

Project Risks

Project Type: Large-scale regional hospital construction project

Risk no.	Phase	Groups	Risk owner	Description	Likelihood (score)	Economy (score)	Likelihood (%)	Time	Economy	Quality	Costs	Operational management	Mitigation measures	Effect if risk occurs?	Estimate related project Cost Estimate if the risk occurs	Column1	Risk Estimate - Monte Carlo Simulation Model													
																	Standard deviation (%)	10%	Total Risk (simulated)	#NAME?	€	16 960 250,00								
1	Planning	Project design/review	RDE	Budget risks	Possible underestimation of the budget and, therefore, possible extension of the Collaboration Phase(2-3) to implement the market research, figure out alternative solution and possible optimization.	4	5	35%	8	20	12	0	Addition of an Extra cost for additional 2 months needed for developing all these activities: Best case: NO delay Most likely: 1 months additional time required 1,5M€ to be compensated (no final	Cost overruns and disruption/delay to the time schedule	EUR 10.000.000	Budget risks	MOST LIKELY	BEST CASE	WORST CASE	Standard deviation (10%)	Effect simulation (Normal distribution or Pert distribution if 3 point est)	Likelihood simulation (Bernoulli distribution)	Risk simulated	Likelihood (0) x Most Likely (2)	Decision-making/need for action	Date for decision/action	Responsible for decision/action	Need for reporting/communication	Additional comments	
2	Planning	Time Schedule and logistics	RDE	Delays because of tight schedule	Risk of underestimation of mobilisation period; need of temporary site facilities (immediate risk) and risk of delays on the overall project.	4	5	35%	12	20	8	0	Addition of an Extra cost for temporary site facilities to be rent until definitive ones arrive Best case: use of RBBI JV office for the first month during mobilisation phase and Erikson Office Most likely: 1 months of additional rent, incl install/dismantl 100000€ + 3W delay (400'000*18gg)=7'200'000 Most: 1month of additional costs	Delays to the completion date of the project.	EUR 7.500.000	Delays because of tight schedule	7 500 000,00		750000	#NAME?	#NAME?	#NAME?	2625000							
3	Planning	Events/accidents/health and safety in general	RDE	Rework and project changes because of complexity in MEP work	Due to the huge number of interfaces with client deliverables and their complexity, risk of lack of experience and professionalism in civil subcontractors that could generate delay and remaking some works.	4	5	35%	9	20	9	0	Invest Professional staff to support this communication between civil and planning side (involved within staff cost, planning technician with experience in Hospitals); if reworks shall be re-made: BEST: 1 extra month (working hours) x 100pp + 10% material = 740'000€ at the initial stage (compensated); ML: 1 extra month (working hours) x 100pp + 10% material = 740'000€ at the intermediate stage not compensated + 0,5month delay = 4'000'000 WC: 1 extra month (working hours) x 100pp + 10% material = 740'000€ at the final stage not compensated + 1month delay = 8'000'000	Disruption and delays.	EUR 4.000.000	Rework and project changes because of complexity in MEP work	4 000 000,00		400000	#NAME?	#NAME?	#NAME?	1400000							
4	Commissioning	Time Schedule and logistics	Hillerod	Insufficient establishment of temporary measures	No coordinated planning phase with the stakeholders. Risk of an extended phase with loss of earnings for NHN Hospital and possible damages to medical equipment.	4	4	35%	12	16	-2	0	Organization of Coordination Meeting with Client representative for monitoring the process (staff included, no additional cost). ALERT	The medical supply is not ensured. Danger of image loss - and subsequently loss of earnings	open	Insufficient establishment of temporary measures	1 000 000,00		100000	#NAME?	#NAME?	#NAME?	350000						Risk could be reduced by a timely and comprehensive planning	
5	Commissioning	Project design/review	Hillerod	No coherent migration concept	No coherent migration concept leads to a loss of functional medical care, risk that medical supply is not ensured. Danger of damaging the image of the new hospital - and subsequently loss of earnings	4	4	35%	8	16	12	0	Support the client in the migrational process (staff included, no additional cost). ALERT	No coherent migration concept leads to a loss of functional medical care	open	No coherent migration concept	1 000 000,00		100000	#NAME?	#NAME?	#NAME?	350000						Risk could be reduced by a timely and comprehensive planning	
6	Planning	Project design/review	RDE	Time risk	Possible shift on structural works due to increasing of time required for these activities affecting the completion of the structure but the phase 3.	3	5	20%	8	15	12	0	Addition of an Extra cost for additional 2 months needed for developing all these activities: Best case: 2 months of running costs extra -> 3M€ Most likely: 2 months of running costs extra -> 3months delay -> 11800000	Cost overruns and disruption/delay to the time schedule	11800000	Time risk	11 800 000,00		118000	#NAME?	#NAME?	#NAME?	2360000							
7	Planning	Purchasing, materials and supplies	RDE	Marked prices are higher than expected	Possible increase of market price due to high activity in Denmark (starting of Ferhmann project) and lack of capable subcontractors during Phase 1; need of subcontractors who have experience with work starting activities in DK and possible delay in signing subcontracts (2 months lost on structural works).	3	5	20%	8	15	8	0	Addition of an Extra cost for accelerating these activities for remedying delay: Best case: double the work for 1 months (300pp * 2000h/g=1200000h * 2,20M€) Most likely: Increase of 10% material fee steel and concrete (2M€) 2 months double shift for remedying delay (300pp x 330h/g=100'000h * 44pp=4,4M€ + 26days delay (10,4M€) = 14,8M€	Higher market prices from all types of vendors	EUR 15.000.000	Marked prices are higher than expected	15 000 000,00		150000	#NAME?	#NAME?	#NAME?	3000000							
8	Planning	Contractual ambiguities or encumbrances	VAMED	Interfaces	Possible mismatch between interface list provided by client and VAMED checklist and long-term decision making; Risk of possible inadequate delineation of services and delay in project execution.	3	5	20%	12	15	6	0	Addition of an Extra cost for additional 3 months needed for developing all these activities: Best case: 1 month delay 1,5M€ Most likely: 2 months additional time required 3M€ Worst: 3 additional month 1,5M€-> 4,5M€	Long-term decision-making: additional costs; too late recognized requirements from the project; delay in project execution	EUR 3.000.000	Interfaces	3 000 000,00		300000	#NAME?	#NAME?	#NAME?	600000						Risk assumption: one percent of project volume	
9	Execution	Project design/review	RdE	Cashflow risk	Due to lack of advance payment, Main Contract presents a payment schedule and client doesn't accept; therefore Main contractor needs to invest at the early stage of the project and ask for a loan;	5	3	50%	5	15	5	0	To proceed with Contract obligations, issue Bonds pay the first costs for the start up of activities; Main Contractor will ask for a loan: ML: 3,5% yearly cost for 4,2M loan = 514'000€	Need to finance the start up of the project	EUR 514.500	Cashflow risk	514 500,00		51450	#NAME?	#NAME?	#NAME?	257250							
10	Planning	Project design/review	RDE	Concurrent engineering with overlap of design and construction can cause rework and/or delay	Possible underestimation, during design phase, of interfaces between MEP and Concrete works. During construction, this could generate need of additional and unforeseen concrete coring after casting.	3	4	20%	9	12	9	0	We consider an amount for unforeseen concrete coring during construction phase (no delays, only operational cost) + an additional work for concrete refurbishment and supervision ML: 250'000€ for extra coring + 200'000€ hours needed for works + 550'000€ for concrete refurbishment.		EUR 1.000.000	Concurrent engineering with overlap of design and construction can cause rework and/or delay	1 000 000,00		100000	#NAME?	#NAME?	#NAME?	200000							
11	Execution	Unforeseen negative factors	VAMED/RDE	Resistance of the population	Construction Activities can generate complaints with Neighbours in terms of noise and dust.	4	3	35%	8	12	8	0	Our cost includes the activity of a stakeholder manager who will deal with neighbors to mitigate possible complaints; estimated cost for possible fine or legal issue: ML: 500'000€	Project delay	EUR 150.000 per day	Resistance of the population	500 000,00		50000	#NAME?	#NAME?	#NAME?	175000						Due to interruption of the construction process	
12	Execution	Project design/review	Rde	Archaeological evidences	Possible additional evidences found out during construction within site boundaries; Risk of stop of activities in the area until Authority provides a new green line.	3	4	20%	6	12	2	0	Running cost for an additional month (1,5M€), implementation of a new traffic plan and possible need of re-routing and compartmentalization of the area (0,5M€), no penalties -> ZME	Running cost	EUR 2.000.000	Archeological Evidences	2 000 000,00		200000	#NAME?	#NAME?	#NAME?	400000							
13	Execution	Contractual ambiguities or encumbrances	VAMED	No definitive Scope of Works (Conditional phases)	As per tender specs, Phase 2 and 3 are unconditional and can be subject to withdrawal; Risk of legal disputes with partner and subcontractors.	2	5	10%	8	20	10	0	Legal Protection against partner and subcontractors (legal advisors, costs related to contracts management, etc.); Estimated cost 3'000'000€	Many interfaces to external project participants.	EUR 3.000.000	No definitive Scope of Works (Conditional phases)	3 000 000,00		300000	#NAME?	#NAME?	#NAME?	300000						Risk assumption: two percent of conditional part; more interfaces and risks in the execution	
14	Execution	Unforeseen negative factors	VAMED	Change of legal framework during project implementation	Changes in the legal framework that came into effect during the construction phase and not taken into account during the planning phase.	2	5	10%	8	10	0	0	Evaluation of the standards, directives and draft laws that are being amended. Kick-off workshop with planning team	No use permit	EUR 3.000.000	Change of legal framework during project implementation	3 000 000,00		300000	#NAME?	#NAME?	#NAME?	300000						Risk assumption: one percent of project volume	

Riskno.	Phase	Groups	Riskowner	Description	Likelihood (score)						Mitigation measures						Estimate related project Cost Estimate if the risk occurs		Column1	Estimate related project Cost Estimate if the risk occurs (EUR)						Effect simulation (Normal distribution or Pert distribution if 3 point est)		Likelihood simulation (Normal distribution or Pert distribution if 3 point est)	Risk simulated	Likelihood (O) x Most Likely (Z)	Decision-making/need for action	Date for decision/action	Responsible for decision/action	Need for reporting/communication	Additional comments										
					Economy (score)	Time	Quality	Cost	Operational management	Impact	Probability (%)	Impact	Probability (%)	Impact	Probability (%)	Impact	Probability (%)	MOST LIKELY	BEST CASE	WORST CASE	Standard deviation (10%)	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?										
15	Execution	Events/accidents/health and safety in general	RDE	Risks associated with health and safety	3	3	20%	9	9	0	6	6	6	6	6	6	The magnitude of the project with many workers working at the same time on large scale construction poses increased risk in relation to health and safety. It must be expected that unions and the Danish Working Environment Authority will inspect the site frequently.	Implement a rigorous safety program on site based on making the work places always safe and aggressive awareness. No additional Cost (HSE staff, inspectors and measures already included in budget cost) Possible potential Fine for implementation of HSE measures: Fine for implementation of HSE measures: 100.000,- DKK	Fines by Authorities.	EUR 500.000	Risks associated with health and safety	500 000,00			50000	#NAME?	#NAME?	#NAME?	100000																
16	Execution	Project design/review	RdE	Quantity variations	3	3	20%	6	9	3	6	6	6	6	6	6	After performing tests on anchors, additional perforation will be needed. Possible risk of increase of cost and time.	In case test results highlight the problem, we consider an extra cost of 500'000€ for extra perforation.	More costs and more time for activity	EUR 500.000	Quantity variations	500 000,00			50000	#NAME?	#NAME?	#NAME?	100000															our indirect cost are almost 43M€ (29RdE+14,5VAMED) so approx 1M/month	
17	Planning	Communication	VAMED	Communication	4	2	35%	36	8	8	6	6	6	6	6	6	Presentation via communication to the client requires considerable additional effort. Digital Sharing Platform will generate a difficult flow and communication between parties due to mutual lack of experience; Risk of possible misunderstanding and delay for decision making.	Additional cost for dedicated staff joining the project for 6 months at the start up persons for organizing and preparing the documents accordingly (digitally). ML: 3pp * 10'000*6months > 180'000	Many discussions and long decision-making paths; optimizations may not even be shown	EUR 30.000 per month	Communication	180 000,00			18000	#NAME?	#NAME?	#NAME?	63000														Additional staff due to more and inefficient meetings		
18	Execution	Unforeseen negative factors	VAMED	Negative environmental effects	2	4	10%	8	8	0	0	6	6	6	6	6	Bad weather, fire, etc.	Protection of storage on site already included within our costs; possible additional cost on MEP machinery already installed during phase 2/3 -> 2% risk on Budget for MEP (1,5M€)	Damage to the building to be refurbished.	EUR 1.500.000	Negative environmental effects	1 500 000,00			150000	#NAME?	#NAME?	#NAME?	150000														Risk assumption: half percent of project volume		
19	Execution	Other suppliers and specialist Sub-contractors	VAMED	Loss of subcontractors	2	3	10%	10	6	6	6	6	6	6	6	6	Due to the magnitude and time-frame for the hospital project, it is likely that some of the sub-contractors will face bankruptcy, which can cause delays and unforeseen cost.	Additional Legal/Administrative local services to support replacement of subcontractors and remedy measures; possible overlap of activities estimated 500'000€	Delay in project implementation, possibly cost increase	EUR 500.000	Loss of subcontractors	500 000,00			50000	#NAME?	#NAME?	#NAME?	50000														Risk assumption: one and a half percent of project volume		
20	Execution	Soil conditions	RDE	Soil conditions: Geotechnical reports may be inaccurate	2	3	10%	8	6	6	6	6	6	6	6	6	If geotechnical investigations/ tests are inaccurate to actual conditions, it may cause unforeseen cost and delays	Adapt to actual soil conditions as fast as possible reducing or even eliminating delays, then manage cost consequence to keep them at a minimum. Estimated cost for additional activities: 750'000€ (longer piles, different anchors).	Mostly cost increase.	EUR 750.000	Soil conditions: Geotechnical reports may be inaccurate	750 000,00			75000	#NAME?	#NAME?	#NAME?	75000																
21	Planning	Communication	VAMED	Upstream services are not appropriate	3	2	20%	6	6	12	12	6	6	6	6	6	Extra effort for coordination and testing	Additional staff of appropriate quality is to be provided	Extra effort for coordination and testing	EUR 30.000 per month	Upstream services are not appropriate	180 000,00			18000	#NAME?	#NAME?	#NAME?	36000														Additional staff required for checks and coordination		
22	Execution	Project design/review	RdE	Quantity variations	2	3	10%	6	6	6	6	6	6	6	6	6	Additional dewatering will be needed (15 days)	Additional pumping system will be required	More costs and more time for activity	EUR 600.000	Quantity variations	600 000,00			60000	#NAME?	#NAME?	#NAME?	60000														half month + additional cost for pumping (estimated)		
23	Migration	Project design/review	Hillerod	BIM	Transfer of BIM to FIM (material test/execution test with regard to quality for FM)	3	2	20%	3	6	6	15	15	15	15	15	Analysis of the published BIM model of design for technical operation (Facility Management/FIM); introduction of VAMED FM know-how	No optimal sequence of operations; higher operating costs; survival cycle; wrong material quality in terms of hygiene, durability, appearance, DGNB	EUR 80.000 per month	BIM	320 000,00			32000	#NAME?	#NAME?	#NAME?	64000														Additional BIM specialist for detailed model review			
24	Planning	External	RDE	Authority permits may be delayed	2	2	10%	10	4	4	2	2	2	2	2	2	There is a risk of delay of building permit and other authority approvals.	Employ acceleration measures to the extent possible. Use time of delay to better plan and organize the works.	Delay on the critical path of the project and some disruption to the operation.	EUR 300.000	Authority permits may be delayed	300 000,00			30000	#NAME?	#NAME?	#NAME?	30000																
25	Execution	Other suppliers and specialist Sub-contractors	VAMED	Quality of execution by subcontractors	4	1	35%	8	4	12	8	8	8	8	8	8	Lack of professional qualifications, poorly trained staff, communication problems	Use of known subcontractors; for unknown applicants increased attention to experience and references; through use of BIM; consistent supervision in the construction process	Quality is not suitable, deviations from the schedule, poor coordination with the remaining project participants	EUR 15.000 per month	Quality of execution by subcontractors	60 000,00			6000	#NAME?	#NAME?	#NAME?	21000														For each additional BIM coordinator to keep the BIM standard at a high level		
26	Execution	Soil conditions	RDE	Soil conditions: Environmental investigations may be inaccurate	2	2	10%	6	4	4	4	4	4	4	4	4	If environmental investigations/ tests are inaccurate to actual conditions, it may cause unforeseen cost and delays	Adapt to actual soil conditions as fast as possible reducing or even eliminating delays, then manage cost consequence to keep them at a minimum.	Mostly delays and also cost increase.	EUR 300.000	Soil conditions: Environmental investigations may be inaccurate	300 000,00			30000	#NAME?	#NAME?	#NAME?	30000																
27	Planning	Project design/review	VAMED	BIM	Quality of the published BIM model; information is missing	1	4	5%	5	4	5	0	5	5	0	5	5	Checklist for procurement process; in-depth examination of the planning documents; kick-off workshop with planning participants; asap; training of the employees.	Sluggish project flow, idling, additional expenses	EUR 500.000 per month	BIM	2 000 000,00			200000	#NAME?	#NAME?	#NAME?	100000														01.07.2019	VAMED/Client	-Collaboration phase with all employees is delayed - Construction has to be stopped - Decision
28	Planning	Project design/review	VAMED	BIM	The number of clashes requiring the planner to perform rework exceeds 2 clash/10,000m³	1	4	5%	5	4	5	5	5	5	5	5	In-depth review of the planning document together with the customer/scheduler	Sluggish project flow, idling, additional expenses	EUR 500.000 per month	BIM	2 000 000,00			200000	#NAME?	#NAME?	#NAME?	100000														01.07.2019	VAMED/Client		
29	Planning	Communication	VAMED	Differing interests of the stakeholders	2	2	10%	6	4	2	2	2	2	2	2	2	Missing information about previous cooperation of client / ARCHI / planner / etc.	Experience from already completed projects with similar scope of services. Risk assessment	Attempts are made to pass known risks onto the contractor	EUR 30.000 per month	Differing interests of the stakeholders	180 000,00			18000	#NAME?	#NAME?	#NAME?	18000														Additional staff for mediation, coordination and adaption of materials		
30	Execution	Construction	VAMED	Execution not up to standards	1	4	5%	1	4	5	5	5	5	5	5	5	Legal framework/standards of execution in the bidders' countries of origin differ from Danish standards and norms	Use of qualified employees; involvement of local employees familiar with the situation.	No official user permit; no DGNB certification (gold) obtainable	EUR 1.000.000	Execution not up to standards	1 000 000,00			100000	#NAME?	#NAME?	#NAME?	50000														All costs for planning and execution related to DGNB are sunk costs. As the certification cannot be granted		
31	All	Project design/review	VAMED/RDE	Delays in decision-making on possible re-scheduling	3	1	20%	9	3	9	0	0	0	0	0	0	The organizational setup and decision-making process may be bureaucratic and lengthy because of many stakeholders, high number of decision-makers, language barriers, and complexity, due to highly specialized clinical expertise.	Evaluation of whether decision processes are plausibly represented in the schedule; assistance in the preparation of bases for decisions (through the use of BIM 360, monitoring of decision-making processes) Early aggressive coordination.	Disruption, delays and cost overruns	Best case: EUR 100 per day if (maximum 20 rooms) Most likely: EUR 20,000 per day (maximum one component) Worst case: EUR 150,000 per day (2 or more components)	Delays in decision-making on possible re-scheduling	80 000,00	5 000	3 000 000		#NAME?	#NAME?	#NAME?	16000														01.07.2020		Due to interruption of the construction process
32	All	Unforeseen negative factors	VAMED	Risk of insufficient human resources (Contractor/vendors)	3	1	20%	9	3	9	0	0	0	0	0	0	Sufficient human resources available in the company.	Possible delay in construction progress, loss of quality.	EUR 40.000	Risk of insufficient human resources (Contractor/vendors)	40 000,00			4000	#NAME?	#NAME?	#NAME?	8000														New contract and start up phase for new employee (amount 4 EUR 10,000)			
33	Execution																																												

Project Risks

Riskno.	Phase	Groups	Riskowner	Risk	Description	Likelihood (score)	Economy (none)	Likelihood (%)	Time	Economy	Quality	Cost - Operational management	Mitigation measures	Effect if risk occurs?	Estimate related project Cost Estimate if the risk occurs (EUR)	ASSUMPTION	Column1	Estimate related project Cost Estimate if the risk occurs (EUR)					Effect simulation (Normal distribution or Pert distribution if 3 point est.)	Likelihood simulation (Normal distribution or Pert distribution if 3 point est.)	Risk simulated	Likelihood (O) x Most Likely (Z)	Decision-making/need for action	Date for decision/action	Responsible for decision/action	Need for reporting/communication	Additional comments
																		MOST LIKELY	BEST CASE	WORST CASE	Standard deviation (10%)										
35	Execution	Project design/review	RdE	Delay in Handing over the site	Enabling works, developed by third party, will take more time and site will be handed over later (15 DAYS)	1	3	5%	2	5				Implement teams and accelerate activities	More costs	EUR 500.000		Delay in Handing over the site	500 000,00			50000	#NAME?	#NAME?	#NAME?	25000					
36	All	Unforeseen negative factors	VAMED	Risk of insufficient human resources (Client)	Failure of key individuals on the part of the client	2	1	10%	8	2	8	2		Documentation must be of a high standard.	Agreements need to be reopened	EUR 40.000		Risk of insufficient human resources (Client)	40 000,00			4000	#NAME?	#NAME?	#NAME?	4000			01.01.2020		Additional coordination
37	Execution	Project design/review	RdE	Currency Risk	Negative rate fluctuation	1	2	5%	1	2	1			Finalise contracts as soon as possible when exchange are at least the current one	Possible increase of cost	EUR 400.000			400 000,00			40000	#NAME?	#NAME?	#NAME?	20000				I CONSIDER THAT PHASE1 WILL BE MAINLY "LOCAL" DKK PAID; PHASE 2&3 POTENTIALLY COULD BE PARTIALLY EURO PAID -> I ASSUMED THAT NOT ALL WILL BE IN EURO BUT THE 75% (FINDINGS AND MEP) APPROX 1.026B DKK (137,6M€). IN THE LAST 10 YEARS MIN 1€=7,42, MAX 1€=7,46 -> RISK BUREAU IS 1,48-1,49	
38	Planning	Time Schedule and logistics	VAMED	Faulty estimation of dates and project flows	Specifications coming from project stakeholders are not recognizable at the start of the project	1	1	5%	4	1	3	2		International project experience through VAMED; detailed market observation.	Project delay,	EUR 15.000 per month		Faulty estimation of dates and project flows	60 000,00			6000	#NAME?	#NAME?	#NAME?	3000			01.07.2019		Additional scheduler
39	Execution	Project design/review	RdE	Temporary Watertight	impossibility of 100% watertightening structure and delete in starting fit-out and MEP activities	5	0	50%	10	0	10			Additional watertight system where steel structure will be installed (to provide a waterproofing during working progress)	More costs to watertight temporarily to maintain the schedule	0		Temporary Watertight	-			0	#NAME?	#NAME?	#NAME?	0					provisional waterproofing on upper floor (tot sqm of floor) NO RISK, IT'S A COST!!