

Deploying and integrating education system indicators with QFD. -Application case-

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Abstract.

This paper presents the Comprehensive QFD Matrixes approach for the deployment of the indicators of the Education Ministry of the State Government of Guanajuato in México (SEG). This application case started with the research and collection of all education's indicators, and the creation of a Balanced Scored Card relations diagram, then the classification and deployment of the indicators using QFD means & target matrixes for the definition of critical processes and selection of main improvement projects.

1.- Introduction.

In recent years global competition accelerated and most of the organizations have been implementing improvement strategies that can lead then to a better quality, reduced cost and reduced delivery time, as well as better design of services and products, supply chain management, strategic planning and project management.

Education systems and schools are not the exception. Mexico started quality in education approaches since de second half of the 1990's and several schools have been recognized with the Mexican Quality Award (Premio Nacional de Calidad) since 1998.¹

¹Several education institutions have won the Nacional Quality Award in Mexico:

- Instituto Tecnológico de Estudios Superiores de Monterrey, Campus Estado de México (1998).
- Centro de Atención Múltiple "Prof. Rubén Reyes Rodríguez" (1998).
- Centro de Desarrollo Infantil No. 3, SEP Nuevo León (1999).
- Unidad de Apoyo Pre escolar No. 1, SEP Nuevo León (1999).
- Centro de Desarrollo Infantil No. 5 Diana Laura Rojas de Colosio, del Frente Popular Tierra y Libertad (2000).
- Instituto Real de San Luis (2000).
- Universidad Tecnológica de León (2000).

Many State Governments and State Ministries of Education are implementing total quality management approaches and also ISO 9000 certification processes with different degrees of success. But one of the main problems is regarding the measurement of the impact of these strategies. Mainly because education systems (not only the classroom process) have to deal with hundreds of parameters that measure educational impact, financial performance, students and parents perception of a good education, coverage with equity, all internal processes performance measurement (process impact and process management indicators), information technology performance, infrastructure, planning processes, as well as, project management.

Mexican mandatory education is from pre school (5 years old) to nine-year basic education (6 years for primary school and 3 more years for secondary school). But also coordinates high school, technical colleges and universities education programs (both public and private initiatives). In all States of the Mexican Republic, education systems consume more than half of the State annual budget, another reason to implement strategies for improving the productivity and efficiency.

Guanajuato is the 22nd State of the Mexican Republic and has a population of more than 4.6 million people. The State Ministry of Education of Guanajuato (SEG) started his Quality in Education Efforts in the late 1990's and one of the priorities since the year 2000 is the consolidation of the main and critical processes that have a direct impact in what is know as "Normalidad Minima" (accomplishment of basic indicators). This program focuses on the implementation of strategic actions directed to guarantee that all schools in the State could meet minimum standards of personnel, operations, facilities, textbooks, information requirements, etcet. In order to achieve this, SEG understands for main and critical processes, those that deal with infrastructure (construction and maintenance of educational facilities and equipment), all satellite based classes (EDUSAT System), distribution of textbooks for students and teachers, reduction of teachers absenteeism, as well as information management and planning processes.

SEG's total personnel is around 55 000 people and the total number of schools is about 12 000 units (pre school to higher education facilities). SEG was also a Mexican pioneer in decentralizing its central structure by creating 8 regional offices with administrative autonomy.

All of these organizational change efforts are now been supported by data processing huge systems such as SAP (Systems, Applications and Products in data processing) in order to manage budgets, projects, salaries, etc.

So the main question was, how to define a strategic plan that allows the SEG to manage all the improvement efforts and finally, how to measure the impact of these improvements. How to control and improve all indicators of education? Which indicators should be controlled by central office and which by regional officers?, What is the first step?

This paper presents the Comprehensive QFD approach for the deployment of the indicators of the Education Ministry of the State of Guanajuato in México (SEG).

Financial and educational impact indicators are correlated with first and second level market (society's) needs and then all of them deployed into the SEG internal processes in order to

prioritize them and determine specific improvement strategies. The output is a mega matrix (of indicators) that determines the most important indicators, their relations and also the definition of the responsible of their management (indicators for central office, regional office, municipality administrative office, school supervision, school and other institutions like: Construction promoter, Municipality and State Government offices).

This application case started with the research and collection of all education's indicators, application of affinity diagram for indicator grouping and organization of indicators groups in a Balanced Score Card based relations diagram (BSC Model for the Education Ministry).

Phase 2 was the deployment of the indicators applying comprehensive QFD model of target means matrixes and the definition of the correlations between them. Deployment and correlations include the interrelations between impact indicators and internal processes, as well as between internal processes and actually running programs and projects (National and State level programs, as well as Ministry and Union integrated projects).

Phase 3 was the definition of main processes and their indicators for the formation of improvement groups, special projects, etc. The actual paper covers up to the results of the phase 3.

Phase 4 will be the use of this scored card in the implementation of a management information system for the monitoring of the whole indicators system and later use of SAP (Systems, Applications and Products in data processing).

2.- Phase 1: Collection of all indicators and relations matrix.

In the 2000 year, in an urgent need for specific actions, special cross functional teams were created to improve the internal processes related to this "Normalidad Mínima" and its basic standards with important results.

In 2001 the "Normalidad Mínima" program continued, but one of its important conclusions was the existence of many indicators (parameters and indexes) in the education system (impact, activity, process, quality, cost and other indicators), with no clear correlation between them and in consequence a lack of real control (as in many other organizations, all processes and departments reached their targets independently, but impacts on the whole system were not necessarily achieved). This same conclusion was obtained after 5 years of implementing quality management strategies (many independent activities but not a systemic approach and achievement of common targets, as well as a betterment of customer perception and qualifications).

Starting in August 2001, the collection of education indicators (impact or final effect indexes) was started and indicators were first grouped with the affinity diagram and principles. This was a very important step, because most of education indicators were commonly grouped by other criteria such as: Level (indicators for pre school, primary school, etc.), type (indicators measured at the end of the one year cycle such as desertion, absorption to the next level, fail

ratio, etc.), state level indicators (accomplishment, number of students, number of professors, etc.), etc.

We decided to categorize the indicators based on the four perspectives of the Balanced Score Card (BSC) (Kaplan & Norton, 1996): Financial, Customer, Internal Processes and Learning and Growth perspectives. After the first stage of the affinity diagram finished, we adapted other names for the perspectives such as: Wealth Creation (results), User Needs, Internal Processes and finally, Development and Growth (fig. 1).

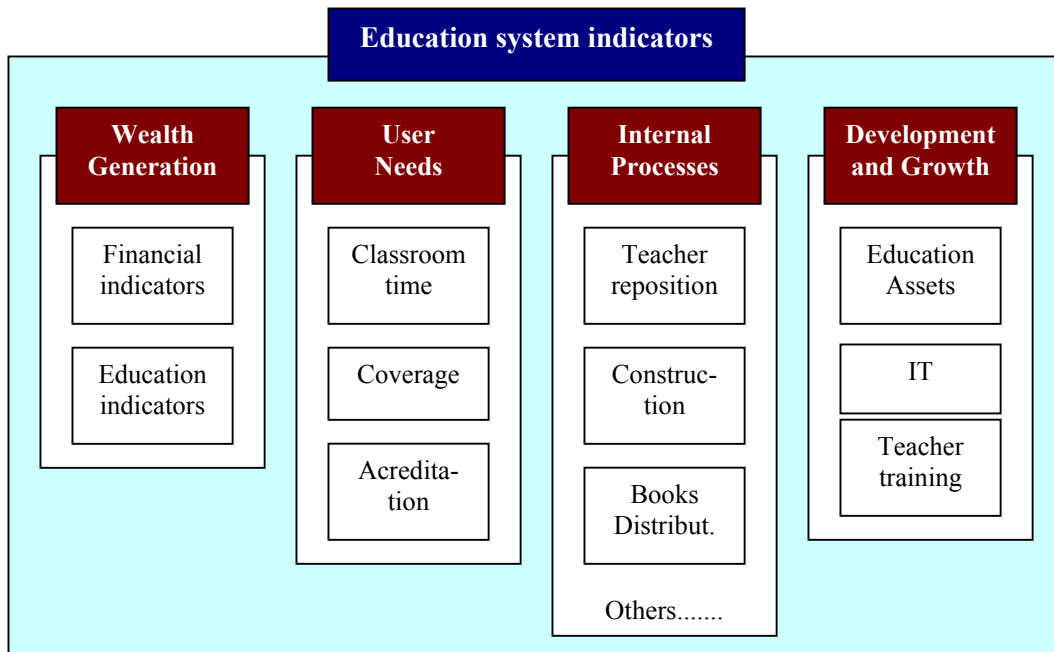


Fig. 1: Affinity diagram of education system indicators.

Each of the indicators subgroups (Financial, education, classroom time, etc.) is also the affinity title of actual parameters or indicators:

For example:

- Financial indicators:
 - Approved budget vs. applied investment.
 - Achieved goals vs. applied investment.
 - Total administrative operation cost.
 - Cost per student (per educational level).
 - Total operation cost.

- Coverage:
 - Installed capacity vs. real demand.
 - No. of students that do not attend secondary school.
 - No. of classrooms vs. real demand.

- Text books for the students:
 - Delivery time to schools (prior new cycle kick off).
 - No. of students with complete textbooks package on first day of classes.

- Teachers reposition:
 - No. of changes in one year cycle.
 - Time to substitute a teacher.
 - Cost of a teachers reposition.
 - No. of temporary incidences (licenses, scholarships, courses, etc.)
 - No. of definite incidences (death, retirement, early termination of contract, etc.)

More than a hundred indicators were detected, but were now properly organized for our next step.

The groups were organized in a "cause and effect" relationships between them using the Balanced Score Card methodology. And finally more indicators were added (internal processes, development, market needs, etc.). (Fig. 2 and 3)

The resulting detailed map showed several important internal processes (fig. 4). As fig. 4 shows certain degree of chaos was still unsolved, and priorities could not be established. If we add, that each box represents a large number of indicators, and that each one of these is measured by different departments and people, objective mapping was not enough. We needed to correlate the indicators.

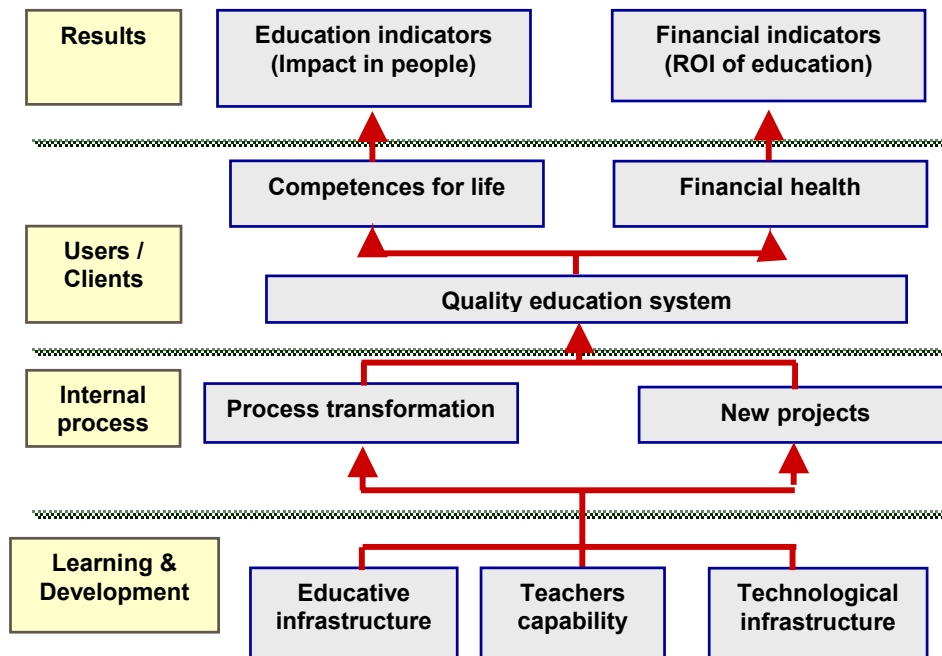


Fig 2: General relations diagram (using Balanced Score Card map).

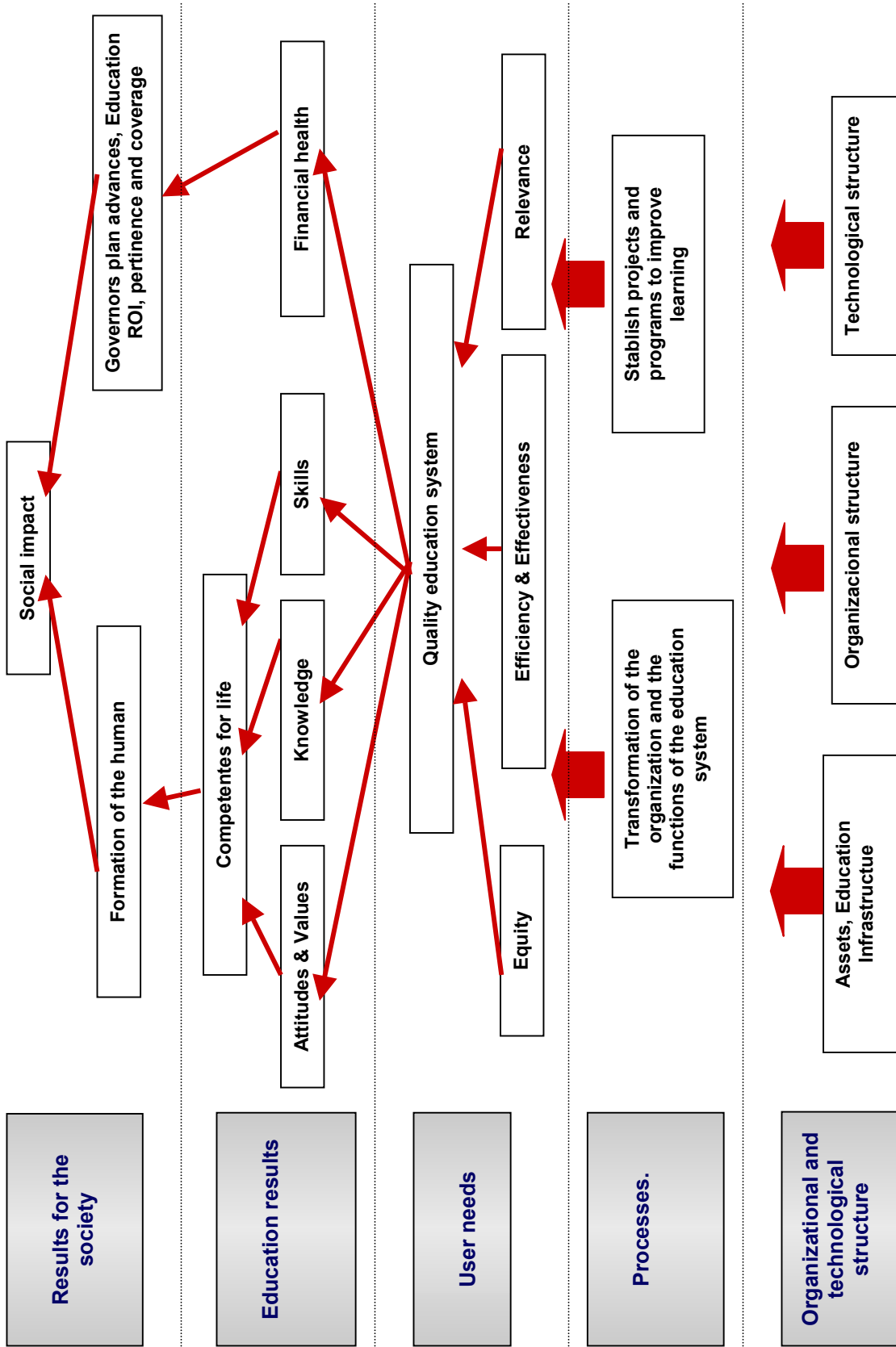


Fig 3: General relations diagram II (using Balanced Scored Card map).

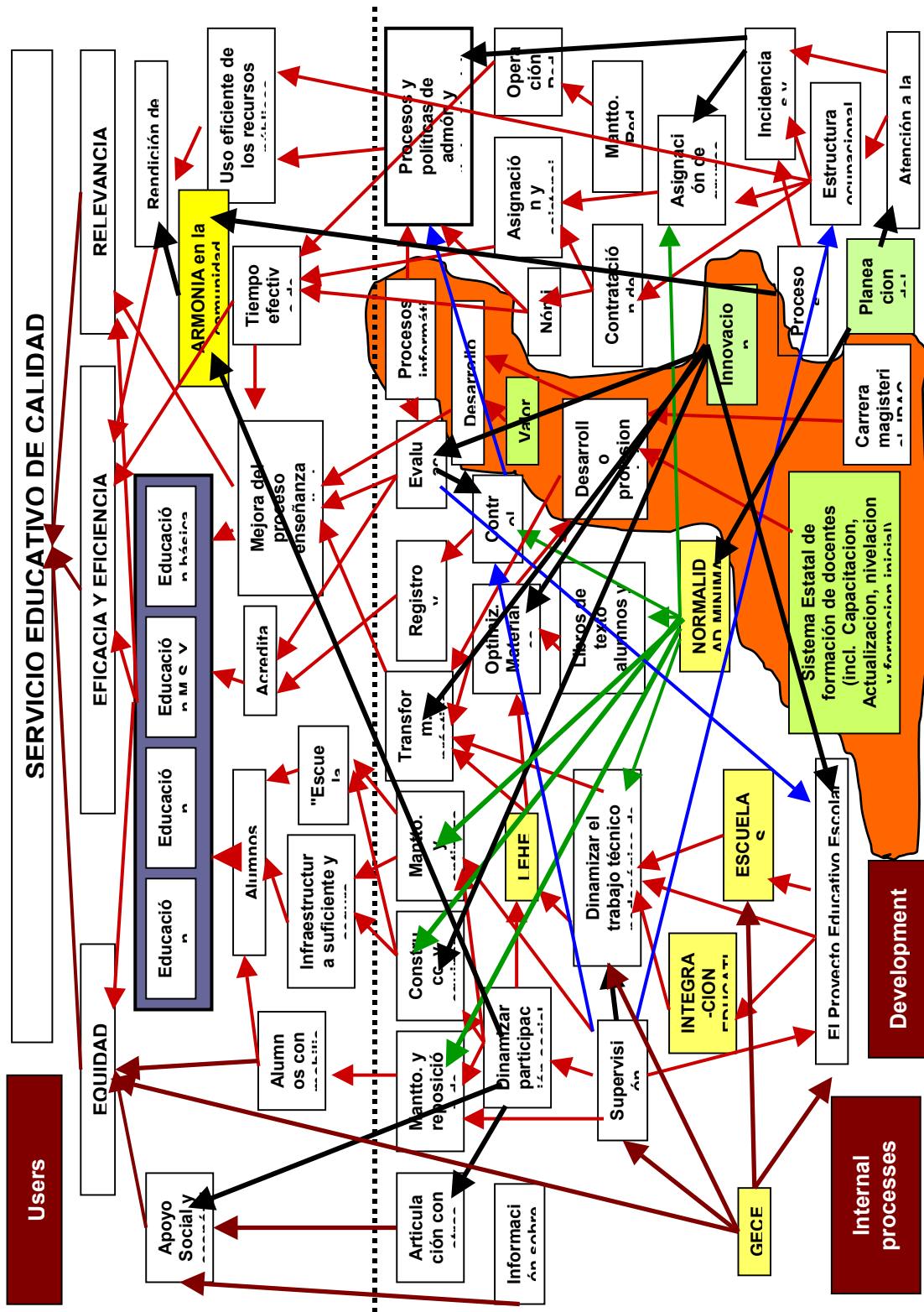


Fig. 4: Detailed users and internal processes perspective of SEG (only part of the diagram is shown).

First level user needs, represent indicators that represent customer needs, such as effective class time, full coverage of education levels and equipped facilities, existence of facilities in all municipalities, etc.

With this matrix we found main user needs and their impact in finances and education indexes.

2) Second, we deployed first level user needs indicators into second level user needs indicators. (see Fig. 6.)

For example the relation between:

- Effective class time vs. teacher’s absenteeism.
- Basic education coverage vs. No. of satellite signal correctly functioning.
- Municipalities with higher education facilities vs. Textbooks on time.
- Accreditation ratio vs. equipment maintenance.

Second level user needs are those related to equipment (chairs, desks, boards, labs., registration and certification coverage, textbooks for students on time, Satellite operations during class time, etc.

GENERACION DE BIENESTAR		1	2	3	4	5	6	7	8	9	10	11	12
Asistencia de maestros	Asistencia del docente vs. tiempo efectivo de clases.		12										6
	Costo estimado que representa la impuntualidad e inasistencia en horas.		12										6
	Tiempo que tarda en cubrirse una vacante de docente frente a grupo durante el ciclo escolar.		12										6
Operación Red EDUSAT	Número de escuelas telesecundarias con equipo que reciben señal, entre el número de escuelas telesecundarias.		6										6
	No. de canales recibidos en el estado.		6										6
Mobiliario	No. de grupos de nueva creación con mobiliario.		1						6				
	Centros de trabajo con mobiliario necesario (suficiente).												
	Número de alumnos entre número de mesabancos en buen estado.		1						6				
	Número de mesabancos en buen estado entre el total de mesabancos.								1				
	Número de aulas entre número de pizarrones en buen estado según criterios.									1			
Aulas suficientes	Cytilización de mobiliario.								6				
	C.T. con mobiliario "batalara".												
Registro y Certificación	Total de aulas entre total de grupos (demanda real).		3										
	No. de aulas que requieren mantenimiento.												
	Existencia de espacios inadecuados.												
Materiales didácticos	Uso de capacidad instalada								12				
	Tiempo que tarda en entregarse certificados, constancias y copias certificadas.									6	12	12	
Actualización docente y desarrollo profesional	Número de alumnos con el paquete completo de libros de texto, al principio y a la mitad de ciclo entre el total de alumnos.												
	Número total de docentes con paquete completo de libros de apoyo según el nivel, grado o asignatura. Entre número de docentes fue												
	No. de escuelas beneficiadas con material didáctico vs. el total (a lo largo de un rango de tiempo).												
	No. de docentes en carrera magisterial por nivel vs. total de docentes		3										
Directivos	No. de cursos de actualización tomados vs. ofrecidos												
	No. de inscritos en C.N.A.												
	No. docentes aprobados C.N.A.									12		3	
	% de docentes capacitados												
	% de directivos capacitados												

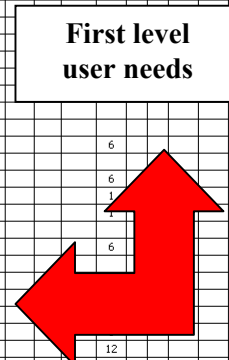


Fig. 6 Correlation between User needs (level 1) and User needs (level 2) indicators.

4) Fourth, we correlated all processes vs. current programs and strategic projects (such as the “Normalidad Mínima” program) to check if all critical processes were in an improvement process. We found that many of the improvement initiatives were correctly addressed and managing critical processes but that several other processes (found to be critical) were not in the list have “needed to improve” and were not tightly controlled (see Fig. 8.)

This gave some guidelines to determine the creation of new strategic projects and/or programs in a cross functional way (the last matrixes were the cross functional management matrixes to determine the participation of the stakeholders).

It is important to mention that in the institutional current programs list, the negotiations committees with the union were also stated.

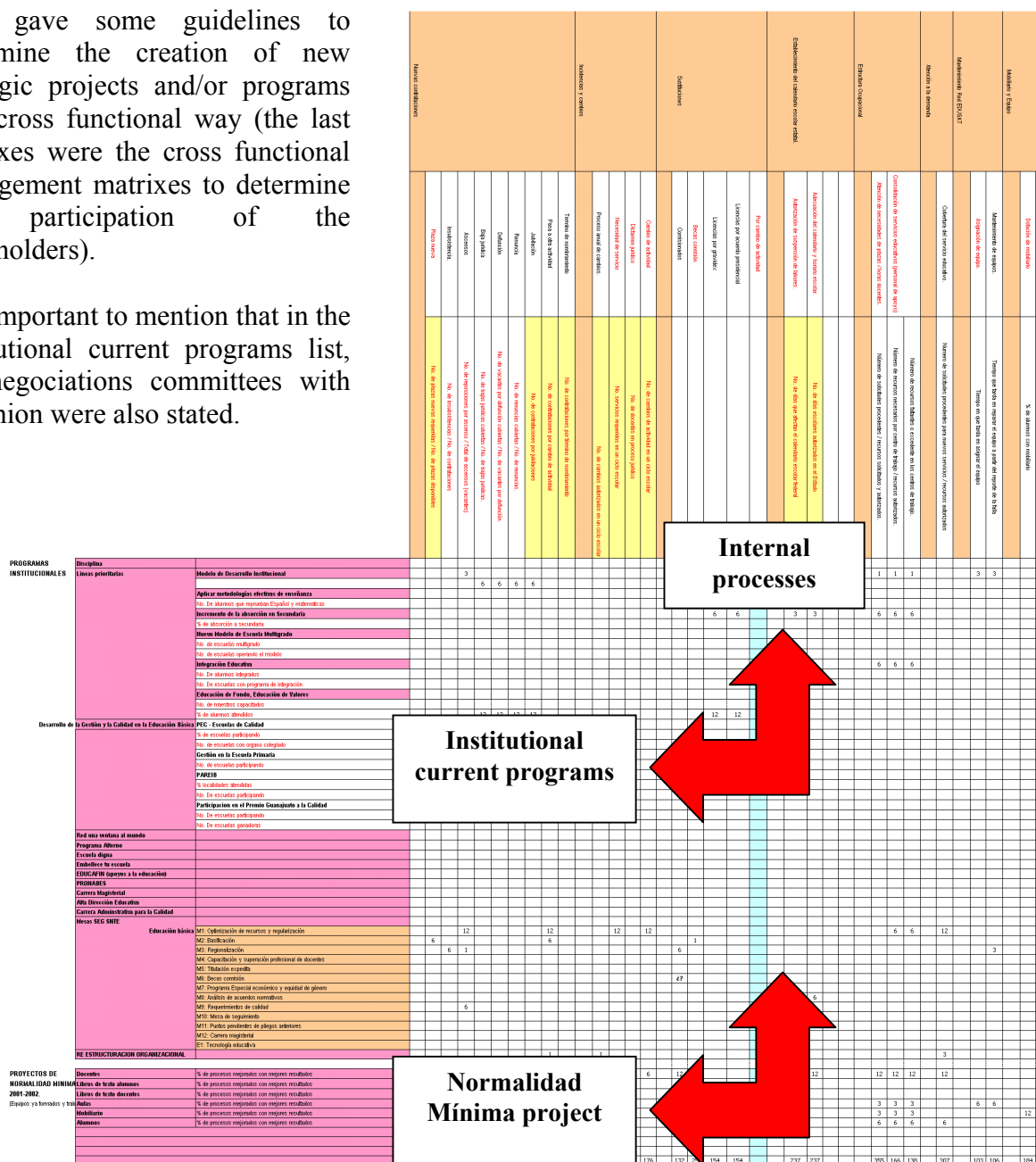


Fig. 8 Correlation between internal processes and current programs and projects.

5) Finally, we created cross functional matrixes to determine the responsables of monitoring, controlling and/or improving each indicator.

Basically, responsables for impact indicators (financial, education and second level user needs), confirmation of the current responsables of running programs and critical projects and definition of responsables of critical internal processes (see Fig. 9.)

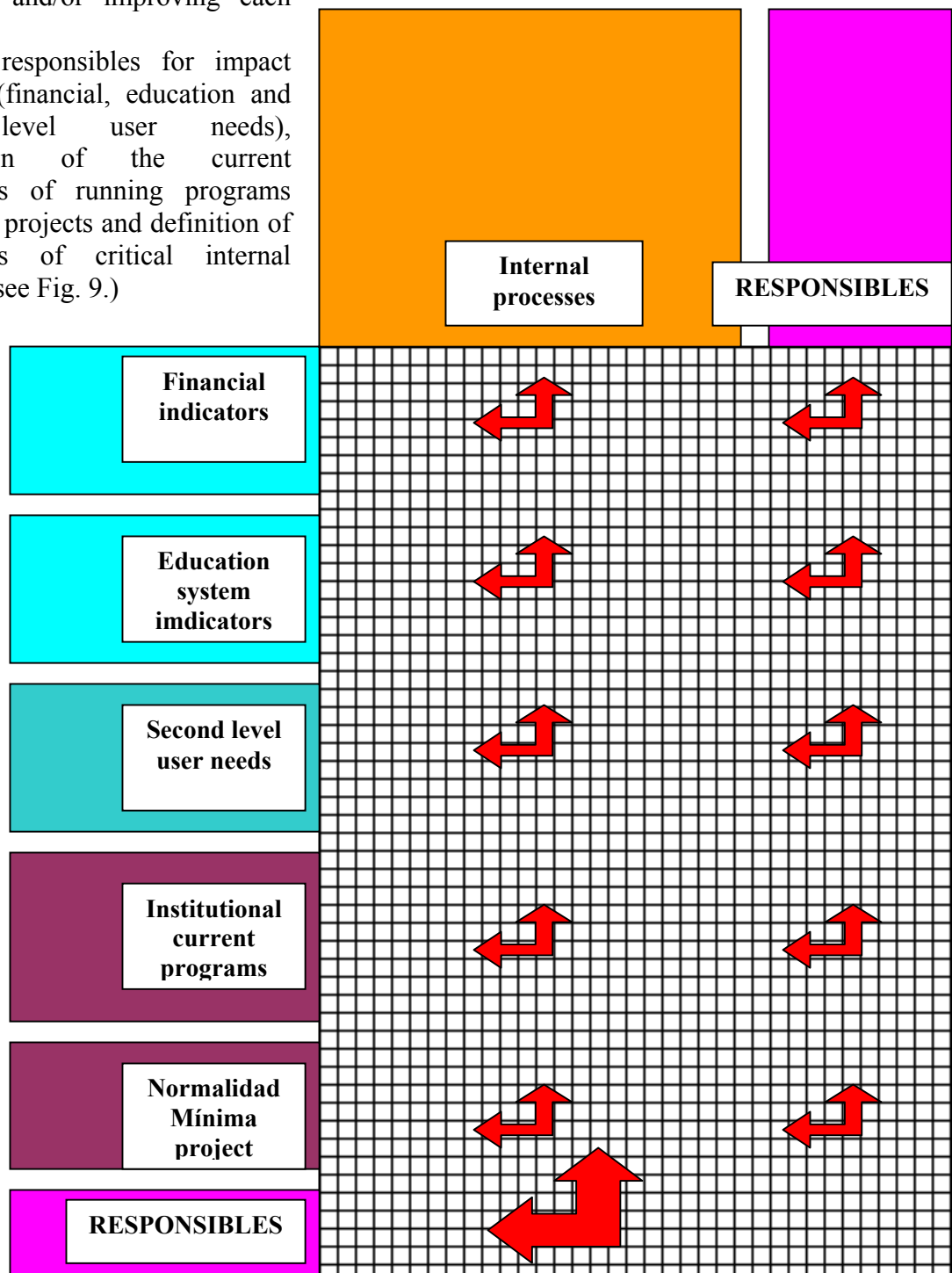


Fig. 9 Cross functional matrixes for internal processes and for impact indicators.

As a resume, we show the next figure 10, where all deployments (correlations) are shown, as well as the definition of responsibilities in monitoring whole indicators (this step is not yet finished).

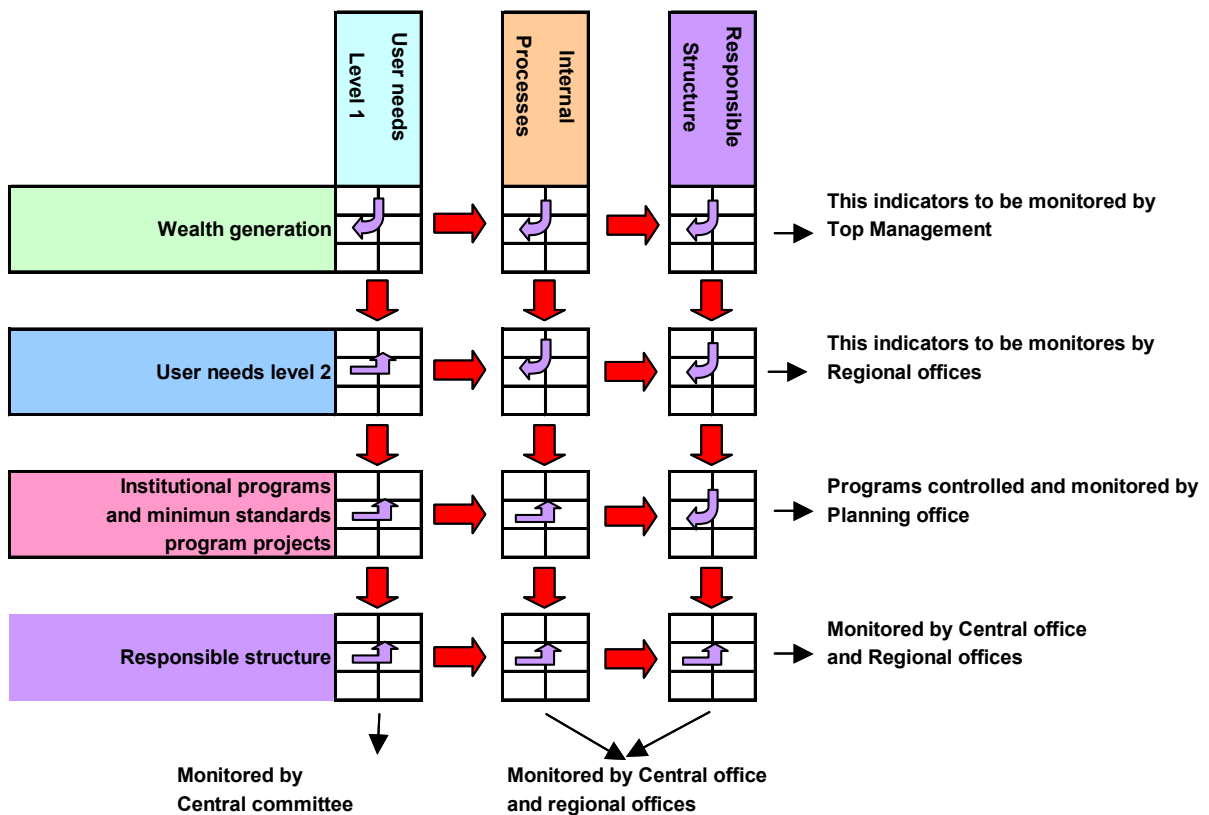


Fig. 10 General design for SEG indicators.

4.- Phase 3: Definition of main processes.

Once all matrixes were done, the results supported the relations diagram (based on mapping with Balanced Score Card, in fig. 2, 3 & 4), and helped to determine critical processes.

Not all processes can be simultaneously improved, mainly because of time and budget, but the strategy is improving day by day.

SEG decided to support current key projects and also create more. Most of these projects look out for the improvement and standardization of critical processes (fig. 12).

The following relations diagram shows how the number of internal processes has simplified because now the name of the projects that manage them appear. Through this methodology we found that a group of processes was not being improved nor controlled, and defined a strategy to initiate a new project. (fig. 11)

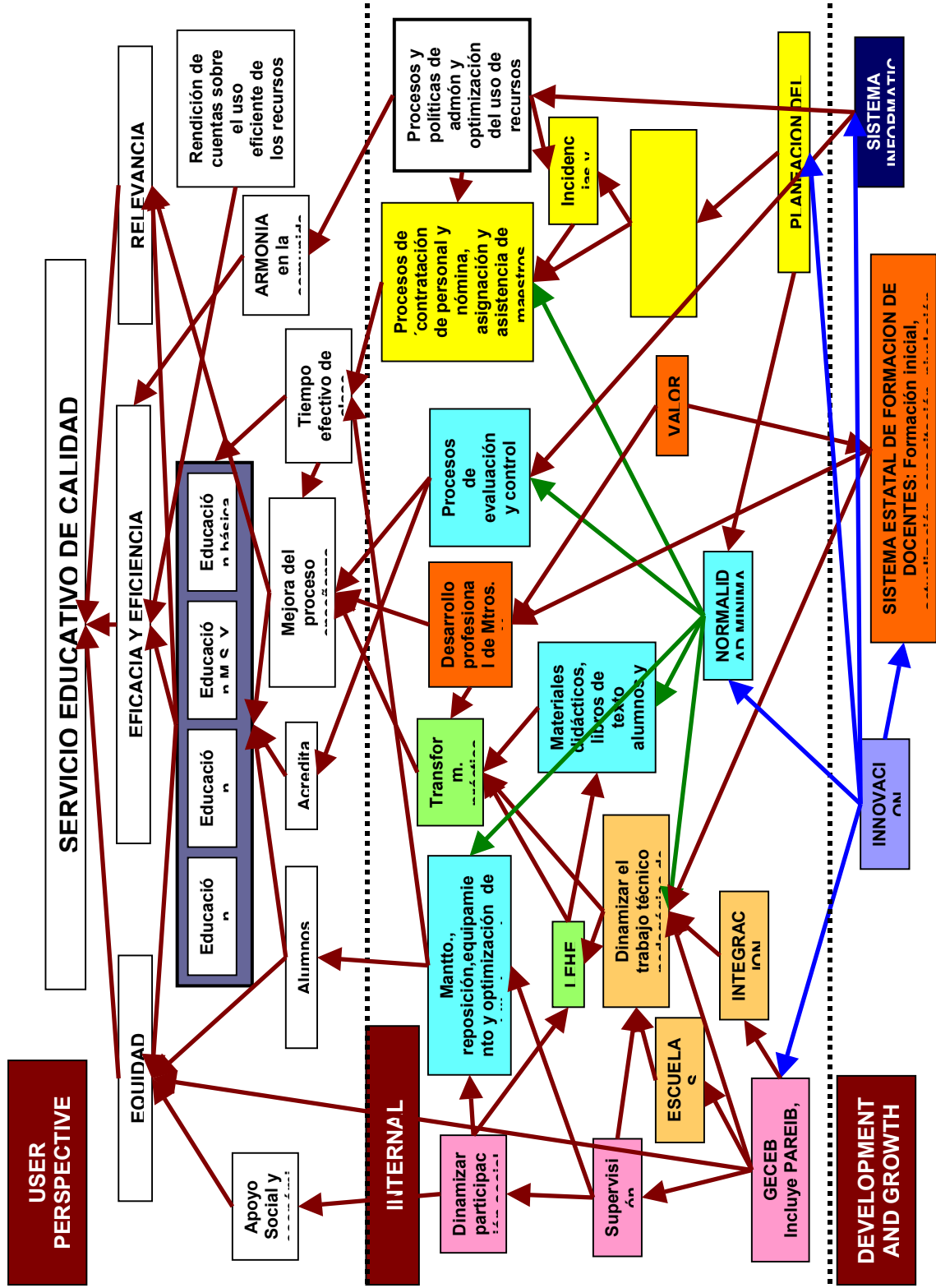


Fig. 11 Simplification of relations diagram. From Processes to Projects.

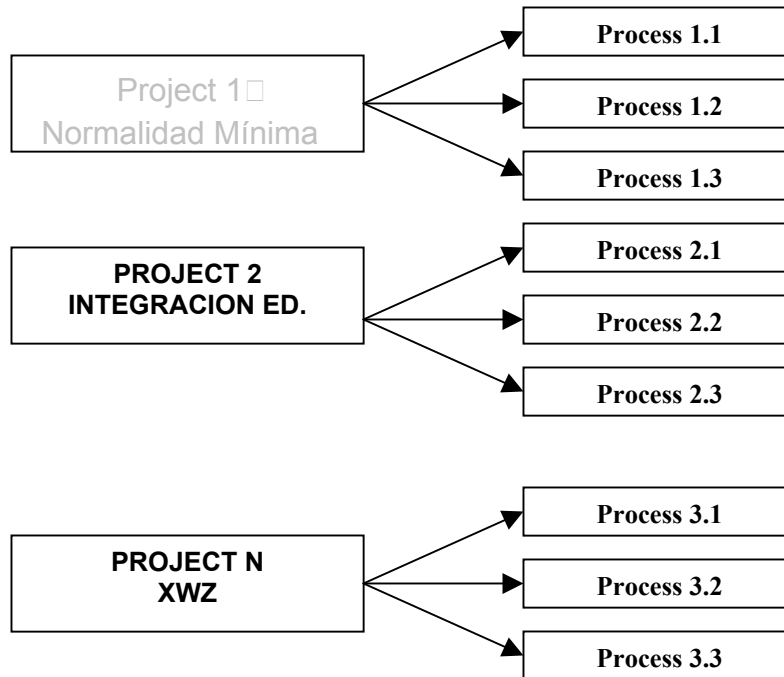


Fig. 12 Definition of special projects that manage and improve critical processes.

5.- Next step.

Many adjustments are being made to the original model and even is its applications has already started, many activities have been delayed.

- 1) The completion and validation of all the indicators of the mega matrix is still in process.
- 2) Validation of the correlations in the field and in the process improvements is still in practice, and many changes are expected.
- 3) The relations diagram (Balanced Score Card) is also to be validated.

Next steps are also defined:

- 1) Final definition of critical indicators to be monitored by all levels of authority in the SEG.
- 2) Creation of a “War Room” for the Education Minister, and the development of an intelligent tool for managing information and indicators.

Conclusion.

The matrixes correlate indicators vs. indicators in a target means focus, and helps us determine the main processes of the Ministry and its educational system that impact in Educational Indexes (system indicators, process indicators and minimum basic indicators programs). Also defines the responsables of managing each one of the processes in a cross functional matrix (identifying all areas that must be interacting in each process) and in consequence the responsible of the process indicators administration.

This indicators analysis is been used to define which processes must be improved, which stakeholders must interact, how to allocate budget to strategic processes and projects and also to introduce modern project management techniques to all main projects and initiatives of the Education Ministry.

This indicators system formally started its application In August with the new school cycle 2002-2003, but many adjustments are being done. The definition of more precise indicators for processes is still working (process mapping and indicators definition).

This model is being copied by other State Ministries in Guanajuato and we hope all offices can deploy their indicators in a similar way.

The use of comprehensive QFD model was very useful to deploy a large list of education indicators that are usually organized by type, but not in a cause effect focus that benefits both the society and the financial status of the institution.

Acknowledgments.

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References:

- 1) Akao, Yoji, QFD Integrating customer requirements into product design, Productivity Press, USA 1990, ISBN: 0-915299-41-0
- 2) Kaplan, Robert S. & Norton, David P., The balanced scored card, Harvard Business School Press, USA, 1996, ISBN: 0-87584-651-3
- 3) Martinez Rizo, Felipe, La Calidad de la Educación en Aguascalientes, Universidad Autónoma de Aguascalientes, Mexico, 1996, ISBN: 968-6259-42-2.
- 4) Mazur, Glenn, Green Belt Workshop notes, USA, 2000.
- 5) Mazur, Glenn, Black Belt Workshop notes, USA, 2000.
- 6) Mizuno, Shigeru & Akao, Yoji, QFD – The customer driven approachot o quality planning and deployment, APO, Japan, 1994. ISBN: 92-833-1121-3.

Links:

- 1) El Premio Nacional de Calidad, México, <http://www.economia-premios.gob.mx/calidad/intranet.asp>
- 2) Ministry of Education of the State of Guanajuato: http://www.guanajuato.gob.mx/seg/contenido_seg.htm
- 3) State Government of Guanajuato: www.guanajuato.gob.mx
- 4) Winners of El Premio Nacional de Calidad, México: <http://www.economia-premios.gob.mx/calidad/ganadores.asp?lenguaje=0>