

Project Business Management^{1,2}

When There is No Way Out - The Sunk Cost Dilemma

Oliver F. Lehmann

"The way out is through the door. Why is it that no one will use this method?"
- Confucius

Summary

In Project Business Management (PBM), one can sometimes observe a dilemma situation typical for games with one player. A series of decisions needs to be made, and each time, the momentarily best and most economic option is chosen. However, the series of good decisions adds up to a major failure.

The Magic Triangle of Customer-Facing Projects

There are surprising similarities of doing projects and playing one-player games, such as the card game Solitaire (Figure 1). While the game is not played against one or more competitors, one may nevertheless win or lose. The same can apply to projects, and when the project is done under contract, additional risks can impact project success, as I will show in the following example.

Talking with project managers in customer projects, there is often an opinion found that customer satisfaction is the only goal that one should have. It is then – correctly – emphasized that making customers happy generally justifies the existence of a project vendor company and protects its future by providing a reference that will make it easier to win incoming business

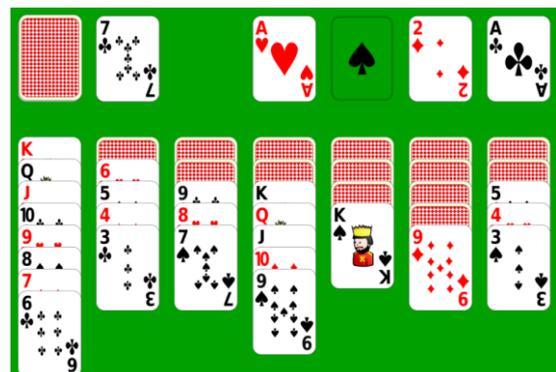


Figure 1: A game for one player: Solitaire

¹This is the 16th in a series of articles by Oliver F. Lehmann, author of the book *"Project Business Management"* (ISBN 978-1138197503), published by Auerbach / Taylor & Francis in 06-2018. See full author profile at the end of this article. A list of the other articles in PM World Journal can be found at <https://peworldlibrary.net/authors/oliver-f-lehmann>.

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opportunities. In addition, a happy customer may give the contractor the status of an incumbent provider, making it easier to make more business.

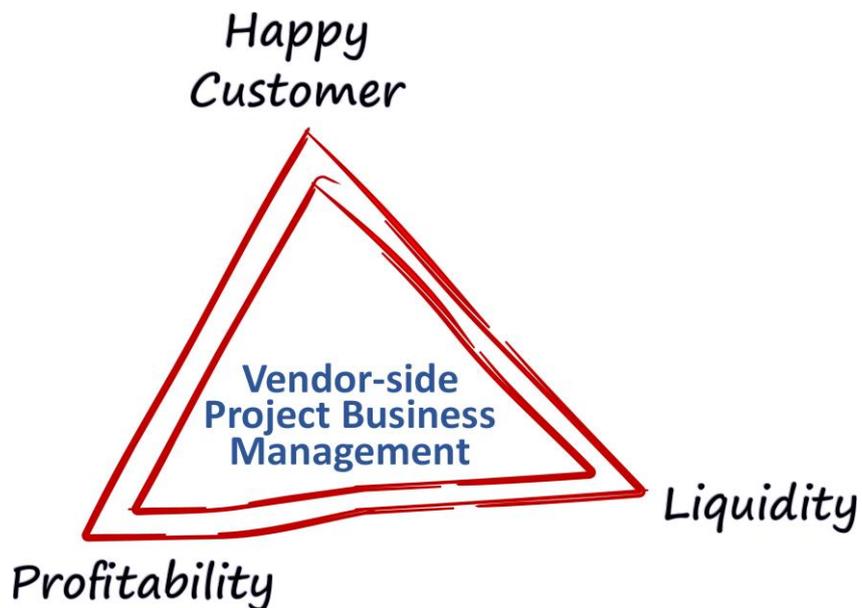


Figure 2: The Magic Triangle of customer projects. All three corners are equally important to protect the presence and the future of the company.

Laying out a game-theoretical model for games with one player, such as the card game Solitaire, I am showing that more aspects of project business need to be considered, particularly the profitability of the project for the vendor and its impact on the company's liquidity, as shown in Figure 2. It cannot be the goal of a project to lead the vendor into insolvency, which would also incapacitate the company to satisfy the customer.

A Project for a Paying Customer

The First Decision: Winning the Contract or Stepping Back?

Sandworm, Inc.³, was certain to have won the best project contract in the company's history. It was a fixed price contract to deliver and implement a business software solution for Wolf Spider Corp. at a value of US \$100 million over a period of nine months. To make the project even more attractive, the contract included a commitment by the customer to add an incentive of 10% on top if they would finish the project two months early. Sandworm had done similar projects in the past and felt it was in a good position to meet the seven months incentive date which would make project very profitable and would also ensure a happy customer.

³ All names changed.

Three aspects of the project seemed less favorable, one being that the bulk of the payment was to be made by the customer after delivery. Sales people had tried to negotiate better payment terms that would be less straining for the contractor, but the customer made it clear that no payment would be made before the software was running and its ability to meet the customer's requirements would be proven, and insisted that otherwise "...there are many other providers, who are happy to do the business under our conditions."

Another detriment was a liquidated damage clause of \$20 million that would apply in the case of late delivery and would be deducted from the fixed price.

The most unfavorable passage of the contract was a performance guarantee in support of the customer. It said that if Sandworm was found unable to deliver at all, the customer would be permitted to immediately terminate the contract. In such a case, the customer would not pay anything to the contractor but the liquidated damages would still apply, meaning Sandworm would have to pay \$20 million to the buyer. The same would apply if Sandworm terminated the contract before the project was finally finished.

Sandworm's business development staff had tried to get these clauses removed from the contract language before signature, but again, the customer insisted on them. Sandworm had to make a decision to accept them or step out of the negotiations and leave the project to competitors.

On a warm, sunny Friday afternoon, Sandworm's management came together in a meeting with two of its project managers to discuss the further proceeding, deliberating risks and opportunities. The project managers viewed the risk as manageable. The software was a homegrown solution taken "off the shelf", that needed some customization for the customer, but this had been done before and the company's software engineers and developers should have an easy project to do. The project should easily be finished in seven months, probably less, which would allow to cash in the price plus the incentive, \$11 million, with limited investment in manpower and other resources.

The manager of the HR department pointed at another project, currently performed for the customer Red Ant Group, which was currently in its "Hot phase" and would soon be finished. A new project was needed to keep Sandworm's employees busy. This also meant that plenty of staff would be available soon for the new project to allow it to meet the seven months delivery goal.

The manager of the finance department pointed at the need to generate future income, when the Red Ant Group project was over. This was supported by the head of product management, who explained the need to expand the installed basis for the product to not fall behind competition. Sales added that the customer would be a great reference to win future business, and what a great benefit it would be to become an incumbent vendor for future projects.

A brief estimation was made of the expected project costs that Sandworm would have. It was calculated at \$70 million, with the majority being “internal costs”, which meant that the charges against the project would from a corporate perspective be balanced by “internal profits” of other departments, so that the actual costs would be much lower.

Analysis showed that the project had four different cost scenarios, depending on its duration and whether it would be finished at all, as shown in Figure 3.

Option 1: Try to Win the Business	
Scenario 1: Project Finish in 7 Months Payment from customer: \$110,000,000 - Costs: -\$70,000,000 Margin from project: \$40,000,000	Scenario 2: Project Finish in 9 Months Payment from customer: \$100,000,000 - Costs: -\$70,000,000 Margin from project: \$30,000,000
Scenario 3: Late Project Finish in Over 9 Months Payment from customer: \$80,000,000 - Costs: -\$70,000,000 Margin from project: \$10,000,000	Scenario 4: Project Nonperformance and Cancellation Payment from customer: -\$20,000,000 - Costs: -\$70,000,000 Margin from project: -\$90,000,000
Option 2: Do Nothing	
Scenario 5: Withdraw from Negotiations Payment from customer: \$0 - Costs: \$0 Margin from project: \$0	

Figure 3: The four income/cost scenarios in the case story, considering the incentive fee (Scenario 1) and the liquidated damages (scenarios 3 and 4). A fifth scenario describes the option to withdraw from negotiations.

Despite its lowest margin of the three profit-making scenarios, even Scenario 3 would be considered a financial success. Most projects of Sandworm yielded far less than its 12.5% margin. The company was clearly a JAM provider – *Just About Managing* to survive, but unable to build financial reserves for difficult times.

Scenario 4 would be a true threat to the existence of the company, but Sandworm felt certain, given its experience in the field and knowledge of the own software product, that this would not happen. The best decision option was obviously to do the project and head for a project finish in seven months.

Soon, the decision was made: The option was taken to accept the risk and try to win the contract. The other option, withdrawing from the negotiation process, was univocally rejected, the need to bring in new business was too big.

The meeting was ended, the attendees adjourned and headed home to their families, to enjoy the beautiful summer weekend. In the next weeks, the contract was successfully won and the project could be started.

The Second Decision: Invest more Resources?

Two months into the project, some unexpected problems became discernable.

- The customer had some special processes in place to value its stock items that were different from the processes used in other companies. These processes were nevertheless legal, but were not supported by the standard solution. The effort to write specific code to customize the software would be significantly higher than what was expected, and doing that brought new risks of coding errors and inconsistencies, risking delays and additional costs to resolve.
- The older project for Red Ant Group, which was expected to be finished soon, had ran into major technical difficulties. Instead of getting personnel free for the new Wolf Spider project, its demand for allocated capacity was even growing, if Sandworm wanted to avoid getting penalized there. The Wolf Spider project was important, but the project for Red Ant was in crisis and resolving that was urgent. The Urgent has always been the most vicious enemy of the important, just like in this case.

Costs of the project had added up so far to \$10 million.

The day was foggy outside and leaves changing their color were a clear sign that fall was about to come. The management team at Sandworm came together in the board meeting room to make new decisions for the Wolf Spider project. What were the options?

Option 1: External resources could be employed from subcontractors that could speed up the project so that the seven-months incentive date could still be met. It was expected that overall costs of the project would go up by \$5 million for doing the procurement under time pressure and for paying the resources. This still ignored that most of the costs would not be outgoing payments against bills. Instead, it would be internal charges between cost centers, circulating inside the company. The scenarios discussed also included not meeting the incentive date after seven months and delivering late after nine months.

Option 2: It was assumed that the project could be done with the internal resources now at hand in nine months, which would mean to forfeit the seven-months incentive. Here, scenarios looked at included a possibility to miss the delivery date.

Option 3: Another option was to terminate the project right now. This would result in damage claims by the customer.

Figure 4 shows the three decision options and the expected outcomes. Option 1 includes the additional \$5 million for the additional personnel that would need to be procured from outside.

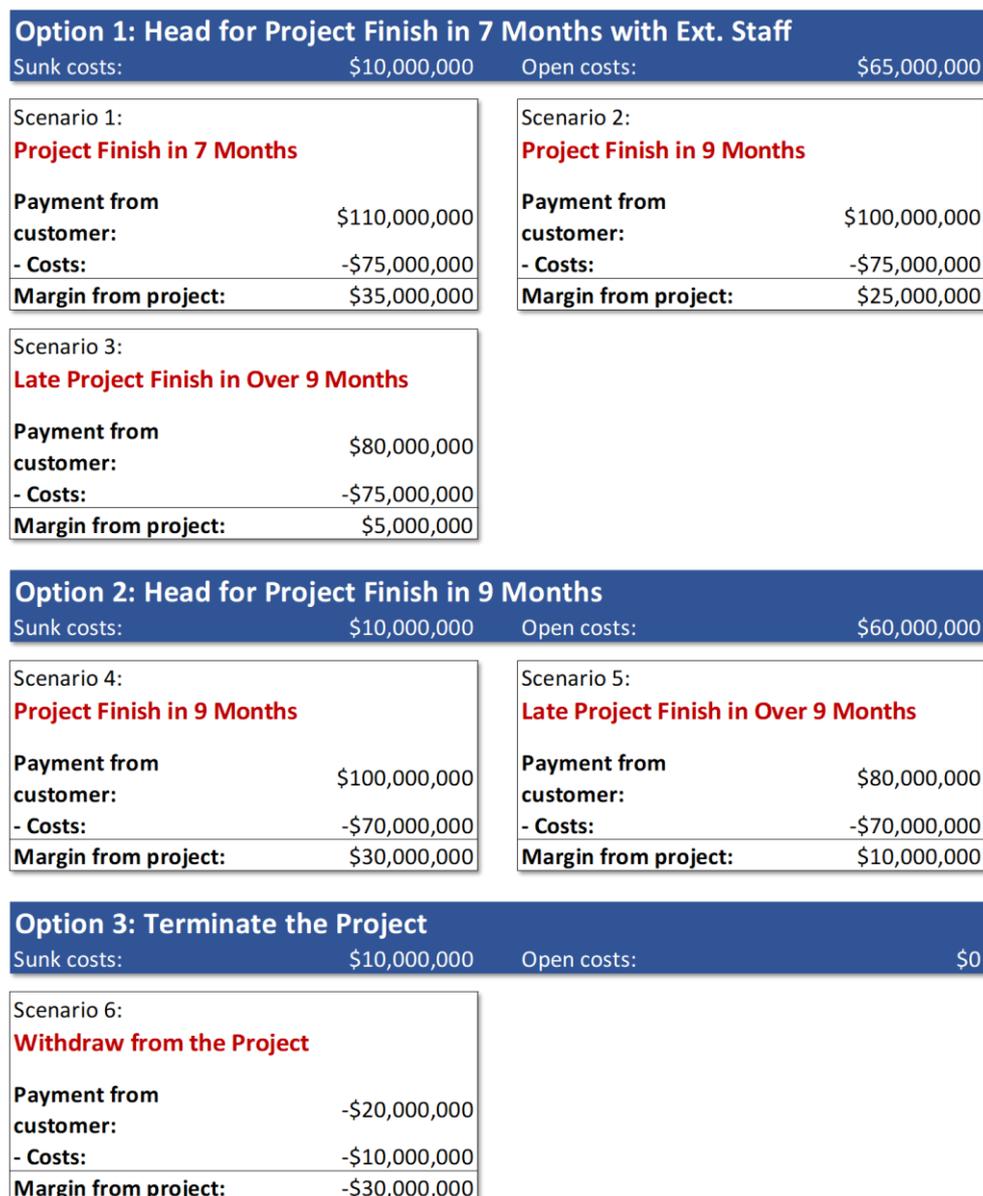


Figure 4: 2 months have passed since the start of the project. The options for the second basic decision and the outcome scenarios that would be expected.

It was clear for the management team that Option 3 would be rejected. There was some discussion whether to choose Option 1 or 2. Option 1 increased the costs of the project by 7%, but preserved the opportunity to achieve the contractual incentive. As it was also considered protective action to avoid not meeting the nine-months deadline and in addition

promised to reduce the pressure on Sandworm's credit line from the massive outlays for the customer. It was finally chosen.

It became an important aspect of the discussion that \$10 million were sunk costs. Whatever decision would be made, this amount was lost, so it was considered irrelevant for the decision⁴. The costs over which one could decide were solely the open costs, in the first option \$65 million, in the second option it would be \$60 million.

When the decision was made to chose Option 1, Sandworm's procurement department was tasked with finding external human resources on a temporary contractual basis, and the meeting was ended with diminished excitement. It may have been due to the weather, or caused by the disappointment that the original expectations for a highly profitable project would not be met, but the numbers were still looking good for Sandworm.

The Third Decision: Should We Go on With the Project?

The fifth month of the project was over. On a cold and rainy day, Sandworm's management team came together to discuss the status of its customer projects and make the next decisions.

Good news: The older project done for Red Ant Group was slowly getting out of its crisis. The additional personnel used to take it out of the trouble zone slowly showed effect, despite the fact that the efficiency of the project suffered from the resource overload.

The project performed for Wolf Spider however got deeper into troubles. The following causes were identified:

- The procurement of external staff was found to be more difficult than expected. The specialists needed for the project were scarce and busy with other work. Once found, they were not immediately available and Sandworm often had to wait weeks until they could be added to the project. They were also far more expensive than what was expected.
- The complex nature of the project and the extravaganza of some of the processes used on the customer side made it hard for the added team members to understand the task and contribute productively. There were also tensions with the existing team members, who felt that having to introduce the new staff took away time they would have needed to work on the solution. Interpersonal conflicts further added to what became a painful *Storming phase*⁵.
- The customer had to make provisions available to the contractor such as data structures and interfaces of existing systems to which the new solution would need to be connected. These came rather late and incomplete, and the described structures

⁴ Considering sunk costs in decision making is often referred to and correctly rejected as "Sunk cost fallacy".

⁵ (Tuckman, 1965)

of the legacy systems seemed inconsistent and not plausible. The team members had to develop workarounds that increased the risk of malfunctions, made additional testing and error-fixing necessary, and reduced the performance of the new software.

- The computer hardware provided by the customer was also found insufficient. While it generally met the specifications of Sandworm, some components used were not up-to-date and became performance bottlenecks. From the customer's point of view, it was the software that was too slow, not the hardware.
- The key resource, and also the scarcest one in most projects is management attention. There is no guarantee that with management attention, all other resources such as people, funding, and others will be available. However, without management attention, there will be a shortage of all other resources. In the case of Sandworm, the crisis project for Red Ants Group consumed so much management attention, that the Wolf Spider project got mostly rejected. Now, this project was also moving into crisis.

The management meeting had to learn that the ambitious seven-months objective for delivery was clearly no more feasible. The nine-months deadline could be met with some luck, or with adding even more resources, increasing project costs further.

The project had incurred so far \$55 million in sunk costs. The additional effort needed to finish it with existing resources was now estimated at \$45 million, leaving it uncertain whether this would be sufficient to meet the nine-months deadline.

Additional external resources would reduce the risk of missing the deadline, but given the time pressure, would also add another \$15 million in project costs.

Figure 5 shows that at that point in time all hope was gone to finish the project with a profit. One could demand that the project is stopped right now to not add further losses, but the termination of the project is actually the option with the by far highest shortfall, financially and given its impact on Sandworm's reputation. At least from a business standpoint, this option was not available.

To avoid the sunk cost fallacy, the decision was finally made based on the comparison of open costs and final payment by the customer, both amounts of money flowing in the future. Adding to that the business value of a happy customer and of a project that was not considered a failure, the decision was made to add further external resources and do everything possible to finish on time.

The project had turned from important to urgent, getting all management attention and other resources needed to end after nine months, which it finally did. It was already clear that the project in total would make a loss, but it seemed that the remaining investment was small compared with the expected payment and the gain in reputation on the market from the happy customer.

Option 1: Head for Project Finish in 9 Months with Ext. Staff			
Sunk costs:	\$55,000,000	Open costs:	\$60,000,000
Scenario 1: Project Finish in 9 Months		Scenario 2: Late Project Finish in Over 9 Months	
Payment from customer:	\$100,000,000	Payment from customer:	\$80,000,000
- Costs:	-\$115,000,000	- Costs:	-\$115,000,000
Margin from project:	-\$15,000,000	Margin from project:	-\$35,000,000
Option 2: Head for Project Finish in 9 Months with Existing Team			
Sunk costs:	\$55,000,000	Open costs:	\$45,000,000
Scenario 3: Project Finish in 9 Months		Scenario 4: Late Project Finish in Over 9 Months	
Payment from customer:	\$100,000,000	Payment from customer:	\$80,000,000
- Costs:	-\$100,000,000	- Costs:	-\$100,000,000
Margin from project:	\$0	Margin from project:	-\$20,000,000
Option 3: Terminate the Project			
Sunk costs:	\$55,000,000	Open costs:	\$0
Scenario 5: Withdraw from the Project			
Payment from customer:	-\$20,000,000		
- Costs:	-\$55,000,000		
Margin from project:	-\$75,000,000		

Figure 5: At the end of the 5th month, the incurred costs do not allow to finish the project with a profit. Should it be terminated?

Project Closeout

There was a snow storm outside, when Sandworm and the customer made a joint decision to finally close down the project. The final payment from the customer after handover and successful acceptance tests was indeed \$100,000,000, but the costs for Sandworm to do the project added up to 125,000,000, mostly because of the mounting bills for the use of external resources from subcontractors. A loss of \$25,000,000 in a project that was originally expected to bring a margin of \$35,000,000. In addition, the final payment from the customer came two months later than planned, which meant Sandworm had to go to the bank to subsidize almost the entire project for its customer over eleven months.

Despite the timely final delivery, customer satisfaction was also not as expected. Sandworm's team was worn out from the distress in the project and from the turnover of team members coming in from outside the company and leaving again after a short time. Developers would have appreciated working with a low degree of disruptions and a regular work rhythm. Both were impossible, given the short time that was finally left to finish the project successfully and the need to on- and off-board temporary team members. The tensions in the team and

the exhaustion from the pressure that it was under impacted the communications with the staff of the customer, which led to a number of requirements partially not met or completely missed. These requirements were not critical enough to be a reason to reject acceptance, but impacted the customer's satisfaction. Sandworm decided therefore not to use the Wolf Spider project as a reference.

Sandworm was in deep troubles that were made worse by the other project performed for Red Ant Group that had also been finished with a loss. The company was at the edge of insolvency and would not survive a third project like these.

Post Mortem Analysis

Following the rule book⁶, the project was audited and analyzed after its formal closure.

How could it fail financially in such a dramatic way? Which decision was the wrong one? The original one to bid for the project? Given Sandworm's business situation during that time, it was the best option. The same is true for the following decisions, in which the specifically best option was taken. A series of momentarily good decisions ended in a huge failure, in which none of the three corners of the magic triangle in Figure 2 was truly achieved.

Sandworm became aware that Project Business Management is generally high risk business, and that a combination of misfortune and insufficient management attention. Not enough had been done to predict difficulties coming up, some of which were predictable, such as delays when personnel was taken off the project to help the other project for Red Ant Group, but most troubles were rather unpredictable.

Game Theory for One Player

Game theory is an interesting discipline, which describes how a focus on particular interests of "players", such as contract partners working in a project, can lead to a failure of the overall systems. It helps describe the nuclear arms race, overfishing of the seas, pollution, massive release of climate gasses by industries and many more effects that are damaging to societies and possibly mankind.

In essence, one can distinguish between two so far well-described forms of game theory:

Two-player game theory: Examples for two-player games include chess, boxing, but also field games with two teams such as football. Game theory for two players was described by John v. Neumann and Oscar Morgenstern⁷ in 1944 using the famous prisoners' dilemma to show, how competitive behavior of the players leads to higher

⁶ (PMI, 2017, p. 41)

⁷ (Neumann & Morgenstern, 1944)

penalties, when cooperative behavior would be more beneficial for both.

N-player game theory: Examples for n-player games are race sports with more than two participants. The literature can be traced back to John Nash⁸, who expanded the previous work by introducing the “*Nash equilibrium*”, a stable condition that occurs, when all parties follow their individual interests and not the common good of all together, which can only be achieved by joint action⁹.

Rarely described so far is the occurrence of dilemma situation in one-player games. There is a number of games in which players do not compete with each other but with destiny and nature. Solitaire card games are an example for that, in which the player competes with pure chance. Kite surfers (and surfers in general) are athletes fighting against the forces of nature and the exhaustion in their muscles and joints. Mountain climbers are another example, in which a team has to act together as one player. One-player games have in common that physical or mental challenges are predictable only to a minor degree or not at all, and mastering them brings the person more satisfaction than winning over others.

In game theory, the focus is less on satisfaction. Instead, it deals with tangible payoffs, generally described in monetary units. Added benefit may come from intangible effects such as customer satisfaction that will make bringing money home easier in the future.

Game theory with two or more players focuses on the conflict between individual interests and the common good that can be achieved, when the common mission success is put first. One-player game theory rather looks at the conflict between individual small decisions and the overall outcomes they generate over time.

Most of the success obstacles for Sandworm in the example came as surprises. At any moment, the goal seemed nearer than it finally was. It was like a carrot on a stick that dangles only a short distance before the snout of a donkey, but while the donkey is moving forward, so is the carrot. Is it wrong for the donkey to follow it? If the stick is invisible to it, the donkey cannot know that it will not get the carrot at all, or will only get it when a destination has been reached, whose location is also unknown to the animal.

Sunk Cost Fallacy versus Sunk Cost Dilemma

Sunk cost fallacy describes the error of making already spent money relevant for decision making. One can compare this with parents, who bought a pair of expensive shoes for a child. When the child rejects to wear them, it hears that it has to do it because “the shoes were expensive”.

⁸ (Nash, 1950)

⁹ I described the often disastrous effects of game theoretical dilemmas on projects in my book “Situational Project Management – The Dynamics of Success and Failure” (Lehmann, 2016)

The sunk cost dilemma describes the quandary that can be caused when the sunk cost fallacy is successfully avoided: Relevant for the decision are solely the remaining open costs. When these are smaller than the overall benefit from the project that is expected, one goes on with the project. It is the effect that makes administrations and corporations waste large amounts of money: Once started, the project can no more be terminated despite getting out of hand step by step, finally turning a misadventure on a catastrophic scale.

One-player game theory dilemmas are sometimes also referred to as “Concorde effect”. This refers to the Concorde development, which had massive cost overruns that would never be paid back by the product business, but as these overruns were mostly sunk costs, they did no more influence decision making and the project was driven into further cost overruns. The sunk cost dilemma is an expression of the uncertainties that are characteristic for Project Business Management: Internal projects have to deal with uncertainties inside the performing organization. In contract projects, additional risks come from the contract partner(s), such as customers and/or contractors, which are even less known and understood than the internal ones.

Sunk costs are open to analysis and assessments as soon as one has data. However, decisions are made on future costs and benefits, that can be estimated and forecast, but not assessed.

Recommendations to Avoid Sunk Cost Dilemmas in Projects

Active risk management is recommendable to all projects. Rejecting it as “scaremongering” or “project fear” is a recipe for disaster. Active risk management becomes even more critical for projects under contract. Some measures that often prove effective:

Select the Most Suitable Contract Type

This is often difficult, as it is based on a joint agreement. Place the risks, particularly the cost risks, on the side of the contract that wants to have most influence on the project, such as frequent and easy change requests. A lot is possible as long as it is paid. If a customer cannot describe situation-specific requirements, or a vendor cannot sufficiently describe a standard product that is intended to be used, risks associated with that uncertainty should be placed on the party with the responsibility for that.

A popular approach “Money for nothing and change for free” can go wrong in unexpected ways.

Ensure Continuing Management Attention for the Project

Management attention is the scarcest and most valuable resource in any project. Attention deficit syndrome is not only a behavioral problem with children, it is a common cause for project failure. Management attention helps identify obstacles and uncertainties early and

respond with appropriate measures. Early response generally mean, that more options are available and their costs are much less.

The responsibility to ensure management attention lays on both project manager and management. The project manager has to keep management updated on the progress of the project and issues that need to be resolved. Management should ensure that tasks such as sponsorship and change request management are performed in a timely manner.

Keep Registers of Assumptions, Constraints, and Stakeholders and of other Forms of Uncertainties

Documenting the uncertainties that underlie decisions that need to be made with sufficient facts at hand is a way to keep all participants aware of the risks in the project. Undocumented, it gets often forgotten that decisions have been made based on assumptions. Assumptions can prove wrong, which could mean that the decision was wrong too.

One should also not forget: An estimate is an assumption with a number on.

Constraints and stakeholders should be logged as well, just to make sure that they do not get forgotten. They are also a cause of uncertainty and of project risks.

Observe the Team(s)

When team members wear off, their performance diminishes, individually or as a group, team spirit and mission awareness fade and goal orientation wanes because error fixing binds attention, it is time to research the causes of the problem and find solutions.

In many organizations, the burden on the team to maintain its spirit is substantial. Reorganizations and team turnover throw leveled and equipoised teams out of balance, forcing team members to redefine their roles, relationships, and interpersonal interfaces. Add the temporary nature of team assignments and the frequent mission changes of projects, and it does not take much empathy to understand what difficulties team members can face.

Know Your Contract Partner(s)

Inadequate organization on customer side can impact the success of the contractor and vice versa. Companies can be over-organized for projects, or underorganized. Or just disorganized – over-organized in general, but under-organized for the needs of the specific project. Often, the contract partner is the primary source of project risk.

Identifying these risks early and taking steps to prevent the project from getting damaged when they occur may then be the most important skill of a project manager.

In projects with more than one contractor it may be advisable to replace the intransparent network of bilateral contracts with a multilateral solution, such as a customer-driven consortium, also known as a project alliance¹⁰.

Identify “the Stick”

When a project under contract is initiated, it may already be observable that expectations are overly optimistic, and that the drivers of costs, delays, extended work and of team disharmony are visible but ignored. Realism is among the most important characteristics of effective project managers, and part of this realism is accepting and managing uncertainty.

Teach Employees Project Business Management

Project management has a focus on organizational matters, and many organizations are well capable to train their project managers in leading internal and cross-functional teams.

Project business management adds a commercial and a legal level on top of that, as it changes the focus from cross-functional to cross-corporate settings¹¹. Business acumen and the ability to make legally prudent decisions are necessary elements of doing projects with business partners.

Project managers are rarely prepared for project management as a business matter, and those who are had to learn it by trial and error. Trial in projects under contract is expensive.

Error even more.

¹⁰ (Heptinstall, 2016)

¹¹ (Lehmann, 2018)

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His seminal book "[Project Business Management](#)" has been published by Auerbach / Taylor & Francis in June 2018 (ISBN 978-1138197503).