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Business Intelligence Governance Model to improve the Quality Management System of careers at theUniversity

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Abstract
Universities and organizations require having clear and precise information to generate knowledge and make decisions that help to stay current in the market, or even better, achieve and sustain the current competitive advantage; and at a level of detail, monitor the key performance indicators of the processes, for continuous improvement. For this, it is necessary to have concrete solutions, such as the strategic application of Business Intelligence, that contribute to the decision-making process of the actors, under a synergy supported by structures, regulations, and tools (in our case Digital Technologies). These described facts frame the proposal of this article and whose objective is to demonstrate the effectiveness of the Business Intelligence Governance Model to improve the Quality Management System in the University's professional careers, carried out under a quantitative approach, experimental type, predictive level and quasi-experimental design of two non-equivalent groups and where the contribution is highlighted in the proposed Model, Architecture of the model, Engineering of the solution and the perspective of the solution, supported by an improvement of about 22 % compared to how it had been working previously.

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1. Introduction

Information is the main asset in organizations, governing and managing it correctly determines its success or failure. For this, solutions are needed that provide better access to information and, what adds value, to its analysis. Business Intelligence (BI) has the objective of supporting organizations sustainably and

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continuously, providing them with the necessary information to support their decisions and in this way they can be more competitive

Another fundamental aspect to take into account is the concept of governance in a pragmatic way, which refers to the processes of interaction between the actors involved in a matter of society or organization, which leads to decision-making or the formulation of models and institutional norms. Finally, a methodology based on various social disciplines is developed that serves to diagnose collective processes, which in turn is based on five main analytical units presented here: problems, actors, norms, procedures, and nodal points.

These factors, in a system framework, enhance its value, considering information as the main asset in organizations with strategic use of Digital Technologies, specifically with solutions based on Business Intelligence. The solution that empowers organizations to generate more practical knowledge and that contributes to decision-making. All this is succinct in the present article and that in a cause-effect way, they generate a synergistic result in the governance of business intelligence, and in our specific case, in the Quality Management System (QMS) of professional careers. Of the Faculty of Medical Sciences of UNASAM.

2. Materials and methods

The research has a quantitative approach, experimental type, predictive level, and quasi-experimental design of two non-equivalent groups, to which a pre-test and post-test were applied at different times. The Experimental Group is made up of 33 teachers from the Faculty of Medical Sciences, and the Control Group is made up of 33 teachers from the Faculty of Social Sciences, Education, and Communication Sciences.
A Documentary Measurement Instrument (IMD-Survey) was used, which consists of 10 items for both the independent variable: Business Intelligence Governance Model (nominal dichotomous) and the dependent one: Quality Management System (ordinal polytonic). This IMD-Survey was applied in a pilot to 10 teachers from the Faculty of Medical Sciences to then check the reliability of the IMD-Survey with Cronbach's Alpha. Subsequently, three experts underwent the Trial, and Kendall's Coefficient was applied to measure the degree of agreement between several judges.
In the Normality analysis, the Kolmogorov-Smirnov test was applied for a sample more significant than 30 individuals and to verify that the distribution comes from a normal distribution, as well as concerning the validation of the hypothesis, the Student's parametric test was applied for two groups with independent samples considering a significance level of 0.05. All these analyses have

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been carried out with the support of the statistical software IBM SPSS statistics 25 [1].

3. Proposed model and motivation

Business Intelligence Governance [2] . - It can be understood that governance "is a rapprochement strategy that allows the incorporation of various social actors and governmental institutions or not, in the construction of indigenous models that allow viewing the local from the social base, based on consensus/agreement".

[3] elaborates the “Analytical Framework of Governance”, which is characterized by working with five main factors: the problems, the actors, the nodal points, the norms and the processes whose analysis must serve to show the gap between discourses and realities and the power games hidden in each social and institutional relationship, on the other hand, [4] Digital Technologies, they refer to Information and Communication Technologies - ICT, including the Internet, mobile technologies and devices, as well as the analytics of data used to improve the generation, collection, exchange, aggregation, combination, analysis, access, search and presentation of digital content, including the development of services and applications applicable to the subject of digital government.

Where is data analytics a systematic process with intensive use of digital technologies, leading to the analysis of the data produced by the University and its context, which aim to enhance the study, accuracy, and timeliness of decisions at the university and its faculties, in such a way that at all times there is the possibility of knowing the current state and it is possible, based on the data (and these with analysis value), to understand what is happening? Why did it happen? What is likely to happen? What is happening now? And what do I want to happen ?. Unleashing in training the University and its faculties to take advantage and transform the data into knowledge to achieve high-performance results sustainably and continuously and thus improve its quality and competitiveness.

Therefore, the Business Intelligence Governance is proposed as Approach strategy, which allows the incorporation of various social actors and governmental institutions or not, in the construction of indigenous models that will enable the local to be viewed from the social base, starting from the consensus/agreement in function and working with five main factors: the problems, the actors, nodal points, standards and processes within the framework of empowering the organization to leverage and transform data into data analytics with knowledge generation and thus facilitate decision-making to achieve high-performance results in a sustainable and thus continuing to improve the competitiveness of the organization.

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Quality management system[5] as a guideline the "Accreditation Model for University Higher Education Study Programs", where it is stated that this new model conceives the evaluation of quality as a training process that offers institutions opportunities to analyze their work, introduce changes to improve in a progressive, permanent and sustained way, strengthen its capacity for self-regulation and install a culture of institutional quality through continuous improvement. It should be noted that the quality evaluation is different from the measurement: the first is expressed in terms.

4. Proposal for solution

In [6],the emerging generation of data warehouses (Datawarehouse) improves the execution of a business strategy, as is the synergistic result of the governance of business intelligence applied to the Quality Management System (QMS) of the University's professional careers.

This evolution improves an increasing set of service maturity levels in the data warehouse architecture. The different levels of maturity of the services shown below have differences such as the questions asked, the number of users, the actions that the company can take, and the decisions that the company can make, Which can be graphed in Figure 1

Given this aspect, it is indicated that the Maturity Level of the Business Intelligence Model for the Quality Management System (QMS) related to the Organization Management Levels and these at a level of depth (granularity) with the Levels of QMS analysis will have dynamic overtime of five levels, which are described below:

Report level. Results by SGC Analysis Level at the end of each Academic Semester. Answer the question: What happened?

Analysis level. Explanation of the leading causes of a fact or phenomenon. Answer the question: Why did it happen?

Forecast level. Validation of a hypothesis, the validation of what will happen if we change some variables (strategies). Answer the question: What is likely to happen?

Operational level. Almost real-time understanding of what is happening with services, processes, and information. Answer the question: What is happening now?

Active Storage Level. Ability to make automated decisions in real-time based on data trends and rules. Answer the question: What do I want to happen?

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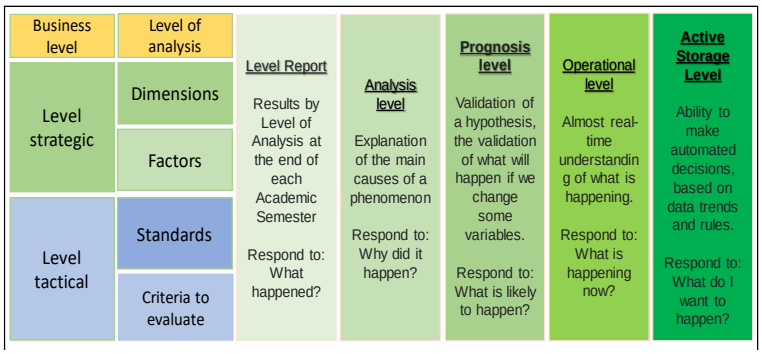

Figure 1. The maturity level of the Business Intelligence model for the QMS.

5. Model architecture

We start from the concept of [7] on Information Technology Architecture as a guiding framework for Electronic Government programs and projects in the regional governments of Peru.

"It is the design at the conceptual level, under a multilayered stratified framework, also being the first level of approach to the solution, where the organization is represented in a double perspective; substantively in terms of the organization's processes, as well as the management and application of Information and Communication Technologies (ICT),for the proper insertion, behavior, and development of the organization in the Information and Knowledge Society ".Which can be graphed in Figure 2.

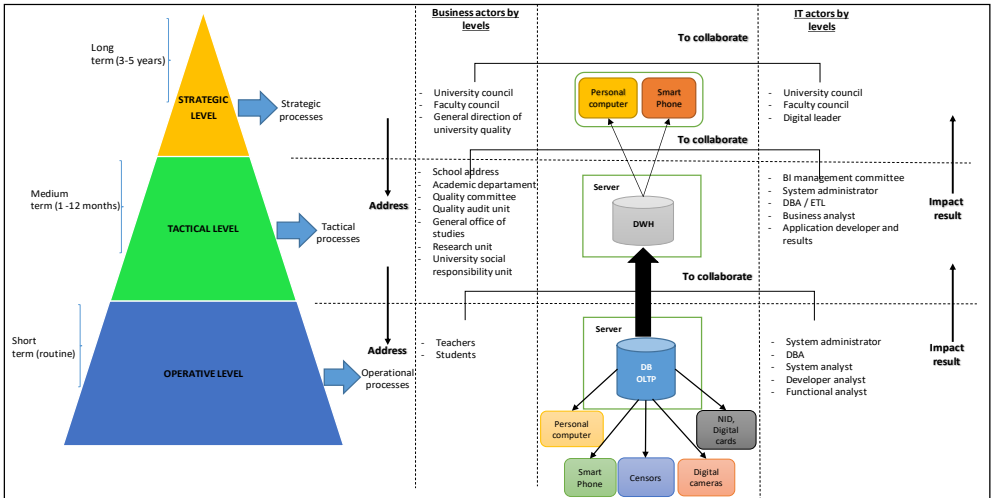

Figure 2. Business Intelligence Governance Architecture Model

In this context of problems (study motivation) and Information Technology architecture, the synergistic Model of Business Intelligence Governance and Business Intelligence Architecture was designed and proposed, based on the "Analytical Framework of Governance", formed by the five main factors:

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- Actors of the organization and actors of Information Technology by management levels: strategic level, tactical level, and operational level, as well as the levels and processes management processes (from top to bottom), generation of results (impact), and collaboration between them.Which can be graphed in Figure 3.

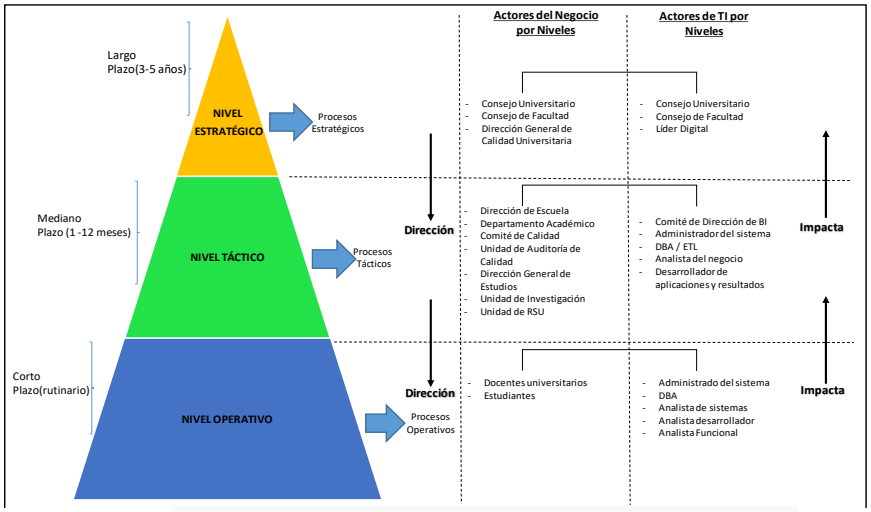

Figure. 3. The nodal point between Business Architecture and Actors

- Processes of the organization by levels of management: At the operational level, short-term, routine operational, or transactional processes. At the tactical level, medium-term tactical (or analytical) processes. And finally, long-term strategic (governance) processes. All of the generators and consumers of data, information, and knowledge depending on the level of management and related processes.Which can be graphed in Figure 4.

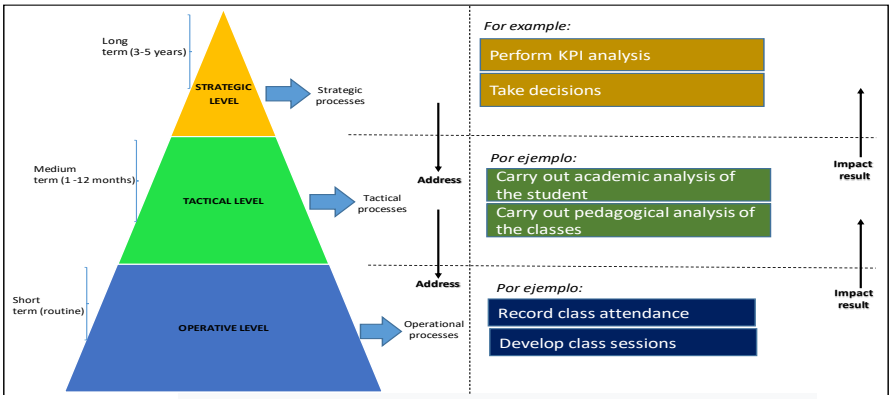

Figure. 4. The nodal point between Business Architecture and Process

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- Nodal points, in this architecture, there is a system made up of three levels of rows and four levels linked together, and that together generate synergy with the Business Intelligence Governance Architecture.Which can be graphed in Figure 5.

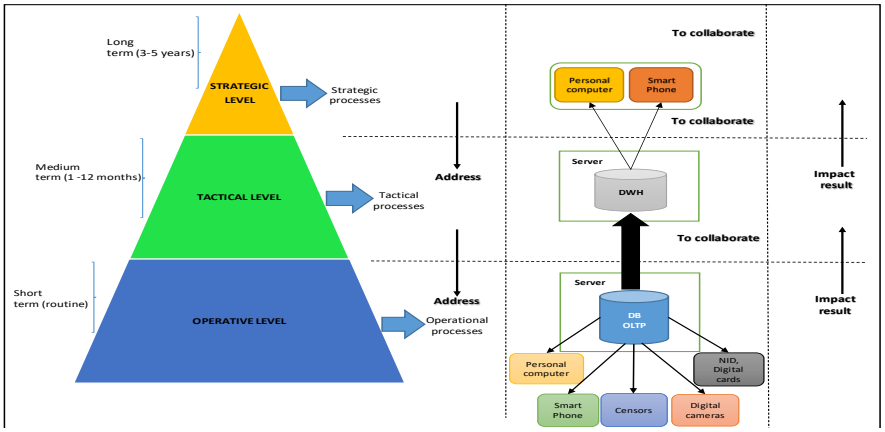

Figure. 5. The nodal point between Business Architecture and Business Intelligence

The regulatory framework, this architecture must be aligned to the Peruvian Digital Agenda 2.0 and be specified in government policies, as well as regulatory and management tools that formalize its use and implementation in organizations.

The regulatory framework, this architecture is aligned with the state guidelines, the University Law No. 30220 [8] and the Digital Government Law No. 1412 [4], as well as that these generate their corresponding State policies and are concrete in regulations, directives, and manuals within the University. It is worth mentioning that at the operational level, it is where the synergy (nodal point) between the implementation of both laws is appreciated, and of course, with the essential facilitator Information Technologies and, in our specific case Business Intelligence. Which can be graphed in Figure 6.

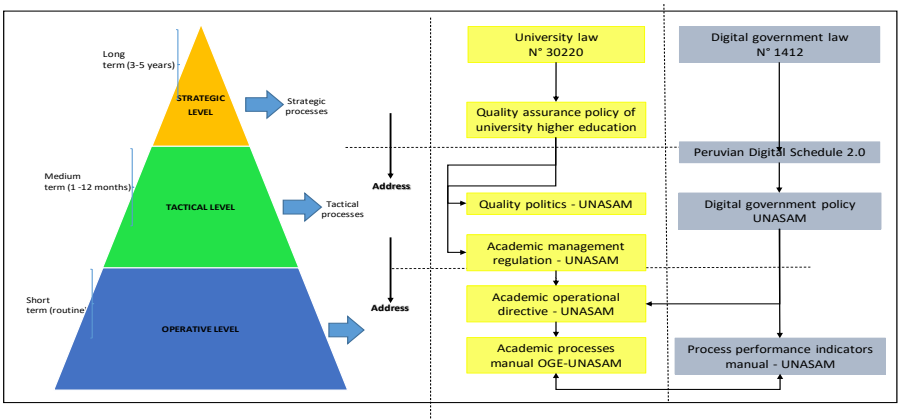

Figure. 6. Nodal point between Business Architecture and Regulations

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This architecture is the framework to equip and train the organization to take advantage of and transform data into data analytics with knowledge generation, and thus facilitate decision-making that contributes to achieving high-performance results sustainably and continuously, thus helping to improve the quality and competitiveness of the organization. Also, it is the guideline input for the management and solution engineering of future Business Intelligence projects that facilitate the solution of some problem of information valuation and knowledge management in the organization

6.Engineering of the Solution

Indeed, this architecture was used as a component of the accreditation process of the professional careers of the Faculty of Medical Sciences, is a guideline for the Engineering of the solution and construction of the Business Intelligence model of monitoring indicators of the processes of the Management System of the Quality of the professional careers of Nursing and Obstetrics,as shown in Figure 7. and which consists of the following components:

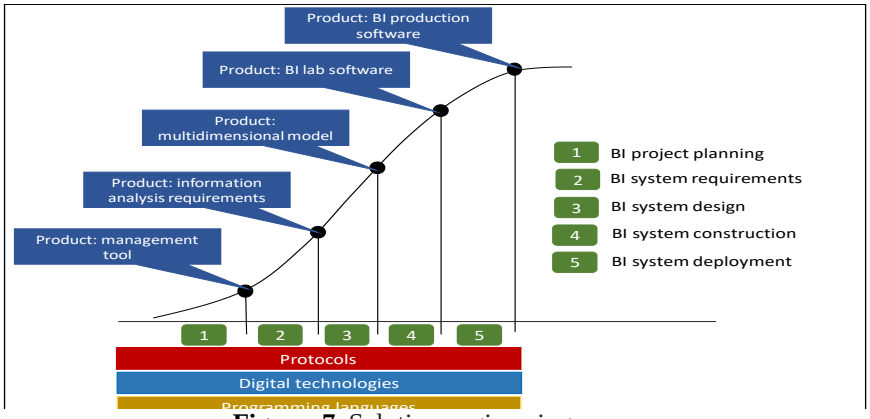

Figure. 7. Solution engineering

6.1. Engineering processes of the solution

The Life Cycle Roadmap reference has been taken [9]. When we drive to a place we've never been before, most of us rely on a road map, even if it is displayed via GPS. Similarly, a roadmap is handy if we are about to embark on the unknown journey of data warehousing and business intelligence. Kimball Lifecycle's general approach has allowed us to establish a sequence of tasks, dependency, and concurrency. It serves as a roadmap to help teams do the right thing at the right time.

- BI project planning. This process determines the purpose of the BI project, its specific objectives, scope and activities, the principal risks, and an initial approach to the information needs from launch to deployment. Obtaining as a product a management

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tool approved by the University Quality Office and the Faculty Council of Medical Sciences.

- BI system requirements. It is the process where knowledge of the current situation is obtained, as well as the information requirements and specifications that users demand, as well as the technical requirements necessary for the design of the BI system. Obtaining the identification and description of key performance indicators (KPI - Key performance indicator) of each process of the Quality Management System (QMS).

- Design of the BI system. It is the design process of the solution, as well as the technical design based on the requirements of the BI system. Obtaining the dimensional modeling, design of the ETL processes, design and specifications of BI applications, user interface design, the design of the technological platform, and the prototype of the software.

- Construction of the BI system. It is the process of implementation or development of the solution design with programming tools and techniques, such as DBMS - SQL Server, SQL Programming, MS-Excel, Framework Laravel, and PHP programming language, where the ETL processes are developed and executed, BI applications and user interfaces. Obtaining the Business Intelligence software for monitoring indicators of the Quality Management System processes.

- Deployment of the BI system. It is the process of technology transfer and commissioning that makes the BI system available and in use by users. Achieving the evaluation and satisfaction of the BI software based on the information requirements and specifications that users demand, also, the training and learning of the operation and management of the software was carried out, as well as the delivery of the software user manual.

6.2. Required Digital Technologies

[10] In the context of rapid technological integration, and [11] there are convergence processes of various technologies that will condition the development of ICT in the next decade. The growing and accelerated convergence between information technologies, media technologies, and telecommunications technologies are materialized in various types of convergence: from communication networks (networks and services), from hardware equipment (mobile multimedia equipment), processing services and applications (cloud computing) and web technologies (web 2.0). These new technologies will configure a new cyclein ICT, which will be characterized by an explosive development of wireless and mobile applications, which will have an exponential increase in processing capacity through cloud computing and will generate new changes in the behavior patterns of users and

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consumers through new networks social associated with web 2.0

- Networks.Cable and mobile network technology for convergence in networks and services. Wireless third and fourth generation (3G and 4G) wireless technologies for convergence in fixed-mobile networks. To generate an impact in developing countries in terms of greater flexibility of services, a new regulation for convergence, and migration of fixed subscribers to mobile platforms.

- Hardware equipment3G and 4G mobile equipment [12], for access to different services from the same device, mobile terminals with various standards and technological platforms, changes in habits due to the use of smartphones.

- Data and application processing services. Cloud computing, with impact on the shift in the ICT business model [13], access to new ICT services, reduction of the cost of ICT services, reduction of the cost of hardware, new local ICT initiatives, new investments in-band wide, and data processing centers.

- Web technology. Web 2.0 with impact on changes in consumer behavior, internet and television consumption habits, social relations and the relationship with government services

C. Tools

It is the set of software tools that facilitate and allow obtaining a BI solution, such as Information structure and processing (DBMS, ETL, SQL), Information analysis (OLAP Analysis, Data mining, and Knowledge Management System) and results inthe sample (reporting tools, Balanced Scorecard, and dashboards).

7. Discussion of results

[11] defined 4 components necessary for BI governance: The creation of a "BI governance committee", defining a "framework for the BI life cycle", configuring a support structure for End-user implementation of a BI program review (evaluation and monitoring) process.

The contribution proposed in this study is based on the Business Intelligence Governance proposal that directs the Architecture of the Model with the contribution of the “Analytical Framework of Governance”. The architecture of the model that, in turn, marks the way for Solution Engineering.

This contribution of the research allows demonstrating that the effectiveness of the Business Intelligence Governance Model allows improving the Quality Management System in the professional careers of the Faculty of Medical Sciences of the National University Santiago Antúnez de Mayolo. This fact can be evidenced, since when applying the Student's t-test, the p-value = 0.004 and $\alpha = 0.05$, therefore:The probability obtained p-value $\leq \alpha$, the reason why H1 is accepted. H1: The Business

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Intelligence Governance model will improve the Quality Management System of the professional careers of the Faculties of Medical Sciences.

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