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The Integration of BI, ERP and CRM Systems

Summary: In the sphere of business there is a lot of confusion among Business Intelligence (BI), Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems with the major one being that most people think BI is the same as ERP, whereas BI is a more evolved technology which, even though it relies on ERP, is also based on back office data. Moreover, not everyone is aware that most CRM functionality can be embedded in ERP and BI solutions. To fully use the potential of the BI and CRM systems, they should be integrated into a central system supporting the management of the organisation which is usually a key element of companies internal IT infrastructure. In this paper the authors are committed to describing and explaining the major differences existing among BI, ERP and CRM systems in various aspects. Also, the authors aim to explain the advantages and disadvantages of those solutions and the future trends. The methods used in this study are analysis, observation and the study of literature.

Keywords: BI, ERP, CRM, IT Integration.

Integracja systemów BI, ERP i CRM

Streszczenie: W sferze gospodarczej występują nieporozumienia dotyczące Business Intelligence (BI), Enterprise Resource Planning (ERP) oraz Customer Relationship Management (CRM). Większość ludzi sądzi, że rozwiązania BI są podobne do ERP. Okzauje się, że BI jest bardziej rozwinętą technologią, która wykorzystuje ERP. Podobne nieporuzumienia dotyczą systemów CRM. Nie każdy zdaje sobie sprawę, że większość funkcjonalności CRM może być zaimplementowane w ERP i BI. Aby w pełni wykorzystać potencjał systemów BI i CRM, powinny one zostać włączone do centralnego systemu wspomagającego zarządzanie organizacją, który w przedsiębiorstwach jest zazwyczaj kluczowym elementem wewnętrznej infrastruktury IT.

W niniejszym artykule autorzy scharakteryzowali i wyjaśnili istotne różnice istniejące między systemami CRM, ERP i BI w różnych aspektach. Ponadto, zostały opisane zalety i wady tych rozwiązań i pojawiające się trendy w tym zakresie . Metody zastosowane w tym badaniu to analizy, obserwacje i badania literaturowe.

Słowa kluczowe: BI, ERP, CRM, Integracja IT.

1. Introduction

Computer systems, global computer networks, as well as large and distributed databases create an environment for the functioning of the e-economy. Currently, a company's success depends on the speed and effectiveness of the use of information to support business decisions [1]. The report, "State of Analytics 2015" shows the growing role of business analytics, which is now nolonger identified as the main base for conducting business.

K. Augustino- states that "Companies have at their disposal more and more data that can be analysed to act more quickly and make better decisions. However, the amount of data grows very quickly, which means that companies increasingly have difficulties to make good use of available data. The study showed that companies with the best results in their industries efficiently use other analytical tools, and more and more do invest in this area. They always try to change their organisational culture to ensure efficient processing and sharing of information. Today you can see clearly the trend of deepening stratification between companies that have achieved proficiency in the use of analytics, and that analytics devote less attention and resources "[1].

These technologies include a wide range of ICT applications and complex IT systems (Information Technology), enabling implementation of the processing and transmission of data at a higher level of abstraction than the level of the hardware. The scope of conceptual ICT includes all communication media (Internet, wireless networks, Bluetooth, fixed line, mobile, satellite communications technologies (audio and video, radio, television, etc.), media to record information (memory sticks, hard drives, CD / DVD, tape, etc.), as well as equipment for information processing (PCs, servers, clusters, computer networks, etc.) [2].

2. Definitions of BI, ERP, CRM

Business Intelligence (BI) is a term that indicates a set of concepts and methods used to improve the quality of decision-making processes in business [3]. BI can be defined as a platform that presents information in a correct way, useful and specific for each person in a suitable manner to serve in making an efficient decision [4]. Sources for BI technologies can be divided into two categories: internal – like databases, data files from the organisation's assets, and external – from the Internet. BI technology processes data from different data sources by OLAP (Online Analytical Processing) analysis, data mining or reports [5]. BI technology concerns areas such as management, business and IT, see figure 1 below:

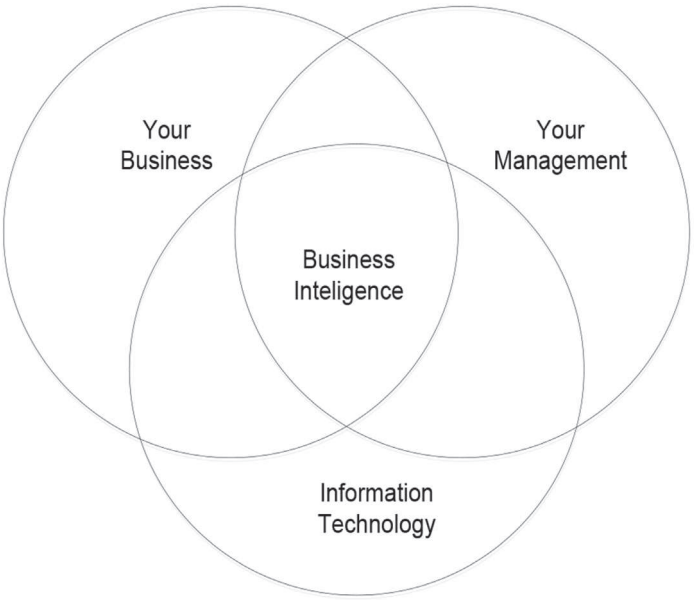


Fig. 1. Domains which contain BI [4]

The main components of BI are a data warehouse, business analytics and business performance management and user interface. Business analytics creates a report as and when required through queries and rules. Data mining is also another important aspect of business analytics. Business performance management is a linkage of data with business objectives for efficient tracking. This business performance is then broadcasted to an executive decision-making body through dashboards and share-point [6]. BI systems can perform many functions, see figure 2. below:

Enterprise Resource Planning (ERP) is a software specialised in business management that finds, stores, manages and interprets data. It provides a view of a business process through the use of databases that are being taken care of by a management system. ERP systems are tools supporting the management of a modern enterprise. Modern ERP has sophisticated software modules characterised by such features and capabilities as the ability to work in "cloud computing" [8] and virtualization. Also, there are modules more frequently used, which have certain features of BI and can very effectively transform data from the ERP into information for the decision-maker. Some systems also have dedicated modules for employees and customers, accessible through the Internet.

ERP is a system of operational and transactional data. It will give you an exact view of your business from an operational perspective, but it is not built to perform trend analyses or give you high-level overviews. It is a tool centred around delivering operational insights [9].

Example areas of business management of ERP systems have been presented in figure 3. below:

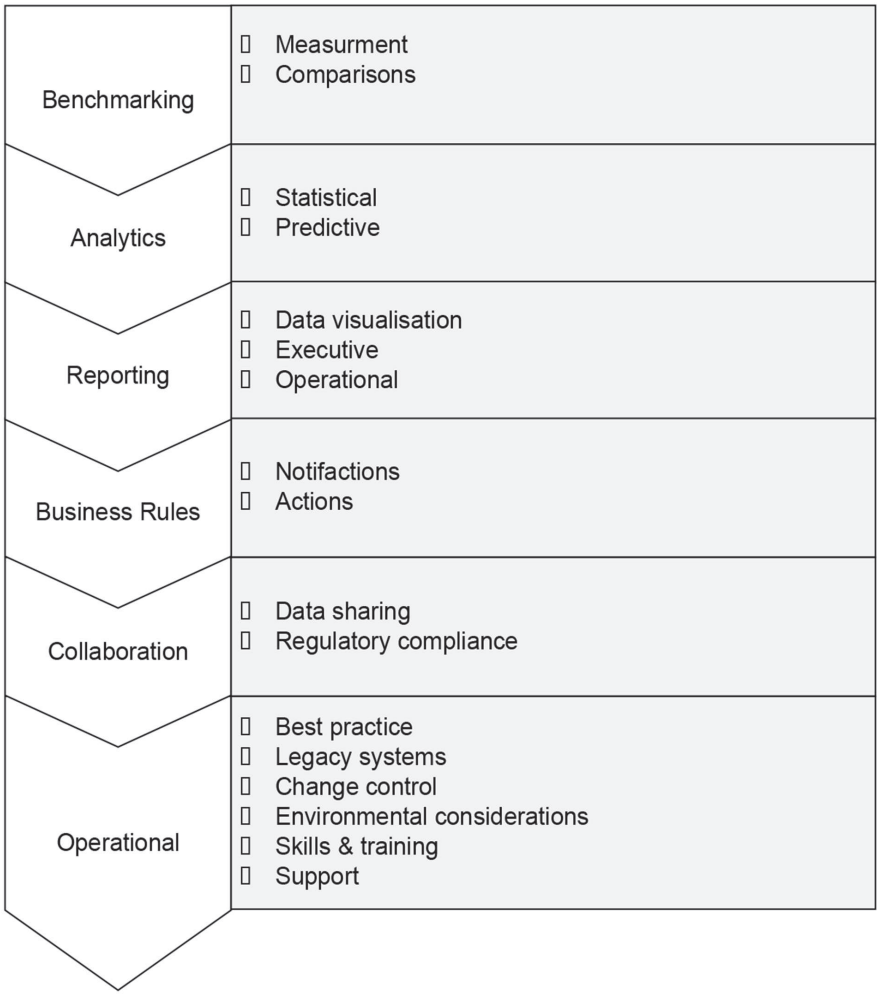


Fig. 2. Examples of BI functions [7]

There is no clear definition of CRM. In the literature, you can see the many interpretations of the same issues, but all these definitions have one common denominator – it is customer orientation. You can treat CRM as an application system or software which allows increasing profitability by automating key processes taking place in the company. The idea of CRM from a technical point of view is to replace human activities, while striving to achieve optimal results.

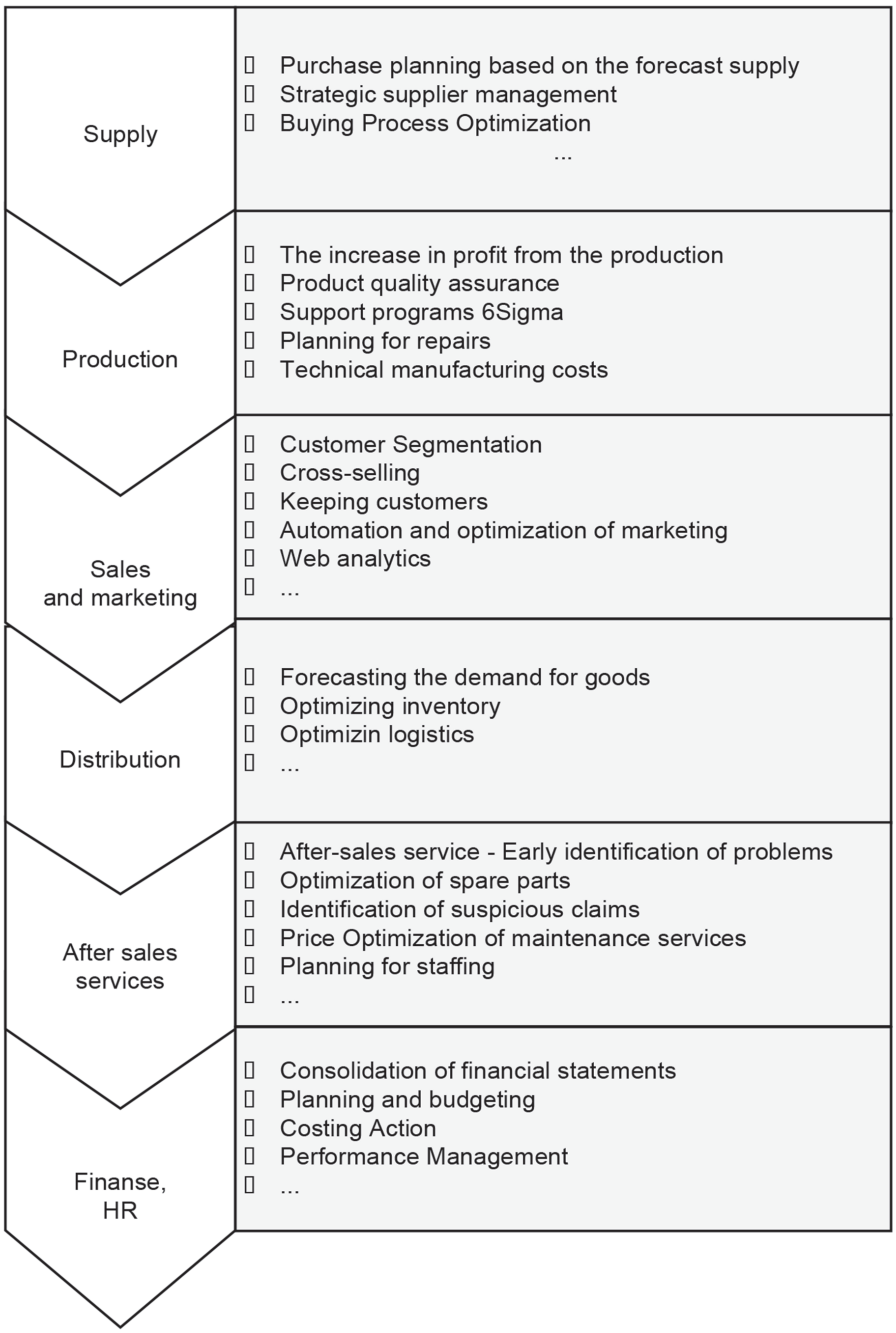


Fig. 3. Areas of business management, based on Kicinger A., 2009 (Kicinger, 2009) [10]

The technology is intended to improve the work of a man, which in perspective is the easiest channel to reduce costs. The company can manage customer relationships in line with the philosophy of CRM and the need to change existing activities [11]. See figure 4.

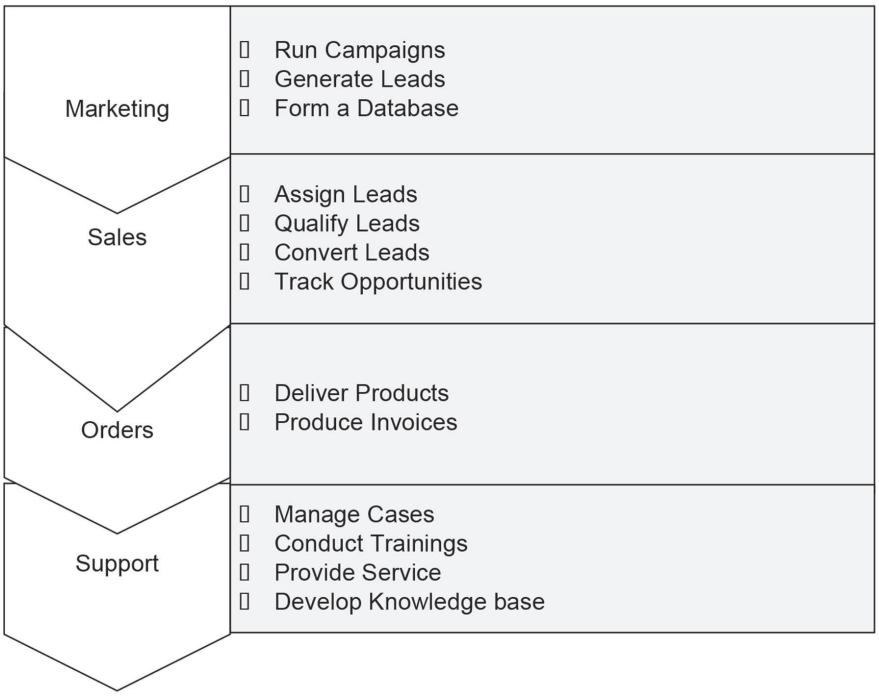


Fig. 4. Areas of CRM systems, own elaboration [11]

3. Literature Review

J. Kisielnicki (2013) notes that thanks to ICT, especially global computer networks companies operating in cyberspace can run a business without the limitations of location, different cultural conditions, a range of consumer behaviour, the difference of their lifestyle, language barriers, as well as technology [12]. According to Przybylak (2010) finding solutions using the best elements of ICT systems has led to the emergence of technological structures, consisting of separated, autonomous units, forming a single unit, matching the expanding needs of the business. The process of converting companies to e-business should not be seen as a way to reduce the number of physical devices in your infrastructure but as a full set of tools to support delivery of efficient business support services. For this reason, you should choose the most appropriate in the current situation and develop solutions in accordance with the previously developed strategy of informatization. Such an approach will help maximise the benefits of this technology [13].

Integrated applications can meet the needs of users regarding flexibility, orientation to business processes, usability, personalization, servicing and optimising the maintenance costs of IT systems. Ebrahim Rahimi and Najibeh Abbasi Rostami (2015) in an article titled „Enterprise Resource Planning and BI: The Importance of Integration" state that ERP and BI can provide significant value for an organisation. The integration of ERP and BI can enhance and improve the ability of companies concerning decision-making. This approach leads to optimal use of both ERP and BI [14]. Dunaway & Bristow (2010) think that the ERP system not only affects the company itself, but also the supply chain including external entities, both customers and suppliers [15].

SearchCrM.com contributor Chris Maxcer (2016) writes that integrating CRM with ERP can help save money and improve relations with customers. Companies want a full view of their customers and connect their CRM and ERP applications in the cloud. They examine the business case for cloud integration of CRM and ERP-reviewing questions about departmental barriers, data memory, staffing and operations [16].

Based on the literature review, analysis of current research, the practical experience of the author and increasingly visible trends in the development of BI, ERP and CRM, it should be noted that studies on the integration of information systems in enterprises should be conducted. The main problem in the area of integration is the lack of satisfactory scientific studies as well as model solutions and recommendations that can be directly applied in business. Entrepreneurs often find it difficult to make the right decision regarding the integration of ICT systems and development planning in this regard.

4. Methodology

This presented methodology framework was designed by the analysis of the specifics of BI, ERP and CRM systems, current literature and also the authors' experience. The paper has been prepared especially for specialists from the areas of BI, ERP, CRM since the knowledge is required. The article can be used in universities as well by both professors and students.

Problem Statement

An analysis of BI, ERP and CRM shows that there are many misunderstandings and divergent opinions in this matter. This results from the following:

- Continuous and dynamic development of systems of this type.
- The fact that managers do not have expertise in particular on the possible benefits.
- Difficult access to finance and investments in the integration of ICT systems.
- Lack of sufficient publication in this field.
- Low level of entrepreneurial skills and talent.

- It affects the level of problems; limits specialization in implementing BI, ERP, CRM solutions and eventually leads to gaining low profits from business activity.

The Goal of the Study

- To identify the difference between BI, ERP, CRM.
- To appropriate the benefits of integrating BI, ERP and CRM systems
- To appropriate further development and the recommendations of BI, ERP and CRM systems.

Research Questions

- What are the differences between BI, ERP, CRM?
- Which benefits can appear after the integration of BI, ERP and CRM systems?
- What further development and recommendations of BI, ERP and CRM systems may be expected?

5. Results

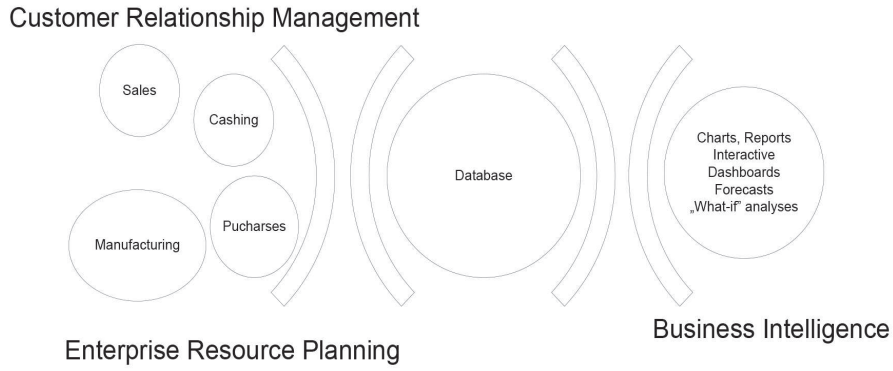
The difference between BI, ERP, CRM.

In this part of the paper, the authors try to appropriate the differences between information obtained from an ERP solution and those from a BI and CRM solution. BI, ERP and CRM solutions are based on modern data warehouses. Thanks to the accumulation of large amounts of information you can carry out a detailed analysis of the results presented in the form of tables or graphs. Of course, it is possible to configure those applications to benefit from a single information database. Unfortunately, some people confuse these concepts. Although the shortcuts are similar, they have a different meaning. The ERP system is responsible for the management of many areas of the company and includes modules in such departments as accounting, warehouse or sales. In contrast to its CRM system it focuses on managing contractors. It allows you to generate reports on sales to individual customers and management confirmations to make their payments [17]. Companies use BI to increase decision-making capabilities for managerial processes such as planning, budgeting, controlling, assessing, measuring, and monitoring [4].

BI solutions have enjoyed considerable development during recent years and companies offering these kinds of systems have experienced spectacular growth despite the economic downturn. The functionalities provided to the users have become increasingly various, covering a wide range of needs, from simple tabular or graphic reports to the opportunity to follow the organisation's key performance indicators in a synthetic and concise way [4]. BI tools are usually leveraged by analysts for high-level discussions which involve strategic decisions. A BI tool accesses all of the data in your data warehouse, both strategic (revenue, profit and growth) and operational (daily sales

performance). BI tools enable you to conduct in-depth analyses to generate comprehensive information that can deliver high-level insights [10].

A BI solution extracts information from other systems (e.g. ERP) and provides it to the decision-makers in an intuitive and easy form. CRM very often is located inside ERP. In this way, the indirect benefits of an ERP and CRM become more easily visible thanks to the BI system. Implementing a solution integrated with ERP helps companies to observe faster the results of the investment, but also provides other benefits that previously would not have been thought of. It is worth presenting the relationship between ERP, BI and CRM, see figure 5 below:



[18]

Fig. 5. ERP, BI and CRM systems [4]

Philosophy functioning CRM is based on obtaining and collecting comprehensive customer information and the sharing of this knowledge among company employees. Precise identification of the customer's requirements, habits and expectations allow you to create a personalised offer. Thanks to obtaining a competitive advantage, the contractor will be pleased with a fast and professional service. The concept of CRM also relies on the identification of key stakeholders and focuses on their use. As you can see, these systems overlap in a way so subtlety that it is not easy to find a dividing line between them. They should not be confused, however, because their basic functions are different. In the most private units, there are implemented IT systems such as ERP, CRM, budgeting, financial analysis, sales analysis, marketing analysis, balanced scorecards, etc., to support their everyday work. These systems, or rather their databases, constitute the data sources for the BI processes. That is why we can say that the BI technologies occupy the central place among management information systems in an organisation (Nycz, 2013) [5].

Considering all the aspects of BI, CRM and ERP before implementing them, you should firstly determine the company's objectives. Making a good choice is the key to achieving the goals that were set. If you need an in-depth understanding of your operational

performance, BI is the answer. But, if you need knowledge of your operational performance and improvements, the ERP system would be a good solution in this case. CRM seems to combine some advantages of BI and ERP systems. It is important to stress that CRM in many real cases is integrated into ERP and some of the CRM system functions can be found in BI.

Thus, the borders between ERPP, BI and CRM are not clear and not always easy to determine. It is possible that in the future all of these systems will be fully integrated, so attempts to identify boundaries will be purposeless due to the monolithic structure of the system.Ultimately, all the mentioned tools are geared towards business improvement and can deliver significant results [10]. See table 1.

Tab. 1. A comparison between ERP and BI reports. Elaboration based on (Bara et al., 2009) [19].

Characteristics	ERP reports	BI reports	CRM reports
Objectives	To analyse indicators that measure current and internal activities or daily reports	To process optimisation, analyse key performance indicators, forecast internal and external data, internal and external focus	To analyse indicators that measure current and internal activities or daily reports
Level of decision	Operational/Medium	Strategic/High	Operational/Strategic/ Low
User involved	Operational level of management	Executives, strategic level of management	Operational level of management
Data management	Relational Databases, Data Warehouse	Data warehouse/ /OLAP/ Data Mining	Relational Databases, Data Warehouse
Typical operation	Report/Analyse	Analyze	Report/Analyse
Number of records/ transaction	Limited	Huge	Limited
Data orientation	Record	Cube	Record
Number of transactions	Many per second	Several per hour	
Frequency of reports	Month / Week / Day	Constant	Month / Week / Day
Level of detail	Detailed, summarised, pre-aggregate	Aggregate	Detailed, summarised, pre-aggregate
Age of data	Current	Historical/current/ /prospective	Historical/current/ prospective
Variability of data / one transaction	For example, 100 bytes	For example, 100 MB	For example, 100 bytes

Integration with BI, ERP and CRM systems

Increasingly in companies and public institutions there are new needs for integration with online, using mobile tools and the availability of BI, CRM and ERP systems. ERP systems of the latest generation offer a combination of all these features, solutions remain flexible and easy-to-use and require lower capital investment compared with older systems. The main task of the ERP system is fast, direct access for each employee to the necessary information, which improves the quality of decisions taken at each point of the use of IS. Also, the ERP solution must be flexible enough to allow adaptation to the constant changes in the business environment without incurring large financial outlays. In the modern ERP, the condition once data entry must be fullfilled. It means that employees can not repeatedly enter the same data in different organisational units. The use of modern ERP systems has a positive effect on the maintenance costs of SI, and what's more – the system is easy "to learn."

To fully use the potential of the BI and CRM systems, they should be integrated into a central system supporting the management of the organisation (ERP), which in companies usually is a key element of the internal IT infrastructure (on-premise model). Integration is necessary if the organisation wants to implement efficient business processes that go far beyond the area of sales – such as order processing, delivery, management, production planning and forecasting results [20].

The main arguments for the integration of CRM and BI with ERP focus on obtaining in real time a coherent view of customers – the possibility of continuous access to everything relating to customer data and information, which in a certain time is needed for its proper operation. The principle is that the completeness and timeliness of data, regardless of whether they reside in the resources of the CRM or ERP databases. A consistent view of the customer allows employees to make the right and quick decisions in the sales process in many different situations.

Another argument for the integration of the three systems is consistency and standards in the wider communications with customers, regardless of who supports the customer or how the customer contacts the company.

Going beyond the area of sales, an often cited benefit of the integration of BI and CRM with ERP is the ability to improve the area of resource management (supply planning, purchasing materials, queue management of production orders, production planning, optimization of warehouse space, etc.), which results from the automation of information flow between sales and production. Especially it is evident in the case of companies with a longer period of sales or manufacturing companies that can plan resources on the basis of the status of opportunities. The integration allows you to indicate the logic of actions in the area of production and resource management – to specify operations to be performed as soon as the business opportunity goes to the next stage, when it is lost or when the end is transformed into a real order [21].

In a fully integrated IT system, the ERP will contain actual transactions (results), CRM contains forecasts (future information), and BI can support accurate simulations including estimates and serve to make an efficient decision. Users can also perform master maintenance easily, thanks to the integrated management of customers, potential customers and vendors. It is worth stressing, that integrating the systems can avoid the duplication of data input and master registration to maximise the benefits of ERP and CRM. In today's market environment, where the advance of globalisation demands faster managerial decisions, the visualisation of information is increasingly important. Under such conditions, customers place a premium on simulation features that use the results obtained from ERP systems with predictions of CRM systems. Based on the following ERP, a BI and CRM deployment model has been presented below. See figure 6:

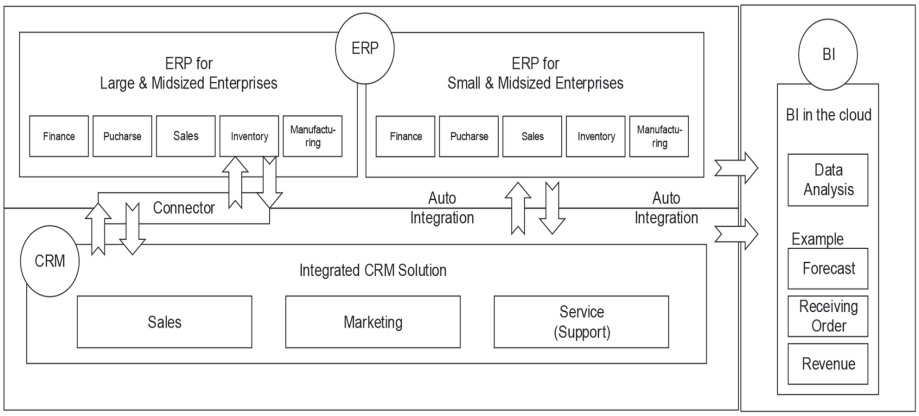


Fig. 6. Integration of ERP, CRM and Bi systems [21].

6. Further development and recommendations of BI, ERP and CRM

Big BI Trends of the Near Future

In the past, BI was used mainly by company executives, providing them with yearly reports on various concerns of the company. As the workforce becomes more mobile, BI is moving outside the boundaries of the office. Modern business leaders demand real-time BI that is always accessible from anywhere at any time using any device. They demand BI that gets the right information into the right hands precisely when it's needed. Below there is a list of next trends that we can expect to see in the next years:

The users are tired of waiting for the IT department to deliver the BI, CRM, ERP applications they need. They are now bypassing the IT department altogether to get what they want. To stop users from using outside services, IT departments will have no choice

but to deliver self-service BI, CRM, ERP options that let users create the own sub-applications they require. This process either involves giving users the development tools to create their applications, or simply creating a variety of canned reports for end users.

After discussions between researchers and analysts, the agreement has been reached: The cloud is the future, even though the public is still reluctant to this idea because of its drawbacks. This combination of BI, CRM, ERP and cloud is very promising with nearly 100% uptime and scalability without all the time and money required to maintain in-house hardware. However, the security issue of this system is still a big matter that raises concern for many firms and companies, who are reluctant to entrust their private data in the hands of the cloud providers.

In the case of social media, the best collaboration platform that can be easily accessed is the internet. This concept translates seamlessly to BI, CRM, ERP. Interacting directly with a coworker through an IT application would be an evidently useful thing. Sharing ideas or pointing out interesting trends found in the data will be possible as well. This will soon be accessible not only to large companies, but also for the small ones that do not have enough money to invest in such applications.

In the next years, there will not be any limitation set by device or location. It will be cross-platform, offering instant access from all laptops, smartphones, tablets and other future inventions that will be provided with internet connection. Now, mobile ICT is making a backward step because of building separate mobile apps for laptops, smartphones and tablets. What they should do involves creating ICT apps that adapt to the device from which they're accessed. They must look like a PC application when accessed on a PC but look completely different when accessed on a laptop, tablet or smartphone.

While traditional BI is typically a one piece product, embedded BI integrates analytics and reporting capabilities directly into your everyday business applications. Essentially, embedded BI brings BI to the end users, working it into their daily routine. This approach is far simpler for users and can lead to better user adoption.

Data will no longer be stored in one or two internal database (s). Soon they will be kept, either in your personal database or cloud services, email accounts, social media, the web, and so on. For example, the BI, CRM, ERP application that you are using might not only provide you with information on products that are on sale, but also reasons and reviews about the product's price. This will offer you a better insight into the usefulness of the specific merchandise.

As BI and CRM beggins to evolve also regarding the use of mobile devices, the utility of GPS locating application is growing. An example of a good association between the two parts would be the situation when you, as a business provider, go to the client and the application gives you data on the client, based on the given GPS location.

7. Conclusion

The paper presents analyses of Bi, CRM and ERP systems. At the stage of analysis, the needs to create the fully integrated information system were specified. The study shows that the growing need to use methods and tools for the analysis of business processes in information systems is very important in the departments responsible for making decisions (management, accounting, human resources, payroll). The proper implementation of ERP, BI and CRM systems requires the use of structured methods and procedures for the implementation of different phases. To deliver complete information about the whole enterprise, though, it is necessary to implement the BI system. This paper also shows how to create it.

BI, CRM and ERP are broad subjects about which many question marks can be raised, especially when referring to future improvements of all of them. Due to the use of BI and the major advantages that they bring to a business company, there has been and will still be a lot of research in this field rather than in ERP or CRM. Studies and experiments on BI are not only conducted in industries' laboratories but also in universities, and therefore, due to this association between industry and academia, there will be big advances in this field, maybe different to the one mentioned previously, which will occur sooner than expected. In spite all the developments that BI will gain in the coming years, we should not forget that the better the gains and the results are, the more they will cost.

The analysis in this study clearly demonstrates that the key to further development of IT systems in business is the comprehensive integration of all parts of the IT system. Despite many difficulties and obstacles, we should attempt to integrate BI, CRM and ERP. Only in this way can you achieve the many benefits which are described in this paper.

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