

SSIE 664 Homework 3
October 10, 2021
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5.0 Tell Me About Yourself (Keep it between 200 and 400 words).

My name is Grant, and I have been doing management consulting for the past 15 years. Over this time, I have helped clients in many types of industries ranging from oil and gas, refining manufacturing, to pharmaceuticals optimize their data collection and processes for doing environmental compliance reporting.

My strength is being able to make sense of various types of information in order to solve challenges related to environmental compliance. In one example, I was able to eliminate the need to purchase greenhouse gas credits by a refinery by piecing various types of seemingly unrelated data, as part of a greenhouse gas cap-and-trade report and this project alone resulted in a cost savings of more than \$750K US. In another example, I was able to help a global pharmaceutical company get into compliance with environmental regulations by reviewing and improving their current practices, which ended up saving at least \$1MM dollars in fines from a local regulatory agency, and prevented possible interruptions to their global operations.

I know that most companies like yours have challenges optimizing the processes needed to do environmental compliance reporting, and am looking forward to talking about how we can help you in the same way that we have helped your competitors.

5.1. A number of years ago, ISO Standards 9000 series were developed to promote work quality by standardizing engineering design, testing, production, and other procedures. How many ISO standards are there, and how well have these standards been accepted in the United States?

From a review of the ISO website¹, it notes that ISO has developed a total of 24,028 standards. In reviewing the 2020 ISO Survey², it seems that the most popular ISO certification is for ISO 9001. When determining how well the ISO standards have been adopted in the US, we will assess the adoption based on the adoption of ISO 9001 since this is the most popular standard.

As shown in Figure 1, from 2006, the number of ISO-9001 certifications issued in the US has decreased overall from the peak seen in 2006. Moreover, it seems that the number of

¹ <https://www.iso.org/standards-catalogue/browse-by-ics.html>

² <https://isotc.iso.org/livelink/livelink?func=ll&objId=21413346&objAction=browse&viewType=1>

certifications issued in recent years seems to be slightly higher than it was in 2010, where it seemed to have bottomed out and in fact, there seems to be a 25% decrease in certifications issued in 2017, when compared to 2010. Assuming that this trend holds across all certifications, one can conclude that the adoption of ISO standards in the US is decreasing.

Number of ISO-9001 Certifications Issued in the US, by Year
(1,000s)

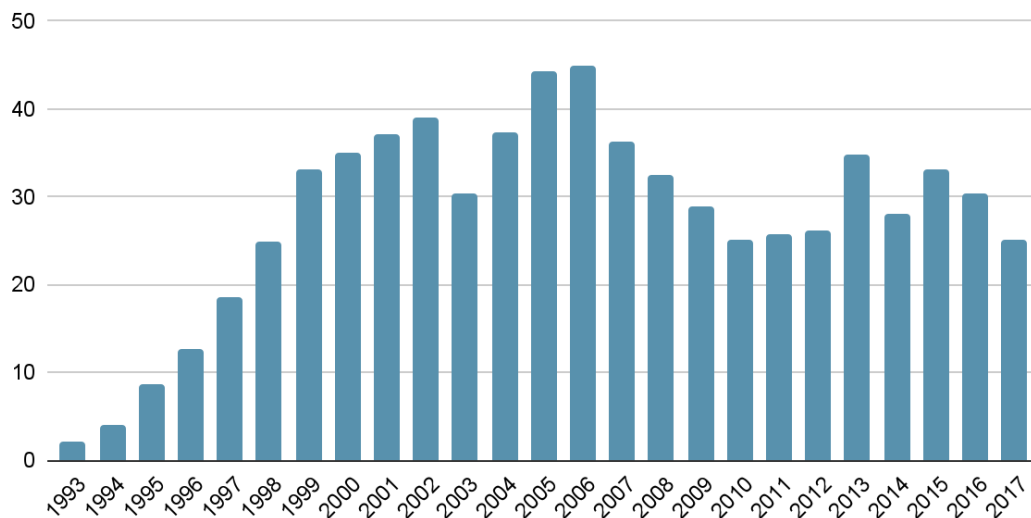


Figure 1: Chart of the Number of ISO-9001 Certificates Issued in the US by Year (1,000s)

5.3. A key engineer in the department hands in her resignation notice; her reason for leaving is that she has been offered a much higher salary by a competitor. The manager recommends to the director that the company match the competitor's offer, even though this would allow the engineer to earn above the maximum for her grade. "We can always give her smaller increases in subsequent years to bring her salary back into line," says the manager. What should the director do?

When it comes to employee resignations, there can be several reasons why they leave, which may not be obvious. Moreover, when providing reasons why they are leaving, there is often the real reason, and there is the reason they feel comfortable disclosing. In my experience, the reasons that they feel comfortable disclosing usually deal with money or career growth since those are "safe" topics; however, folks should not rule out the fact

that there may be issues with culture and their manager which may be contributing to the real reason that they are leaving.

My response to this question will be based on my experience as an engineering manager over the past ten years.

First, the director should benchmark her salary to understand if the current salary is in line with the market. If it is not, I will counter with an amount that is at least the market, and hopefully, that amount would match her offer. I would set an upper limit to the counter in the negotiation so that the negotiation does not turn into a bidding war. In addition, if it turns out that the counter will end up having her make outside of her pay band, then I would try to understand if the pay band is under market or in line with the market. In addition, it is also important to be sure that her salary is not biased given the fact that she is a female, so when benchmarking, it's important to understand the genders of the folks who are included in the benchmarking study so that this bias is not factored into the results.

Second, I would be prepared for this person to leave the company. For instance, it's common knowledge for managers that about 50% of people who accept a counter leave their current company after 12 months³, and so even if she stays, there is a good chance she will leave. If she does leave, it suggests that salary was not the issue, and there may be more systemic problems that need to be addressed. On the other hand, if she stays, it also suggests that salary was the real issue.

Third, as the director, I would discourage giving her smaller raises in future years since this approach can hurt morale since salary adjustments should be awarded based on merit and performance and should increase with the rate of the CPI at the very least. To retain employees, they must be paid fairly and based on the roles and responsibilities of their job, and so any effort to thwart this, as suggested by the manager, can end up hurting the company more than it can help.

Finally, depending on how many employees have left the group managed by the manager, I would also seek to collect feedback from the other employees to understand if there is a systemic issue present in the manager's group. In this way, we can be sure that if there are any issues, corrective actions can be taken now to prevent future employees from leaving the company.

³ <https://hbr.org/2016/09/why-people-quit-their-jobs>

6.1. The company is evaluating two specific proposals to market a new product. The current interest rate is 10%. Proposal A calls for setting up an in-house manufacturing shop to make the product, requiring an investment of \$500,000. The expected profits for the first to fifth years are \$150,000, \$200,000, \$250,000, \$150,000, and \$100,000, respectively. Proposal B suggests that the manufacturing operation be outsourced by contracting an outside shop, requiring a front-end payment of \$300,000. The expected profits for the first to fifth years are \$50,000, \$150,000, \$200,000, \$300,000, and \$200,000, respectively. The expected profits would be lower in earlier years due to third-party markup. Which proposal should the company accept?

Using the methods outlined in Section 6.5.4 in the Textbook⁴, the company should select Project B since it has a higher profitability index (1.54) when compared to Project A (1.00). The supporting calculations are provided as an Appendix to this document.

6.3. A dam is being considered on a river that periodically overflows. Each time the river overflows, it causes about \$600,000 in damages. The project horizon is 40 years. A 10% interest rate is being used. Three different designs are available, each with different costs and storage capacities (see Table 6.14). The U.S. weather service has provided a statistical analysis of annual rainfall in the area draining into the river (see Table 6.15). Assume that the dam requires no annual maintenance, has zero salvage value at the end of its 40-year life, and is essentially empty at the start of each annual rainfall season. Which design alternative would you choose?

Using the methods outlined in Sections 6.4.2 and 6.5.2 in the Textbook⁵, the best design is Design Alternative B, since it has the lowest expected annual cost. The expected annual cost for Design Alternative A is \$139,743.71, the expected annual cost for Design Alternative B is \$93,060.13, and the expected annual cost for Design Alternative C is \$98,429.47. Note that these expected annual costs were computed from doing a Monte Carlo simulation (100,000 simulations, for each design alternative), and the supporting calculations are provided as an Appendix to this document and are also hosted on GitHub⁶.

⁴ Chang, C. M. (2016). Engineering management: Meeting the global challenges. CRC Press.

⁵ *Id* at Ref. 4

⁶ <https://github.com/grantaguinaldo/ssie/blob/master/ssie664/ssie-663-problem-6-3.py>

TABLE 6.14
 Design Options

Design Alternatives	Cost (\$)	Maximum Storage Capacity (units)
A	500,000	1
B	625,000	1.5
C	900,000	2.0

TABLE 6.15
 Annual Rainfall and Probability

Units Annual Rainfall	Probability
<0.1	0.1
0.1–0.5	0.6
0.6–1.0	0.15
1.1–1.5	0.1
1.6–2.0	0.04
2.0 or more	0.01

6.7. You are considering a good-looking Toyota hybrid car priced at \$28,000 or an elegant GM luxury car at \$24,000. The fuel efficiency is rated at 50 miles per gallon for the Toyota and 25 miles per gallon for the GM. The annual maintenance cost for both cars is about 0.5% of the car price. The gasoline in the local market is selling at \$2.00 per gallon. The cars are to be driven about 10,000 miles per year. You plan to keep your car for five years only. At the end of the fifth year, the resale values of the Toyota and the GM are about 40% and 30%, respectively, of their original prices. The interest rate is 6%. Which car is the better choice from the standpoint of costs?

Using the method outlined in Section 6.5.2 in the Textbook⁷, the Toyota is the better choice since it has a lower annual cost. The total annual cost was calculated to be \$2,973.24 for the Toyota and \$3,113.24 for the GM, based on the data provided in the problem statement. The supporting calculations are provided as an Appendix to this document.

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⁷ *Id* at Ref. 4

Appendix