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Support of E-business by business intelligence tools and data quality improvement

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***Abstract*—The aim of this paper is to evaluate what electronic commercial and business opportunities firms and organizations in this modern world have and which opportunities are best suited for them. The paper categorizes and describes currently available e-business tools in the electronic business model proposed by Timmers. The next part discusses the tools and activities for creating successful implementations of e-business within companies and organizations, in particular, business intelligent tools, strategic management tools, electronic forms, and competitive intelligence. The paper then offers general recommendations and a summary of which tools used for which purposes depending on the size of business and organizations.**

I. Introduction

INDUSTRIAL society is changing in front of our eyes to the society, in which the information and knowledge play the major role. There is a global information infrastructure that processes and transmits an increasing amount of data and information. The order of the Industrial Revolution was to maximize the quantity with the least cost. The goal of the information revolution is the highest possible quality at a reasonable price in the shortest possible time.

In the information society a human is searching for his place again. New technology allows him to become a passive and easily driven consumer of information, on the other hand, however, allow him to become their active producer. Convergence of information, communication and multimedia technologies, create new business opportunities in the upcoming decades which will play a key role in the economy and public life.

Worldwide, we can see the results of massive expenditure on information and communication technologies that cause the changes of business and commerce. Between 1980 and 2005 the private business investment in information technology increased from 34% to 50% of the total capital invested. How to effectively invest the money? Companies invest into information systems to achieve strategic business and marketing objectives: operational excellence, perfection of new products, services and business models, intimate knowledge of customers and suppliers, improve decision making, competitive advantage and survival. The interdependence between business and information system capabilities is growing. Changes in strategy, rules and business processes require changes in hardware (HW), software (SW), in data storages and telecommunications equipment. Often, if the company wants to do something, it depends on what the information system allows.

II. Types of e-business

Since 2000, the Economist Intelligence Unit publishes an annual ranking of the world's largest economies in readiness for e-business. Criteria for assessing the readiness for e-business were developed by the Economist Intelligence Unit in cooperation with the IBM Institute for Business Value. This is a summary of factors that indicate how the market is open to Internet opportunities. This indicator express how the country is open in terms of e-business. Evaluation methodology is undergoing continuous modification.

E-business is a way of communication and commerce using the Internet as the main instrument or other networks and is seen on a wider scale than e-commerce, much as it is itself a subset of trading business. E-business is a series of processes, pursuing a specific goal, involving more than one agency and implemented by electronic means.

E-commerce means using the most modern information communication technologies to increase the effectiveness of relationships among companies and among individual consumers. It includes not only error-free electronic transmission of information and documents, but mainly signing contracts or strategic business partnership over the Internet. E-Commerce is a series of processes associated with the course of commercial transactions carried out by electronic means

E-marketplace is a virtual, on-line marketplace, where supply and demand meet online. Its main advantage to the ordinary "stone" market is the possibility of efficient and convenient prices comparison, and the comparison of delivery and payment conditions and especially the technical parameters of each product.

The **E-procurement** term can be very loosely described as "obtaining", "providing" something over the Internet. Practically this is the part of e-commerce, based on the needs of shoppers. Its basic feature is the creation of value, hence the cost savings for the buyer. For its realization the main reason is the reduction of transaction costs. Other advantages of e-procurement are rebate, reduced inventories at the customer, better control of the process, minimizing cash transactions and integration with the information systems of customer and supplier.

E-marketing is the opposite of the e-procurement. Businessmans are selling products through a network, where the driving force in this case is the seller (supply). Its essence is to attract customers and convince them about the quality and convenience offered to purchase goods or services. E-mar-

keting is primarily focused on the value creation (increase in turnover and revenue) for the seller.

A. E-commerce models

Business-to-business (B2B)

Business-to-business means secure communication, transmission of documents, concluding business contracts and establishing long term business relationships between companies. This kind of activity is particularly associated with using the Internet to facilitate communication in the supply chain. Relationships between individual firms on the B2B market are almost always formally adjusted by the contracts.

The specific models of the B2B are for example the e-commerce models by P. Timmers [10]

- Value chain service provider, specializes in one of the functions of the value chain (such as payment or logistics) in order to obtain a competitive advantage by differentiating.
- Value chain integrator, focuses on integrating multiple steps of the value chain and on evaluation of the potential of information flow between these steps as further added value.
- 3rd party Marketplace, in its basic form it is a user interface to the catalog of products or services which may be extended with special services such as advertising, brand, payment, logistics, orders or comprehensive service to ensure the implementation of secure transactions. An example of a business relationship B2B marketing can be a single event (e.g. conference, backed by well-known and trusted company in the field) if necessary.

Business-to-consumer (B2C)

Business-to-consumer means the sales of goods to the end user via the Internet or other information and communication technologies, without direct physical contact with the customer's dealer. B2C are typical for single networking vendor - the consumer, with no long term contractual underpinning.

The typical models of B2C by P. Timmers are:

- E-shop is comparable to the catalog sales, the catalog is in this case in the form of web pages and communications between buyers and sellers take place mostly in electronic form. E-commerce must address the issue of payment and delivery of goods. From the perspective of transaction costs seem ideally the intangible goods (tickets, software, trips). Transaction costs are often an impediment to trade in goods, whose unit price is very low.
- E-mall is a set of e-commerce under one roof or under the common umbrella of one brand. It is essentially analogous to the giant shopping malls. When you specialize in a particular market segment, the commercial center is becoming a center for the entire industry.

Consumer-to-business (C2B)

C2B model means that the customer offers in the system price he is willing to pay and the seller is considering whether to accept the bid.

Among the models of electronic commerce (according to the classification of P. Timmers) that make e-business from the e-commerce, that means those models that offer additional services, are:

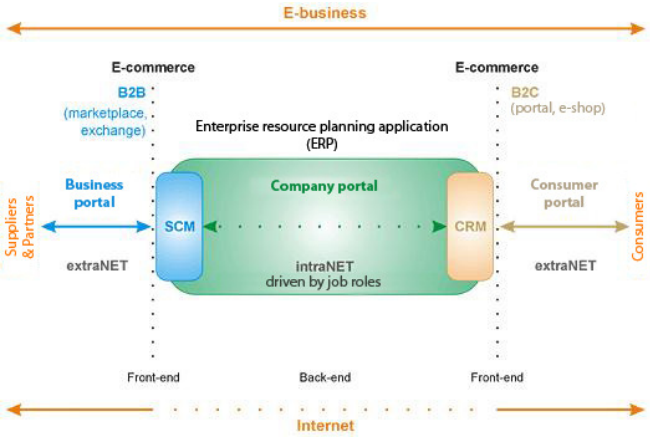
- Virtual communities, which is a fundamental value generated by members of the community (customers or partners) who add their information into the basic environment that guarantees by provider.
- Collaboration platform is a set of tools and information environment for cooperation between businesses. It may be focused on design for example. Business opportunities can be found in the management of all services (fees) and sales (licensing) of special tools.
- Information brokerage represents a wide range of new value-added services to the amount of data, which are located on open networks, or derived from integrated business operations such as drawing up a customer profile, brokering business opportunities, investment advice, etc. Specific categories of services are provided by certification authorities.

B. Implementing the concept of e-business

For the implementing of e-commerce in practice, it is necessary to address the following areas:

- Deployment of business and information portals. The portal is the gateway to information and serves the information via web browsers, allowing access from mobile devices. It represents a single and personalized access to information services and content that is targeted to the business processes of all participants - customers, employees, suppliers or partners - and with regard to the available means of communication. Through an information portal, users can create and manage content and content authors can generate and grade reports, documents, web pages, without deeper knowledge of Internet technologies.
- Support for modern forms of communication.
- Unification and management all communication channels.
- Investments in information systems security. To mitigate risk and minimize losses in case that a risk event occurs. Complement the specification of security policy elements of PKI (Public Key Infrastructure) enables the deployment of digital signature.
- Business Process Integration, Technology Integration (subject to satisfactory comprehensive e-business solution is the integration of the entire corporate information system at the user interface, data structures, data exchange and applications). There is also required integration with financial and logistical services. To benefit from the competitive and strategic benefits of e-business solutions, it is necessary to integrate fully all customers, partners and

suppliers into a single on-line network and focus on key processes. Others that are not directly related processes, they are left to specialized firms (e.g. logistics).



Note: SCM - Supply Chain Management; CRM - Customer Relationship Management

Fig. 1. E-business solutions, source [9]

All of the listed changes are linked to sufficiently significant organizational changes, and create conditions for digital business. Digital firm can be defined in different ways. For our purposes, we will apply the following definition: "Digital business is one in which nearly all organizationally significant business relationships with customers, suppliers and employees are digitally enabled and mediated, where the main business processes are implemented through a digital network embracing the whole organization or a multi-organization" [8].

Digital firms may react to their environment faster than traditional firms. They are more flexible in terms survival in a turbulent environment. The digital business is time-lag and shift in space standard. Time shift means that the transaction is a continuous 7 x 24 hours per week and not only on working days in a limited period of time. Spatial shift means that the sale takes place on the global market without national borders. Work is performed there, which is advantageously feasible in the world. E-business can expect intensified competition and interaction of traditional and new businesses, projects, policies and rules and end e-business in today's terms (every business is e-business).

III. Strategic management

Strategic or institutional management is the conduct of drafting, implementing and evaluating cross-functional decisions that will enable an organization to achieve its long-term objectives. [11] It is the process of specifying the organization's mission, vision and objectives, developing policies and plans, often in terms of projects and programs, which are designed to achieve these objectives and then allocating resources to implement the policies and plans, projects and programs. A balanced scorecard is often used to evaluate the overall performance of the business and its progress towards objectives.

Strategic management is a level of managerial activity under setting goals and over Tactics. Strategic management provides overall direction to the enterprise and is closely related to the field of Organization Studies.

A. Strategy formulation

Strategic formulation is a combination of three main processes which are as follows:

- Performing both internal and external as well as both micro-environmental and macro-environmental situation analysis, self-evaluation and competitor analysis.
- Concurrently with this assessment, objectives are set. These objectives should be parallel to a timeline; some are in the short-term and others in the long-term. This involves crafting vision statements (long term view of a possible future), mission statements (the role that the organization gives itself in society), overall corporate objectives (both financial and strategic), strategic business unit objectives (both financial and strategic), and tactical objectives.
- These objectives should, in the light of the situation analysis, suggest a strategic plan. The plan provides the details of how to achieve these objectives.

B. Strategy evaluation

Measuring the effectiveness of the organizational strategy, it is extremely important to conduct a SWOT analysis to figure out the strengths, weaknesses, opportunities and threats (both internal and external) of the entity in question. This may require to take certain precautionary measures or even to change the entire strategy.

Strategic management techniques can be viewed as bottom-up, top-down or collaborative processes. In the bottom-up approach, employees submit proposals to their managers who, in turn, funnel the best ideas further up the organization. This is often accomplished by a capital budgeting process. Proposals are assessed using financial criteria such as return on investment or cost-benefit analysis. Cost underestimation and benefit overestimation are major sources of error. The proposals that are approved form the substance of a new strategy, all of which is done without a grand strategic design or a strategic architect. The top-down approach is the most common by far. In it, the CEO, possibly with the assistance of a strategic planning team, decides on the overall direction the company should take. Some organizations are starting to experiment with collaborative strategic planning techniques that recognize the emergent nature of strategic decisions.

Strategic decisions should focus on Outcome, Time remaining, and current Value/priority. The outcome comprises both the desired ending goal and the plan designed to reach that goal. Strategic management requires paying attention to the time remaining to reach a particular level or goal and adjusting the pace and options accordingly. Value/priority re-

lates to the shifting, relative concept of value-added. Strategic decisions should be based on the understanding that the value-added of whatever you are managing is a constantly changing reference point. An objective that begins with a high level of value-add may change due to influence of internal and external factors. Strategic management by definition is managing with a heads-up approach to outcome, time and relative value, and actively making course corrections as needed.

IV. BI tools purchase possibilities

If a company or organization decides to purchase business intelligence tools, the choice is always driven by the price, utilization and consequent size of the company. Even at the turn of the millennium, BI tools were a privilege of big companies with huge budgets only that made it worthwhile to invest considerable sums in implementing solutions to the corporate network or individual workstations. Today, this kind of acquisition of BI tools still has a lot to offer, but thanks to their robustness and costs it is unacceptable option for small businesses.

On the other hand, there is a form of Software as a Service, simply SaaS. SaaS is a quite new technique in the world of IT which allows you to hire a software application only when there is a requirement of such an utility. The main reasons for its popularity are high services, low costs and less maintenance.

In the software as a service model, the application, or service, is deployed from a centralized data centre across a network - Internet, Intranet, LAN, or VPN - providing access and use on a recurring fee basis. Users "rent," "subscribe to," “are assigned”, or "are granted access to" the applications from a central provider. Business models vary according to the level to which the software is streamlined, to lower price and increase efficiency, or value-added through customization to further improve digitized business processes. [18]

V. Improving the data quality

The main sources of information within companies and institutions are now both operating systems supporting the company (ERP, SCM, CRM) and external databases (dials address, municipality, telephone directories, business register, etc.). These resources are not usually able to provide questioner the information of desired quality. The reason is that data are stored in many places, on different platforms in different structures and formats. The problem is the quality of data. The data are often incomplete, contain errors, invalid values are stored in the structures unsuitable for analysis and do not contain history.

A. Tools for selection, transformation, transmission and data integration

Obtain quality information now means to transfer data into the relevant structures of the data warehouse. **Data warehouse** is a database containing the consolidated data from all available resources, optimized for reporting, analysis and archiving. The data warehouse integrates and stores data from both internal and external sources.

To transfer data into the data warehouse are used ETL (extraction, transformation, loading) tools. The extraction means the ability to take data from the widest range of data sources of different types. Transformation is a gradual series of operations to prepare the extracted data to be retrieved from the data warehouse. Many of the data obtained from the extraction is still not nearly ready to load into storages. Among the reasons why not, it is mainly the mismatch between data from different sources and their incompleteness. There are applied the checks, additions or changes in data transfer on the same formats and inconsistencies elimination, data consolidation - the unification of the main entities and the calculation of aggregation by major entities. To clean the data tools containing typical samples of impurities are used. Load means inserting data into its own physical space data warehouse.

Implemented ETL means primarily program implementation of data pumps, testing their time requirements and setting operating parameters. Parameters of the ETL tools are supported platforms and their connectivity (range of supported source and target systems), support for metadata management, the possibility of multiphase pump operation according to schedule, the level of support for workflow, logging level data pump, and support data processing in real time. Trend in the ETL tools is merging with the tools for managing metadata and tools for ensuring data quality, as well as their delivery, together with the standard database engine. [3]

EAI tools (Enterprise Application Integration) - EAI can be characterized as a set of approaches, methods and technologies that allow us to connect initially often incompatible solutions, or partial information systems.

The process of EAI from the perspective of the data is based on the following principles:

- elimination of semantic inconsistency of data that arises from different perspectives on the data in various applications (e.g. differences in customer address records)
- removal of content data inconsistency, which arises from the existence of duplication (e.g. two different applications registered address of the customer, but only one of them has been changed)
- minimisation the fragmentation of data (providing a comprehensive view of data)

EAI works unlike ETL tools in real time, they were created in a layer of transactional systems and their purpose is to integrate primary systems in a company or organization, and reducing their mutual interface. [5]

B. Applications for data storage

Applications for data storage provide the processes to storage, updating and data management. These include data warehouses, data marts, operational data store and data staging areas.

Data Warehouse is a central data repository, where the requirement for consistency is crucial (DW must provide "a

single version of the truth"). Integrated data warehouses are presently considered to be the best solution.

Data Marts are separated data repositories for individual applications or departments. They are problem-oriented data warehouses to implement flexible ad hoc analysis.

Operational Data Store (ODS) are supporting analytical databases - a central repository, processing the key data in nearly real time. The data processing operations needed to ensure of data quality are carried out by ODS and it also integrates relevant data from different systems (examples might be the validation of address information identifying the type of identification number, or tracing and correction of incorrect data). At the operational level of the data storage are also clearly and conspicuously identified and described the various data elements; there are agreed technical and semantic definitions (metadata).

Data Staging Areas (DSA) are used for temporary storage of selected data from source systems from their own processing to other database components of BI solutions. Their purpose is to accelerate the selection of data used for initial storage of the non transformed data from these systems.

C. Data quality

Data quality is one of the basic characteristics of data warehouses and operational data stores. Data quality is not one of their automatic features, but nowadays the necessary one. Data quality can be defined in different ways, in this case we choose a simple definition - high quality data are those which correspond to reality, they are complete and consistent.

If you want to work with high-quality data, you must ensure that there are five basic characteristics:

- Completeness - the need to identify and treat the data that are missing or inapplicable,
- Standardization - all data should match the requested format,
- Consistency - no data may contain values that represent conflicting information,
- Uniqueness - if there are duplicate entries, they must be removed
- Integrity - data should include all the defined relationships to other data. [1]

Data quality is at present designed by the majority of suppliers of information technology as a set of two processes - **data profiling** and **data cleaning**. These processes are periodically repeated and reflected in the data warehouse environment. The result is a complex process in the literature called the Data Supply Chain. DSC is an automated process in which the first phase are extracted data from data sources, whether internal or external, in the second phase are analyzed the data sources and data are cleaning is performed. In this second phase the data profiling (identifying types of data defects, quantifying the number of individual defects, identifying synonyms and homonyms, the evaluating completeness in terms of supporting business processes and conformity assessment of attributes with their definitions) and data cleaning (standardization, verification against internal and external dials, correction of address data, identification of redundant records and householding identification are implemented. [2]

Thus processed data are then stored in the warehouse. Data warehouses are typically updated regularly it means that all processes of the DSC are recurrent.

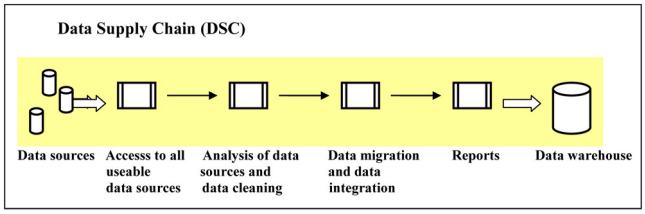


Fig.2. Data supply chain, source [author]

D. Metadata

As well as data quality, a quality description of its contents is a necessary component of any modern information system. It means how was the content created and how is the content being used - metadata. Recently the importance of metadata, as the principal means of determining the content and status of information systems, increased significantly. The underlying reason for the existence of metadata (defined as data about data) is that they add context and meaning into inaccurately described cluster of information. The main advantage of the existence of metadata is the ability to facilitate understanding of the principles, capabilities and content of the various information systems.

Metadata in the company can be divided into technical metadata - that is, information about setting up various information systems and relevant technical processes and substantive metadata - information about the substance of the solution, thus adding context and importance of individual values (and not only in terms of content meaning of that word - as understood in the organization, but also in the form of computing - how it is possible to reach a value of that expression).

Ensuring the sufficient quality of data and their description is mainly the task for their users. The main reason for the progressive transfer of responsibility for ensuring data quality and description of the importance of individual data elements is that the users who work with them in a long term know the data better than anyone else. The data are produced by information systems that are developed on the requirements of their users and the completeness, consistency, accuracy, uniqueness and integrity of data is ensured.

Metadata make sense to individual information. At the same time the tools and processes to ensure data quality, help you to capture, manage, share and provide error free and accurate data. In practice this means that by the involvement of these solutions into an integrated information system, we can obtain a simpler and better quality work of all components involved in the decision-making at all levels of management - if the person who decides on the basis of certain data understands the meaning of the data well, he or she

can make the right decisions at the right time and right place. They also support the building of confidence in the data - if users understand the meaning of the data while the data is correct, then they gain confidence in these data and it will result in a streamlining of their work and increase of efficiency of the support elements (development of new solutions) - if end-users understand the state and content of the solutions, they can effectively specify their requirements for further development and this development can also be faster and more efficient. [5]

The final aim of the described tools is to provide readable, organized and analyzable in real-time, information available from a peak of corporate databases and external sources, which can be widely used at the management of a company or an institution. As the managers have ensured quality data, they gain a quick overview of the functioning of the company or institution and can devote their time to the processes leading to positive change of the situation. Quality data allow the management of an organization in accordance with knowledge.

VI. Competitive intelligence

A broad definition of competitive intelligence is the process of defining, gathering, analyzing, and distributing Intelligence about products, customers, competitors and any aspect of the environment needed to support executives and managers in making strategic decisions for an organization.

Key points of the definition above are:

- Competitive intelligence is an ethical and legal business practice, as opposed to industrial espionage which is illegal.
- The focus is on the external business environment. [14]
- There is a process involved in gathering information, converting it into intelligence and then utilizing this in business decision making. CI professionals emphasize that if the intelligence gathered is not usable (or actionable) then it is not intelligence.

A more focused definition of CI regards it as the organizational function responsible for the early identification of risks and opportunities in the market before they become obvious. Experts also call this process the early signal analysis. This definition focuses attention on the difference between dissemination of widely available factual information (such as market statistics, financial reports, newspaper clippings) performed by functions such as libraries and information centers, and competitive intelligence which is a perspective on developments and events aimed at yielding a competitive edge [15].

The term CI is often viewed as synonymous with competitor analysis, but competitive intelligence is more than analyzing competitors — it is about making the organization more competitive relative to its entire environment and stakeholders: customers, competitors, distributors, technologies, macro-economic data etc.

Organizations use competitive intelligence to compare themselves to other organizations ("competitive benchmarking"), to identify risks and opportunities in their markets, and to pressure-test their plans against market response (war gaming), which enable them to make informed decisions. Most firms today realize the importance of knowing what their competitors are doing and how the industry is changing, and the information gathered allows organizations to realize their strengths and weaknesses.

With the right amount of information, organizations can avoid unpleasant surprises by anticipating competitors' moves and decreasing time response. Major airlines change hundreds of fares daily in response to competitors' tactics. They use information to plan their own marketing, pricing, and production strategies.

Resources, such as the Internet, have made gathering information on competitors easy. With a click of a button, analysts can discover future trends and market requirements. However, competitive intelligence is much more than this, as the ultimate aim is to lead to competitive advantage. As the Internet is mostly public domain material, information gathered is less likely to result in insights that will be unique to the company. In fact there is a considerable risk that information gathered from the Internet will be a misinformation and will mislead users.

As a result, although the Internet is viewed as a key source, most CI professionals should spend their time and budget gathering intelligence using primary research — networking with industry experts, from trade shows and conferences, from their own customers and suppliers, and so on. Where the Internet is used, it is to gather sources for primary research as well as information on what the company says about itself and its online presence (in the form of links to other companies, its strategy regarding search engines and online advertising, mentions in discussion forums and on blogs, etc.). Online are subscription databases and news aggregation sources which have simplified the secondary source collection process are also important

Organizations must be careful not to spend too much time and effort on old competitors without realizing the existence of any new competitors. Knowing more about your competitors will allow your business to grow and succeed. The practice of competitive intelligence is growing every year, and most companies and business students now realize the importance of knowing their competitors.

VII. Conclusion

The goal of digital tools implementation into business processes is to get a good position in developing e-market as well as to offer better services for customers. Main attention is focused on the problems that have to be solved in connection with the implementation of e-business in companies and institutions.

Use of the business intelligence tools, along with the emphasis on the quality of strategic management in a company or institution and the high quality used and data sources relevant to the issue (competitive intelligence), creates conditions for the choice of form and development of the e-business within the company. Other critical attribute is the size of the company and especially its global strategy.

In Table I, you can see the opportunities and recommendations for various companies (according to the number of employees). One of the authors of this article is a chairman of the regional section of the Czech Society for Systems Integration for North Moravia and Silesia (www.cssi-morava.cz) and maintains frequent contacts with representatives of management of many companies. The results shown in the table were made on a series of guided interviews with these managers.

Current indications suggest that a firm that does not pay attention to the possibilities of e-business offers, might become unattractive to their customers, therefore, managers should set out the recommendations given due attention.

In recent years the use of the new information technologies leads to a significant increase in market places (globalization) and convergence fields. Innovation becomes a key factor in the development of companies and the role of the client (active customer) is being significantly changed. Due to information and communication technologies the network character of all industrial sectors is growing and ITC also changes the structure of costs in almost all sectors.

Economic laws of "a world of bits" are being gradually penetrated into the" world of atoms" and informatics does fundamental changes in almost all sectors of the economy [6]. By our team work intensively with three business intelligence tools of different formats. Unfortunately we have no detailed information directly from the private sector, because firms guard their sensitive data and don't let us look under the cover, but on the basis of many simulations we have obtained enough information on the findings above.

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TABLE I.
OPPORTUNITIES FOR DIFFERENT COMPANIES AND ORGANIZATIONS, SOURCE [AUTHOR]

	Tiny or small company		**Medium company**		**Big company**	
Deployment of business and information portals	yes	Very cheap, great opportunity for e-marketing or e-commerce	yes	e-marketplace	yes	e-marketplace, e-procurement, both including electronic payment
Support of the modern communication forms	yes	Very fast, very cheap	yes	Very fast, great way to keep in touch with all employees	yes	Very fast, great way to keep in touch with all employees
Integration of communication channels	yes		yes		yes	
Implementation of the PKI elements	no	Very expensive	?	Expensive but useful for security	yes	Very good for security
Strategic management support	?	Too much work to prepare the strategy but good results	yes	It is essential to have a strategy	yes	It is necessary to have a strategy
BI tools (way of purchase)	?	If yes, the best solution is to rent the "SaaS"	yes	To rent the "SaaS" or to buy a local installation	yes	To buy a local installation
Data storage	yes	Data marts	yes	Data warehouses	yes	Data warehouse staging areas, operational data stores
Data profiling	no	Not possible	yes	Good for future work with data	yes	Good for future work with data
Data cleaning	yes	Good for future work with data	yes	Good for future work with data	yes	Good for future work with data
Competitive intelligence	no	Expensive, needs to be regularly updated	yes	Essential to succeed	yes	Essential to succeed

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