













the previous example, Program A experienced a delivery rate, requiring a workforce reduction. Program B continues to build at the same delivery rate as before and requires no change in headcount. But because of the “bumping” of employees across the shop floor, Program B now finds itself with employees who formerly worked on Program A and are unfamiliar with the unique requirements and processes of Program B. This too will create some temporary disruption.

Designating  $p$  as the total number of employees and  $d$  as the number removed, Cochran defines the “new man ratio” for a task turnover as:

$$t_t = d/p$$

For a crew of 15, assume five mechanics are removed and their places taken by new ones. This yields  $t_t = 5/15 = 33\%$ . So at least a third of the mechanics will be performing tasks which are new to them.

### Estimating the Impacts of Changes

Calculating the “new man ratio” for a workforce change does not, however, tell us the cost impact of a workforce change. We cannot assume that a 25% “new man ratio” translates to a 25% cost increase. If we think back to Anderlohr’s five elements of learning improvement – production personnel, supervision, continuity of production, tooling, and methods – we can see that only the first and second elements are impacted by a workforce change. (Anderlohr, 1969.) Assuming there is no change to the production configuration, tooling, or the production process itself, those contributors to learning should not see an impact.

It is also probable that minor workforce changes do not impact cost. In any large organization, there is a certain level of turnover – hires, firings, retirements – which occurs as an ordinary part of the business. “[I]t appears,” writes Cochran, “that the new manpower effect must exceed a certain ‘threshold’ level before its cost effects need be taken into account.” (Cochran, 1968.)

Nonetheless, it assumes reasonable to make four assumptions about the impact of workforce changes:

- a) Employees new to a task will initially perform less efficiently than experienced employees.
- b) Over time the performance of new employees will improve relative to experienced employees.
- c) At some point the performance of new employees should converge with that of experienced employees.
- d) How long it takes to fully integrate a new employee varies depending on how much prior experience that employee has – with the industry he is working in, with the specific company he works for, with the production program that employs him, and with his or her specific work assignment. The more familiar an employee already is with Program A, for example, the faster his performance in a new job will approach the other Program A employees already performing that job.<sup>1</sup>

---

<sup>1</sup> Compare these to the assumptions of RAND’s 2004 model to assess changes in shipbuilding labor: “(1) It takes three years to become fully proficient at a trade; (2) worker productivity improves linearly with experience to a fully qualified status, beyond which no further productivity is modeled; (3) a worker with no experience has a productivity of two-thirds that of a fully proficient worker; and (4) the changes of hiring a worker at any experience level are identical.” (Arena, 2004.)





























