Project Management Plan

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In this document we aim to design a computer software system for luxury cars. Resources required to develop such software is given in the report. It shows that our head office is in Sweden (Karlskrona), our site 1 is in India (Bangalore), site 2 is in Australia (Melbourne), site 3 is in China (Beijing) and there is a sub-contractor in Poland (Gdansk) who would be glad to take our project, he acts like offshore out-sourcing. The total budget of the project is **€1,900,000.**

Traditional waterfall model is used or should be used as software development model according to our report and the total project should be completed in 21 months. The 5 phases involved in waterfall model are:

Waterfall model phases	**Period in months**
Analysis	3
Design	3
Development	6
Test Planning	3
Test Execution	6

INTRODUCTION ON GLOBAL SOFTWARE DEVELOPMENT

Globalization of software development business has now became a trend since past few decades. Economic forces are turning national markets to international markets yielding new level of competency and cooperation. This has not only changed marketing and distribution but the analysis, design, construction, testing and deployment of the products [1].

Software now a days became an important factor in business world, to maximize profits many organizations adopted Global Software Development process in search of skilled labour, access to skilled resources at low costs. All these can be adopted in remotely located software development facilities with outsourcing [1].Global Software Development associates with teamwork and effective communication between all sites across the world. Along with these the product line of the software should be same, i.e. process, methodology and terminology [2].

Task Assignment Summary

The task allocation for our project is detailed in Table 1. The site(s) that have been allocated to work on a task are marked with an X.

Table 1 Task distribution

		Analysis		Design				Development					Test Planning		Test Execution		
ID	SE	IN	AUS	SE	AUS	CN	PL	SE	IN	AUS	CN	PL	SE	AUS	SE	IN	AUS
1																	
1.a.			X		X					X				X			X
1.a.i.			X		X					X				X			X
1.a.ii.			X		X					X				X			X
1.a.iii.			X		X					X				X			X
1.a.iv.			X		X					X				X			X
1.b.			X		X					X				X			X
1.b.i.			X		X					X				X			X
1.b.ii.			X		X					X				X			X
1.b.iii.			X		X					X				X			X
1.b.iv.			X		X					X				X			X
1.c.			X		X					X				X			X
1.c.i.			X		X					X				X			X
1.c.ii.			X		X					X				X			X
1.c.iii.			X		X					X				X			X
1.c.iv.			X		X					X				X			X
1.c.v.			X		X					X				X			X
2																	
2.a.	X			X				X					X		X		
2.b.	X			X				X					X		X		
2.c.	X			X				X					X		X		
2.d.	X			X				X					X		X		
3																	
3.a.	X			X				X					X		X		
3.b.	X			X				X					X		X		
3.c.	X			X				X					X		X		
4																	
4.a.	X			X				X					X		X		
4.b.	X			X				X					X		X		
4.c.	X			X				X					X		X		

Task Distribution Strategy

This section describes why tasks were allocated to each site. Only two sites among the given sites are selected for software development process in order to avoid integration complexities, transportation costs of technicians. There are sufficient number of technicians in Sweden and Australia itself.

Any tasks are not allotted to China as resources are not sufficient there and transportation of technicians from china to Sweden is lot of cost. Moreover there are only designers and developers in china and it can cause a considerable time and communication overhead since designers and developers in china may ping back with results in certain time. Furthermore, the technicians in different phases located in different sites may get affected by this overhead. Subcontractor Poland is also not considered as offshore outsourcing as Australia, Sweden are more than sufficient for the project. Even India has not been assigned any modules as it has only junior technicians, so I cannot take any risk in maintaining quality by assigning any task to junior technicians.

Analysis Phase

This is the first phase of traditional waterfall model, requirements gathering is done in this phase. In this project, analysis phase is divided to Sweden and Australia. Safety control, Human machine Interface and comfort systems are assigned to Sweden. Powertrain module is assigned to Australia.

Safety control, Human machine Interface and comfort system module is assigned to Sweden as it is a European country and has very good experience about European climatic conditions and road conditions. So it is quiet safe to assign these tasks to Sweden itself.

Powertrain module is assigned to Australia as it has experienced technicians, which assures quality of this feature. Because of their reputation I couldn't afford to assign Power train module to any other sites even if Australia is bit more costly than any other offshore sites.

Design Phase

This is the second phase in traditional waterfall model, in this phase a design or an architecture for the whole project development is done. This phase is also divided between Sweden and Australia i.e. Powertrain module to Australia and all the other tasks to Sweden. As the analysis phase of these tasks are assigned to Sweden and Australia, the design phase of these modules are also allocated to those sites only so that it will be more comfortable and easy to design an architecture. Moreover there are 12 designers in Sweden and 20 designers in Australia who are well experienced than other sites, so no other sites were allotted with design phase to avoid communication overheads which may cause deadlocks in case of dependable modules.

Development Phase

This is the third phase in traditional waterfall model where development of the product is done i.e. writing code, developing deliverable product. This phase is allocated to Sweden and Australia itself as it would be comfortable as the analysis and design phases of particular modules are done in these sites itself which helps to avoid locks (for example: if code in site2 is dependable on code of site1 and site1 couldn't complete their task on time then site2 should wait until the completion of site1's task, which results in waste of time and product also may not be delivered on time). Australia develops Powertrain module, while Sweden develops all other tasks.

Test Planning Phase

This is the fourth phase in traditional waterfall model which deals with a plan on how to execute testing process on the developed product before it is launched or delivered to the customer. This phase is very important as it deals with the architecture of testing process. Testing process is the process of finding and mitigating the errors in our product, so architecture of this phase is the criteria which is responsible for effective test execution. So this phase is assigned to Sweden and Australia as they have experienced testers and I cannot compromise on this particular phase as any mistake in this process may lead to disasters.

Test Execution Phase

This is the fifth phase in traditional waterfall model, in this phase testing process is done according to the test plan. This phase is given to Sweden and Australia itself as the previous modules are given to these sites only, it will be comfortable to perform test execution in these sites only as they all are linked together.

Project Management Effort

The project management effort required in each phase is detailed for each site in Table 2. In each phase the project management effort is equal to approximately 10% of the budgeted work.

Table 2 Project Management Effort by Phase and Site (Person Months)

	Analysis		Design		Development		Test planning		Test Execution	
ID	SE	AU	SE	AU	SE	AU	SE	AU	SE	AU
Estimated effort budget	12.00	21.25	14.50	54.0	34.0	57.50	9.50	31.0	37.50	60.75
Project management effort	1.2	2.12	1.45	5.4	3.4	5.75	0.95	3.1	3.75	6.07

Overall Project Responsibility

Final product is delivered to the customer by the head office i.e. Sweden site. As it has more than sufficient requirements to bring all the modules from other sites and integrate them to form a final product and to deliver it to customers in Germany.

Most of the modules regarding to engine of the car is given to Sweden site as:

- Sweden site knows well about roads and weather conditions of Europe, they can for sure build those particular modules as safest as possible.
- Sweden site has most experienced team of software developers who can not only collect and integrate modules but also can verify each module keenly to avoid any faults before delivering the final product.

Analysis Phase

Only two among the given sites are selected which are Sweden and Australia, as they alone have sufficient resources to execute this phase. 15% of project estimated effort is assigned to this phase as it is one of the most important phase in SD process, 3.3 person-months is assigned and shared by two sites.

The project management effort allocated for this phase is summarised as:

Effort for phase	33.25 person months	(a)
PM effort for phase	3.3 person months	(b)
Percent PM Effort	15%	(b) / (a) * 100

Design Phase

This phase is the architecture of the entire project i.e. blue print. So this phase is assigned to Sweden and Australia as they have experienced technicians. 6.8 person-months effort is assigned and is shared between two sites. For this phase 10% of PM is sufficient as this deals with only Architecture for the requirements.

The project management effort allocated for this phase is summarised as:

Effort for phase	68.50 person months	(a)
PM effort for phase	6.8 person months	(b)
Percent PM Effort	10%	(b) / (a) * 100

Development Phase

This phase deals with producing final product, as this phase is one among the most important phases this phase is allocated to Sweden and Australia , as the previous phases are done in those sites itself. Both Sweden and Australia has most experienced technicians so this phase is allocated to those 2 sites with 9.1 person-months effort and is shared between them. Here 15% of PM effort is included as this phase is most important phase in SDLC process as it has many lines of code, tools etc.

The project management effort allocated for this phase is summarised as:

Effort for phase	91.50person months	(a)
PM effort for phase	9.1person months	(b)
Percent PM Effort	15%	(b) / (a) * 100

Test Planning Phase

This phase deals with planning or design for test execution. This is an important phase as it is a blueprint of how testing is executed on the final product. Testing the final product is mandatory to find and mitigate any risks in the product before delivering it to customers. 4.05 person-months effort is assigned and is shared between those 2 sites. As this phase deals with only planning for test execution 10% of PM effort is sufficient.

The project management effort allocated for this phase is summarised as:

Effort for phase	40.5 person months	(a)
PM effort for phase	4.05 person months	(b)
Percent PM Effort	10%	(b) / (a) * 100

Test Execution Phase

This is the last phase of traditional waterfall model, this phase ensures that the final product doesn't have any errors or faults. This phase is assigned to Sweden and Australia as they have experienced testers than other sites. 9.85 person-month effort is assigned and is shared between those 2 sites.

The project management effort allocated for this phase is summarised as:

Effort for phase	98.25 person months	(a)
PM effort for phase	9.85 person months	(b)
Percent PM Effort	10%	(b) / (a) * 100

Integration Effort

As the tasks will be completed by different people, and perhaps even in different sites some integration effort will be required in this project. Table 3 details the integration effort budgeted for each site and phase.

Table 3 Integration Effort (Person Months per Site and Phase)

	Analysis		Design				Development					Test Planning		Test Execution		
ID	SE	AU	SE	AU	CN	PL	SE	IN	AU	CN	PL	SE	AU	SE	IN	AU
Effort	1		1				2					0.6		1.5		

All these modules are developed in different sites, so they have to be integrated to form final product and delivered to the customer and effort spent to integrate each module is also calculated.

Sweden site is the head office where integration of all the modules is performed and is delivered to the customer in Germany.

I consider 20 working days per month.

Effort is calculated by the formula:

Effort= Number of persons*(Number of days for integration/ Total number of working days per month.

Analysis Phase

Integration of this phase is done in head office Sweden, as it is responsible for delivering the final product to customers in Germany. Modules from Australia are sent to Sweden with 2 analysts, so that they can help in integration process. In case if the customer wants

to impose few changes in the product in any module, then they can be improved as the analysts from Australia are also present in Sweden. So it will be easy for them to impose those changes and deliver the product to customers ASAP.

Number of persons assigned for integration process: 4

Number of days for integration: 5

Integration Effort= 4*(5/20) = 1 person-month from 2 sites.

Design Phase

Integration of this phase is also done in Sweden, as it is responsible for overall delivery of the product. From Australia 2 designers are sent to Sweden for integration process and to assist Sweden designers in case of any error fixing. Even from Sweden branch 2 designers are selected to work with Australian designers in integration process. Integration is done in 5 days. Since the design phase is an architecture for the whole project, its integration effort should be low.

Number of persons assigned for integration process: 4

Number of days for integration process: 5

Integration effort= 4*(5/20) = 1 person month from 2 sites.

Development Phase

Integration of this place is also done in Sweden site itself as it has all the resources for integration process and also it is head office and is responsible for overall delivery of the product to customers in Germany. Development phase and testing phases are done concurrently hence integration effort for this stage will be high as development phase is one of the most difficult phases among waterfall model as it produces final product. Codes from module 1 should be integrated with codes of other modules in Sweden site so amount of work required will be more. From Sweden 2 developers are assigned for integration process, whereas from Australia also 2 developers are sent to Sweden to assist Sweden developers for integration process.

Number of persons assigned for integration effort: 4

Number of days assigned for integration process: 10

Integration effort: 4*(10/20) = 2 person months from 2 sites.

Test Planning Phase

Test planning and development phases are done concurrently, as this part deals with planning for test execution phase integration for this phase will be small. From Sweden site 2 testers are assigned and from Australia 1 tester is sent to Sweden for integration process. According to me 4 days are enough for the integration of test planning phase, as it is the blue print of how to execute test execution.

Number of persons assigned for integration process: 3

Number of days assigned for integration process:4

Integration effort: 3*(4/20) = 0.6 person month from 2 sites.

Test Execution Phase

This is the crucial part as it deals with testing of overall product for any errors or faults. Integration effort of this phase is high as it deals with integration of codes and algorithms. Integration of this phase is also done in Sweden along with integration of other modules as Sweden is responsible for overall delivery of the product. For this purpose 2 testers from Sweden and 1 tester from Australia are assigned to perform integration process. It may take 10 days' time to complete integration of this phase.

Number of persons assigned to perform integration process: 3

Number of days for integration process: 10

Integration effort: 3*(10/20) = 1.5 person month effort is from both sites.

Communication Plan

This section describes events, meetings and training sessions held within the project.

Communication between two sites of a global software development process is quiet necessary, video conferences, telephone conferences, emails and other messaging tools are present which can aid us to create a communication barrier between two sites. Few meeting should be held face to face, usually tasks with high importance (requirements phase) are carried out face to face, and simpler phases can be communicated through other means. These meetings are held after completion of each and every phase.

Meeting with customer:

This meeting is held to discuss the customer requirements and how to proceed with them. This meeting is held after the customer gives the contract to the head office, for this event, analysers from Australia are also present so that they also can know about requirements of the customer and plan for Software development process and dividing the modules between 2 sites.

This meeting is done face to face, with customers so that his requirements are prioritized. This event is held in Sweden where analysts from Australia, Sweden sit with customer to prioritize his requirements. 2 analysts from Australia are sent to Sweden to avoid misunderstandings in requirements which may lead to lot of rework.

Meeting done after prioritizing requirements:

After prioritizing requirements, a design or an architecture should be developed for software development process. An architecture is formulated which can lead the project to success. The architecture is formulated in this meeting and necessary changes or improvements are done to the design by considering opinions of the designers from both sites.

This meeting is held in Sweden (head office) and the design which is formulated is sent to Australia, so that power train control module is developed there. There is no need for any designer to travel to Sweden for this meeting as it is held through video conference.

Meeting done after completion of every phase:

After completion of every phase, technicians meet through video conference and discuss the outcome of their work, issues faced by them and how did they manage or mitigate those issues. For this meeting technicians from both the site are involved by sitting in conference rooms in Australia and Sweden sites. This is done after completion of every

phase. Technicians from both the sites help each other to mitigate any risks occurred, at the same time helping themselves from deviating from the requirements. As these meetings are held through video conferences there is no need for any technicians to travel to Sweden.

Meetings held for integration process:

After completion of each and every task in assigned sites, all the modules should be integrated, finally checked for any errors and should be delivered to customer. For the integration process, technicians from Australia are sent to Sweden as the integration process is done here and is responsible for final delivery of the product to customers. This meeting cannot be done through video conference as the technicians who are familiar with particular module should be present in Sweden to make sure that there is no error after integration, before delivering the product. Our organization gives flight and other local transportation and living charges to technicians who went abroad which is included in budget.

Meeting held after delivering the product:

After delivering the product to customer, all the technicians from all the phases of software development process meet via video conference and discuss issues they have faced during the process and how did they deal with them. All this information is documented so that this information could be helpful in other projects.

Additional Human Effort

- At the beginning of the project, technicians who are new to the organisation should go through training program, which teaches the SDLC model used, coding techniques used by the organisation etc. but in this project Sweden and Australia has experienced technicians so there won't be any such training programs in this project.
- Technicians are sent from Australia to Sweden at the beginning and at the integration process. Their hotel, flight charges are provided by organisation only. Which is included in overall budget. Project manager visits Australia site after every phase, even his accommodation and flight charges are included in budget.

Additional Costs

This section details cost other than human capital. All costs are in Euro (EUR).

Costs related to travel are summarised in Table 4.

Table 4 Travel Costs

Item	Comment	Unit Cost	Quantity	Total
Flight: Australia to Sweden for analysts for requirements specification	1 person, return	700	2	1400
Hotel: Sweden including food	1 person, 2	200	2	400

Item	Comment	Unit Cost	Quantity	Total
	nights			
Flight: Australia to Sweden for analysts integration process	1 person, return	700	2	1400
Hotel: Sweden including food	1 person, 5 nights	500	2	1000
Flight: Australia to Sweden for designers for integration process	1 person, return	700	2	1400
Hotel: Sweden including food	1 person, 5 nights	500	2	1000
Flight: Australia to Sweden for developers for integration process	1 person, return	700	2	1400
Hotel: Sweden including food	1 person, 10 nights	1000	2	2000
Flight: Australia to Sweden for test planning integration	1 person, return	700	1	700
Hotel: Sweden including food	1 person, 4 nights	400	1	400
Flight: Australia to Sweden for testers for integration process	1 person, return	700	1	700
Hotel: Sweden including food	1person, 10 nights	1000	1	1000
Flight: Sweden to Australia for project manager to visit AU after every phase	1 person, return for 5 times	3500	1	3500
Hotel: Australia including food.	1 person, 2 nights for 5 times throughout the project	1500	1	1500
			GRAND TOTAL	**17,800**

Other costs are summarised in Table 5.

Table 5 Other Costs

Phase	Item	Unit Cost	Quantity	Total
All phases	Lunch at site for PM for every time he vists AU	500	1	500
Integration	Lunch for technicians at site in Sweden until whole integration process	250	8	2000
All phases	Tools needed for Software development process on whole	500	1	500
Success party	After delivery of product to customer	3000	1	3000
			GRAND TOTAL	**6000**

Budget

A summary of the budget is presented in Table 6.

Table 6 Budget Summary

Item	Amount (EUR)
Human Capital (From Excel)	1955475
Travel Costs	17800
Other Costs	6000
Grand Total	***1979275***

Risk of deviation

The product we developed is of very high quality, nothing is compromised because of budget boundary i.e. assigning tasks to sites which has most experienced technicians even though there are other sites which are less costly that Sweden and Australia. They are not considered as I don't want to compromise on the quality of the final product. Risk of deviation is not considered as the budget of the final product has already exceeded the given budget, so I don't care if it costs few more euros. Moreover both Sweden and Australia has experienced technicians so chance of deviation is almost negligible.

Risks

The major risks faced by this project are listed in Table 7.

Table 7 Major Project Risks

Risks	Likelihood	Impact	Mitigation/Reduction Strategy
Misunderstanding customer requirements.	medium	high	In order to avoid this risk a meeting is held with customer before starting of the project to make the requirements clear. Technicians from Australia site also attend this meeting.
Cultural differences	medium	medium	Cultural differences causes lot of misunderstanding, which may affect the project. This is reduced by mingling the technicians face to face, this builds trust among themselves and cultural differences can be mitigated.
Loss of data while transferring from one site to other	medium	high	This risk can be avoided by applying backup for the files.
Integration errors	high	medium	This leads to disaster final product if there occurs any error in any module. This is avoided by assigning experienced technicians from both the sites
Delay in project	high	high	Delays in project is usually because of the delays in the modules. Dependent modules cannot be completed until the

Risks	Likelihood	Impact	Mitigation/Reduction Strategy
			other part is completed. This can be avoided by giving gap between every phase [3].
Lack of motivation among staff members(technicians)	medium	low	Many technicians may leave the project and quit, if an important technician quits the project then it may lead to lot of problems, in order to avoid this friendly environment and regular collaboration between the team members should be encouraged

References:

[1] J. D. Herbsleb and D. Moitra, "Global software development," *IEEE Software*, vol. 18, no. 2, pp. 16–20, Mar. 2001.

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