

# CUSTOMER CENTRIC STRATEGIES FOR VALUE CREATION: ACADEMIC EXPERIMENTATION

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The exigency to assure the maximum of efficacy and efficiency of the educational processes is an important challenge to the social and economic development. The use of customer centric strategies is a crucial opportunity to the monitoring and the continuous development of the performance amelioration.

This paper presents a new customer intelligence system that offers an indispensable support to improve the performance of the academic educational system by extracting knowledge from a data warehouse.

In particular, the experimental analysis made on undergraduates of the Faculty of Economics of Bari proves that the CIS allows to detect early the dropout reducing the academic death rate.

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## 1 Introduction

Among the great problems affecting the ITC environment, and above all Public Administrations, there are: a poor integration of the applications involved in the analytic processes of the different business areas with the data saved in various repositories; an even poorer inclination to use solutions to optimize the quality of the data.

A company willing to be competitive has to center its strategy on customers in order to create a proactive relationship with them.

To do this it is no more sufficient to center the decisional processes on the information contained within the transactional systems, but it becomes important to produce knowledge to create a unique and reliable outline of all the customers' data, to build the customer experience.

To know always better the customers/users, to be able to understand their exigencies, to propose the right solutions to satisfy them: that is the challenge that companies are asked to win, in order to resist on the actual market. The same challenge is awaiting Public Administrations that can no more produce only information but have to produce the knowledge allowing to take decisions based on scientific methodologies of business intelligence.

Actually, in modern economics, knowledge has become a production factor as important as the traditional ones (information, financial resources, human resources and material resources). The business value itself is always more linked to the knowledge that is within productive process, products and services, the relationships with customers, suppliers and partners. Unfortunately great part of knowledge is dissipated and thus underexploited: there are still many companies that do not produce knowledge but are destroying it, although this may sound strange only to the most distracted. To manage knowledge means to identify and to acquire information, to manage it and to make it available to any sector of the company, developing new competences and more effective processes.

For this reason information systems have to be re-shaped in a customer centric perspective, to gather more accurate information about customers and to have a good unified vision at the most detailed level.

In this paper, we will present a model that explicates the relationship among data, information, and knowledge, that will lay the methodological foundations for the implementation of customer centric decisional processes; the idea that the business road map is the one traced by various authors will be confirmed: "companies are extending their operational and decision structures to include those of their customers, suppliers, distributors, and alliance partners. Product-centric strategies are replaced by customer-centric strategies that facilitate value creation." (Chan, 2005)

The model was tested on the undergraduates enrolled in two degree programs of the University of Bari, academic years 2011/2012 and 2012/2013. The target was to reduce the death rate of the Italian universities. The results prove that the problem, sadly and worldwide known, can be solved by the application of user centric scientific models that allow to know deeply the users and help the management to intercept the dropout, as in the case of this paper.

The organization of the paper is the following. Section 2 presents the Data-Information-Knowledge-Wisdom hierarchy model considered in this paper. Section 3 presents the new Customer Intelligence System (CIS) developed in this paper and oriented to support the Academic System. Section 4 presents the experimental framework that was considered for the test, while the experimental results are reported in Section 5. The conclusion of the paper is reported in Section 6.

## 2 From Open Data to Wisdom

“The now taken-for-granted notion that data lead to information, which leads to knowledge, which in turn leads to wisdom was first specified in detail by R. L. Ackoff in 1988. The Data-Information-Knowledge-Wisdom hierarchy is based on filtration, reduction, and transformation.” (Chan, 2005)

The scheme is pyramidal, in that data are plentiful while wisdom is almost nonexistent, as shown in figure 1.

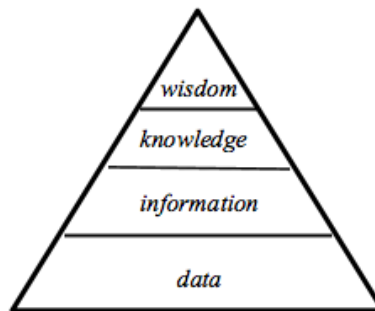


Fig. 1 - The Data-Information-Knowledge-Wisdom hierarchy as a pyramid

The pyramid in figure 1 is not universally recognized in literature.

Actually, Chaffey and Wood propose their own model in (Bernstein, 2009), different from the one proposed by Pearlson and Saundes in (Chaffey & Wood, 2005). In the model proposed by Jashapara in (Pearlson & Saunders, 2012), the hierarchy has one more stage at the top that refers to “truth”. On the contrary,

Choo draws a scheme in (Jashapara, 2004) that is considerably different from the others and that focuses on the transformation process among signals, data, information and knowledge.

“Typically all of these formulations of the hierarchy share a common view that:

- the key elements are data, information, knowledge, and wisdom;
- these key elements are virtually always arranged in the same order, although some models offer additional stages, such as understanding, or enlightenment;
- the higher elements in the hierarchy can be explained in terms of the lower elements by identifying an appropriate transformation process;
- the implicit challenge is to understand and explain how data is transformed into information, information is transformed into knowledge, and knowledge is transformed into wisdom.” (Choo, 1996)

The reference model for this research work was the one shown in figure 1, as we are staunch supporters of the original formulation of the DIKW hierarchy.

Distinctive elements of this model are: data, information, knowledge, wisdom, as specified later.

## 2.1 Data

“Data is raw. It simply exists and has no significance beyond its existence (in and of itself). It can exist in any form, usable or not. It does not have meaning of itself.” (Rowley, 2007)

Data is the element you have to make a judgment, characterize a phenomenon and reach the solution of a problem. It could be defined as an elementary description, often coded, of something, a transaction, an event, or anything else. Data is the first mental representation, the most elementary: the result of an process of abstraction.

Thus, data contains in itself uncertainty that can be removed only turning it into information.

“Data in his terms are the product of observations, and are of no value until they are processed into a usable form to become information. “ (Chan, 2005)

## 2.2 Information

“The difference between data and information is functional, not structural.” (Bellinger *et al.*, 2011)

A properly processed data, complete with descriptions, sent to who is asking for it, at the right time and in the right place, becomes information. Information

is born then by the request made by someone who does not know and is willing to know; it requires a communicative process between sender and receiver and moves among the organizations in paper or digital voice form.

“Information is contained in descriptions, answers to questions that begin with such words as who, what, when and how many. Information systems generate, store, retrieve and process data. Information is inferred from data.” (Bellinger *et al.*, 2011)

## 2.3 Knowledge

“Knowledge is neither data nor information, though it is related to both, and the differences between these terms are often a matter of degree...Confusion about what data, information, and knowledge are - how they differ, what those words mean - has resulted in enormous expenditures on technology initiatives that rarely deliver what the firms spending the money needed or thought they were getting.” (Ackoff, 1989; Ahsan & Abad, 2006)

Knowledge can be conceived as information put to productive use.

The individual knowledge is the result of a learning process and a change in the behavior that occur in a person after having internalized information; it is the integration of values, experiences and information as a part of a mental model.

Knowledge is structural, lattice, made up of nodes and relationships; it is multidimensional: it is always open. It has therefore a variable nature and it is made up individually and socially. Knowledge is “*una combinazione fluida di esperienze, valori, informazioni contestuali e competenza specialistica che fornisce un quadro di riferimento per la valutazione e l'assimilazione di una nuova esperienza e nuove informazioni. Essa origina e viene implicata attraverso i conoscitori. Nelle organizzazioni la conoscenza risulta legata non solo ai documenti, ma anche alle procedure e ai processi organizzativi, alle pratiche e alle norme.*” (Davenport & Prusak, 2000) (“a fluid combination of experience, values, contextual information and specialist expertise that provides a reference framework for the evaluation and the assimilation of a new experience and new information. It originates and is involved through experts. In organizations, knowledge is linked not only to documents but to proceedings and productive processes, too, to practice and norms”).

Within Davenport’s statement there is the lack of simplicity and uniqueness of the concept of knowledge; on the contrary, it is a set of different elements: it is fluid and structured at the same time; it is intuitive and thus difficult to explain literally or to understand in pure logical terms. Knowledge is diffused among individuals, it is an integral part of the human complexity and unpredictability.

Knowledge is a mix of experience, values, contextual information, intuition that provides the reference model to the evaluation and the input of new information and experiences.

It is originated and it is applied in people mind and, within organizations, it is integrated above all with procedures, routines, processes and practices and organizational norms not only with archives and documents.

Information can turn into knowledge only if a proper business intelligence system is designed and implemented, that extracts the data saved in the OLTP systems (data that can be unstructured, semi-structured and structured) and integrates them with its own already acquired knowledge domain.

The distinctive feature of knowledge, that information does not possess in itself, is to have implications on decision and judgment, as it is generated from the comparison with a target and from the integration with its own knowledge.

## 2.4 Wisdom

“Wisdom is not a product of schooling but of the lifelong attempt to acquire it.” Albert Einstein

“Wisdom is the ability to increase effectiveness. Wisdom adds value, which requires the mental function that we call judgment. The ethical and aesthetic values that this implies are inherent to the actor and are unique and personal.” (Bellinger *et al.*, 2011)

We may agree with Jashapara (Pearlson & Saunders, 2012) when he suggests that wisdom is a very elusive concept. It perhaps has more to do with human intuition, understanding, interpretation and actions, than with systems.

## 3 A Customer Intelligence System for the Academic System

The data analytics processes, which are designed to suit the education environment, as in the case of the model in this paper, aim at producing the knowledge suitable to ameliorate the performances of the academic learning process.

The company data are created during routine operations: in the meantime the company wheels roll. They are generated by the TPS systems and stored in the database.

To turn data into a support for the company decisions, there is to say to turn it into knowledge, it is indispensable to give it a “new life” within different archives suitably created, designed and implemented; it is necessary a process that:

- extracts data from the company database, with the subsequent cleaning to raise the intrinsic quality;

- transforms them into a format suitable to the new target;
- loads into new and distinct archives, the datawarehouse, whose function is to produce knowledge.

The production of knowledge needs the continuous and interactive interaction between management, that is willing to know, and repository; the subtended processes provide the creation and the management of queries that can be surfed and customized according to the staff exigencies.

Queries provide different types of graphs, always decomposable. The surfing of these very queries allows management to obtain the knowledge which otherwise would remain obscured under the great amount of giga bytes stored in repositories.

In the Italian University, the progressive reduction of ministerial funds for universities is and has to be a stimulus to the renewal of the management processes so to improve the quality of the data stored in the system OLTP (On Line Transaction Processing), and also to make the Establishment more reactive toward its users. Today the ordinary financing (F.F.O) that government delivers to university is always more conditioned by the evaluation systems and thus university, among other necessities, needs to know its own users, the undergraduates.

In this scenario, methodologies and techniques that support decisions are for University a breakthrough toward the promotion of a bigger culture of the evaluation.

The customer intelligence system presented in this paper is based upon a warehouse made up of three integrated data mart, and powered by various data sources resident in the university computing center, as well as in local departmental repositories. The three data mart are:

1. The data mart related to the fact Exams;
2. The data mart related to the fact Reservations (that in the project is defined background, as it precedes the ground exams and does not express measures). It is about the compulsory reservation for those students willing to take an exam.
3. The data mart based upon “factless fact tables” (AllExamsPossible), that detects the events, so the exams, that has not happened. It is useful to measure the global performances of the undergraduates. The fact table Exams records only the exams actually taken and does not record the ones that are not. To evaluate the university performances it was necessary instead to answer to questions about what did not happen, that is to say about the exams undergraduates could take and did not: this is the use of the data mart based upon the factless fact tables, which does not contain metrics to measure (because actually the exams did not happen)

but it catches the relationship among the keys involved.

- The factless fact table is a coverage table, that is to say a dense table about the exams undergraduates can take. In particular it is useful to answer to the questions about the exams students could take but did not: the desired answer is the set difference between these two lists of records.

Figure 2 shows the star scheme of the first of the three data mart implemented in ROLAP environment (Relational On Line Analytical Processing).

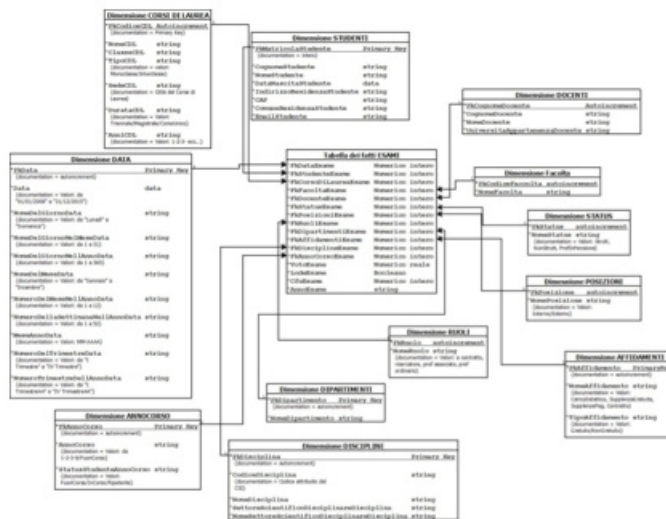


Fig. 2 - Star Scheme of the data mart EXAMS

## 4 The Experimental Framework

The customer intelligence system of this work was used within a project of the Orientation and tutoring Service of the former Faculty of Economics of the University of Bari (Department of Taranto), whose target was to detect the dropout.

The project was applied to the students attending the Bachelor Degree course in Economy and Corporate Administration during the academic years 2011/2012 and 2012/2013 (Economia e Amministrazione delle Aziende in Italian language; then EAA in the following tables) and the Master degree in Business Strategy and Management (Strategia d'Impresa e Management in Italian language, then SIM in the following tables).

In particular, the system was used to analyze a set of indicators, rates and



statistical analysis to answer the OLAP analysis (On Line Analytical Processing) as:

- How many students of the first year enroll in the second for each course?
- How many students of the second year enroll in the third for each course?
- How many students have transferred to / from other programs?
- How many students are out of course for each course?
- How many credits were granted by the degree in one academic year ?
- How many credits were given by each discipline in an academic year?
- What is the average grade for each course?
- What is the average rating for each discipline taught in the center?
- Is there a correlation between the marks obtained by a student for an exam and the temporal proximity of the exam with the professor's lessons?
- What is the time of acquisition of the degree?

Through the multidimensional analysis of the career of the students and of the educational output, the data stored in the warehouse have been “surfed” to intercept the dropout of the students and to identify the potential problems of a particular teaching or degree program.

The first step of the project was the analysis and the reconciliation of the data sources; that is to say the integration of the heterogeneous sources of data (relational data, data files and legacy sources) and the consequent individuation of correspondences among the concepts represented in the various local schemes. At the same time conflicts were solved to create a unique global scheme whose elements can be related to the corresponding local schemes elements.

Furthermore, the Esse3 database schemes implemented on Oracle were reconciled with those on the students secretaries located in the peripheral devices, and containing the reservation of the exams and the request for thesis.

Some of the results are described in the following section.

## 5 Experimental Results

The star scheme allowed to “surf the data” under various points of view. Some of the indices used to intercept the students were:

- Elapsed time between the last and penultimate test.
- Elapsed time between the last and third last exam.
- Elapsed time between the penultimate and antepenultimate exam.
- Downtime of the student.
- Percentage of exams that the student did have to overcome and did not.
- Number of exams passed compared to reservations made.

The students who were intercepted were given a tutoring protocol to restore the normal activity.

Table 1a shows that the customer intelligence model allowed to intercept 118 students in two years, so 8% of students attending the first year of Bachelor Degree course in Economy and Corporate Administration.

Table 1b highlights similar data for the Master degree in Business Strategy and Management, the percentage goes from 10% of the first year to 8% in the second, for a total amount of 19 intercepted students.

**Table 1**  
**STUDENTS INTERCEPTED BY THE CUSTOMER INTELLIGENCE MODEL**  
**(a) EAA**

Intercepted students	% intercepted students	Total students	a.y.
63	8%	754	2011/2012
55	8%	726	2012/2013
Total intercepted students: 118			

**(b) SIM**

Intercepted students	% intercepted students	Total students	a.y.
8	8%	98	2011/2012
11	10%	112	2012/2013
Total intercepted students: 19			

Among the 118 students intercepted and enrolled in the graduate program in Economy and Corporate Administration, 72 declared they were to abandon their studies (61% of the intercepted students), whereas 10 stated they did not want to abandon but were thinking about it (8%). The remaining 31% said they would not want to quit and lamented a moment of difficulty.

It is interesting to notice how the dropout passed from 46% in 2011/2012 (without CCS) to 34% in 2012/2013 (with CCS) for Economy and Corporate Administration and from 38% in 2011/2012 (without CCS) to 27% in 2012/2013 (with CCS) for Business Strategy and Management, as shown in table 2.

The improvement percentage is around 26% for the course in Economy and Corporate Administration and around 29% for the course of Business Strategy and Management.

Table 2  
STUDENTS DROPOUT

	EAA	SIM
Without CCS (a.y. 2011/2012)	46%	38%
With CCS (a.y. 2012/2013)	34%	27%

## Conclusion

In the specific case of this research, it is important for university to know the students and their curricula, to enable initiatives suitable for their satisfaction and / or recovery, as well as to meet the ministerial quality criteria.

A better access to a wide range of attributes of the student population and the analysis which derived from it, allows university, as shown in this work, to better address “messages to receivers” and to better allocate resources.

One of the target of this research was the improvement of the quality of the data stored in the repositories of the OLTP proceedings, reached through a phase of recognition. Too often the poor quality of the data is underestimated by the business management that change his mind when the futility of the same data for different purposes is highlighted, for example for OLAP analysis, by the system, the OLTP, that produced them.

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