

# Importance of a computer system of indicators in the department of planning, programming and budgeting in the institutions of higher education

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## Abstract

In this article, we will address the importance of indicator systems within higher education institutions, the processes that are generated in the tasks performed for the continuous improvement of the same, the impact generated by the indicators, it is to measure the quality of the institute and to make better decisions; all this by having the necessary information of each indicator needed in the institutions and the work plan that establishes its monitoring.

During the research and analysis of studies of existing computer systems (IS), we found that they are based on objectives and goals, the most important point that stands out is the great benefit of having an information system as a tool to help in the activities established for the fulfillment of this process. Thus, due to the needs found within the Higher Education Institution of the Instituto Tecnológico Zona Olmeca of the Tecnológico Nacional de México, an indicator tracking system will be developed to help the institution with the current problems in its indicator tracking process. The main objective of this system is due to the monitoring of indicators, to obtain standardized information, to have a self-criticism and internal evaluations in the expected progress, as well as to identify the real time feeding of the results related to the indicators.

## Resumen

En este artículo, abordaremos la importancia de los sistemas de indicadores dentro de las instituciones de nivel superior, de los procesos que se generan en las tareas realizadas para la mejora continua de las mismas, del impacto que generan los indicadores, él es medir la calidad del instituto y poder tomar mejores decisiones; todo esto por tener, la información necesaria de cada indicador necesidades en las instituciones y al plan de trabajo que se establece su seguimiento.

Durante la investigación y análisis de estudios de los sistemas INFORMATICOS (SI) existentes, encontramos que están basados en objetivos y metas, el punto más importante que se resalta, es el gran beneficio de tener un SI de información como herramienta ayudando en las actividades establecidas para el cumplimiento de este proceso. Así debido a las necesidades encontradas dentro de la Institución de Educación Superior del Instituto Tecnológico Zona Olmeca del Tecnológico Nacional de México, se desarrollará un sistema de seguimiento de indicadores que ayude a la institución con la problemática actual en su proceso de seguimiento de indicadores. El objetivo principal de realizar dicho sistema, es debido al seguimiento de los indicadores, el lograr obtener la información estandarizada, contar con una autocrítica y evaluaciones internas en los avances esperados, así mismo, identificar la alimentación en tiempo real de los resultados que se relacionan a los indicadores.

**Keywords:** information system, indicators, Work plan, monitoring of indicator, higher education.

**Palabra cable:** Sistema de información, Indicadores, plan de trabajo, Seguimiento de indicadores, Educación superior.

## 1. INTRODUCTION

The Technological Institutes belonging to the network of the Tecnológico Nacional de México (TecNM), carry out evaluations through their planning of educational work in each of their campuses; These are governed by

the Institutional Development Plan and the strategic processes that allow it to control and progress by periods, which are carried out during the year through the indicators. The indicators that are worked on within the campuses emerge from the Annual Work Program (PTA) and Quality Master Plan.

At present, there is no information system for indicators that would allow monitoring progress in Higher Education Institutions (HEIs), due to the fact that statistical indicators and targets established within them are managed; but in turn these indicators are involved in decision-making and audits; where the results of the progress achieved are reflected, added to this, these indicators show the commitment to quality that is provided in the HEI through the metrics that are used.

## Precedents

The objective of conducting a study on indicator information systems is to have a result of the importance of this, so the results of some repositories based on the monitoring of indicators were obtained; different types of opinions were found making known the needs that each institution must have and why having some system of indicators helps meet your objectives, evaluations, make decisions within a technological network.

The scope of this research is to publicize the benefits of a computer system of indicators in the department of planning, programming and budgeting in higher education institutions benefiting the main areas allowing them to upload their evidence, the planning of the indicators and the established times, showing your metrics within your progress of the institution.

We will find a brief explanation of each research helping to understand the purpose of this analysis, the importance and the results we expect to make a computer system of indicators

The indicator information systems referenced are the following:

- **Proposal of a basic system of performance and quality indicators for the national system of technological institutes.**
- **Construction of Indicators of the Institutional System for Monitoring Agreements**
- **Computer system for monitoring and follow-up of indicators to the institutional development program**
- **Institutional Evaluation Indicators for Higher Education**

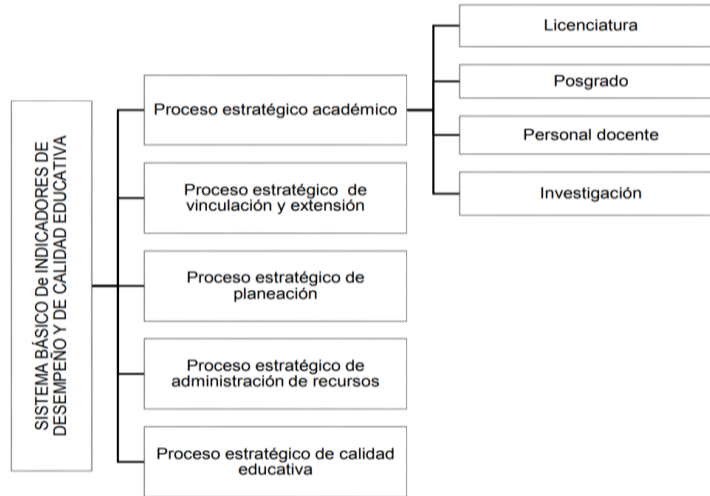
## 2. INDICATOR INFORMATION SYSTEMS

### **Proposal of a basic system of performance and quality indicators for the national system of technological institutes**

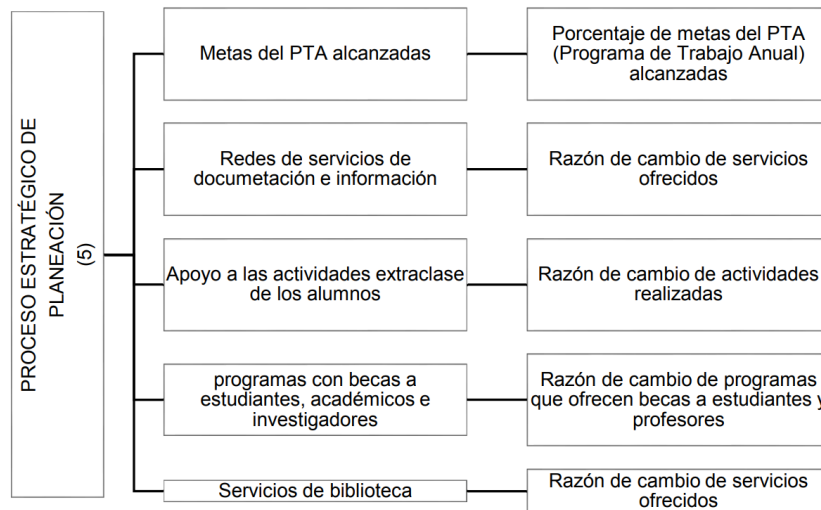
According to the research, the indicators used in higher education in Europe, the United States, Latin America and Mexico are conducted; a proposal was made for a basic system of performance and quality indicators in technological higher education, based on the indicators established within the Higher Education Institution, the HEIs work with the indicators to capture the activities they measure or evaluate within each of the criteria; likewise, counting on the evidence allowing to measure the progress of the fulfillment of the expected goals and objectives, within the results.

The variables obtained within the indicators are foreseen within the strategic processes that are established within the substantive functions that are carried out in the Technological Institutes; there are usually five strategic processes within the HEI (Higher Education Institution) but these may vary depending on the network of Technological. (Serrano, 2016)

**Example of strategic processes:**



**Figure 1.** academic strategic process, in which substantive activities are divided into the National System of Technological Institutes.



**Figure 2.** shows the 5 indicators and their descriptions, corresponding to the strategic planning process, which are proposed for the National System of Technological Institutes. (Serrano, 2016)

As a conclusion of the above, the importance of an information system of indicators **within** any Higher Technological Education Institution is highlighted, since the main objective is to establish institutional profiles that allow and facilitate the taking of dediciones for the continuous improvement of the institutions, facilitating the measurement of the changes within the Technological ones by having the set of indicators that are applied in the technological community.

**Construction of Indicators of the Institutional System for Monitoring Agreements**

At the Autonomous University of Campeche (UAC), a web application was developed to carry out the monitoring of agreements (SISC) that allows measuring the impact of the agreements that are made in various institutions and educational programs of the Autonomous University of Campeche.

This project analyzed and synthesized the necessary information for the proposal and elaboration of indicators for the monitoring of agreements which resulted in a matrix of indicators that allows to visualize in an organized way the categories, areas and activities that generate the data that are required to collect the significant figures for each indicator, of which 5 areas are identified, of the university work that are generated from the activities of linkage:

- Research.
- Teaching.
- Employers.
- Diffusion.
- Infrastructure services.

These cover 14 categories, 37 activities and a total of 85 indicators.

Ámbitos	Categorías	Actividades	Indicadores
Investigación	Proyectos.	Proyectos de investigación con financiamiento interno. Proyectos de investigación con financiamiento externo.	Cantidad de proyectos de investigación con financiamiento interno y externo. No. de beneficiarios. No. de participantes por tipo de Proyecto.
	Publicaciones.	Libro. Memorias arbitradas. Artículos.	Cantidad de libros, memorias arbitradas y artículos publicados. No. de participantes por cada tipo de Publicaciones.
	Movilidad.	Estadías empresariales. Movilidad de docentes y alumnos.	Cantidad de estancias empresariales e intercambios de personal. No. de participantes por cada tipo de Movilidad.
	Producto tecnológico.	Prototipo.	Cantidad de prototipos realizados. No. de participantes por cada tipo de Producto Tecnológico.
	Estancia Investigación.	Internado de pregrado. Estancia de investigación.	Cantidad de internados de pregrado e investigaciones conjuntas. No. de participantes por cada tipo de Estancia de Investigación.
	Propiedad Intelectual.	Patentes. Modelos de Utilidad. Diseños industriales. Derechos de Autor.	Cantidad de patentes, modelos de utilidad, diseños industriales realizados, derechos de autor. No. de participantes por cada tipo de Propiedad Intelectual.
	Producción Académica.	Tesis. Ponencia. Cartel de investigación.	Cantidad de tesis, ponencias y carteles de investigación realizados. No. de participantes en carteles de investigación por cada tipo de actividad de Producción Académica.

<b>Docencia</b>	Capacitación.	Posgrados. Certificación. Taller. Curso. Seminario. Diplomado. Conferencia. Foro. Coloquio. Congreso. Simposio. Jornada.	No. de beneficiarios por cada tipo de actividad de Capacitación.
<b>Empleadores</b>	Servicio social.	Servicio social.	No. de beneficiarios. No. de instituciones por sector.
	Prácticas profesionales.	Prácticas profesionales.	No. de beneficiarios. No. de instituciones por sector.
<b>Difusión</b>	Actividades de extensión.	Jornadas de salud. Visitas guiadas. Instalación de módulos itinerantes. Acciones de ética y transparencia. Actividades de difusión de la cultura.	Cantidad de jornadas de salud, visitas guiadas, instalaciones de módulos itinerantes, acciones de ética y transparencia, actividades de difusión de la cultura. No. de beneficiarios. No. de participantes por cada tipo de Actividad de Extensión.
<b>Servicios de Infraestructura</b>	Gestión de material bibliográfico.	Préstamo de material bibliográfico. Intercambio de material bibliográfico. Suministros de documentos entre bibliotecas. Donación de material bibliográfico.	Cantidad de préstamos e intercambios de material bibliográfico, suministros de documentos entre bibliotecas, donación de material bibliográfico. No. de bibliotecas participantes. No. de donadores de material bibliográfico.
	Prestación de servicios.	Prestación de servicios de laboratorios.	Cantidad de servicios prestados por cada laboratorio. No. de beneficiarios.
	Consultorías.	Consultorías.	Cantidad de consultorías realizadas. No. de beneficiarios.

Figure 3. Matrix of Indicators, classified by scope, category and activity.

### Computer system for monitoring and follow-up of indicators to the institutional development program

In the Autonomous Municipal Government of La Paz requires a system of Monitoring of Indicators to carry out the fulfillment of its goals, as support to decision-making for better public management, they manually carry out all the evaluation and monitoring processes, having a system can facilitate the status of each indicator, also have access to the information of the evaluation committee or verify the status of the progress of the indicators and planning that is part of the activities carried out in the Municipal Autonomous Government of La Paz, which results in a more efficient administration of time and economic resources.

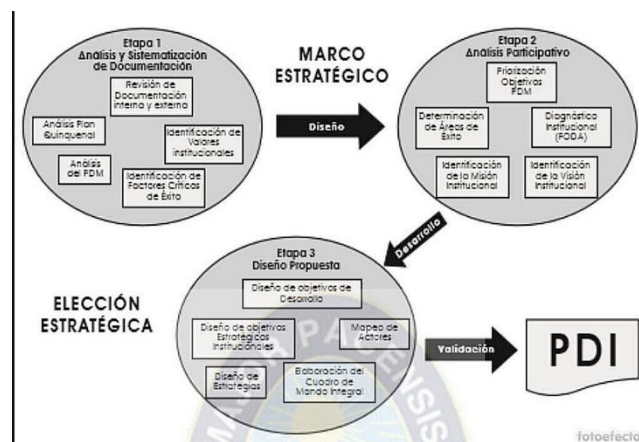


Figure 4. Marco Strategic

The image shows the results that handle me within the processes fulfilled and within the expected results, the strategic framework shows the processes that are carried out from interviews, meetings and workshops within the methodologies.

## Indicators

The indicators that are worked within the Municipal Government of La Paz serve to keep track and define the established goals that allow to know the measures that meet the objectives.

To identify a good indicator in data entry, the following were considered:

- Objective
- Objectively measurable
- Relevant
- Specific
- Practical and economical
- Associated with a term

For the measurement of the indicators of the Municipal Government of La Paz, three phases were considered: Impact, effect and compliance.

**Impact indicators:** This indicator allows to measure the changes that are established within the goal or result that is expected within the objectives.

**Effect indicators:** Allows you to measure changes during the execution of the project.

**Compliance indicators:** Measure the execution of the goals set in the project activities. You can also quantify the fulfillment of the scheduled time and budget.

Impact and effect indicators correspond to the level of evaluation and monitoring.

## Proceeds

Institutional Development Program of the Autonomous Municipal Government of La Paz, I consider to carry out a monitoring system of indicators as a general importance to maintain a control of monitoring in the evaluation of indicators. Helping users make their reports, with centralized information on future progress.

Highlighting the required compliance of the institutions that handle indicators, it is recommended to obtain projects in meticulous systems helping in decision-making, etc., since this research was of great help in the indicator evaluation processes.

## Institutional Evaluation Indicators for Higher Education

In the Virtual University of the Technological Institute of Monterrey, an analysis was carried out on the importance of indicators in higher education institutions for this study, 26 higher education institutions were taken into account in which 54 indicators to be evaluated are considered. These indicators belong to the institution and to the participants that they elaborate within the activities carried out within the institution.



The results obtained within the database were obtained from the evaluation components and their indicators Integral training, quality and Human Capital the most used by higher education institutions.

The importance of the evaluations of the indicators within the institutions of higher education is to maintain an analysis of information providing a better service in decision-making, also knowing the values that are generated in each indicator benefiting in the results and scope that could have.

The entire higher-level institution works with the tools of indicators since these generate information of any process in a standardized way are used by internal evaluators or body of evaluators, this is used in decision-making and continuous improvement of the institution.

It has been highlighted that as institutions it is committed to providing the best service to society, therefore, you cannot have good control of your services without updated information.

The indicators are very important tools for the fulfillment of the objective and above all to guide effective decision making, such indicators represent different alternatives of use as in the advances of time that generate important changes as more useful information for the institution.

The higher-level institution is governed by different rules, quality statutes that establish the procedures, processes and activities that are carried out internally. Educational institutions reflect the results of applying an institutional evaluation using indicators to disseminate important information that highlights the performance of higher-level institutions.

Another importance is that the information handled by each institution is put before the use of one or another indicator since these give results and provide the necessary parameters for the best fulfillment of the objectives of the same.

For the improvement of the processes of the institutions of higher level it is necessary to detail the institutional indicators to detect the results that are intended to be analyzed since there may be different objectives for each indicator, as well as the differences in the values generated by each institution.

The indicators help to evaluate the scope that the institutions have contemplated as well as amounts of accreditation of processes needs a range of indicators these allow a detailed analysis of the profile of the institution.

Higher level institutions work an infinity of indicators the more indicators they handle within the institution, the greater the information to calculate and analyze by the evaluator.

Each institution generates different types of information, where it is considered a guideline to develop an institutional evaluation system since this will allow to present values of statistical data, political, reissue of accounts such as the search for educational objectives and mainly the improvement of quality.

Evaluation within an institution is an important factor for the quality that the quality of education is proposed as a goal (Yzaguiere, 2005). The evaluation that allows the measurement of processes and activities within an institution are the values obtained within the indicator.

The importance of the application of a system of indicators lies in the fact that it is established from a series of factors that act in the institutions both for the type of indicators that can be of great relevance, and for the impact they generate in an evaluation. At present there is a euphoria of the identification and measurement of indicators, as a result of the strong international comment of educational systems (Serramona, 2004)

### **Integral Training and Quality Component**

The integral formation and quality is the component that includes aspects such as training, evaluation of teaching staff and everything that has to do with the curricular structure and academic aspects in the institution, in such a way that the professional life of an educational institution remains in continuous development where each of the aspects compose list a series of Evaluation indicators that are denoted below:

1. Frequency of updating curricula and programs
2. Proportions relating to the materials intended for the different dimensions of student training.
3. Degree of compliance with the provisions of the curriculum in terms of the number of groups that were addressed and should have been addressed.
4. Degree of compliance with the provisions of the curriculum in terms of topics that they were taught and that they should have been taught.
5. Results of the teacher evaluation system
6. Results of program evaluation
7. Departmental examination results
8. Student dropout rate
9. Average number of students in each school group
10. Student grade statistics
11. Proportion of graduate students who are working in their area professional
12. Average annual income of students who graduated five and ten years ago

Human Capital Component Being thus a component of utmost importance, the indicators that They are:

1. Number of training hours offered to teachers annually
2. Number of perch training taken by teachers annually
3. Relative proportion of each training area offered by the institution annually.
4. Relative proportion of each training area taken by teachers annually.
5. Number of teachers belonging to the different ranks or systems classification.
6. Number of full-time versus professorial professors.
7. Number of teachers belonging to the SNI
8. Index of improvement of the level of quality of life of workers in function of their economic remuneration.
9. Results of the evaluation of the work environment
10. Internal turnover rate
11. External turnover rate

This research proves that the indicators are generated and used by the departments. The indicators are used by the institutions through evaluation of their activities.



At the end of the higher education indicators, the study highlights the importance of usefulness in the indicators in the institutions helping in decision-making since this is in global internal and administrative development in the institutions that collect and generate a value of each indicator.

There is a multi-disciplinary number of institutions that handle indicators, so the criteria grow within an organization because the indicators are different or there are changes.



Figure 5. Screenshot User Registration



Figure 6. Screenshot Indicator log



Figure 7. Screenshot List of Indicators

Table 1. Indicator systems comparison table  
Comparative table of indicator systems

Systems	Purpose	Advantage
Construction of indicators of the institutional system for monitoring agreements.	<ul style="list-style-type: none"> <li>Have information about the agreements available from a web browser.</li> <li>Automatically generate the indicators requested by accrediting bodies of educational programmes.</li> <li>Monitor in an agile way the activities of linkage by educational program.</li> <li>Support for the generation of strategies so that the agreements do not become a "Letter of Good Intentions"</li> </ul>	<ul style="list-style-type: none"> <li>Generate a database that protects the information and digital copies of the linking agreements.</li> <li>Offer online consultation of the various types of agreements.</li> <li>Register the different types of products generated by each linking agreement.</li> <li>Generate statistics to evaluate the impact of each linking agreement</li> </ul>
Proposal of a basic system of performance and quality indicators for the national system of technological institutes.	<ul style="list-style-type: none"> <li>They should always be easy to capture.</li> <li>They must be stated objectively and as simply as possible.</li> <li>They must be relevant for decision-making.</li> </ul>	<ul style="list-style-type: none"> <li>Raise the quality of the Education</li> <li>Expand the Opportunities</li> <li>Make it easy to take Decisions</li> </ul>
Computer system for monitoring and follow-up of indicators to the institutional development program"	<ul style="list-style-type: none"> <li>Facilitate and expedite the monitoring of all indicators of each organizational area (Offices, Directorates, Special Directorates, Sub-mayors and Municipal Companies) of the GAMLP, in order to see the status of compliance.</li> <li>Facilitate the monitoring of strategic objectives, instrumental policies, programs and projects to be executed in a certain time in the Autonomous Municipal Government of La Paz.</li> <li>Facilitate Monitoring each indicator in times determined by an evaluation committee, this monitoring must make the calculation for each evaluation carried out.</li> </ul>	<ul style="list-style-type: none"> <li>Functionality</li> <li>Reliability</li> <li>Usability</li> <li>Efficiency</li> <li>Ease of Maintenance</li> <li>Portability</li> </ul>

	<ul style="list-style-type: none"> <li>Facilitate and expedite access to searches for each indicator, monitoring and get reports of the desired data.</li> </ul>	
Institutional evaluation indicators for higher education.	<ul style="list-style-type: none"> <li>Progress of indicators.</li> <li>Evaluation applying indicators.</li> <li>Information generation.</li> <li>Institutional evaluation.</li> <li>Decision making for the internal and administrative development of higher education institutions</li> </ul>	<ul style="list-style-type: none"> <li>Assess the quality of the studies offered.</li> <li>Evaluates teacher performance.</li> <li>It allows transparency in the use of resources by the institution.</li> <li>Monitors and facilitates the solution of deficiencies of the institution.</li> </ul>
Information System for the Monitoring of Quality and PTA Indicators (SICyPTA); of the Department of Planning, Programming and Budgeting of the Tecnológico Nacional de México Olmec Zone Campus.	<ul style="list-style-type: none"> <li>Visualize the progress of the institution's indicators graphically.</li> <li>Create a repository of the results of previous exercises.</li> <li>Keep the evidence of indicators accessible and up-to-date.</li> <li>Facilitate the registration and monitoring of the institution's indicators.</li> <li>Provide information for audits.</li> <li>Streamline the process of monitoring graduates for responsible personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate the quality of the institution quickly and efficiently.</li> <li>Keep track of the tracking process easily and reliably.</li> <li>Help with relevant information for decision making.</li> <li>It facilitates the process of monitoring indicators of the institution.</li> <li>Provide reliability to the relevant information of the monitoring of indicators.</li> </ul>

### 3. RESULTS

Derived of the ISO 9001: 2015 Standard, which is to be implemented in the IT of the Olmeca Zone the proposal is the development of an **Information System for the Monitoring of Quality Indicators and the PTA (SICyPTA); of the Department of Planning, Programming and Budgeting of the Tecnológico Nacional de México Campus Zona Olmeca**. That seeks to impact on the planning of processes for monitoring indicators, customer satisfaction in meeting established goals, continuous improvement of the institution and decision making based on the evidence stored in the system.

This Institute belongs to the TecNM, which needs to keep the reports updated within the organization, and with this system will achieve great benefits in decision making, since as an institute, one of the commitments is to maintain control of the activities that are carried out to measure performance. and the quality that the institute offers; in addition, it is contemplated to make several tools for the system such as the export of reports in the reports made, a progress of evaluation of indicators, reports of the indicators and Backups of indicators.

With the development of the information system for the monitoring of QUALITY AND PTA (SICyPTA) indicators; it is wanted to ensure that the departments in charge of making the reports maintain current data of the established goals of each indicator, the IT of the Zona Olmeca will be able to see the performance that has been obtained and the goals achieved during the year; it is of great importance to obtain a system of monitoring of indicators facilitating the process to the institution and according to the Research is carried out there is no institutional system of indicators that impact in the network of the Tecnológico Nacional de México.

### System benefits (SICandPTA)

- Indicator reports allowing to show the measures of the progress of the established periods.
- Keeping information updated, reliable and secure.
- Immediate access to indicator information.
- Facilitating the centralization of data in the system.
- Repository downloads in pdf.
- The system can be used by multiple users.

### 4. CONCLUSIONS

According to the above mentioned in the Investigations we can conclude that it is of utmost importance to have a control that allows measuring the daily progress of the institutions and the quality of the same for a continuous improvement in the services they offer to the public, taking into account how laborious this type of processes can be, it is important to have a tool that facilitates these tasks, That the information is reliable, truthful and timely for the fulfillment of the goals proposed by each institution.

It is important to mention the following points for the development of indicator-based information systems:  
Delimit the scope of the system.

Understand the process to be carried out.

Consider the information to be stored.

Analyze the information required by the indicators with which you are going to work.

It is impossible to encompass all the systems of indicators that exist; however, it is of great help in having certain guidelines that allow us to better understand the importance of these processes for institutions.

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