



ASQ Education Brief

Education
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University of Process

Using quality tools and data to eliminate process waste, sustain improvements

by Norma S. Simons

Higher education in the United States has been regarded as one of the best systems in the world—creating innovative discoveries in science and technology, impacting the economy and solving social and environmental issues, and it has enhanced the social and economic mobility of a diverse population resulting in increased productivity and economic growth for the country.¹ But the current systems are being challenged by political and financial changes, and therefore, higher education must make adjustments to enhance its ability to compete.

Although some colleges can find funds from external sources to close their financial gaps, there is a need for more robust internal processes, use of leading performance indicators, removing process waste and applying problem-solving concepts to continually improve performance.

Challenging environment

Most U.S. higher education institutions have experienced reduced funding.² This began long before the last recession and continues on a downward spiral. Rising costs and reduced state support has caused reductions in research, elimination of academic programs, increased class sizes, less desirable faculty to be hired and fewer remunerations paid to faculty. Many colleges have increased tuition to make up for less state funding. This strategy, however, limits their ability to compete in the market.

Hiking tuition also causes a large disparity between the costs of attending public and private colleges, and this has placed higher education out of reach for some families. Colleges continue to rely on endowments, funding and expensive sports programs to finance their operations, but they also must examine and change internal systems to respond to the external environment. The shift has to be carefully crafted and controlled. If it isn't, institutions will continue to move on the same path and eventually won't be able to adjust.

The education industry must address the ability to provide a quality education at a reasonable cost. The required changes will include:

- Developing robust internal processes.
- Establishing performance measures.
- Identifying and removing waste in internal processes.
- Applying problem-solving methods to close the performance and financial gaps.

Develop robust processes

A robust process can be considered one that is clearly defined, structured and has the ability to deliver consistent outputs. For this to occur, the steps in the process must be clearly shown using a visual tool, such as a process map or a value stream map. College processes usually are not clearly identified or defined, and as a result, the outputs of processes cannot be controlled.

Process mapping or value stream mapping enables a process to be visible and clearly understood by beneficiaries and stakeholders. This allows individuals in the process to identify activities that are not essential to the function of the process.

Some processes may exist within a functional area or may involve several cross-functional areas. The decision to define and develop a process map rests with the impact those key processes can have on the beneficiaries and the probable cost of the process to the institution. Several processes in higher education must be monitored to reduce costs and improve efficiency (see Table 1).

Developing a process focus in higher education requires improvement teams to:

- Identify key processes—those having significant effects on the success of the institution. For each key process, a team should begin with a supplier, inputs, process, outputs and customers (SIPOC) diagram (see Figure 1). A SIPOC diagram helps identify the scope or boundaries of a process, and its beneficiaries.
- Determine the requirements of process beneficiaries. This helps teams distinguish between value added and nonvalue-added activities.
- Develop a visual representation of the existing process using a process map to show major steps within the boundaries of a process.

- Use process metrics to evaluate process performance. These metrics are leading indicators used to monitor a process.
- Identify process owners—individuals required to monitor and maintain the performance of a process.
- Hold formal process reviews. This must be done regularly for the institution to take corrective actions and improve performance.

Processes found in higher education / TABLE 1

| Key processes | | | | | |
|----------------------|---|------------|--------------------------------|------------|--------------------------------------|
| 1.0 | Acquire students | 2.0 | Teach students | 3.0 | Support students |
| 1.1 | Identify student markets or groups. | 2.1 | Determine learning objectives. | 3.1 | Develop calendar and schedule. |
| 1.2 | Identify current and potential student needs. | 2.2 | Design programs and courses. | 3.2 | Assess preparedness. |
| 1.3 | Determine and assess programs. | 2.3 | Design course delivery. | 3.3 | Advise students |
| 1.4 | Determine pricing. | 2.4 | Provide learning resources. | 3.4 | Facilitate funding |
| 1.5 | Market to students. | 2.5 | Instruct students. | 3.5 | Provide safe and secure environment. |
| 1.6 | Enroll students to first census. | 2.6 | Assess learning and courses. | 3.6 | Maintain student records. |

| Enabling processes | | | | | |
|---------------------------|---|------------|------------------------------|------------|---------------------------------------|
| 4.0 | Value people | 5.0 | Manage processes | 6.0 | Lead and plan |
| 4.1 | Identify skills. | 5.1 | Monitor financial resources. | 6.1 | Create environment and culture. |
| 4.2 | Recruit and orient employees. | 5.2 | Design programs and courses. | 6.2 | Strategic planning. |
| 4.3 | Develop and train employees. | 5.3 | Design course delivery. | 6.3 | Risk assessment. |
| 4.4 | Motivate and evaluate performance and engagement. | 5.4 | Provide learning resources. | 6.4 | Review institution performance. |
| 4.5 | Pay employees and provide benefits. | 5.5 | Instruct students. | 6.5 | Communicate expectations and results. |
| | | 5.6 | Assess learning and courses. | | |

Definition of a SIPOC diagram / FIGURE 1

| Supplier | Input | Process | Output | Customer |
|---|--|--|--|---------------------------------------|
| The group or individual providing input to the process. | What the supplier adds or provides for the process step to take place. | Individual steps listed in sequence to complete the process. | The result of the process step being provided to the customer. | Recipient of the output of a process. |

Establish performance measurements

Data exists in education, but its use is not clearly understood. In most instances, the data only reflect outcomes of the institution, and as a result, what is measured is a lagging indicator—a metric that only reports historical performance. Useful data are those that help monitor performance prior to the end of a semester or school year. These data are considered process data and can promote understanding and encourage response to performance.

For example, all institutions are concerned with retention and persistence (freshmen re-enrollment rates and student behavior related to achieving goals), and take steps to reduce student attrition. It is important to examine the internal processes that could impact retention and identify how these processes can be monitored.

A cross-functional team at a university used the deployment matrix to study processes that affected retention (see Figure 2). At this institution, retention was a part of the balanced scorecard and the measure was considered a lagging indicator. The deployment matrix identified leading indicators that affected retention and could be monitored on a regular basis. The team focused on a strategy to improve student registration as a means to improve persistence and overall retention. For the two years, the project studied factors that influenced late registration.

Using the matrix, the team identified the following processes as affecting the university's retention:

- Continuing-student registration.
- Orientation.
- Completed academic goal.
- Updated academic plan.
- Transcript audit.
- Financial aid packaging.
- Input of student registrations.
- Officially register students.
- Degree clearance.
- Student complaints.

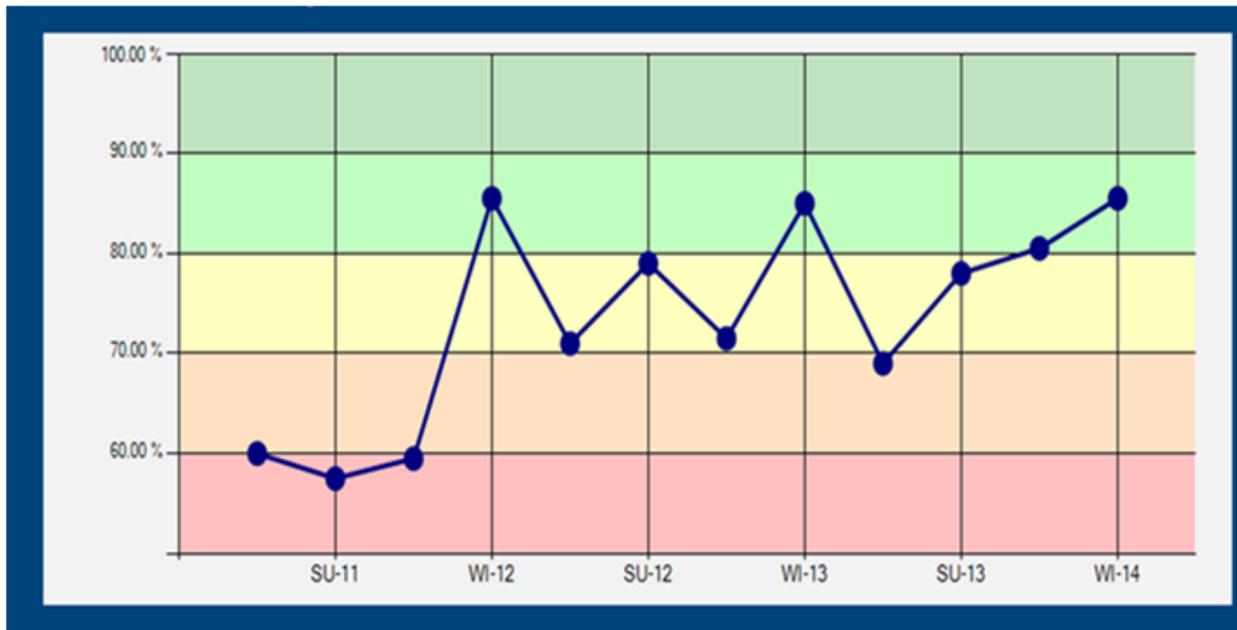
The list of process metrics in the center of the deployment matrix also are leading indicators that impact retention (see Figure 2). There also was a correlation section of the matrix (not pictured), which showed the relationship of the process metrics to the processes identified.

Example of a deployment matrix / FIGURE 2

| | | Determine the factors influencing timely registration | | | | | | | | | | | | | | | | | | | | | |
|------------|---|---|---|---|---|---|---|---|---|---|---|----------------|---|---|---|---|---|---|---|---|---|---|---|
| | | Improvement Projects | | | | | | | | | | Process Owners | | | | | | | | | | | |
| Strategies | Register students unofficially by deadline (S2) Register students officially by deadline (S2,S4) | <i>Retention</i> | | | | | | | | | | | | | | | | | | | | | |
| | | Processes | | | | | | | | | | | | | | | | | | | | | |
| | | Process Metrics | | | | | | | | | | Accountability | | | | | | | | | | | |
| | | Persistence Rate | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | Completion Rate | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | (Leading Indicator) Completion Rate | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | Orientation Pass Rate | ○ | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Percent of students unofficially registered by deadline | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Percent of students officially registered by deadline | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Percent of Up-to-date Academic Plans | ● | ○ | ● | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Comparison of Academic Plan to Actual | ● | ○ | ● | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Percent of Advisor-Auditted Transcripts | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Timely Packaging of Financial Aid | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Timely Input of Student Registrations | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Accurate Input of Student Registrations | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Percentage of Class Changes | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Attrition Reason Report | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Risk Analysis Report | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Counseling Reason Report | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | | Department Call / Ticket Log (TBD) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

The objective of a deployment matrix is to ensure leading indicators are used to evaluate and respond to performance. For example, the metric “on time unofficial registration” tracks timely registration over several registration periods. Figure 3 illustrates that the team is monitoring this metric’s performance, with green cells reflecting acceptable performance.

A leading indicator for retention—on time unofficial registrations / FIGURE 3



SU = summer

WI = winter

Understanding the performance of key processes requires use of lagging indicators and leading indicators, enabling teams to quickly respond to poor performance. The deployment matrix is a visual tool which identifies key processes that impact retention, process metrics, process owners and their responsibilities.

Identify and remove waste

A visual map of university processes and process metrics helps teams understand how processes are managed, whether they're falling short of beneficiary or stakeholders' expectations, and how to reduce activities that add little value.

Waste can be defined as anything within a process that adds time and cost without adding value.³ To identify waste, it's important to identify the flow and beneficiaries of a process.

Processes that are not identified and defined are automatically delivering waste. Research shows that business processes may consume up to 90% of an organization's resources in waste, with only about 10% of the used resources producing value to the individuals receiving process outputs.⁴

Process waste creates inefficiencies and poor quality for the people served by that process. Individuals who work in various processes are often unaware of the types of wastes that may exist and the unnecessary costs they generate. Many institutions employ a cost-cutting strategy, which involves cutting faculty, reducing offered programs or amenities, raising tuition and relying on the external environment to provide additional funding.

Higher education institutions must strive for additional funding, but more importantly, they must remove process waste to deliver a better quality education at a lower cost.

The types of wastes found in a college setting can appear in four categories:

1. People.
2. Processes.
3. Information.
4. Assets.⁵

Within these four types of waste, there are subcategories (see Table 2). In some situations, it may be easy to identify and remove waste, but in other instances, it could require

a more detailed evaluation of the process and the application of a structured problem-solving method.

Types of waste in higher education / TABLE 2

| Major categories of waste | Subcategories |
|--|---|
| People Failure to fully utilize the skill and knowledge of workgroups. | <ul style="list-style-type: none"> • Goal misalignment • Incorrect assignment • Waiting for resources, actions or information • Waste of motion • Work performed in a less efficient and effective manner |
| Processes Poor performance of university processes. | <ul style="list-style-type: none"> • Ineffective control • Variability • Making arbitrary changes to the process • Unreliable processes • Processes not standardized • Poor scheduling • Waste of workarounds • Excessive approval steps • Corrective errors |
| Information Information for processes is inefficient or ineffective. | <ul style="list-style-type: none"> • Missing information • Loss of information due to hand-offs • Irrelevant information • Inaccurate information |
| Assets Failure to effectively use facilities, people and material. | <ul style="list-style-type: none"> • Oversupply of resources and materials • Unnecessary movement of people information and materials • Inefficient use of facilities • Overburdening people, equipment and facilities |

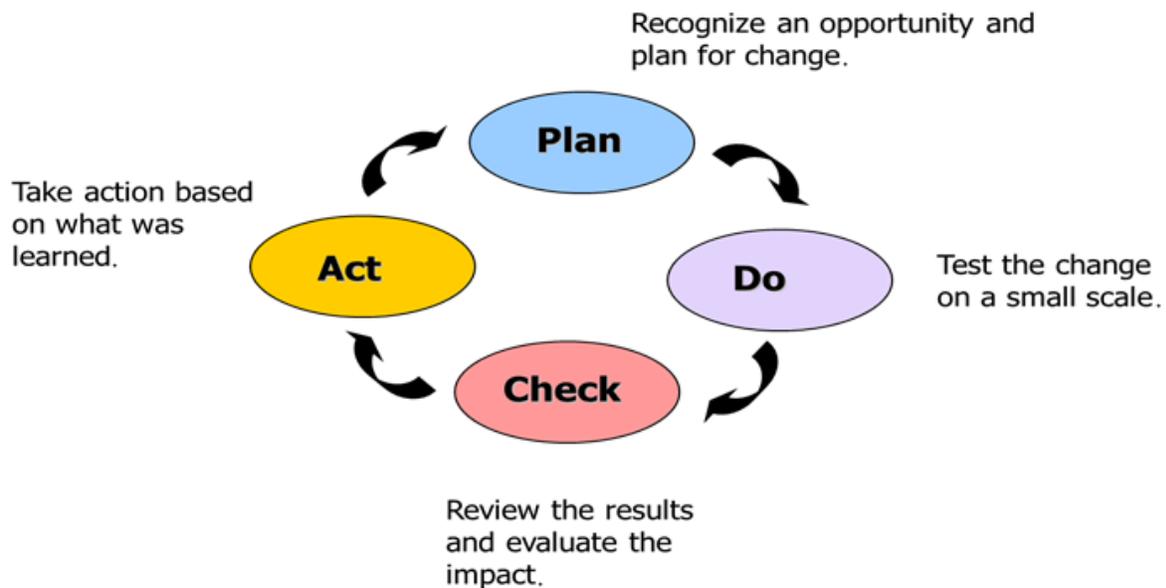
Problem solving

The ability to solve problems involves evaluating processes and relying on process metrics to determine unfavorable performance. In education institutions, individuals are often unfamiliar with the use of a systematic process for problem solving and root cause analysis. Instead, the approach to problem solving results in solutions with little use of a scientific process.

The plan-do-check-act (PDCA) cycle is a tool that drives continuous improvement (see Figure 4). It helps organizations focus on prevention instead of firefighting, and it incorporates

the seven basic quality tools (cause and effect diagram, check sheet, control charts, histogram, Pareto chart, scatter diagram and stratification). Toyota uses the PDCA cycle as an important component of its problem-solving method.

PDCA cycle diagram / FIGURE 4



The lean Six Sigma method uses the define, measure, analyze, improve and control (DMAIC) process as a template for problem solving, root cause analysis and continuous improvement. DMAIC provides a roadmap to achieve project objectives and the means to effectively communicate and resolve problems, and it fosters collaboration across an organization's functional silos. The process enables the identification of hidden costs that waste resources, people and time, and do not enhance the quality of education.

Higher education must have a strategy to respond to current and future challenges, and institutions must stop making short-term decisions that increase financial viability at the expense of offering a quality education.

Changes should be made to internal systems, and this requires institutions to become process focused, enabling responses to current challenges the flexibility to meet the changing needs of shareholders and beneficiaries.

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