An example of ERP system application, OLAP ANALYSIS with the use of MS SQL SERVER (analysis services) for management support in the Pozkal Printing House in Inowroclaw

The application of BI tools for management generates a number of problems in the period of their long-term exploitation and is caused by many reasons. There are mostly faults closed to data processing organization, and what causes a lack of clarified solutions for data warehouses during updating in which the results, confronted with transactional systems reports, can exhibit many differences.

Discussed in this monograph are cases of failure and resignation from the BI systems’ exploitation in two organizations and serve as a clear warning.

An analysis of the circumstances resulted in success with regards to the implementation and exploitation of the BI system in POZKAL firm allowing for the clarification of applied solutions for data processing organization which ensured the stability and efficiency of exploitation of those solutions for a period of approximately four years for their usage.

Extensive literature on the development of knowledge applications in company management

1. Extensive literature on the development of knowledge applications in company management concerns the most commonly mentioned seven tools for their implementation. [14] Document management systems – used for storing and classifying documents, usually determined by the ERP system solution or created standards of WEB solutions for information processing.

2. Workflow systems supported by the procedures of the creation and exchange of information within an organization and between organizations, allowing for the collection and processing of document contents.

3. Group work support systems, allowing free flow and knowledge sharing, usually limited by the applicable software standards and the functionality covered by the system. [9]

4. Data warehouses constituting easily accessible data repositories, widely discussed from the point of view of their use and organization conditions for processing are presented in this chapter.

5. Decision support systems such as interactive solutions for information provisions needed in the decision-making processes in planning, logistics and cooperation at the operational, tactical and strategic management level.

6. The Internet is a basic environment for cross-organizational data exchange and management virtualization assisted with WEB software standards supporting integrated system standards operated in enterprises.

    Corporate portals – internal resources of various types of data created in enterprises (constructive-technological, marketing), databases functioning in CRM and SCM systems, made available in their respective decision-making positions.
Basic tools for knowledge management support presented above are determined by the application efficiency of ERP integrated systems, defining the required quality level of databases to create data warehouses, as emphasized by [17, 19, 22] and [26]. The testing of the ERP system implementation effectiveness in an international corporation in the chemical industry showed [3, 4, 5] that the key factor to success is the selection of tools to support PRINCE II and AIM Oracle project management to ensure the effective work of the implementation team. The results of these tests confirm the results presented in the works [16, 17, 19], in which the authors draw attention to the importance of the selection of proper implementation methods for the outcome of their subsequent operation. The right solutions to implement an ERP system in corporations are very important in order to carry out successful work during the period of intensive development of an organization and its complex modernization, which occurred in PESA SA in Bydgoszcz [9].

A group of users with advanced ERP systems, enhanced with CRM and SCM systems and MAXIMO software adapted to their requirements, for the support of fixed asset operation management is represented by Kujawy Lafarge SA. In these international corporations [10], we find examples of ICT progress enabling the implementation of Business Intelligence tools. Formed during years of use in corporations, ERP systems and their implementations applied in recent years differ in their ability to adapt to changes occurring in the environment, which can be noted in the organizations mentioned above, as well as such works as [17, 18, 19]. The ERP system implementation and the operational experience, supported by a three-year operational period of the data warehouse exploitation and Business Intelligence tools in SME enterprises, deserve a more thorough analysis, which was developed in Chapter 5 of the monograph.

8.1 Characteristics of the research objective

POZKAL Printing House is headquartered in Inowroclaw, Cegielna 10/12. The company, founded in 1986 by Tadeusz Chęsy, an engineer, as a part of a restructuring processes that Kujawska Printing House, with a 150-year tradition and serious economic problems, took over in 1996. The combination of the managerial vision and the concept of a Company repair programme, addressed to the crew led to the preservation and expansion of earlier threatened jobs. The success measurement and the innovative character of actions may be constituted by the fact that, in the search for a SME company with perfectly-implemented applications of BI systems, the POZKAL company emerged as a leader of this standard of information and communication technology application.

Numerous awards and distinctions confirm the high quality of products and services provided by POZKAL, which was honoured with the Diamond Griffin prize as the only printing house in Poland. POZKAL holds certificates ISO 9001: 2008, ISO 14001: 2004 and FSC (Forest Stewardship Council). The POZKAL company employs 240 employees, including 13 engineers and 79 technicians, and 13 middle-rank managers. Whereas, the management board consists of 3 individuals, and the strict management team includes 7, 209 employees take part in the production and logistic processes. The company has modern technological lines, providing the opportunity to meet the quality and time expectations of over 400 contractors that have been cooperating with POZKAL for many years.

The total surface area of the radically rebuilt and modernized production halls tailored to the length of technological lines, exceeding in some cases 150 m (Figure 8.2.), is approximately 12,000 m², which visualizes the scale of financial burden caused by the handled fixed assets.
Figure 8.1 Employment during 2007–2011 (data from 2011 contained in Chapter 4 includes the first 6 months)

Source: Own research.

Figure 8.2 Book Binding machine – BOLERO in the Müller Martini company

Source: Company archives.
The primary production focuses on the printing and binding of books in a wide range of technologies, including: hardback, paperback, complex, soft, and booklet covers, wire binding, needle binding, and PUR gluing. The machine complex includes, among others, machines for offset sheet printing, machines for offset roll printing, and systems for digital printing.

![Figure 8.3 The amount of orders (projects) by production type in 2010](image)

Source: Own research.

![Figure 8.4 Sales value (mln PLN)](image)

Source: Own research.

The specificity of production is based on the fact that each order is a new project that is unique in terms of content, which results in the necessity of process control over each order at every stage of the production processes (for each order, a proper set of machines is necessary). On this matter, one of the main parameters is circulation (number of copies of the final product),
which carries a value from 1 to several million copies. Both the method of elaboration and the effective raising of European Union funds facilitated the process of funding and the modernization of fixed assets as well as equipment and computer software standards applied within the enterprise. High competitiveness of many specialized printing houses in the region and country entailed a condition for the strategic implementation to maintain and even to increase the number of posts – it was a radical re-modeling of methods and tools for management support hitherto applied.

The area requiring special concern was the radical improvement of the planning process and the settlement of production costs. The fact that the ordering parties, making use of a substantial increase in production potential of the industry to offer progressively lower prices in tenders, was decisive, which directly affected the true level of profit margins and risk reduction arising from the lack of sufficient recognition of the actual production costs in the process of trade negotiations. Using POZKAL’s own experiences or competitors’ solutions (benchmarking) was, in this case, limited due to the fact that the entire industry was in pursuit of effective and original methods of solving the problem. Key elements of enterprise management solutions, along with information systems unique in their concept and data processing technology presented in the following three subchapters, constitute an extremely important factor in the implementation of the development strategy of POZKAL.

8.2 The analysis of critical success factors for the implementation of ERP system and BI tools in the SME – POZKAL Printing House in Inowrocław

POZKAL, located in Inowroclaw [8], an SME in the printing industry, is an organization the basis of which we can assess the effective implementation of the ERP system in connection with controlling as well as exemplary implementation and BI (business-intelligence) operation solutions. The refinement of such a form of cooperation with the creator of a new system of implementation as to define the subsequent, often not quite accurately-located substantive problem, was crucial. An example of such a problem is the identification of the lack of coherent and an unambiguous code base for naming and the quality of structural and technological parameters, which relied primarily on the frequent presence of many different names for the same technological process. The organization of content of technological sets required approximately 9 months of work in technical, planning and IT services. The result of this work is the application of 10 names of technology types instead of more than 116.

The modification of the structure of technology sets and order planning under the ERP CDN XL system by COMARCH was followed up by systems for inventory recording, planning and wage accounting, supplies and sales, adjusted to POZKAL’s needs and supported by the CRM system. These solutions ensure the efficient implementation of the contractor servicing function, ensuring flexibility customized to their expectations. The financial and accounting system, with an efficient function of invoice payment settlement and fixed asset register, as well as ABC controlling (Activity Based Cost) ensure smooth data processing in the creation and updating of transactional information. The implementation of the modernized version of the ERP system was the basis for the implementation of a data warehouse and business intelligence system.

One of the purposes of building an analytical system was to implement ABC calculation. This objective was achieved. Reports presented on subsequent pages contain information that would not be obtained without the implementation of activity cost calculation. Most of the presented reports were created on the basis of OLAP cubes – “Model_PozkalABC”, for which the main sources of
data are derived from such systems as financial-accounting, stock records and production control. Aliquot algorithms were defined in the structure of the platform and IBIP platform constructed after a service period of 2 years with the use of the cube “analysis of orders”.

The first cube was formed on the basis of elaboration and assumption tested with the use of calculation spreadsheets and data from the financial-accounting system. The second cube was built on the basis of the first one and extended with additional dimensions from the Workflow system, OLAP cubes – Payment analysis, Sale, RCP (working time registration). In system reports, costs are presented with a negative value, and income with a positive value. Due to the need to synthesize information from various information reports in making strategic decisions, graphic outputs have a high relevance in the process of synthesis of materials from individual reports.

8.3 Decisive factors for BI system application stability in POZKAL

The information contained in Chapters 2 and 3 constitute an extremely important starting point for considerations contained in this chapter, dealing with the problem of critical factors in the implementation of innovative solutions for information and communication technology applications within the enterprise. Transactional IT systems operated for several years in the Kujawska Printing House enterprise and allowed efficient power support of the implementation of employment – the wages record function. A broader range of applications for IT systems at POZKAL allowed one to test order recording and accounting; however, the problems with ensuring uniform codification of technological activities impeded the possibility of achieving more advanced methods of cost settlement.

In this case, it can be noted that a high degree of specificity of each order made it difficult for the enterprise to obtain the level of information management support characteristic of MRP (Management Resource Planning) or ERP (Enterprise Resource Planning) products. A deep change in applied solutions in the fields of technology and organization of production processes that took place in the enterprise after proprietary transformation also required equivalent solutions of applied IT technology. The company’s management board was aware that costly modernization in the organization could not provide sufficient financial effects, unless radical improvement of the methods of cost calculation preparation and precise methods for cost accounting were possible. Precisely, these considerations helped to determine priority objectives of IT system modernization, under which the priority for the new system was the implementation of cost settlement with the use of the Action Cost Calculation (ACC) methodology [12]. The elaborated specification of the tender documentation to develop the implementation and the introduction of an integrated system took into account the deletion of the weak points of the exploited system and enabled one to identify a competent implementing company.

The discussed ERP system solutions for printing houses are not particularly innovative technologies; however, they can be a unique standard by introducing a specific organization of data processing. The application of controlling according to Activity Based Cost constitutes an example of the search for enabled solutions to manage the use of fixed assets more effectively. Even a higher value is constituted by three years’ experience of the continuous effective operation of data warehouse and OLAP tools for the support of operational, tactical, and strategic decisions.

Figure 8.5 illustrates the most commonly applied solutions for the organization of data processing, starting with the process of source document creation through their storage in a transaction database, then their placement in a data warehouse and creation of reports with the use of OLAP tools, data mining or graphic outputs. Figure 8.6 shows the solutions applied in
POZKAL that were significantly different from the processing organization presented in Figure 8.5. The difference concerns an extremely important process of solutions for data warehouse updating, made at the end of transaction processing on a given day, which provides feedback allowing for the verification of those erroneous records by IT system users in the area of operational information.

The record status of all the record data generated at the beginning of the next day is used as a basis to process information for the current day by downloading the status from the data warehouse and running operations from current transaction documents. They constitute the basis for the creation of source documents and recording the OLAP file status. The solution applied at POZKAL appears to be fully evident; however, it is with all probability used infrequently in practice. This is due to the fact that the use of a data warehouse to create all the operational information can raise executive and employee concerns about warehouses, purchase departments, sales departments or settlements with counterparties departments, in terms of additional sources of this process disruption.
Figure 8.5 Typical integrated data processing system

Source: Own research.
Figure 8.6 Integrated data processing system with feedback solution
Source: Own research.
The aforementioned concern may be justified since the introduction of the complex process of updating data warehouses and using their results as the sole power source of operational information in the enterprise (Figure 8.6) was a courageous decision burdened with the risk of failure. The application of precise algorithms for updating the collections of data warehouses tested in advance and their linking with the analysis of transaction data from the last day could give rise to doubts as to the accuracy of these operations. The results of a three-year application of this solution at POZKAL proved to be fully effective from the perspective of their long-term application. The benefits of these solutions are obvious because the records of transaction data are valid only if they are constantly reviewed in all the functions of data processing in the organization.

Conclusions formulated in this chapter may provide the basis for the explanation of causes of unintended use or resignation from properly-designed and deployed systems of data warehouses in organizations and Business Intelligence tools in many enterprises and bodies of the State administration. The elaboration of parameters of new orders, according to the established rules of creating and updating technological sets allowed for the verification of the correctness of implemented software and the adaptation of report patterns to the expectations of system users. Limited exploitation of a new system helped to identify the need for solution definition and printing reports for the operational, tactical and strategic level of management.

Making the decision on the application of data warehouses for data archiving and processing with the use of the OLAP method by the management board of the company made it possible to apply OLAP cubes for most information reports created within the enterprise. The problem of information distribution on workstations within the company has yet to be resolved. For this purpose, the application of a work-flow system standard for the generation and distribution of reports according to users’ needs and authorizations was designed. In the distribution of information, the principle that for individual workstations’ reports with fixed structure and up-to-date information are made available was applied. In the adopted organization of data processing, the principle of the possibility to introduce new information statements at any level and workstation in order to maximize the use of information inputs in the organization was valid. In order to protect the company against an overflow of often unjustified change proposals, all new standards are co-elaborated or accepted by a report coordinator from the IT Department before their implementation.

In the following subchapters 8.5, examples of system reports embracing the issues within the field of operational, tactical and strategic management are presented. The starting point for a solution search was to determine the purpose and to balance the business expectations. The multiplicity and diversity of expectations already reported from the beginning of the process of defining the implementation project imposed the need to search for solutions wider than the very notion of BI and, at the same time, very flexible in terms of adapting to the ever-evolving business and new technologies that are dynamically entering the printing industry. [6]

Preliminary inquiries were sent to the 12 firms offering the implementation of BI systems. Many of them were rejected due to the possibility of cooperation (ETL) with only one specific ERP and MRP II system. There were BI system offers without data warehouses. There were also offers of a BI system which could not be modified after implementation (fixed power supplies, fixed processing algorithms). Final negotiations were conducted with three suppliers: COMARCH S.A., CONTROLLING SYSTEMS and INTENSE S.A. INTENSE signed the contract for implementation, having offered its own solution under the name of “Intense Business Intelligence.
Platform” (IBIP) and had undertaken to extend its own software with the items that were not there at the time of signing the contract and that were expected after the implementation of the system. [8] The implementation period was primarily about searching for a mutual plane of understanding among members of teams appointed in both companies in the field of applied nomenclature. The involvement of members of the top management of POZKAL was very intense in that period. The team consisted of 3 individuals: the Chief Executive Officer, Chief Accountant, and Chief IT Specialist.

In addition, depending on the area of decision-making which was affected by the discussed problems, in the implementation work the following team members took part in as well: the Commercial Director, Production Director, Chief Technologist, and Managers of Production units. Disputes were solved by the team or, in case of the lack of consensus, the decision was made by the Owner. Most discussions were mostly concerned analytical dimensions and applied measurement units.

![Figure 8.7 OLAP cubes and part of the size list (from 2009)](image)

*Figure 8.7 OLAP cubes and part of the size list (from 2009)*

Source: Own research.
The implementation lasted 6 months. After another 3 months, the work-flow system was launched for the distribution of reports within the framework of the ongoing projects. The components of the system presented a synthetic solution found in Figure 8.8. The term “synthetic” should be understood as a structural system solution taking into account only a part of the relevant constituents in the process of implementation. The condition presented in the scheme was achieved in 2009. In accordance with its provisions, the platform for the system is constantly modified and developed, which is a decisive factor for the high efficiency of management support achieved with the use of solutions for Business Intelligence class, as it is presented in Figure 8.9.
8.4 Analysis of the 3-year operational experience of BI application in management

It was decided to present the evaluation of operational experience in terms of results of the applications of the developed and implemented system, more specifically – management support functions obtained in the implementation at the operational, tactical and strategic level. This is a difficult task in the process of implementation due to the integrity of management functions and the penetration of the decision-making process in the various time horizons, levels of information aggregation or management hierarchy. The above-mentioned claims were considered necessary, since some readers may have reservations as to whether the way the reports were presented actually concerns the management level indicated in the report.

The presented reports constitute only a selected example of the juxtapositions appearing in numerous amounts in the information system and providing the opportunity to make executive decisions at the operational-level for most workstations. Reports for tactical and strategic decision-making are much more complex, most often specific in terms of the inputs necessary to support various management functions. The presentation of reports were dominated at the level of operational management.

Supporting information functions at the management operational level concerns all information inputs for decision-making on executive posts and current maintenance of the function of managing. These functions are the following: production, logistics, finance, operation of production systems, and staff directing support. Such large-scale inputs make the selection of system reports necessary, even for a brief illustration of this particular complicated group of information outputs. The selection of report representatives adequate for task groups, that are the most important in the framework of specific management functions, can provide help in solving the problem. The report presented in Figure 8.10, whose content illustrates the demand for the type of information required during daily production meetings, constitutes an interesting example. It is available for operators who participate in these meetings.
The next report presented in Figure 8.11 contains detailed information limited to one component of a carried-out task. This report supports the actions of a shift supervisor and a foreman. The source of information is developed by the platform’s operational base and CDN XL system base.

Source: Own research.
The managers of the production departments usually use reports that contain accumulated information about orders in progress and those scheduled to develop. Examples of these reports are in Figures 8.11 and 8.12. The range of input data is identical; however, different groupings were applied. Report 11 groups active orders according to the type of technology (1 degree) to be applied for implementation in the production department and scheduled lead time (2 degree). It allows for scheduling the movement of employee groups for their optimum use. Report 12, presented in Figure 8.12, is the deadline for orders which are grouped according to the scheduled production date (1 degree) and technology type (2 degree). The report helps to control the execution order on operating slots within the production department.
Operational reports provide information derived almost in its entirety from transaction systems. They are used primarily by the Production Director and Commercial Director. A unique feature of these reports is the way they are obtained: that is, ad hoc. In the near future, paper reports from the operational field are to be replaced by ‘information kiosks’ that will be located in production departments.

### 8.5 Presentation of reports supporting the tactical management level

Supporting the decision-making process at the level of tactical management concerns the horizon of the annual-quarterly-monthly planning, which includes juxtapositions embracing the information for the planning and execution aggregated in cross-sections of order groups and basic categories of contractors and products. Reports for the purposes of tactical management are mostly supplied to recipients in the form of attachments (*.mht) to an e-mail. The contents of reports are determined with their recipient or recipients. The elaboration of reports is most often the task of the IT department.

If the thematic scope of the report does not exceed the decision-making scope of the one in need of the report, then it is made in the shortest possible time, and report recipients are added to automatic subscription system: plus, the frequency for report generating and sending is determined. An update of reports related to tactical and strategic management occurs in a 24-hour cycle. This is done during night hours, when the server load is the lowest. Reports are the last element of the day-to-day extraction of data, warehouse input and OLAP cube processing. Below are a few examples of graphical outputs that enable a quick diagnosis of changes in the areas concerning a given report.

![Figure 8.13 Sales dynamics (generated automatically)](image.png)

Source: Own research.
Figure 8.14 Monthly statement of the production value within certain technology (in Polish)
Source: Own research.

Figure 8.15 Summary of the planned expenditure on individual projects
Source: Own research.
Figure 8.16 Resources usage

Source: Own research.

The presented contents of reports from number 8.13 to number 8.16 in the form of graphical outputs and tabular summaries illustrate the real potential of supporting the decision-making processes that occur at the tactical level of management. A unique feature of the information inputs in question is their selective nature, which usually causes the need to prepare several information summaries providing complex information necessary for the decision-making process.

8.6 The presentation of reports supporting the realization of strategic functions in POZKAL

Supporting the execution of the strategic management functions is subject to the decision-making needs of company executives. The scope and structure of reports necessary to support strategic management functions are among the least repeatable solutions; hence, the examples contained in this subchapter are only an attempt to illustrate the decision-making processes occurring in this area. Some of them illustrate the examples of decision-making determined by the needs of market analysis relevant to the development of an organization and information conditioning necessary to make decisions about purchasing technological equipment. One of the purposes of building an analytical system was the implementation of ABC calculation. This objective was achieved. The reports presented on the following pages contain information that could not be obtained without the implementation of Action Cost Accounting. Most of the presented reports were created on the basis of OLAP cubes –“Model_PozkalABC”, for which the
main sources of data are derived from the financial-accounting system, stock record system, and production control system. The algorithms of aliquots were defined in the structure of the platform and IBIP platform built after a period of 2 years with the use of the cube “Analysis of orders”. In the reports, costs are presented with a negative value and income from a positive value. Due to the need to synthesize information from various information reports in making strategic decisions, graphic outputs have high relevance in the process of synthesis of materials from individual reports.

Figure 8.17 Basic costs structure

Source: Own research.
Figure 8.18 Costs by types

Source: Own research.

Figure 8.19 Extended cost by structural types

Source: Own research.
The aforementioned reports are generated no sooner than monthly due to the way that the costs are posted. Quantitative data based on production are transformed into a 24-hour cycle, while a portion of the cost is posted in much longer periods. Very important information is derived from the reports presenting the dynamics of changes in the structure for dimensions data. Changes in typical reports can be observed, such as: the structure of the turnover with customers; the structure of orders in progress according to the type of technology; the structure of assets and liabilities; the cycle of stock rotation; the dynamics of sales; the structure of stock turnover; the dynamics of performance and activities for cost centres.

Top management during regular meetings analyzes different elements of company business. The starting point for discussion is constituted by reports automatically generated for the heads of individual departments. During such meetings, the most common form of obtaining additional information is the presentation of data stored on the OLAP server with the use of data drilling and filtering. Therefore, the chief IT specialist ensures the elaboration of the report and the necessary decision-making is involved in every meeting [7]. Interesting examples of strategic decision-making support are presented in the figures from the number 8.17 up to the number 8.20, due to the use of reports obtained by the BI POZKAL system, which concerns important purchasing. These reports have been hitherto carried out through co-operation of making operations related to the purchase of machines for a specified amount. The lack of an efficient exploitation of production efficiency of expensive machines would result in the deterioration of POZKAL’s competitiveness in relation to other companies.

Simulated calculations and report printings were made by using statistical data, which illustrated different consequence variants for that decision, depending on the structure of the executed orders. Having analyzed the pre-made statements concerning the reports used within the discussions of managerial staff that took place in the past few months, it was decided that the
transfer of the results of this work and the input structures of strategic planning elaborated in the reports could be a threat to POZKAL’s competitive advantage.

**The assessment of synergy results achieved in BI system application in question**

1. In the chapter on methodical aspects of the implementation of business intelligence tools, the results of the internal analyses made in the period directly preceding the implementation of the system were presented. Similar analyses were carried out in September 2011 and implemented while maintaining the information structure of the previously-used source information. The results of surveys discussed in this chapter illustrate the fact that in the minds of respondents representing different workstations, important changes were observed.

2. High proficiency in handling computer techniques and the support of task realization, achieved by the majority of company employees, contribute substantially to the improvement of professional customer service. Such professionalism includes, on the one hand, the provision of quick answers to client’s complex questions, and, on the other hand, the precise explanation of the reasons behind the level of offered prices of a product to clarify that this price is derived from the actual values of material investment, labour and the necessary working time of machines and technological equipment.

3. The second area of the synergy occurrence, associated with a high level of company management and the application of advanced information technology, brings positive results in terms of the execution of processes within the organization. These results are justified by the given operational connections performed on production lines operated by a computer with operations of low productivity, which appear as technological processes. The synchronization of diverse technological processes with a large number of different orders, workstation loads and execution dates, determine the level of achieved performance and productivity of manufacturing resources.

4. The areas of application, especially predisposed for the occurrence of changes in quality and synergy effects, appear at the level of top management in the form of processes of standard support in strategic decision-making within an enterprise. Examples may include both the creation of guidelines for a price negotiation policy and co-operation with clients. They also apply to the proposals of parameter values which determine the decision-making processes in negotiations and the conclusion of contracts by middle-rank management. Another example is the long-term work on the motivation system, under which simulation tests for project development related to a new motivation system were practically applied, ensuring synergy effect, in work organization and achieved performance.

**Bibliography**
