# [1. QUANTITATIVE EFFECTS OF PROJECT CHANGE (RS43-2)](https://www.construction-institute.org/quantitative-effects-of-project-change)

**Report Summary:** Change management is an organization’s process for incorporating a balanced change culture that recognizes, plans, and evaluates project changes in order to manage them effectively. These changes include those related to scope, error, design development, estimate adjustments, schedule adjustments, and changed conditions, either elective or required.

This research concluded that a significant correlation exists between the percentage of change on a project and labor productivity in terms of design, engineering, and construction. The decline in overall productivity due to an environment of excessive change can alter the cost/benefit evaluation of potential changes and should be taken into account in project decision-making. Project management should track the expected amount of change over time to assist decision-makers with timing/scheduling and/or the organization of change implementation.

The analysis of the projects submitted for this study also shows that projects have a diminishing ability to recover lost time and costs in their later stages. This effect is expressed in a probability profile. A normalized contingency draw-down curve for the projects submitted suggests that many changes occur late in the project life cycle. Analysis of the data indicates that the timing of the construction start does have an effect on the amount of change in the engineering phase and in the total cost of changes, but that the effect on construction change is negligible.

This research also examined the amount of change experienced on projects of different types and with varying contracting strategies. The conclusion drawn is that organizations should analyze and retain project data as well as provide trend information that general management can use as benchmarks to monitor project performance.

**Key Takeaways:**

## (1) Measure the relationships between the overall project change ratio and productivity, both in terms of engineering and construction.

## (Project Phase: Detailed Scope through Commissioning and Start-Up)

* Track any changes to the original scope work, by craft, throughout the project.
* Monitor the overall project change ratio and its impact on engineering and construction productivity.
* Analyze the obtained data to identify trends and correlations between the change ratios and productivity declines.
* Develop predictive models to forecast the potential productivity impacts associated with future changes.
* Implement process improvements to minimize or mitigate the negative effects of high-change periods.

## (2) Measure the relationships and ratio between the change work and original scope work.

## (Project Phase: Detailed Scope through Commissioning and Start-Up)

* Forecast expected changes by craft and period (e.g., months) to predict or minimize productivity declines.
* Track actual changes against forecasted changes to identify trends and areas for improvement.
* Analyze the impact of high-change periods on labor costs, material usage, and overall project schedule.
* Develop strategies to manage change work efficiently, such as phasing construction activities or adjusting the resource allocation.
* Regularly review and adjust forecasting methods to ensure accuracy and effectiveness in managing future changes.

## (3) Measure relationships and ratio between the total change dollars and the material dollars.

## (Project Phase: Detailed Scope through Commissioning and Start-Up)

* Track the ratio of the total change dollars to material dollars over time to measure implementation efficiency.
* Analyze trends and patterns in this ratio to identify areas for improvement and optimize the change management process.
* Use data to forecast potential impacts on the project schedule, budget, and resource allocation that are due to changes.
* Develop strategies to minimize waste and inefficiencies by optimizing the use of materials and resources during change implementations.
* Regularly monitor and adjust these metrics to ensure continuous process improvements and better decision-making.

## (4) Analyze the probability of on-time project completion relative to reported progress at key project milestones.

## (Project Phase: Detailed Scope through Commissioning and Start-Up)

* Review and analyze close-out reports from completed projects to identify trends in project schedules.
* Plot the probability of completing projects on time against reported progress at key milestones (e.g., 25%, 50%, 75% complete).
* Identify patterns or correlations between reported progress and actual completion dates to inform future project planning.
* Use these analysis results to develop strategies for improving schedule performance, such as adjusting the resource allocation or implementing a more effective change management process.
* Regularly update and refine the probability of on-time project completion based on new data from completed projects.

## (5) Analyze the probability of completion on or under budget relative to reported cost trends.

## (Project Phase: Detailed Scope through Commissioning and Start-Up)

* Review and analyze close-out reports from completed projects to identify trends in project costs.
* Plot the probability of completing projects within budget against reported cost trends at key milestones (e.g., 25%, 50%, 75% complete).
* Identify patterns or correlations between reported cost trends and actual completion dates to inform future project planning.
* Use these analysis results to develop strategies for improving budget performance, such as adjusting the resource allocation or implementing a more effective change management process.
* Regularly update and refine the probability of on-budget completion based on new data from completed projects.

## (6) Analyze the amount of change for projects of varying size and type.

## (Project Phase: Detailed Scope through Commissioning and Start-Up)

* Categorize completed projects by size (e.g., small, medium, large) and type (e.g., revamp, new construction).
* Analyze close-out reports to identify trends in the amount of change experienced across the different project categories.
* Calculate the ratio of total change dollars to material dollars for each project category to measure implementation efficiency.
* Compare the results from various project categories to identify patterns or correlations between the amount of change and the project size and type.
* Use these comparative analysis results to inform future project planning, resource allocation, and risk management strategies.

## [(7) Tool: Project Change Management (SP43-1)](https://www.construction-institute.org/project-change-management)

## (Project Phase: Detailed Scope through Commissioning and Start-Up)

This tool is designed to:

* Establish a good up-front baseline agreement that allows all team members to recognize and measure change.
* Use a classification process to determine whether the change is required or elective.
* Generate a measurable outcome that indicates successful achievement of some quality objective.
* Use this metric to enable the appropriate management level to implement or reject the change in a timely manner.
* Use analysis results to inform future project planning, resource allocation, and risk management strategies.
* Clearly define the person who will be responsible for taking the necessary action, based on the metrics supplied.
* Collect and store data that are relevant to management decision-making and change measurements, and to make these data accessible.
* Use the data collection system to facilitate the timely presentation of analyzed data to the appropriate decision-makers.
* Use established benchmarks to monitor project performance.
* Ensure that all team members consistently use the recording or reporting system to document all changes.
* Establish a recognition/reward system for those who initiate beneficial change.
* Establish agreements between the project participants at the different levels of the project.