Risk in IT outsourcing

A mathematical foundation for break-even and risk analysis of using outsourcing in IT

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Abstract

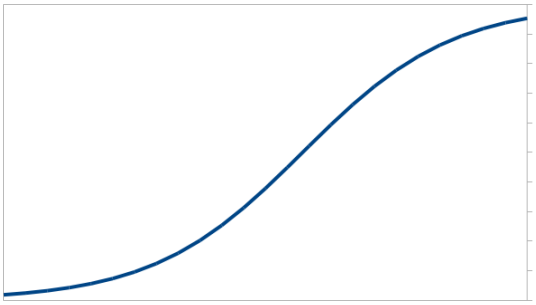
Consultant turnover is the principal risk in utilizing an outsourcing partner for IT development or operations. The company outsourcing IT has few options for mitigating this risk. Relying on outsourcing for development and operations of complex systems carries an often overlooked risk.

The principal risk in IT outsourcing

There is a potentially undersold risk as a company considers outsourcing IT development or operations: The loss of internal productivity to mentor outsourcing consultants are often difficult to recuperate.

When we learn complex systems, our competence usually follows a "Sigmoid curve"[1] (also known as "S-curve" or "Logistic curve").

> *"Many natural processes, such as those of complex system learning curves, exhibit a progression from small beginnings that accelerates and approaches a climax over time."*[2] *"In this case the improvement of proficiency starts slowly, then increases rapidly, and finally levels off."*[3]



When a company is looking to outsource the development or operations of proprietary complex IT systems, the consultants will usually follow this learning curve. But in order to eventually become productive, the consultant will rely on mentors to learn the ropes.

An internal competent developer or system administrator is assigned as a mentor to the external consultant. The mentor will experience a drop in productivity, and regain the productivity concurrent with the consultant.

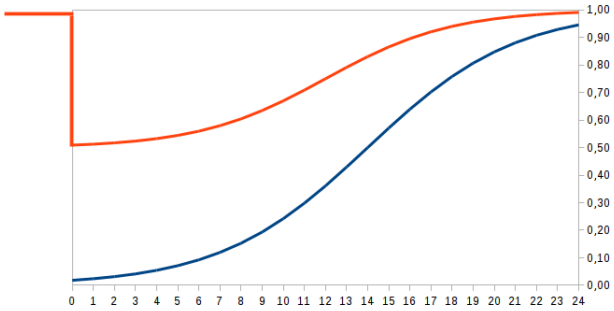
Spreading the burden among several mentors may make the productivity loss less visible, but the combined loss of the mentors may even be greater.

As an example, more than 50 employees was interviewed in a company that had made a strategic decision outsource parts of its IT development and operations. The systems are complex with a 24 month runway for a new developer to reach full productivity. And that is when a mentor is assigned to help the employee get up to speed. According to the mentors, they experienced a drop in productivity from 60% – 80% when they started their mentoring.

For simplicity and to stay on the safe side of judgement, we set the productivity drop at 50%.

As the external consultant becomes more proficient, the mentor's productivity loss will taper off.

The critical question is: "When does the consultant's productivity make up for the mentor's productivity loss?" or "How long until this scenario breaks even?"



[1] Sigmoid curve: `http://www.wolframalpha.com/input/?i=sigmoid`

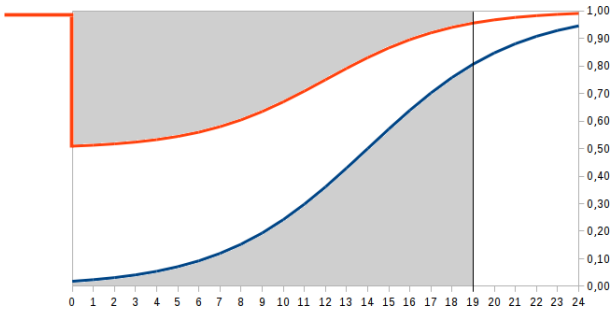
[2] Sigmoid as the learning curve for complex systems: `http://en.wikipedia.org/wiki/Sigmoid\_function#Examples`

[3] Learning curves: `http://en.wikipedia.org/wiki/Learning\_curve#Examples\_and\_mathematical\_modelling`

All too often the risk of not recuperating this cost is overlooked. Short term benefits, often presented by the outsourcing vendor becomes the center of attention.

The basis for the break-even analysis is given in the appendix.

The answer is perhaps surprising: **It takes 19 months for the cost of an external consultant to break even**.



It is interesting to note that:

- After 6 months, the company has lost more than 2.5 months of development productivity
- After 12 months, the net productivity loss is almost 3.5 months
- After 19 months, the net value of including the external consultant in the development team is the same as if the consultant never arrived

To accommodate for this long term investment, the company would have to move milestones for new features several months into the future during the next two years.

It can be argued that external consultants can be put on tasks that requires less time to reach full productivity, perhaps even half the time “T”. If this is done, then the time needed for break-even would be reduced to 9.5 months.

One can, to some degree, mitigate this risk through effective Knowledge Management. A competent Knowledge Manager with an excellent company wiki solution and efficient training setups could shorten the time to break-even by perhaps 20%. Nevertheless, it’s a serious risk to consider - especially since tacit knowledge from years of experience in the company is hard to transfer. Add to this the risk of the mentor quitting or is put on other tasks. Thus the consultant’s stay should exceed “T” by a good margin.

A serious focus on Knowledge Management will go beyond the mitigation of the outsourcing risk. It will also benefit the company’s own employees by facilitating more effective building and sharing of knowledge across the organization.

There are of course alternatives to the outsourcing scenario, such as hiring more employees or building one’s own development organization in a low cost country. The former may be expensive in the short run, carries a higher risk in the long run as future markets are hard to predict, but the long term financial gains are potentially greater as the retention of employees is far easier to control locally.

While the company has virtually no real control over the turnover situation among the consultants, you will have better control over employees in a branch office. Raising the salaries of key employees, targeted career planning and better integration into the company culture and social interaction are but a few of the tools available to help keep employees beyond the break-even time (“T”).

While this document focuses on the productivity loss, and thus financial risks of outsourcing, there are several other risks that are much harder to calculate:

- Internal motivational drop
- Mentors' frustration in having to bring external consultants up to speed
- Time lags introduced by dealing with an external outsourcing vendor
- Legal bureaucracy, red tape and the need for more formalized processes

There are also several potential benefits that are hard to quantify:

- Better documentation
- Formalizing of needed internal processes
- Building of experience and better Supplier Management regimes
- Better scalability of resources (can also be achieved with a branch development office)

It is hard to determine if these less tangible benefits outweigh the less tangible risks. Given that they more or less cancel each other out, one is left with the main risk presented in this article.

Appendix: Mathematical foundation for break-even analysis of outsourcing

The general and practical approach that should be used for assessing risks in IT outsourcing is: First figure out how long it usually takes a new employee in the company to get up to full production speed. Add some time if the consultant speaks a different language, is of a different culture and especially if the mentoring is done from a distance. This will be your "T" time.

Then, by a few short pilots, figure out the mentor's productivity loss. This will be your drop "D". With the methodology described in the appendix, this is all you need to calculate the break-even for the outsourcing project. With the use of some employment statistics from the outsourcing company or the IT industry of that country, you will have a pretty clear picture of the risk involved.

To calculate the break-even for an outsourcing consultant, we turn to the Sigmoid function:

$$f(x) = \frac{1}{1+e^{-x}} \tag{i}$$

Productivity of the consultant (p) is the Sigmoid function over time (t). We adopt the function to go from 0 to the time needed to become fully productive (T).

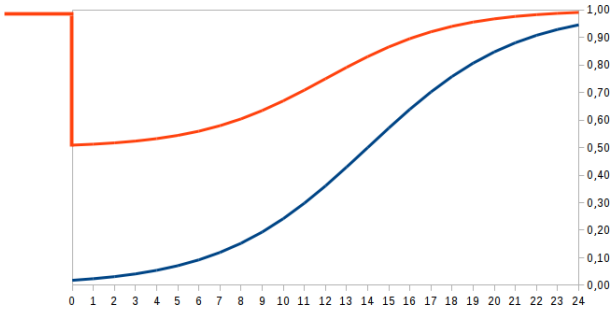
$$p(t) = \frac{1}{1+e^{4-\frac{7t}{T}}} \tag{ii}$$

Then we adopt the function for the mentor's productivity (P) starting from his dropped productivity and back to full productivity after T time. The drop (D) is the fraction of his full productivity (1).

$$P(t) = 1 - D + \frac{D}{1+e^{4-\frac{8t}{T}}} \tag{iii}$$

The reason for the slight difference in the equations (the factors "7" and "8") represents the fact that even after the time "T", the consultant would on average still be a notch lower in productivity than the mentor.

The two curves combined with "T = 24" and "D = 0.5":



The accumulated productivity of the consultant over time is the area under the blue curve, i.e. the integral of p(t).

$$\int p(t)\,\mathrm{d}x = \frac{T}{7}\ln(e^{\frac{7t}{T}} + e^4) \tag{iv}$$

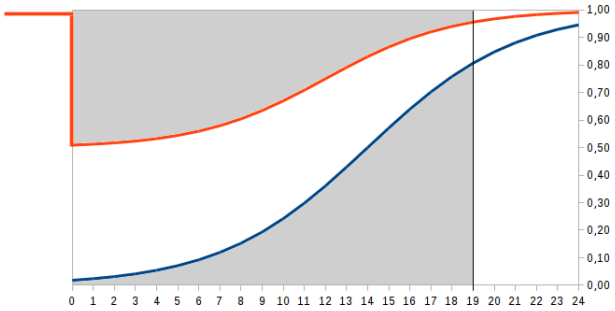
To get the accumulated loss of productivity of the mentor over time, P(t), we first invert the mentor's productivity to get his productivity loss, Q(t).

$$Q(t) = D - \frac{D}{1+e^{4-\frac{8t}{T}}} \tag{v}$$

And the integral of Q(t).

$$\int Q(t)\,\mathrm{d}x = Dt - \frac{DT}{8}\ln(e^{\frac{8t}{T}} + e^4) \tag{vi}$$

The central question is “At what time (t) does the consultant’s productivity make up for the mentor’s lost productivity?”



With:

$$\int_a^b f(x)\,\mathrm{d}x = F(b) - F(a) \tag{vii}$$

Which translates to:

$$\int_0^t f(x)\,\mathrm{d}x = F(t) - F(0) \tag{viii}$$

We want to know when the integral of “Q” from “0” to “t” equals the integral of “p” from “0” to “t”. We then get:

$$\frac{T}{7}\ln(e^{\frac{7t}{T}}+e^4) - \frac{T}{7}\ln(e^{\frac{7\times 0}{T}}+e^4) = Dt - \frac{DT}{8}\ln(e^{\frac{8t}{T}}+e^4) - (D\times 0 - \frac{DT}{8}\ln(e^{\frac{8\times 0}{T}}+e^4)) \tag{ix}$$

This is the general equation for the break-even analysis of including external consultants into IT development. An approximation of this general formula will suffice for quick gain/loss calculations:

$$G(t) = \frac{T}{9.2}(\ln(e^{\frac{8t}{T}}+e^4)-4)(1+D) - Dt \tag{x}$$

The variable “t” can be solved iteratively by rearranging this approximation formula:

$$t = \frac{T}{8}(\ln(e^{\frac{9.2Dt}{T(1+D)}}-1)+4) \tag{xi}$$

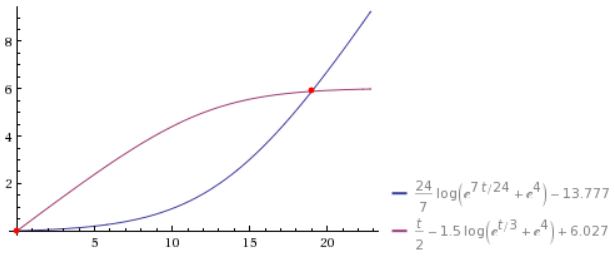
Using “T = 24” and “D = 0.5” in the general equation (ix):

$$\frac{24}{7}\ln(e^{\frac{7t}{24}}+e^4) - \frac{24}{7}\ln(e^{\frac{7\times 0}{24}}+e^4) = 0.5t - \frac{0.5\times 24}{8}\ln(e^{\frac{8t}{24}}+e^4) - 0.5\times 0 - \frac{0.5\times 24}{8}\ln(e^{\frac{8\times 0}{24}}+e^4) \tag{xii}$$

. . . which reduces to:

$$\frac{24}{7}\ln(e^{\frac{7t}{24}}+e^4) - 13.777 = \frac{1}{2t} - \frac{3}{2}\ln(e^{\frac{8t}{24}}+e^4) + 6.027 \tag{xiii}$$

Graphically represented:



And the numerical answer is 19. The hidden risk is that *if the consultant quits before that time, the outsourcing is a losing proposition*.

So, if a company considers outsourcing IT, one must be very certain that the turnover of their consultants is above this break-even by a good margin.