

Risk Management Plan

Enterprise Software Selection supporting new Supply Management Strategy at Harley-Davidson

Viktor Karabut

Jan Rehwaldt

Table of Contents

1. Document introduction	3
2. Risk management	3
2.1. Detailed risk records	3
2.2. Risk prioritization	12
2.3. Risk countermeasure analysis	13
3. Activity-level risk analysis	16
3.1. Important milestones	16
3.2. PERT estimations	16

1. Document introduction

This document provides the risk analysis for the project internally called *Enterprise Software Selection supporting new Supply Management Strategy at Harley-Davidson* aiming at introducing a centralized procurement software for Harley-Davidson¹. During an earlier feasibility study² the project's benefits were itemized. Potential costs are estimated within the budget plan³.

This document aims to identify risks, which have impact on the project execution, in section 2 followed by an activity-level analysis of execution times and likelihood of failing deadline in section 3. A risk mitigation or avoidance proposal is finally given in section 4.

2. Risk management

The identified risks are itemized in detail in section 2.1. They can be categorized into four main types, whereas combinations of those are also possible: actor-, structure-, technology- or activity-related. In section 2.2 the risk importance was analyzed and a prioritization carried out.

2.1. Detailed risk records

This section covers the ten risks, which are considered most serious based on their impact as well as probability of occurrence. The benchmark data for record are given in the following detailed descriptions. An impact-probability-analysis is done later on in section 2.2.

The given risk records follow a certain template structure. *Probabilities* and *effectivity* are, if not stated differently, provided on a scale from zero to 100 percentages indicating the likelihood of achieving the mitigation or reduction respectively the effectiveness of both. *Impacts* on costs, duration and quality are given on a scale from one to ten. Zero means no impact expected, whereas ten states a high impact, which would most likely cause a serious project interruption or even failure.

2.1.1. #1: Worker deficiency

Owner: Viktor Karabut **Date raised:** 21th March 2012 **Status:** did not occur

Risk description

In succession to internal (organization-based) or external events a worker deficiency may occur. Those external events may be illness, pregnancy or resignation amount others. In between events are holiday planning as well as retirement, as they can be considered beforehand during project start and may be easily manageable and not that likely. Internal causes are misplanning and incorrect resources allocation.

¹ Case Study "*Harley-Davidson Motor Company: Enterprise Software Selection*", Harvard Business School 9-600-006, Revision January 22, 2003

² Feasibility Study and Project Selection: *Enterprise Software Selection supporting new Supply Management Strategy at Harley-Davidson*, Viktor Karabut and Jan Rehwaldt, February 2012

³ Budget Plan: *Enterprise Software Selection supporting new Supply Management Strategy at Harley-Davidson*, Viktor Karabut and Jan Rehwaldt, April 2012

Recommended risk mitigation / avoidance / reduction

External causes may not easily be avoided as there are only less means to influence them. The occurrence of illnesses such as depression or chronic backache can be reduced by regular medical checks by an external doctor paid by Harley-Davidson. Additionally, internal training may reduce the chance of mobbing or other sources of stress. Mitigation provisions, such as substitute or additional workers have to be taken into account.

Internal causes, on the other hand, can be avoided by choosing a highly skilled project manager and perform constant monitoring of the project progress.

Events, which are not clearly related to either of those categories, but rather belong to both may be mitigated or even completely avoided due to good project planning.

The impact on cost and duration is highly dependent on the affected worker's position. A shortfall of the project manager has dramatically more impact than of an software developer, who is not allocated alone for this project. A deficiency is generally considered as being rather cost intensive with major impact on the duration. External causes are more difficult to handle than internal.

Probability / impact values

External causes	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	50	4	4	3
Post-Action	25	3	3	1

Internal causes	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	5	5	4	3
Post-Action	1	5	1	0

So-so causes	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	20	2	3	1
Post-Action	8	1	1	0

Incident / action history

Date	Incident / Action	Action	Outcome / Comment

--	--	--	--

2.1.2. #2: Receival of insufficient tenders

Owner: Jan Rehwaldt **Date raised:** 3rd April 2012 **Status:** did not occur

Risk description

During the project execution invitations to tender have to be submitted. In case of too short deadlines or unexpectedly high requirements and constraints only insufficient offers or a too less number of offers may be received. This might force the project manager to rerun single activities or activity paths in order to gain broader results. In case of occurrence major time constraints will not be held and project budget will be considerably higher.

Recommended risk mitigation / avoidance / reduction

Several countermeasures may be taken in order to avoid the risk: Potential vendors may be carefully chosen and their general applicability checked beforehand. Submission deadlines should be generous, if possible. Project requirements should be well-defined, clear and concrete. User scenarios may be provided to allow better understanding of software usage.

Probability / impact values

	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	10	4	6	0
Post-Action	5	1	0	0

Incident / action history

Date	Incident / Action	Action	Outcome / Comment

2.1.3. #3: Stakeholder's responsibility not well-defined

Owner: Viktor Karabut **Date raised:** 3rd April 2012 **Status:** did not occur

Risk description

In case the participant's responsibilities are not clearly defined and separated from each other the stakeholder's planning may be against each other. This leads to unclear project objectives, no stable budgeting foundation and misplanning in general.

Recommended risk mitigation / avoidance / reduction

Establish well-defined responsibilities and accept those beforehand. Settle main responsibility and budgeting stakeholder for the whole project duration. Install communication ways for solving critical questions beforehand. During the project run the project manager has to ensure, that the different

stakeholder's objective are still taken into account and matching with the expected outcome.

In case the risk already occurred a mediator may help to resolve the loss of trust between the stakeholders and re-establish generally accepted responsibilities.

Probability / impact values

	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	35	4	6	6
Post-Action	5	1	4	6

Incident / action history

Date	Incident / Action	Action	Outcome / Comment

2.1.4. #4: Insufficient integration of suppliers

Owner: Viktor Karabut **Date raised:** 28th March 2012 **Status:** did not occur

Risk description

Important for the success of this project is the final integration of the suppliers into Harley-Davidson's new infrastructure. The goal is to decrease storage costs and improve supply and procurement ways and processes. Therefore the suppliers have to be properly integrated into Harley-Davidson's processes. Without proper integration of the suppliers within the software introduction process their integration may fail by chance of 45 percentages.

Recommended risk mitigation / avoidance / reduction

During the specification process also requirements regarding partners have to be considered and analysed. Partners have to be informed regularly and integration tests performed focusing on the incorporation of the partner's infrastructures.

Probability / impact values

	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	45	4	5	2
Post-Action	15	1	2	1

Incident / action history

Date	Incident / Action	Action	Outcome / Comment
------	-------------------	--------	-------------------

2.1.5. #5: Weak requirement specification

Owner: Jan Rehwaldt **Date raised:** 15th March 2012 **Status:** did not occur

Risk description

While analysing the company intern processes and requirements towards the new ERP software a too weak specification may be produced failing to cover major aspect of the procurement process. On basis of this specification and requirements serious wrong decisions or, on the other hand, no stable decisions at all may be caused.

Recommended risk mitigation / avoidance / reduction

During development of the specification and gaining the intern processes expert should be included on all sides. Each team should be backed up with specialists having experience in this field. Especially the process analysts and project manager may be advanced experts in their fields. During evaluation result should be plausibility checked for recognizing mistakes as early as possible. Earlier recognition means less impact on cost and duration if the risk occurs.

Probability / impact values

	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	25	5	8	3
Post-Action	5	1	4	6

Incident / action history

Date	Incident / Action	Action	Outcome / Comment

2.1.6. #6: Project deadlines fail

Owner: Viktor Karabut **Date raised:** 13th March 2012 **Status:** did not occur

Risk description

During project execution some deadlines may be too strict or caused by different risks (eg. risk #1) not be held. This postpones the overall project execution and finalization leading to a duration and cost

increase. As this organization plan is well-defined and deadlines are strongly considered to be reasonable the probability of this risk is estimated to be 30 percentages due to other pre-occurring risks such as #1, #5 or #7.

Recommended risk mitigation / avoidance / reduction

Good monitoring during the project runtime has to be set up and the results constantly analyzed. Additionally may an experienced project manager achieve a successful project end on time and budget with only reasonable impacts on cost.

In case deadlines are missed the organization plan may be reconsidered by the project manager and activities reallocated or -planned. Project plan synchronization should be achieved for predefined milestones (see phases in project plan; Organizational Plan) easing monitoring and planning in general.

Probability / impact values

	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	45	4	5	2
Post-Action	25	2	4	1

Incident / action history

Date	Incident / Action	Action	Outcome / Comment

2.1.7. #7: Inexperienced staff produces unreliable results

Owner: Jan Rehwaldt **Date raised:** 20th March 2012 **Status:** did not occur

Risk description

If inexperienced staff is used for critical or even non-critical activities the results may not be reliable, stable or stressable. This can easily lead to a delay in due dates.

Recommended risk mitigation / avoidance / reduction

As countermeasure staff should be well selected and their progress as well as quality of results monitored. During the project runtime the project manager should react in case of occurrence and reallocate certain tasks or add additional resources for an activity.

Probability / impact values

	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	60	3	5	4

Post-Action	10	1	4	2
--------------------	----	---	---	---

Incident / action history

Date	Incident / Action	Action	Outcome / Comment

2.1.8. #8: Insufficient offers from tender

Owner: Jan Rehwaldt **Date raised:** 20th March 2012 **Status:** did not occur

Risk description

After vendor selection and invitation to tender offers are received. Those may, for different reasons, be insufficient. They could either be too limited in number (not enough offers) or not well-suited for Harley-Davidson's requirements. If this risk occurs the deadlines may not be held and a budget as well as time increase is necessary. In the worst case scenario a part or complete rerun of the project has to take place.

Recommended risk mitigation / avoidance / reduction

Specify concrete requirements with usage scenarios and use cases. Focus on value of features and avoid looking for the most-featured solution. Provide proper deadlines for vendors to send offers. See mitigation strategies for risk #5.

Probability / impact values

	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	5	3	5	3
Post-Action	2	1	3	2

Incident / action history

Date	Incident / Action	Action	Outcome / Comment

2.1.9. #9: Uncalculated budget increase

Owner: Viktor Karabut **Date raised:** 4th March 2012 **Status:** did not occur

Risk description

The project plan is not well-defined or unsuccessful processed leading to a budget increase. Additionally requirements may be weak or useless delaying the project end.

Based on wrong assumptions or miscalculations the project could stay on time, but out of budget. Estimations have to be double checked and their adherence monitored during the project run.

Recommended risk mitigation / avoidance / reduction

Mitigation strategies comprise of having exit strategies and upper limits for the budget. All stakeholders should be made aware of all constraints.

If the project is finished on time the likelihood of budget explosion is decreased, but still to take into account.

Probability / impact values

	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	30	7	4	0
Post-Action	15	6	2	0

Incident / action history

Date	Incident / Action	Action	Outcome / Comment

2.1.10. #10: Requirement specification changes during project run

Owner: Jan Rehwaldt **Date raised:** 6th April 2012 **Status:** did not occur

Risk description

This risk is similar to risk #5, but focuses on a stable specification, which for different reasons is changed during the project runtime. Reasons may be insufficient communication during specification processes or critical changes in Harley-Davidson's infrastructure by another project.

Due to changes certain activities may be required to be re-run delaying the overall project finalization. Additionally requested vendor offers may be discarded if the specification is changed in a very late state of the project.

Recommended risk mitigation / avoidance / reduction

Focus on requirements and specification completeness and stability from the very beginning. Allocate resources and time as soon as possible involving experts from different departments of Harley-Davidson

Motor Company. Provide a seamless communication channel for all participating stakeholders to the project manager and clarify responsibilities and objectives as early as possible.

Probability / impact values

	Probability	Impact on Cost	Impact on Duration	Impact on Quality
Pre-Action	40	5	3	1
Post-Action	20	2	1	1

Incident / action history

Date	Incident / Action	Action	Outcome / Comment

2.2. Risk prioritization

This section evaluates the previously in detail presented risk records according their impact-probability ratio. The probability is measured as given in the records from section 2.1. In order to evaluate the impact the total sum over impact on cost, duration and quality was aggregated and visualized in the following table (2.2.1).

On the probability axis a distinction between *low*, *moderate*, *significant* and *high* was made ranging from zero to 19 for low, 20 to 39, 40 to 69 and finally 70 to 100 percentages for high. The scale was chosen to be nonlinear in order to emphasis the likelihood. Risks in the level significant and high are considered as likely up to rather likely to happen.

The second axis illustrates the aggregation of cost, duration and quality impacts and is as well separated into low, moderate, significant and high, but on another scale. An impact between zero and eight is considered low and most uncritical. Following are impact levels nine to 16 (moderate), 17 to 24 and 25 to 30 (high) with rising criticalness from lower to higher numbers.

In order to identify risks, for which countermeasures should be highly considered, the following combinations of impact and probability are marked as critical:

1. High + Moderate
 2. High + Significant
 3. High + High
 4. Significant + Significant
 5. Significant + High
- notion of ordered list: Impact level + Probability level*

Risks, which are identified within those five combinations are critical and should be avoided, mitigated or reduced.

Table 2.2.1: Impact-probability analysis

Impact	Probability			
	Low (0 - 19)	Moderate (20 - 39)	Significant (40 - 69)	High (70 - 100)
High (25 - 30)			#3, #5	
Significant (17 - 24)	#8	#9	#1, #6, #7	
Moderate (9 - 16)	#2		#4, #10	
Low (0 - 8)				

According to table 2.2.1 the risks #3 (stakeholder's responsibility not well-defined), #5 (weak requirement specification), #1 (worker deficiency), #6 (project deadlines fail) and #7 (inexperienced staff produces unreliable results) may be avoided or reduced as described in the corresponding detailed risk record from section 2.1. Countermeasures for those risks are analysed in the following section 2.3.

Additionally risks #9 (uncalculated budget increase), #4 (insufficient integration of suppliers) and #10 (requirement specification changes during project run) can be considered, but are not as important and impacting.

2.3. Risk countermeasure analysis

As identified in section 2.2 risks #3 and #5, #1, #6 and #7 should be considered for countermeasures. As there are several possible actions for each risk (mitigation, transfer, avoidance, ignoral) some of the most cost-efficient are evaluated and proposed in this section. In this state only the actions for risks #3, #5 and #7 are evaluated.

Therefore the costs of each risk and its countermeasures are estimated and contrasted. For each action the risk exposure (*RE*) is specified based on the potential damage (*PD*) and probability of occurrence (*POO*):

$$RE = PD \cdot POO$$

On the basis of this risk exposure a risk reduction leverage (*RRL*) is calculated taking the risk exposure before and after actions were made into account:

$$RRL = \frac{RE_{pre} - RE_{post}}{Costs\ of\ Action}$$

A *RRL* above one indicates a reasonable investment into the investigated actions. Below one the ignoral of the risk stays more cost effective.

#3: Stakeholder's responsibility not well-defined (35/4-6-6 | 5/1-4-6)

The **damage costs** with are incurred by the occurrence of the risk are expected to be **250,000 EUR**, because of the heavy delay which will result and the part or total re-run of several activities.

The following countermeasures may be considered:

[Avoidance] Accept stakeholder's responsibilities beforehand

[Avoidance] Specify main responsible stakeholder before project starts

[Avoidance] Choose project manager to be vastly integrated into main stakeholder's site

The three abovementioned countermeasures are considered together as they are not costly intensive, but rather organizational actions, which should take place before or at the beginning of the project start. A cost analysis does not take place, because no extra costs are considered to incur.

Those actions are **highly recommended to be executed**.

[Avoidance] Establish communication channels between different stakeholders

[Avoidance] Constantly monitor matching of stakeholder's requirements with actual plannings

The **avoidance costs** for installing communication channels, including having half-time responsible people on each stakeholder's side at hand as well as providing office equipment and technical means for meeting are estimated to be **28,000 EUR**. They include 24,000 EUR for 400 hours á 60 EUR total additional labor costs. Those are 50 days of total work days. With two additional participating stakeholders besides the main one (which is represented by the project manager) for each stakeholder's project responsible a total workload of 25 person-days is estimated to support the project. Additionally 4,000 EUR of office costs are expected.

In case those two actions are executed the risk probability may be decreased from 35 % to only 5 %.

$$RE_{pre} = 250,000 \text{ EUR} \cdot 0.35 = 87,500 \text{ EUR}$$

$$RE_{post} = 250,000 \text{ EUR} \cdot 0.05 = 12,500 \text{ EUR}$$

$$RRL = \frac{87,500 \text{ EUR} - 12,500 \text{ EUR}}{28,000 \text{ EUR}} = \frac{75,000 \text{ EUR}}{28,000 \text{ EUR}} \approx 2.68$$

As the risk reduction leverage is evaluated with 2.68 **the execution of both actions is recommended**.

[Mitigation] Employ mediator to resolve trust and acceptance between stakeholders

In case the risk already took place in order to recover the project outcome and bring the execution back on its organizational track a mediator should be employed. The cost is expected to be 5,040 EUR based on 56 person-hours with a salary of 90 EUR per hour.

As the overall project value is much more than 2,000,000 EUR according to the Budget Plan from April 2012 a project failure has to be strictly avoided. Therefore the **installation of a mediator is highly recommended** in case of project coordination problems.

#5: Weak requirement specification (25/5-8-3 | 5/1-4-6)

The **damage costs** for this risks are expected to be **150,000 EUR** in average. The later the risk occurs, the higher may rise the costs.

[Avoidance] Involve external experts into specification process

The following table 2.3.1 is an excerpt from working hours estimation in section 3.1, Budget Plan. It shows the total amount of person-month estimated to create the requirements specification.

Table 2.3.1: Total time estimated for specification process (excerpt from section 3.1, Budget Plan)

Activity	Duration	Project manager	Process analyst	System designer	Stakeholders
2. Perform survey with stakeholders	0.50	0.50	0.50		0.50
3. Prepare checklists	0.25	0.25	0.06	0.25	0.25
4. Feedback from internal stakeholders	0.25	0.25	0.25		
5. Develop project specification	1.00	0.75		1.00	
Total	2.00	1.75	0.81	1.25	0.75

According to this table 0.81 and 1.25 person-month are allocated for process analysts respectively system designer. In order to support this process by external experts with an average salary of 80 EUR 0.4 pm (20 % of 2 pm; 8.8 person-days and 70.4 person-hours) of expert time should be additionally allocated.

$$\text{salary} = 70.4 \text{ ph} \cdot 80 \text{ EUR} = 5,632 \text{ EUR}$$

The **avoidance cost** will be **5,632 EUR**. By executing this action the risk probability may be decreased from 25 % to 5 %.

$$RE_{pre} = 150,000 \text{ EUR} \cdot 0.25 = 37,500 \text{ EUR}$$

$$RE_{post} = 150,000 \text{ EUR} \cdot 0.05 = 7,500 \text{ EUR}$$

$$RRL = \frac{37,500 \text{ EUR} - 7,500 \text{ EUR}}{5,632 \text{ EUR}} = \frac{30,000 \text{ EUR}}{5,632 \text{ EUR}} \approx 5.33$$

Based on those estimations the RRL value is 5.33 indicating the cost efficiency of this action. **It should be executed.**

#7: Inexperienced staff produces unreliable results (60/3-5-4 | 10/1-4-2)

The **damage costs** for this risks are expected to be **80,000 EUR**.

[Avoidance] Select experienced staff

By selecting experienced staff a slightly higher salary has to be paid. Expected is an average increase of 5 EUR per hour. According to the Budget Plan 2.40 respectively 1.65 person-months (422.4 and 290.4 person-hours) are allocated for process analysts and system designers making a total of 712.8 hours of labor time with increased salary.

$$salary = 712.8 \text{ ph} \cdot 5 \text{ EUR} = 3,564 \text{ EUR}$$

The **avoidance cost** is **3,564 EUR** for higher salaries. The probability that this risk will occur may be reduced from 60 to 10 %.

$$RE_{pre} = 80,000 \text{ EUR} \cdot 0.60 = 48,000 \text{ EUR}$$

$$RE_{post} = 80,000 \text{ EUR} \cdot 0.10 = 8,000 \text{ EUR}$$

$$RRL = \frac{48,000 \text{ EUR} - 8,000 \text{ EUR}}{3,564 \text{ EUR}} = \frac{40,000 \text{ EUR}}{3,564 \text{ EUR}} \approx 11.22$$

RRL level is 11.22 indicating a high impact when executing this countermeasure. **The action should be run.**

[Mitigation] Allocate additional staff for certain activities

In order to bring the project execution back on track in case the risk impact occurred a mitigation strategy could be allocating additional resources for certain activities.

Depending on the activity time and delay varying costs may arise. With an average activity duration of five days and an expected delay of five days two more full-time resources should be allocated for three days to bring the project back on a relatively stable roadmap.

Assuming an average labor cost of 60 EUR per hour and 40 working hours per week an additional salary of **4,800 EUR** has to be invested (**mitigation cost**).

$$2 \cdot 40 \cdot 60 \text{ EUR} = 4,800 \text{ EUR}$$

As this risk may occur multiple times this amount may be required more than once.

A project delay may cost 1,000,000 EUR per year, which is 3,774 EUR per day (**damage cost**). Thus the mitigation cost for reducing a five day-delay is lower than the loss expected to result from five day-delay of the overall project (loss of 18,870 EUR in five days).

The mitigation should be executed if the overall project deadline is delayed by the considered activity.

3. Activity-level risk analysis

3.1 Important milestones

1. Project specification should be developed by week 8.
2. Final software vendor should be specified by week 14.
3. The whole project should be done within 75 working days (15 weeks).

To estimate probability of meeting or missing targets we Program Evaluation and Review Technique (PERT).

3.2 PERT estimations

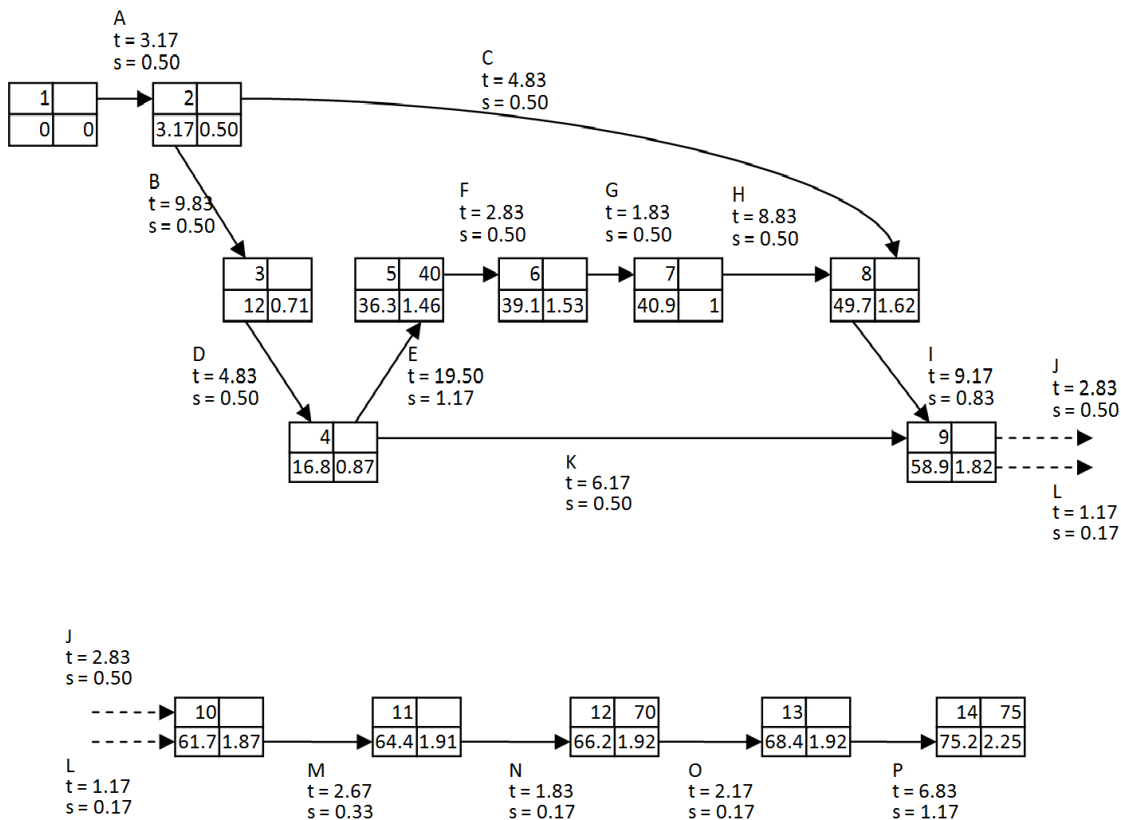
Table 3.1 describes project activities, identifies durations estimates and standard deviations for each activity. Table based on Table 1 from Organization Plan⁴. Figure 3.2 shows project event network, expected times and their standard deviations.

Table 3.1: Expected durations and standard deviations for activities.

Activity	Depends on	Optimistic time (a)	Most likely time (m)	Pessimistic time (b)	Expected time (t)	Standard deviation (s)
A. Create expert groups	-	2	3	5	3,17	0,50
B. Perform survey with stakeholders	A	8	10	11	9,83	0,50
C. Prepare checklists	A	3	5	6	4,83	0,50
D. Feedback from internal stakeholders	B	3	5	6	4,83	0,50
E.. Develop project specification	D	15	20	22	19,50	1,17
F. Create potential vendor list	E	1	3	4	2,83	0,50
G.. Send invitations to tender	F	1	2	2	1,83	0,17
H. Organize provider software conference and presentation	C; G	7	9	10	8,83	0,50
I. Select top four vendors	H	5	10	10	9,17	0,83
J. Invite potential vendors for interview	I	1	3	4	2,83	0,50
K. Prepare product demo test cases	E	5	6	8	6,17	0,50

⁴ Organization Plan: *Enterprise Software Selection supporting new Supply Management Strategy at Harley-Davidson*, Viktor Karabut and Jan Rehwaldt, February 2012

L. Invite potential vendors for product demo	K; I	1	1	2	1,17	0,17
M.. Discuss details and prepare decision	J; L	1	3	3	2,67	0,33
N. Select final vendor	M	1	2	2	1,83	0,17
O.. Negotiate contract	N	2	2	3	2,17	0,17
P. Sign up contract	O	1	8	8	6,83	1,17



Figure

3.2 Project event diagramm

1. **Target:** project specification will be done by day 40 (event 5).

$$T = 40; t_e = 36.3; s = 1.46$$

$$z = \frac{(T - t)_e}{s} = 2.53$$

Probability to meet target: 99.4%

2. **Target:** select final vendor by day 70 (event 12).

$$T = 70; t_e = 66.2; s = 1.92$$

$$z = \frac{(T - t)_e}{s} = 1.99$$

Probability to meet target: 97.7%

3. **Target:** whole project will be done within 75 days.

$$T = 75; t_e = 75.2; s = 2.52$$

$$z = \frac{(T - t)_e}{s} = -0.08$$

Probability to meet target: 46.8%