with a physical nature which has a critical role in the business and embeds specific knowledge to carry out the organisational processes. It can be equivalent to some of the traditional fixed assets of an organisation such as physical infrastructure and information and communication technology. The intangible knowledge asset adopting the International Accounting Standard Committee's interpretation can be defined as follows:

“an identifiable non-monetary asset without physical substance held for use in the production or supply of goods or services, for rental to others, or for administrative purposes. It is a resource,

- 1 controlled by an enterprise as a result of past events
- 2 from which future economic benefits are expected to flow to the enterprise.” [23]

Further interpretations can be found in the context of knowledge management. Within this discipline the intangible assets are analysed from different perspectives [1–4,20,24]. Hall [22] divided intangible assets into intangible properties and intangible resources. The intangible property can be defined as knowledge related to legal ownership, for example patents, trademarks, copyrights, trade secrets, registered designs, brands as well as computer software, contracts and databases [25]. Instead, intangible resources are mainly formed by individuals' experience and organisational routines and relational resources such as reputation, client loyalty, as well as all the firm's relationships [6,26–28]. The literature provides further methods of classifying intangible assets. One of

the frequently quoted classifications is the model proposed by Skandia [21,3]. In order to evaluate its market value Skandia proposed to split its market value into financial capital and intellectual capital, the latter is considered to equate to the firm's intangible assets. To identify the components of their intellectual capital, it has been subdivided into know-how of the workforce, i.e. human capital, and other intangible assets embedded in the organisation itself called structural capital. Structural capital can be further subdivided into customer capital, e.g. the value of customer relations and brand, and organisational capital. The latter can be further broken down into process capital, related to the procedures and routines of the company's internal processes, and innovation capital, that represents the enablers to innovate products and processes. The Skandia approach, therefore, splits intellectual capital into the following four categories: human capital, customer capital, process capital and innovation capital. Another largely adopted model to understand intangible assets is Sveiby's Intangible Asset Monitor [17,18], which is also mainly aimed at evaluating intangible assets for the purpose of external reporting, i.e. to assess a company's market value. It is based on three categories of intangible assets: intangibles related to the internal structure, those related to the external structure, and intangibles represented by competencies of individuals. Internal structure includes features such as intellectual property, patents, copyrights, corporate culture, management processes, networking systems (i.e. computer and administrative systems). External structure contains relationships with customers and suppliers. Employee competencies are related to human capital that in turn take into account all the know-how embodied in the individuals working in the firm [29].

The concept of knowledge assets is important since it shows that the company's business processes are the result of the combination of tangible and intangible assets. Often the role of intangible assets can only be explained with reference to tangible assets. Business processes that are the result of the integration of specific technologies and experienced individuals provide an example. The value of the intangible assets, such as individual know-how, can only be understood by taking the characteristics and utilisation of certain technology into account. Changing technology could result in certain intangible assets losing their value, since new technology could require different abilities.

In order to understand the composition of the capabilities and underlying assets of today's e-businesses a series of case studies were conducted to analyse and identify the key assets and capabilities in the e-business environment. The next section of the paper will discuss the main insights of the case studies of three e-businesses to identify the key knowledge assets underpinning their capabilities.

3 Key capabilities and knowledge assets – case study insights

Successive case studies were carried out at three e-business companies. In a series of semi-structured interviews with the executive management of these companies the real strategic capabilities of each company were explored. In these case studies some general information about the company was collected first. Subsequently, a description of the company's strategy and the relevant capabilities was drawn up before the underlying knowledge was discussed.

The data was collected in a series of interviews with the Managing Director and HR Director of Intershop UK, the Managing Director of Lycos UK Ltd and the CEO of

Jungle.com. A brief introduction of the case study companies at the time of the research is provided below.

Intershop is one of the world's leading suppliers of sell-side business-to-business e-commerce software solutions. They employ about 1000 people in offices around the globe and sell their products in more than 100 countries. For their enterprise customers they developed Intershop Enfinity, an e-commerce application that allows their customers to sell on the internet and enables integration with existing business systems. Intershop's other products – Intershop 4 Hosting, Merchant and e-pages – give Application Service Providers (ASPs) the ability to provide a range of e-commerce hosting solutions. Furthermore, service and support for Intershop products is provided through their own consulting organisation.

Lycos UK Limited is an e-business that offers users a full-service web destination complete with search tools and navigation resources, personalised services, chat, an industry leading online shopping area and free e-mail. Lycos UK Limited is part of the multimillion Dollar Lycos Network, which is the world's number one provider of electronic community and includes the second most visited 'hub' on the web. Lycos was launched in 1995 as a search engine and since then steadily expanded to include chat-rooms, e-mail, online shopping, home page building tools, and many other services. Today Lycos includes the website building service Tripod and the directory service WhoWhere as well as some of the web's most recognised sites including hotbot.com, gamesville.com and hotwired.com.

Jungle.com is a £100 Million online business with 307 employees based in the UK and owned by Great Universal Stores. Jungle.com was launched in August 1999 with the largest internet give-away. The e-tailer sells PCs, computer peripherals and software, as well as music, videos and brown goods. In September 2000 Great Universal Stores, owner of the Argos catalogue chain, acquired the company.

In the following sections the paper will discuss the themes that emerged from the case studies to identify some of the most relevant knowledge assets underpinning the e-businesses' capabilities. They are used together with the results of a literature review on IC measurement to form the basic structure of a knowledge asset classification framework.

3.1 Stakeholder relationships

Interviewees of all three case study organisations stated that relationships with their stakeholders are key assets and maintenance of these relationships is a core capability of those e-businesses. Intershop has strong partnerships and strategic relationships with a global network of solution providers in order to ensure that their customers' needs are being met world-wide. Their partnerships include alliances with major system integrators, technology partners, internet marketplaces, and hardware and software platform providers. For Lycos the relationships with external advertising companies, agencies and content providers are key assets. In fact, Lycos considers brand management as a key knowledge asset in order to drive traffic to their virtual ventures. Jungle.com has build a strong relationship with their suppliers in order to be able to jointly drive new sales. In their mission statement Jungle.com indicate that they want to become the best for their employees (team members as they call them), customers, suppliers and investors. This also verifies the importance of alliances identified in the Value Creation Index, the result of a yearlong joint research by Ernst & Young, Forbes ASAP and the Wharton School's

Research Program, which identified the five drivers for corporate value in e-commerce firms as follows (in rank order):

- 1 alliances
- 2 innovation
- 3 eyeballs (usage traffic)
- 4 brand investment
- 5 stickiness (minutes spent on the website) [30].

3.2 Human resource

The employees with their skills, motivation and commitment were also key to all three companies that were interviewed. Intershop emphasised the joint effort of the young and energetic team which allowed them to create an entrepreneurial spirit and enthusiasm as one of their key assets. In a very similar way Lycos describes team work as one of their key assets. Moreover, as a result of identifying brand management as a key asset underpinning their strategy Lycos looked into their brand management capabilities. They discovered that only a few individuals, the brand managers, have the majority of the brand skills and carry out the brand building processes. These brand managers handle the communication of the brand as well as the press releases and they coordinate the consistency of the communication of all the various brands Lycos manages. They are the people to speak to for any information concerning the brand. Jungle.com states that team members (employees) are the most valuable asset and for them staff retention is most important. In particular, the experienced marketing team that knows how to build a brand and the programming team that knows how to build a web page.

3.3 Physical infrastructure

Although many e-businesses are service providers with fewer tangible assets than most brick and mortar companies, technology is still at the very core of their processes. They have to ensure that their servers deliver the website 24/7 in order to achieve 6 sigma reliability. Lycos and Jungle both state that speed and reliability of their web pages is a key asset and downtime is unacceptable and too serious to not be top priority. Intershop also recognises the importance of this with their software design to support fast and reliable access.

3.4 Culture

For all three case study companies the culture in the organisation was a key asset. Culture embraces management philosophy and corporate rules and behaviour. Intershop emphasised their entrepreneurial spirit and casual and enthusiastic 'start-up' atmosphere within a young team with an average age of just 27 years. Jungle.com also stresses their 'can-do attitude' amongst their young team. In addition to their mission statement, Jungle has issued a culture and value statement. Jungle considers culture as a major determinant for business performance and as a result they have implemented ways to communicate and maintain the culture they value so much. They believe that it is essential for each

staff member to understand the organisation's mission and culture. For this reason, Jungle has codified their culture in order to communicate it. Each new team member receives an employment guide called 'Finding your way in the jungle' which includes a clear mission statement but also a culture and value statement in language which is very easy to understand. Jungle.com used to print the mission statement on the back of their business cards but have now introduced a set of playing cards which are circulated widely within the company and include all the various culture, mission and value statements. This set of cards is used as a trigger for discussions in team meetings to continually improve awareness of the various facets of the culture and values of the company and also to challenge the statements and to discuss whether they are still valid and implemented within the organisation. Lycos, like many other start-ups, used to operate from a small and crowded office which created an entrepreneurial culture. After the recent move to a new and bigger office in central London the organisational culture has changed and people perceive their job and positions in a slightly more organised and hierarchical way. All operational processes of Lycos used to be performed in one office, which allowed sharing of knowledge and creation of a team culture. Lycos is very determined to preserve their culture in their new offices as one of their key assets.

3.5 Practices and routines

The often informal culture allows many informal practices, routines and workflows to share knowledge and create virtual networks. Databases and codified procedures were mentioned by all three companies as key assets. These databases include customer databases as well as Intranet databases to retrieve best practices or individuals with specific capabilities. In particular, Lycos produced a document internally referred to as the 'Brand Bible'. This codifies brand knowledge and explains the various brands and their objectives, and gives exact guidelines on how to manage the brands; it functions as a template and knowledge base for all employees within Lycos. The idea at the basis of the Brand Bible is that by broadening the understanding of their various brands and of the intended communication among their entire staff, Lycos would be able to better achieve their overall objectives of brand recognition and subsequently market share growth.

The Brand Bible is a database in which the knowledge about how to communicate and manage the brand is continuously codified and collected. It ensures everyone within Lycos understand the requirements and rules of communicating the brand and the intended perception and brand image the company wanted to create. The database not only includes the brand managers' own knowledge but also best practices from external companies. The plan is to generate new knowledge by continuously acquiring knowledge from external sources such as marketing agencies and by benchmarking. The Brand Bible is owned and maintained by the brand managers but is accessible to everyone to learn about the brand and how to communicate the brand image.

The Brand Bible is also used by Lycos as a knowledge base for discussions amongst experts in order to define new approaches or to improve the current ones. This allowed Lycos to develop a knowledge database of best practices that can be consulted by each employee on the organisation's Intranet. In this way, the knowledge sharing process is facilitated amongst everyone within the organisation. Lycos uses focus groups to monitor whether the message they communicate is consistent and whether they get the right message across amongst the various target groups for their different brands. The results of the focus group discussions showed that, since the implementation of the Brand Bible,

Lycos has improved the consistency in the communication of the brands and as a result its brand recognition and market share has improved significantly.

3.6 Intellectual property

Intellectual property is an important assets for companies with few tangible assets. For Intershop, their software product is a key asset, which in its nature is intangible and has to be protected by patents and copyrights. For Lycos, as well as for Jungle, their major intellectual property asset is the brand name of the company. For e-businesses the brand name and the registered URL can be an important asset as users need to type in the exact name of the URL to reach the company's web page, when they are not using a hyperlink on another website.

4 Assessing knowledge: the knowledge assets map

In recent years a number of models have been proposed to measure IC or intangible assets. They can be considered as an answer to the ineffectiveness of the traditional measurement frameworks in capturing the knowledge dimensions within organisations. A review of the management literature on IC assessment filtered out the following as the most significant models: the Skandia Navigator, the IC-Index, the Technology Broker and the Intangible Asset Monitor.

Skandia is a pioneer in the field of intangible asset assessment. They are considered to be the first company to have implemented a systematic effort to assess an organisation's intangible assets. The Skandia approach splits intellectual capital into the following four categories: human capital, customer capital, process capital and innovation capital. On the basis of the above classification Skandia has developed an IC assessment tool called Navigator. It presents similarities with the Balanced Scorecard proposed by Kaplan and Norton [31,32] and identifies the following five foci of measurement: the financial focus, the renewal and development focus (innovation capital), the human focus (human capital), the process focus (process capital) and customer focus (customer capital). For each area Skandia has identified a set of metrics to monitor the intangible assets. In particular, Edvinsson and Malone [3] propose 112 basic metrics using dollar amounts, direct counts, percentages, ratios and survey results.

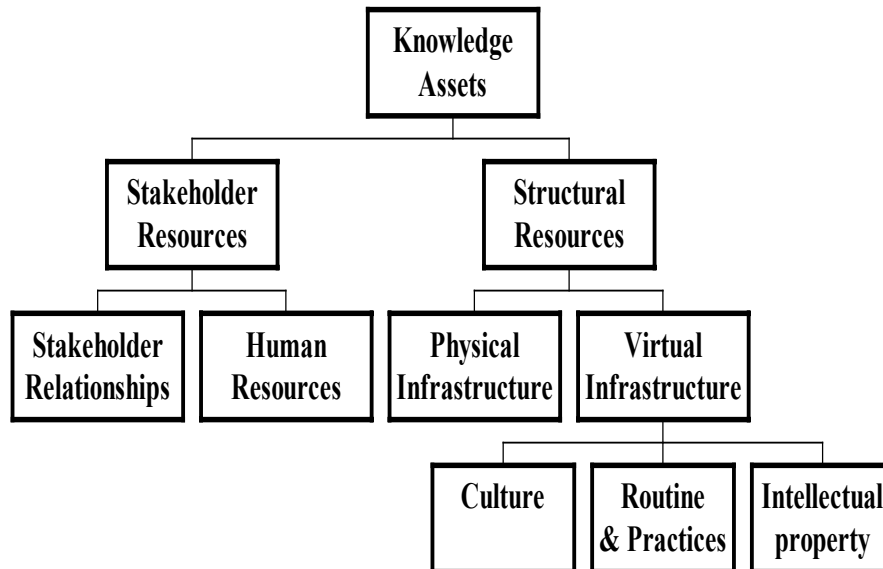
The IC-Index Approach represents an attempt to assess the organisational IC holistically. According to its authors [1] the IC-Index Approach is based on an IC distinction tree. It considers the IC to be composed of human capital and structural capital. The former is further split into competence (i.e. skills and education), attitude (i.e. the behavioural components of employees' work), and intellectual agility (i.e. the innovation ability of employees), whilst the latter is considered to be an aggregation of the following three components: the relationship capital or internal structure (i.e. the relationships that the company undertakes with customers, suppliers, allies, shareholders and other stakeholders), the organisational capital or external structure (i.e. all sources of organisation, e.g. databases, process manuals, culture and management styles) and the renewal and development value (i.e. the intangible side of 'anything' and 'everything' that can generate value in the future, e.g. investments in training employees, reengineering & restructuring efforts, research and development).

The Technology Broker model proposed by Annie Brooking [20] is based on an interpretation of IC as an amalgam of four components: market assets, human-centred assets, intellectual property assets and infrastructure assets. Market assets are the market-related intangibles such as brands, contracts, customers, distribution channels, licensing agreements and franchise contracts. Human-centred assets are the knowledge of the people within the organisation and involve components such as expertise, problem solving capability, creativity, entrepreneurial and managerial skills. Intellectual property assets are corporate assets for which it is possible to provide a financial evaluation. Examples of these assets are trade secrets, copyrights, patents, service marks and design rights. Finally, infrastructure assets equal those technologies, methodologies and processes which enable the organisation to function.

Finally, the Intangible Asset Monitor developed by Sveiby [17,18] adopts three categories of intangible assets. These categories are the intangibles related to the internal structure, those related to the external structure, and intangibles represented by the competence of people. Internal structure includes intellectual property, patents, copyrights, corporate culture, management processes, networking systems. External structure includes relationships with customers and suppliers. Employee competencies are related to human capital that in turn takes into account all the know-how embodied in the individuals working in the firm.

Using the evidence of the case studies, together with the insights from the literature review, a knowledge asset classification framework – the ‘Knowledge Assets Map’ – is proposed to support managers in assessing company’s knowledge assets.

The Knowledge Assets Map provides managers with a broader framework to evaluate the organisational knowledge from both an external and internal point of view. It is based on a broader interpretation of IC, addressing the assessment of all the knowledge assets of e-businesses. The Knowledge Assets Map provides a framework which helps to promote understanding of the structure of the company’s knowledge assets. It allows the identification and definition of the critical knowledge areas of a company and guides the design of indicators to assess the knowledge capital. The Knowledge Assets Map is based on an interpretation of the company’s knowledge assets as the sum of two organisational resources: stakeholder resources and structural resources. This distinction reflects the two main components of an enterprise, its actors, who can be either internal or external to the organisation, and its constituent parts, i.e. the elements at the basis of the organisation’s processes. Figure 1 illustrates the hierarchy of knowledge assets with its sub-classifications. Stakeholder resources are divided into stakeholder relationships and human resources. The former category identifies all external actors of a company whilst the latter represents the internal actors. Structural resources are split into physical and virtual infrastructure, which refers to their tangible and intangible nature respectively. Finally, the virtual infrastructure is further sub-divided into culture, routines & practices and intellectual property.

Figure 1 The Knowledge Assets Map

The six categories of knowledge assets identified by the Knowledge Assets Map are defined in further detail below.

Stakeholder relationships include all forms of relationships established by the company with its stakeholders. These relationships could be licensing agreements, partnering agreements, financial relations, contracts and arrangements about distribution channels. The stakeholder relationships also include customer loyalty, company names and brand image, which represents a fundamental link between the company and its stakeholders. The brand image and perception of the organisation is particularly essential for e-businesses. With a strong brand organisations build up trust and this is one of the most important issues for an e-business, particularly, when customers cannot walk into a physical building and see the people working there. In the 'physical world' brand is the sum of personality, presence, and performance of a given product or service, the '3Ps' [33]. On the web if the company has not established a good brand image a customer can never know what kind of company he or she is buying from and therefore may be reluctant to give away their credit card details.

Human Resources contains knowledge provided by employees in the form of competence, commitment, motivation and loyalty as well as in the form of advice or tips. Some of the key components are know-how, technical expertise and problem solving capability, creativity, education, attitude, and entrepreneurial spirit. Particularly important for e-businesses is the skill sets of employees compared to the skills the organisation requires. In fact, in the e-economy this required set of skills changes more frequently with the dynamics in the market place and therefore multi-skilling of employees is an important quality and recruitment of qualified staff becomes a fundamental topic.

Physical infrastructure comprises all infrastructure assets, such as structural layout and information and communication technology such as computers, servers and physical

networks. All e-businesses rely heavily on technology which makes this aspect different from the old economy. Scalability and capacity of web servers that have to deal with request peaks without increasing download times or even shutting the server down become crucial issues for every e-business. Time to execute website updates is important for e-businesses and system integration is especially a concern for clicks-and-mortar companies. The facilities and the equipment the company requires are essential for a young business that has yet to build up the infrastructure needed. This could include setting up call centres, distribution centres and delivery fleets, as well as hardware upgrades.

Culture embraces corporate culture and management philosophies. Some important components are the organisation's values, the networking practices of employees as well as the set of mission goals. Culture is of fundamental importance for organisational effectiveness and efficiency since it provides the organisation's members with a framework in which to interpret events [1]. The culture provides organisations with a framework that encourages individuals to operate both as an autonomous entity and as a team in order to achieve the company's objectives.

Practices and routines include internal practices, virtual networks and routines, i.e. tacit rules and procedures. Some key components are process manuals providing codified procedures and rules, databases, tacit rules of behaviour, as well as management style. Practices and routines determine how processes are being handled and how workflow processes flow through the organisation. This can have huge impacts on the efficiency and effectiveness of the processes that the organisation has to perform. In particular for e-businesses the practices would include security accreditation and privacy policy handling.

Intellectual property is the sum of patents, copyrights, trademarks, brands, registered design, trade secrets and processes whose ownership is granted to the company by law [1]. It represents the tools and enablers that allow the company to perform its daily processes to produce results. Particularly important for e-business are new forms of intellectual property such as mailing lists and customer databases.

5 Designing knowledge asset metrics

The Knowledge Assets Map provides managers with a framework that assists in the selection of the critical knowledge assets underpinning the company's capabilities. Once the knowledge assets have been identified managers have the task of designing a set of metrics to perform the measurement. For this reason managers can adopt a structured approach towards designing performance metrics frameworks such as, the Performance Measure Record Sheet proposed by Neely *et al.* [34]. It is possible to provide a wide range of indicators for each category of a company's Knowledge Assets. Table 1 presents a variety of performance indicators suggested in the management literature [3,4,35]. The management team has the task of identifying and/or defining the most meaningful indicators that help to assess their company's capabilities and assets. Therefore, it is important that managers do not merely adopt any metrics proposed in the literature since most of them are general and do not necessarily address the types of knowledge that have a critical role in the specific organisation's value-added processes [36].

Table 1 A sample of knowledge assets metrics

<i>Knowledge Assets Indicators</i>	
<i>Stakeholder Relationships</i>	Number/quality of partnering agreements, number/quality distribution agreements, number/quality licensing agreements, public brand recognition survey, demographic analysis of brand awareness, market share, length of relationship, partner satisfaction index, customer retention, etc.
<i>Human Resources</i>	Demographics indicators, e.g. number of employees/number of employees in alliances, average years of service with company, average age of employees, full-time permanent employees as percentage of total employment, employees working at home/total employees, number of women managers, Competence indicators, e.g. number of employees with high qualification, number of people with PhD and/or master degree/total employee, average years of service with the company, number of years in specific professions, definition of a competence map, etc. Attitude indicators, e.g. average level happiness (number measured i.e. with Likert-type scale), savings from implemented suggestions from employees, number of new solutions, products and processes suggested, qualitative descriptions of employees (commitment, loyalty, entrepreneurial spirit, enthusiasm), motivation and behaviour indicators, etc. Human resource management practices indicators, e.g. training expenses/employees, employees turnover, time in training, expenses for employee development activities (social and personal), indicators about activities to motivate employees, indicators about recruitment practices, etc.
<i>Physical Infrastructure</i>	Scalability/capacity measures, facilities/equipment vs. plan, time to execute server updates, system integration, availability, etc.
<i>Culture</i>	Management philosophy, number of internal disputes, number of internal complaints, qualitative measures about employee satisfaction, feedback, values, behaviours, motivation, commitment, loyalty, opinion survey, etc.
<i>Practices and Routines</i>	Site traversal measures, Level of security accreditation, best practice privacy policy benchmarks, norms, database availability, Intranet usage, etc.
<i>Intellectual property</i>	Revenues from patents, number of patents and registered design, value of copyrights, value of patents vs. R&D spend, Trademarks, etc.

Managers need to start from the recognition that the knowledge assets are absolutely unique to each company and that they have to design metrics that really address and measure their organisational key knowledge assets underpinning their capabilities.

The following section outlines a set of guidelines which should be considered in order to design efficient and effective knowledge asset measures.

Linking knowledge assets measures to corporate strategy

The definition of knowledge assets metrics must always be related to strategy. There are two different approaches for defining knowledge indicators which derive from the two different ways of strategy definition, either top-down or bottom-up.

Using the top-down approach the knowledge assets metrics are derived from strategy, where the strategy is based on the wants and needs of the company's stakeholders. Within this approach the definition of knowledge indicators is aimed at evaluating

whether the knowledge assets underpinning the company's capabilities are consistent with the corporate strategy. In this case the measures are designed to monitor what is strategically important for the organisation as well as to communicate the corporate direction.

The bottom-up approach, on the other hand, is about exploring the capabilities of a company in order to define a strategy based on its strongest knowledge assets. Thus, in this case the knowledge indicators are used to identify the company's core competencies on which to base the corporate strategy.

Focus on the end-user

The design process of the knowledge assets metrics should always be based on a clear definition of the end-users and on a prediction of the use and value of the metrics for the end-users. The typology and the contents of the metrics should change depending on the needs of the end users of the measures. In particular, for knowledge assessment purposes it is important to distinguish between internal and external end-users. The former are mainly interested in measures that communicate the stock and the flow of the organisation's knowledge assets in order to manage the company's business performance. The latter are primarily interested in proxies to evaluate the economic value of the company's intangible dimensions.

Keep the indicators meaningful, simple and comprehensive

Having a complex set of indicators can blur the focus and reduce their importance for the end-user. The knowledge assets metrics have to be simple, easy to interpret, and meaningful, i.e. focused on investigating and monitoring a specific knowledge area. It is better to have a few key indicators rather than a long list of measures which might dilute their effectiveness. The following basic criteria help to keep the knowledge indicators simple, meaningful and comprehensive:

- 1 address the organisation's key knowledge areas
- 2 make them relevant for the end-users, providing meaningful information
- 3 ensure they are practical and manageable, i.e. only a few, easy to understand and to communicate
- 4 build on existing data streams if possible
- 5 put measures under the control of those measuring them.

Balanced set of knowledge assets metrics

All knowledge assets categories identified by the Knowledge Assets Map are considered equally important for competitiveness of e-businesses. Although companies might emphasise specific knowledge areas it is recommended that companies address all critical knowledge dimensions and derive a balanced set of knowledge metrics. A company's long term competitiveness is gained only from the integration and synergy of all key knowledge assets. Therefore, a few key indicators in each critical knowledge asset area have to be designed. In this way a comprehensive knowledge dashboard is developed.

Aggregating knowledge assets metrics

In order to describe and monitor the dynamics of the organisation's knowledge assets it can be useful to aggregate them into a single index or a few indices. The IC-Index approach proposed by Roos *et al.*[1] provides guidelines on how to aggregate different measures into a single measure.

6 Discussion

In today's economy knowledge is recognised as one of the most important factors contributing to company competitiveness. Knowledge forms the foundation of a company's business performance as its capabilities are based on knowledge assets. Even though the strategic role of knowledge is mutually recognised by academics and managers, many existing measurement frameworks do not consider this dimension. This is a critical shortcoming of measurement frameworks. The business environment is more and more knowledge driven and therefore managers need a control panel to assess knowledge assets both to communicate the company's value to the outside world and to better manage the capabilities of an organisation internally.

The contribution of this paper is seen to be threefold. Firstly, the paper indicates that new approaches towards measuring and managing strategic knowledge assets are needed for knowledge intensive organisations such as e-businesses. Secondly, using the case study evidence and earlier findings in the literature, the paper presents a framework, the Knowledge Asset Map, to evaluate knowledge assets in order to better manage organisational capabilities. This is based on a classification of knowledge assets to assess the knowledge owned by an organisation. It allows the identification of factors which have to be considered when companies wish to measure and manage their knowledge assets. Knowledge is context specific and task orientated and therefore it is not appropriate to provide one template of measures to fit all organisations. A list of measures has been provided with the aim of suggesting some measures that might be used in each category. Managers need to design the key knowledge performance indicators in the light of the context and/or tasks and all performance indicators have to be linked to the goals of the organisation. Thirdly, a set of managerial guidelines to design knowledge assets metrics has been provided. However the assessment of knowledge assets is not enough to manage an organisation's capabilities. In fact assessment only offers a snapshot of the knowledge foundations of a company's capabilities at one point in time; it does not provide any insights into how to maintain and increase these capabilities nor about the dynamic interactions or flows. For this reason, managers also need to understand the dynamics of these knowledge assets and then find knowledge management processes that allow them to pull the right levers that can be used to exploit, generate, renew, update and maintain knowledge assets.

The role of knowledge for competitiveness is particularly important for e-businesses. In fact the case studies point out that the assets and capabilities considered as most important in e-businesses are indeed intangible in their nature, which makes knowledge assets and intangible assets a major competitive resource [14,15].

With this research we hope to have laid the basis for a more extensive investigation of the subject of managing and evaluating strategic knowledge assets underpinning the

capabilities in organisations. The research sample of this study should be extended and further research into identifying the key knowledge assets for e-businesses and other knowledge intensive organisations is suggested and encouraged at this stage in order to take the area of measuring and managing knowledge assets further and show how these assets represent the real drivers of business performance.

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