Strategic Resource Planning Based on Staffing profiles

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Abstract - At any given time, an organization has a finite capacity to perform work and although this capacity could be modified, the process of acquiring or reducing the necessary resources takes time. Because of this, the organization needs to plan how much work to take in, or if a decision to change its current capacity is made, when and by how much. Failure to plan leads to paralysis by firefighting or to inefficiencies in the use of the available resources. This paper describes a method to efficiently do this based on the idea of staffing profiles.

Keywords – Project Portfolio Management, Resource Forecasting, Project Management Office

I. INTRODUCTION

Overloading a system, whether a truck, a computer or a development organization does not result in a more efficient use of their resources but rather on its collapse under a weight they were not designed to carry.

As organizations turn to the project form as their preferred way to organize their development work, the need to coordinate the use of scarce resources and align initiatives becomes evident since the consequences of local projects' decision such as delaying a task or increasing the overtime propagates to seemingly unrelated ones through the implicit dependencies created by sharing resources and results. This coordination needs to be done over relatively extended periods of time to give the opportunity to the organization to steer into the future and not just react to events and hence the strategic aspect of the proposed resource planning process.

The process presented in this paper was implemented at a large telecom equipment provider where it was used to plan for an organization of about 1,500 people organized in 5 different development centers comprising 24 competence areas with a portfolio of 300 projects over a 3 year planning horizon. The process was based on the idea of staffing profiles which are a set of normalized curves defining how much of the total project effort must be allocated to a particular competence for the purpose of planning and how this effort will be distributed over time. By normalized curves, we mean curves that describe the project independent of its total duration and effort.

The fact that each development center provided their own staffing profiles for the kind of business they conducted: development, installation, maintenance;

instead of these being imposed from a central project management office (PMO) contributed to the organizational buy in and to the ultimate success of the process.

II. THE PROBLEM OF RESOURCE OVER-COMMITMENT

Prior to the introduction of the strategic resource planning process, some of the product development centers, were suffering "paralysis by over-commitment". Progress and risk reports, like the one show in Figure 1 made up 58% [1] of the problems projects were reporting.

No	Risk Description	Corrective Actions	Risk Priority	Resp	Due Date	Status
1	No more pulling design resources for quick studies, rollout problems, from the project (sssssssss)	• Bring 15 CDC resources to LMC to be able to do market patches. • Tracking of resources pulled out for other projects/tasks. • Quick studies assigned to yearly resources. • Stronger maintenance organization. • Medium term: put into place a resource planning tool.	HIGH	xxxxx	6 April	Open Status: vvvvv to discuss with wwww. 13 April: ongoing 4 May: To compensate to elevate the delay we are taking resources from zzzzzzz project.
2	Need senior resources to do desk-check (five people).	• Re-plan design resources to allow for Code Review (CR). (Resource re-allocation) Function tester should be doing code reviews.	HIGH	yyyyyy	7 April	Status: Open 13 April: ongoing 4 May: Closed. Deskcheck has been completed by stopping the design work and review the use cases.
3	PU directive supersedes design objectives (align road map with PU bandwidth). This conflicts with TG2 deliverables). Groups affected are: OOO, YYY, System, Team Leaders). **Full time 3 weeks.**	• Send to OSG for prioritization. • Propose to push start after TG2. (May 1st).	VERY HIGH	jjjjjjj	6 April	3 April: Open (New) Status: 4 April Ppppp discussed with lllllll and as this is a VERY HIGH priority issue, we can move TG2 deliverables after May 1st providing the design work is not impacted. 13 April: Closed. Date has been moved to 5 May.

Figure 1 Actual risk reports from a telecom equipment provider

The problem of over-committing resources is such that once the process gets started, it keeps feeding itself [2, 3]. As illustrated by Figure 2, the vicious cycle works like this: As a project's deadlines start to fall behind, three things happen: first work pressure increases, this produce some initial recovery, but soon leads, through the loss of productivity by fatigue, to further delays. Second, as engineers take shortcuts in their work in response to the pressure, the quality of work is compromised, this at a time when the same fatigue makes engineers more "error prone". Eventually the problems would have to be fixed which leads to an increase in the workload due to rework, which fuels additional delays. Third, cuts in the scope of the projects, originated in attempts to keep the promised deadlines foster "Band-Aid" projects, this and the delay on freeing shared resources negatively affects the

availability of resources for other projects and in this way delays in one project propagates to other projects in the portfolio that are started without being resource covered which leads to further delays in which projects are doomed even before starting.
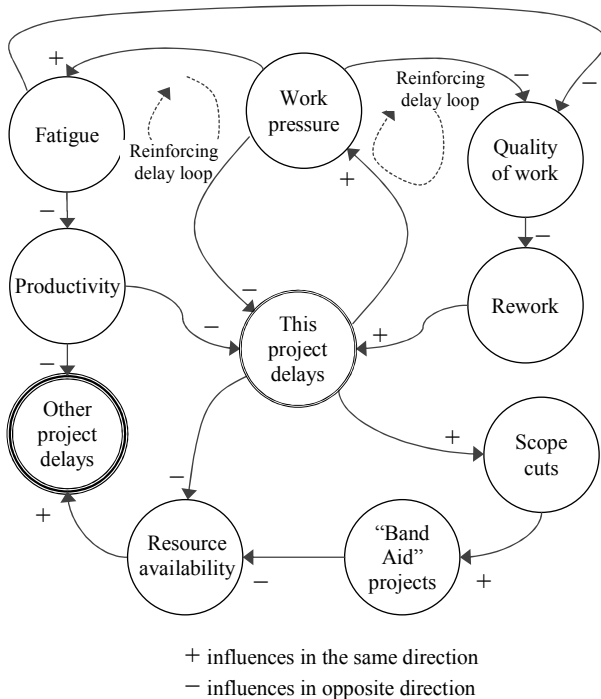

Figure 2 The vicious cycle triggered by the over-commitment of resources coupled with variability on the project execution

III. SUCCESS FACTORS

To be successful, a resource planning process needs to provide management actionable information, support the exploration of alternative courses of action, require short turnaround times, respect the ways of working of the participant units and be impervious to political games.

To verify the process provides actionable information, one must check that it is capable of answering the following questions:

- Do we have enough people to meet our current demand?
- What work is planned for next year?
- Do we have a balanced workload from the business perspective: enough cash cows, some stars?
- Does the competence mix match the one required by the workload?
- Where are people need next? When?
- Where are people available? When?
- What can we move to make room for an urgent request?

Experienced managers employ recognition-based reasoning in making decisions [4], so it is important that the tools employed support this cognitive strategy by providing results, preferably in graphical form, then ask the user for some additional input and produce some other result rather than providing a final result that nobody can explain how was attained nor modified.

Short turnaround times require that the process operates on readily available data and that it doesn't consume an inordinate number of man-hours to produce the forecast. Processes requiring detailed planning and resource allocations usually fail because of the high-cost and the lateness associated with gathering the required data. How to do this is the focus of this paper and it will be explained in the next section.

The fourth success factor is that the forecasts are based on planning constants provided by each unit involved in the process. This prevents units from challenging the planning results on the basis of work approaches that do not match their ways of working.

Finally an independent review of the data submitted, from the planning and business perspectives keeps the development centers honest, preventing the padding of estimates and the reporting of unlikely work.

IV. STRATEGIC & TACTICAL RESOURCE PLANNING

In order to make the resource planning process efficient there is the need to break it down into at least two levels [5, 6]: the strategic resource planning level and the tactical one. At the strategic level, the one we are focusing in this paper, the main purpose of the process is to balance resource capacity with forecasted work demand. The balancing can be done by prioritizing projects, spreading the workload over a longer period, by increasing the talent pool, by retraining suitable staff and unfortunately sometimes by reducing it. The purpose of the tactical resource planning on the other hand is to provision projects with resources to carry them out. Typical questions that must be answered by the tactical resource planning process include:

- Which project or projects is John working on?
- When will be Fiona available?
- Which programmers are available now? Next week?
- Which tasks are understaffed?
- Who is working on the task X?
- Which understaffed tasks are on the critical path of project Y?

Table I below summarize the differences between the two processes.

V. THE PROCESS STRATEGIC RESOURCE PLANNING

Figure 3 depicts the process put in place at the telecom provider. From the resource planning perspective, the only inputs required are: project start window, planned duration, required effort and the staffing profile to be used to calculate the necessary resources. The project start

window defines the range of dates in which the project might start without affecting its commercial value. Figures 4 to 6 illustrate typical outputs.

TABLE I STRATEGIC AND TACTICAL RESOURCE PLANNING SUMMARY

	Characteristics	*Purpose*	*Execution*
Strategic (Long to medium terms)	Planning horizon: 1 to 3 years Planning basis: Project and competence Accuracy: second order approximation, in the tens of people	Strengthen ability to plan for resource build-up, competence shifts, reduction or transfers on a company wide basis Provide a factual base for negotiation of new or changed mandates	Senior Management Performed quarterly or when major changes so require Profile based calculations
Tactical (Short to medium terms)	Planning horizon:1 to 6 months Planning basis: Tasks and named individuals Accuracy: days	Satisfy the needs of the projects Develop individuals by providing challenging assignments	Line and project managers On-going Negotiation

The forecasts are made by first breaking down the total number of hours specified for a project in hours per competence type, i.e. project management, system engineering, software development, system integration, network support, etc. and second by spreading the number of hours allocated to each competence over time according to a set of user defined load curves. The breakdown by competence together with the set of curves used for spreading the hours is called a staffing profile. See figure 7. The different shapes of the curves reflect the degree of involvement of a competence over the life of the project. For example the involvement of the project management throughout the project tends to constant while that of systems engineering tend to be more upfront decaying towards the end. The detailed procedure for generating these curves is described in Section VII.
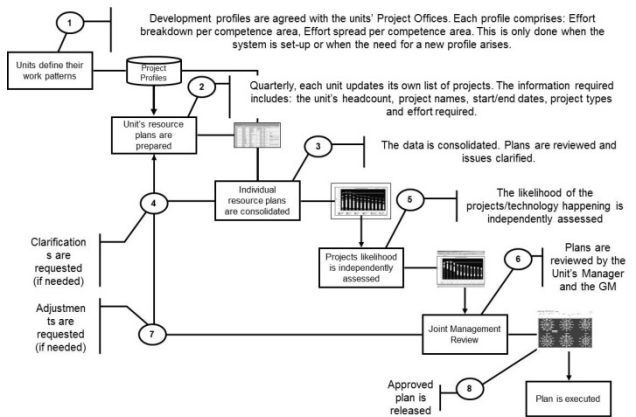

Figure 3 strategic resource planning process

Uncertainty in the plans is captured by requiring three values (best, most likely and worst case) for parameters such as project effort and project duration and running a

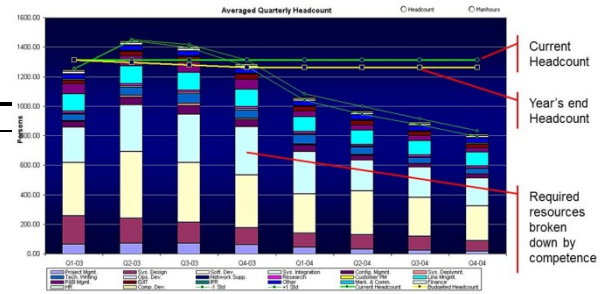Monte Carlo simulation to calculate the probability distribution of the resulting forecasts

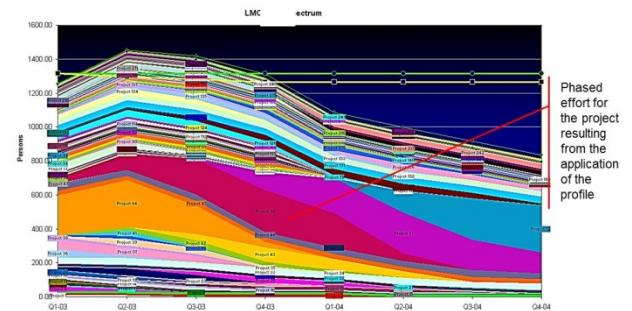**Figure 4 Forecasted demand broken down by competence area**

Figure 5 Work spectrum. The chart shows the distribution of effort over time required by each project in the portfolio
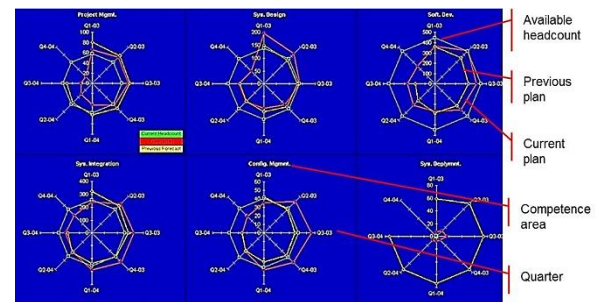

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Figure 6 Capacity vs. demand charts showing the forecasted workload against the current headcount for each competence category
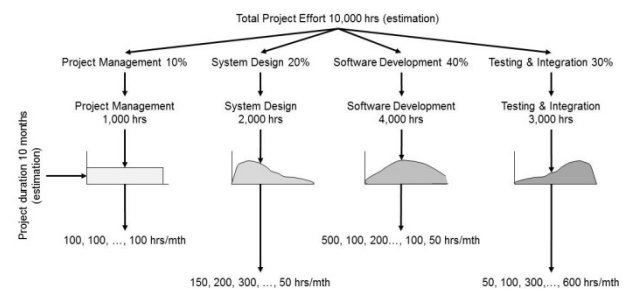

Figure 7 Application of a staffing profile to a 10,000 hrs. project.

VI. EXECUTING THE PLAN

The execution of the plan consists in balancing the workload with the available capacity within the constraints imposed by the business strategy using one or more of the following:

- Shifting projects
- Terminating/putting on hold projects
- Outsourcing work
- Establishing frame agreements / contracting
- Personnel transfers
- Competence development
- Downsizing
- Recruiting

Shifting projects involves moving them to the left, or more commonly, to the right within the prescribed window of opportunity. Projects that fail to deliver or whose priority has dropped can be terminated or put on hold to make room for more pressing ones. Outsourcing refers to the transfer of work to another party for development. Frame agreements are temporary loans of resources from one unit to another used to bridge surpluses and shortfalls in which the borrowing unit assumes the cost of labor. At the expiration of the set term the resources return to the lending unit. Contracting is similar to frame agreements but the ownership of the resources corresponds to a third party. Transfers imply moving resources from one unit to another in situations where a business or product is reaching the end of its lifecycle and another is starting. Competence development is an instrument used to respond to the continuous evolution of technologies. When balance cannot be achieved through these mechanisms, management resorts to lay-offs or recruiting.

VII. STAFFING PROFILES

This section explains how staffing profiles are defined and used in the forecasting of resource needs.

Each staffing profile describes two things: how the total project effort is broken down according to competence or discipline and how the amount of effort allocated to a discipline is spread over time. In other words, the demand d of resources with competence c at time t for project p which is of type k is:

$$d_{pct} = w_{kc} \times s_{kct} \times TotalEstimatedEffort_p \quad (1)$$

$$\sum_{c \in competences_k} w_{kc} = 1$$

$$\sum_{t=1,2,\ldots,n} s_{kct} = 1$$

To calculate the s_{kct} values, the project manager or the reporting organization will first draw a series of curves describing how he envisions the effort corresponding to each competence c will be distributed over time for a given type of project. In more mature organizations these distributions might be derived from historical data. The set of curves resemble those shown at the bottom of Figure 7. Each of these curves can be expressed by a vector A_{kc} such as $[1 \ 1 \ 1 \ 1 \ \ldots \ 1 \ 1]$ which represents a constant distribution of effort or by $[1 \ 2 \ 2 \ 1 \ \ldots \ 0.5 \ 0]$ which represents a mild frontloaded curve or by $[1 \ 1 \ 1 \ \ldots \ 3 \ 4 \ 4]$ which

represents a steep backloaded distribution. The meaning of a vector element being twice as large, or a third of other; is that at a given point in time in the project, the effort required by a given discipline will be twice as large or one third of the effort required at the other time. As these vectors will be normalized so that the sum of their elements is equal to 1, what matters is not the absolute magnitude of each value but rather its weight relative to that of the other elements. The number of elements in the vector (n) is selected to give enough resolution. Having one element is clearly not enough, having fifty 24 will result in a resolution of 15 days for a yearlong project. In the case of the implementation described in this paper, the number chosen was 12. This meant that for a project with a duration of one year, each interval corresponded to a month and for a 6 months project, each interval corresponded roughly to 15 days.

The values s_{kct} are derived from the A_{kc} vectors as follows:

$$s_{kct} = a_{kct} \Big/ \sum_{a \in A_{kc}} a_{kct} \quad (2)$$

The values w_{kc} corresponding to the fraction of the total project effort to be allocated to a given discipline can be derived from historical data or experience.

An organization will typically have several staffing profiles: one for each class of project such as new platform development, product extension, research, maintenance, etc. The monthly or quarterly demand for each competence for a giving project is calculated as:

$$D_{ct} = \sum_{p \in Portfolio} d_{pct} \quad (3)$$

As mentioned before all these quantities can be defined in terms of their best, most likely and worst cases and an expected value calculated using Monte Carlo simulation or under suitable assumptions analytical methods with the purpose of leaving some unused capacity (white space, slack) to absorb variations on the demand without throwing the organization into a downward performance spiral. For reasons of space we do not address these here.

VIII. CONCLUSION

The strategic resource planning process described here helped the organization navigate through the tumultuous climate resulting from the contraction of the telecommunications industry. The process succeeded where other attempt had failed mainly because of three factors:

- It provided timely actionable information to management

- It did not imposed a heavy burden in the development centers responsible for providing the basic data

- Got buy in from the development centers based on their ownership of the staffing profiles.

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