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Design Effective Prediction Models

A Practical Approach

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Agenda

- Need for a custom specific approach
- Deciding the QPPO (business objectives)
- Building the model for development
- Key factors for a model for development
- Building the model for services
- Key factors for a model for services
- Prediction models
- References

Need for a custom specific approach

The key parameter while designing the prediction model is "work type".

When a prediction model is designed an appropriate approach has to be established based on what "work type" it is developed for:

"Development" or "Services"

Development

Software development is traditionally stable

Lead indicators are used to manage the project

Corrective action are taken at each milestones towards the target

Services

Software maintenance is traditionally reactive

Lag indicators are used to manage the project

Corrective action are taken when current performance slips below target

Deciding the QPPO (business objectives)

Development: Focuses on “Operational” Level performance

- Stage level improvement planning
- Cascading down to project’s final objectives

Eg: Cost and Quality of each sub-process in the life cycle

Services: Focuses on “Tactical” Level factors

- Spontaneous Results achieved
- Work is produced and consumed simultaneously

Eg: Service Level Agreement and Resourcing for the work

“Work type” is important because the interpretation and the use of the model would differ based on the organization preferences

Building the model for development

For development work type, "**progressive approach"** is best suited

This is an approach where the predictions and decisions are executed in a progressive manner

Development project milestones are progressive in nature

At milestones, we need predictions on the process performance

The development models should be able to tell us how the impact of variation cascades down to the future milestones

Progressive approach enables an early warning system and risk mitigation

Progressive approach gives the cascaded effect of variation on the process performance

Key factors for a model for development

1: The model will be best suited and more effective if it is sub-process based. This provides an opportunity to control the leading indicators at every stage of development

2: The model should give the flexibility to use organization historic data or project historic data, as sub-process level data collection is comparatively easier in development projects

3: The techniques chosen for the building the models should typically be of techniques which can study the progressive behavior of data and its impact on other forms of data.

Techniques to study progressive behavior

Regression Analysis

Evaluate the consequences of the hypotheses from one's past experience

Models the variations in input and output parameters

Enables what-if analysis

Supports decision making in the event of multiple choices of action

Monte-Carlo simulation

Enables prediction of the effects on downstream processes based on current results

Models the variations in input data

Reduces the errors and risks of less data points

Building the model for services

For services model, "**time dynamic approach"** is best suited

This is an approach to find the optimal solution on sequences which vary in time

Nature of service work is very time dynamic

The actions and decisions taken on service work is on a real time basis

The prioritization and allocation of tickets cannot have a pre-fixed formula. It varies based on the priority and service commitment on the ticket

Only a time dynamic approach can address the real time variations in the parameters like inflow of tickets, a sudden inflow of a business critical ticket etc

Time dynamic approach is best handled by queuing theory where similarity between two sequences which may vary in time is taken care of

Key factors for a model for services

1: More practical approach for services would be to look at any queuing theory related techniques. Controlling of sub-processes in services becomes difficult as these are typically short durations

2: In a services environment, one project is different from the other in terms of defining the parameters like complexity of the service request. More practical approach for services would be to design a model which would use project's historic data. That way, data consistency and quality issues would be taken care of

3: Technique should give self recalibration flexibility to the stakeholders to the situation created by the use of the model

Techniques to study queuing

Queuing Theory

The theory takes into consideration the factors:

- **average wait time in the queue or the system**
- **expected number waiting or receiving service**
- **probability of encountering the system in empty or full state, or having an available server or having to wait a certain time to be served**

Time series forecast

Forecasts the optimum resource requirements to handle the inflow pattern and volume growth

Models the dynamic variations in queues

Reduces the errors and risks of target slippage

Prediction Model – Development work type

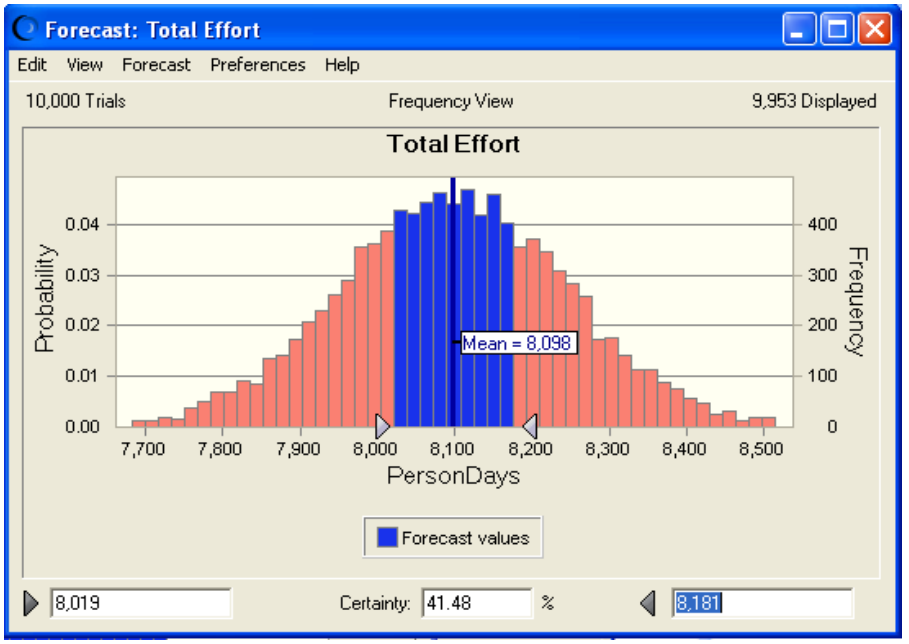
QPPO: Cost control

Sub-process based model

		Avg	SD	1
Analyze	Effort	80.00	1.00	80
	Cycle time	33.89	1.00	33.8903
	Defects	12.51	1.00	12.51

		Avg	SD	1
Design	Effort	132.12	1.00	132.12
	Cycle time	48.51	1.00	49
	Defects	36.34	1.00	36

Monte carlo prediction outcome



Illustrative values

Prediction Model – Services work type

QPPO: Resource utilization

Queuing theory

Settings

Time Period to Analyze
Day
% Resource utilization at request level
85%

Request specific goals

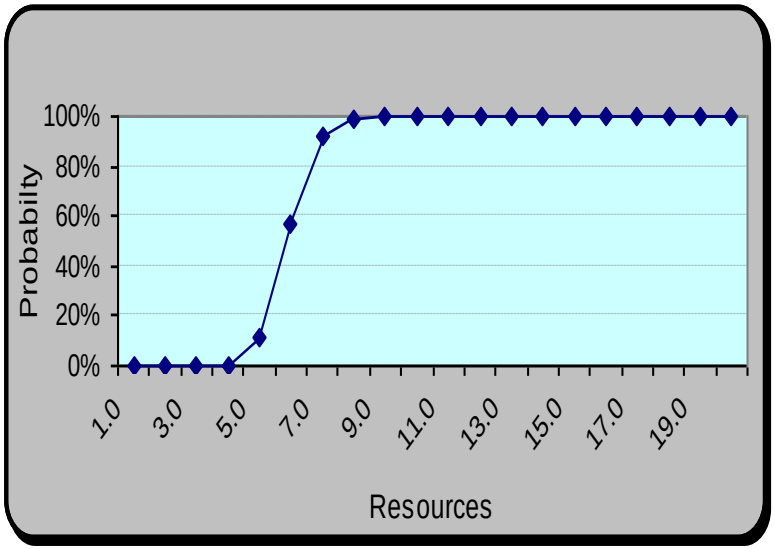
Request Target Turnaround Time (hours)
8
% SLA Compliance
90

Request specific input

Expected # of requests per time period
120

Ticket arrival rate

Prediction outcome



Illustrative values

Conclusion

- Prediction model helps in critical decision making using data and facts rather than just experience.
- Applying a business goal (QPPO) driven approach will make the models practically usable
- When applying the real work type specific factors, the prediction models would enable quantitative business decisions
- The factors presented here are one among the best fit factors for the development and services
- These factors being real work type are achievable by tighter data integrity & collection checks and hence makes design easier

References

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