

OUTSOURCING DEVELOPMENT AND LIFE CYCLE MANAGEMENT

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ABSTRACT

During the last few decades we have seen the development of open supply chains for production. These supply chains are quite mature in terms of balanced relationships between OEMs and suppliers, as well as in terms of the associated business models and ways of working. The expectation is that we will see a similar development towards open supply chains for Development and Life Cycle Management (D&LCM) during the next few decades.

Outsourcing D&LCM involves three challenges. The outsourcing of Development requires the Original Equipment Manufacturer (OEM) and the supplier to manage development projects carefully and to agree on fair risk-reward schemes for the risks associated with innovation, including technology risks, warranty on design and intellectual property. After outsourcing Development, the outsourcing of Life Cycle Management is often a relatively small step, but the implications are significant, as this outsourcing will impact virtually all disciplines in both organizations. Again, this requires compensation and risk-reward schemes, which should create a win-win situation for both parties. Managing the cooperation between the OEM and the supplier can easily become as complex as managing an alliance between companies, requiring great strategic alignment, a high level of operational integration and comprehensive contracts.

The selection of a D&LCM partner requires a broad approach. The Total Quality Model is introduced as a means to guarantee such a broad approach. It touches all relevant organizational enablers: leadership and strategy, resources, people competencies, and processes. It also provides a guide to evaluating the relevant result areas: customer satisfaction, people and society -related results and business results.

The implementation of the alliance is described as a step-by-step process. It requires continuous management of the balance between control and trust between the alliance partners. Once the alliance is established, it requires continuous evaluation and improvement, and it can be developed further by longer term joint product and competence roadmaps. Finally, there are some considerations around ending a D&LCM partnership, or not.

Prerequisite	Generic knowledge of innovation management and alliance management.
Objectives of the lecture	<ul style="list-style-type: none"> - Understanding the relevant industry trend towards outsourcing D&LCM. - Understanding the three key challenges for outsourcing D&LCM and the ways to deal with them. - Understanding the methods to select a D&LCM partner. - Understanding the way to organize a D&LCM partnership.
Workload	4-6h teaching; 4 h self-study.
Learning outcomes	<p>Knowledge</p> <p>LO #2: To explore the concepts of collaborative innovation and apply them.</p> <p>LO #38: To identify the nature and characteristics of the innovation process.</p> <p>LO #56: To understand the dynamics of Alliance formation.</p> <p>Skills</p> <p>LO #30: To identify and plan the phases and factors of innovation activity in a firm from the life-cycle viewpoint.</p> <p>LO #71: To identify Open Innovation activities in real life companies. To appraise the key indicators for successful implementation of the open innovation model in an organization. To identify the key success factors related to open innovation strategies on organizations.</p>
Reading List	<p>Steenbergen, Wim. Outsourcing Development & Life Cycle Management. Eindhoven : www.wimsteenbergen.com, 2017.</p> <p>Chesbrough, H. Open Innovation. sl : Harvard Business School Press, 2003.</p> <p>Man, Ard Pieter de. Alliances. sl : Wiley, 2003.</p> <p>Lencioni, Patrick. The Five Dysfunctions of a Team. 2002.</p> <p>Bell, John H.J. Walking the tight rope: balancing between cooperation and competition. sl : Katholieke Universiteit Nijmegen, 2003.</p> <p>Weele, Arjan J. van. Purchasing and Supply Chain Management - 6th edition. sl : CENGAGE Learning, 2014.</p>
European Qualifications Framework (EQF) Level	Levels 6, 7.

INTRODUCTION

THE GENESIS OF AN OPEN INNOVATION NETWORK

During the last few decades we have seen the trend of outsourcing activities which are not the core activities of an organization and which could be executed more effectively by specialist organizations. This has happened for secondary processes like ICT, administration and catering, and for primary processes like the production of parts, modules or complete products.

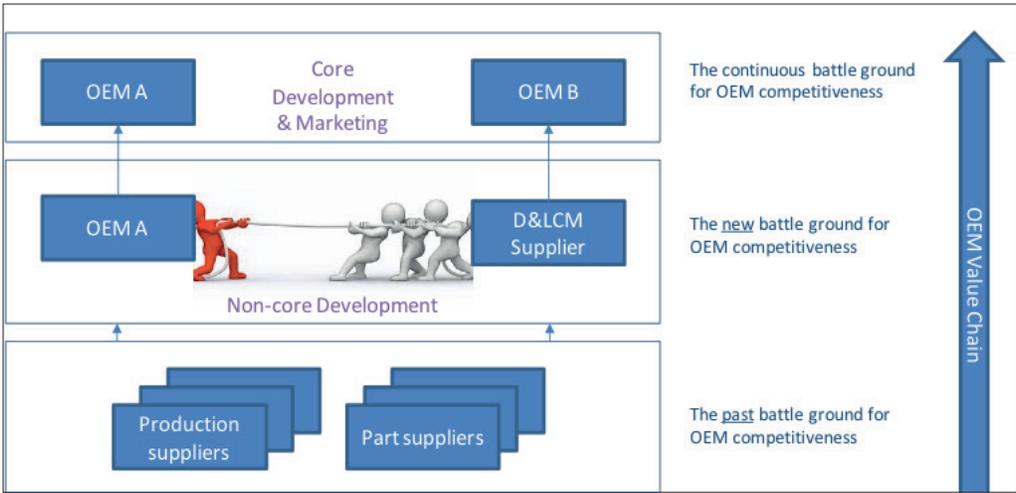


Figure 1. OEM Value chain with the new battle ground called Open Innovation

Figure 1 shows a simplified value chain of an OEM. The continuous battle of an OEM is in the area of its core development and marketing. Core development refers to the innovation activities which allow the OEM to differentiate itself in its market. This innovation will typically be done by the OEM. At the bottom of figure 1 we see what we call the past battle ground of competitiveness: outsourcing of parts and of production. During the last few decades we have seen the trend from totally vertically integrated OEMs towards open supply chains.

At the middle level of figure 1 we find the development activities which are relevant, but not core for the OEM. This is where a new battle has started to develop. Suppliers are specializing in development competencies, which are relevant but not core to the OEM. This is where the OEM will need to benchmark its own development activities and to take strategic decisions about 'make and buy'. Not making such strategic tradeoffs may turn into a competitive threat, just like staying as a vertically integrated production company became a threat just a few decades ago.

While the open supply chains for production are quite mature in terms of balanced relationships between OEMs and suppliers and in terms of the associated business models and ways of working,

the supply chain for Development and Life Cycle Management is still quite immature. There is very little literature about this form of outsourcing. This contribution provides an introduction to the 'new battle ground for OEM competitiveness': the outsourcing of Development & Life Cycle Management (D&LCM). The contribution is a summary of a book that will be published in early 2017 (Steenbergen, 2017). The book aims at contributing to the development of a mature supply chain for D&LCM and, as such, at contributing to the Genesis of an Open Innovation network.

There are various reasons to outsource D&LCM. Figure 2 is an adaptation of Chesbrough's Open Innovation funnel (Chesbrough, 2003), with three examples of the role of the D&LCM supplier:

1. An OEM who decides that they will get a better return on innovation investment by letting their own development resources focus on the core competences of the company. The D&LCM supplier is asked to provide D&LCM with non-core modules or products. Example: a manufacturer with 6 billion euro revenues who outsources D&LCM for non-core modules of its lithography machine.
2. An OEM who does have its own development competence in a new relevant innovation area. Outsourcing makes sense because building up development competencies can easily take 2 to 3 years, and it is costly and risky. Example: a supplier of bottling lines (around 1 billion euro revenues) who outsources the development and production of printing modules to enable direct printing on bottles.
3. A start-up with researchers and a core technology, but without a development organization. Again, time to market and risk reduction are important reasons to outsource D&LCM. Example: a market leader in table top electron microscopy who outsources part of its developments to gain time to market.

Finally, there are economies of scale. The supplier development organization can develop products and modules for multiple OEMs, which can make this development organization more effective than the development organization of the OEM. This is especially likely when non-core products or modules do not require a continuous development effort, and this does not justify having own OEM development resources available all the time.

The ways of working in this contribution were developed in the high-tech machine industry. OEMs and suppliers in other markets are recommended to consider the adoption of similar ways of working.

THREE CHALLENGES

Outsourcing D&LCM involves three big challenges. The first challenge is outsourcing Development. The people in OEMs who are typically involved in outsourcing (for instance purchasers) do not necessarily understand how development works, what development risks are and what reasonable

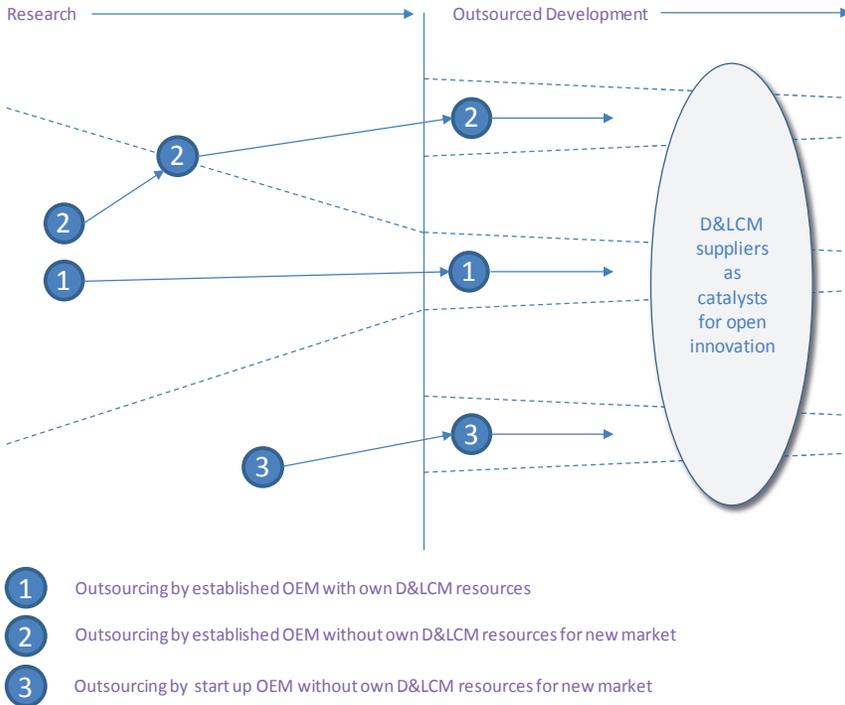


Figure 2. Open Innovation and outsourcing D&LCM (adapted from Chesbrough (2))

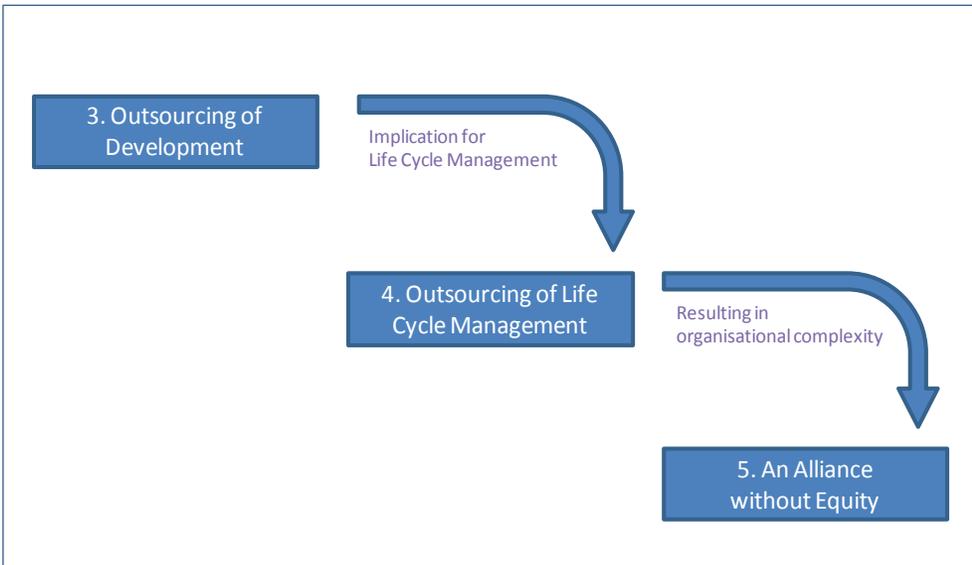


Figure 3. How a seemingly small decision grows big

risk-reward models are. Paragraph *Outsourcing Development* provides some basic insights into this subject matter: Once Development has been outsourced, it makes a lot of sense to outsource Life Cycle Management as well. It is important for the D&LCM partners to realize this dependency from the outset and to make it part of the scope of the cooperation (Paragraph *Outsourcing Life Cycle Management*). The implication is that virtually all disciplines in the partner organizations will have to work together, very much like in an Alliance, but this time there is no equity stake, or one line of command that will eventually deal with costs and risks and with profit and loss. In a D&LCM partnership all the elements of the cooperation need to be translated into a financial win-win, with a fair risk reward (Paragraph *An Alliance without equity stake*).

OUTSOURCING DEVELOPMENT

Outsourcing development typically involves innovation risks. People are challenged to develop and build a product they have never built before. As a result, the outcome of a development project is uncertain when it starts, both in terms of product functionality and in terms of cost and lead time to develop the product. To manage this uncertainty, a development project is normally split into various phases (Figure 4).

- The Definition phase is meant to agree on the product requirements. This is not an easy task, especially when we are dealing with complex, high tech products. In this phase also the critical design and production process elements are identified, which makes it difficult to predict the outcome of the project.
- In the Feasibility study the critical design and process elements are investigated. This helps to reduce the risk in the subsequent phases of the project to an acceptable level. The result of this phase is a set of concept choices for the actual design of the product.

The first two phases are very dynamic, and they are hard to plan. They should be considered as part of the innovation risk the OEM is willing to take when starting a project. This implies that the supplier will typically not be able to offer a fixed price quote for these phases and will be compensated by the OEM for all related costs. The subsequent phases, however, should be considered as phases in which the supplier uses its workmanship in a way that can be planned reliably. The supplier can therefore offer these phases for a fixed price. The exception is when both parties agree to start these phases with a residual innovation risk.

- In the Design phase the design is worked out in detail, for instance as drawings for mechanical and optical parts, designs for printed circuit boards, or software.
- In the Product Validation phase the first prototype is built and tested.
- In the Process Validation phase the production process is tested to prepare for volume production.

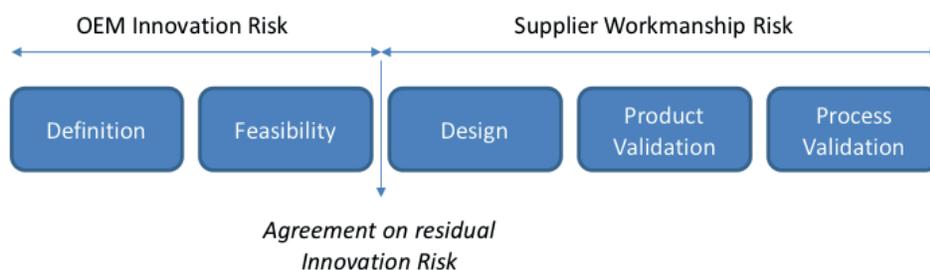


Figure 4. Development Project phases and innovation risk

Besides project-related risks there are various other types of risks associated with Development. The implications of these risks are normally absorbed by the OEM. This is one of the reasons why OEMs typically have much higher gross margins than their suppliers. When outsourcing development it needs to be agreed explicitly who carries these risks. When the supplier accepts these risks, he needs to be compensated for it.

- Design warranty – after a product has been released to be sold, problems with the design may pop up. This may lead to costs of redesigns, scrapping of faulty parts and upgrades in the field.
- Patent infringement – even after lots of research, it may turn out that the product design violates the patent rights of someone else. This may lead to financial claims.

Finally, there is Intellectual Property (IP). During the development project the supplier may develop a new IP, possibly together with the OEM. It needs to be agreed if and how this new IP can be applied after the project by the supplier and / or the OEM.

OUTSOURCING LIFE CYCLE MANAGEMENT

In the previous section we have described that Development involves both product design and production process design. For this reason it makes sense to ask the Development partner to take the responsibility for the production and the supply chain management of the product. This avoids additional costs and risks associated with the transfer of the product design to another production partner. It also avoids unclarity about product responsibility, for instance at the appearance of a warranty claim.

Another element of life cycle management is customer service. The partners will have to agree on the way of working, for instance on who will be responsible for the installation of the product, product training, and for maintenance and repairs.

Finally, life cycle management requires clear agreements about product roadmap responsibilities. Examples of this are management of component obsolescence, a cost roadmap to address market price pressure, and product upgrades.

Every element of life cycle management has its own characteristics and therefore requires its own compensation or risk-reward model.

AN ALLIANCE WITHOUT EQUITY STAKE

The implication of the development and life cycle management activities is that virtually all functions in the OEM and the supplier organization get involved in the cooperation, very much like in an Alliance. The difference is that the companies will in general not be interested in equity stakes. One important reason for this is that the supplier will want to have the freedom to work with the competitors of the OEM.

De Man (2003) describes various forms of alliances. In his terminology the outsourcing of D&LCM can best be described as a contractual alliance. Figure 5 shows a model to illustrate the scope and depth of D&LCM cooperation:

- Outsourcing of D&LCM will normally require a long-term relationship, and therefore the level of strategic integration should be high. This involves for instance the alignment of product and competence roadmaps.
- In the previous section we have seen that the level of operational integration is also very high.
- The financial integration shall be contractual, with risk-reward elements. The challenge is that many of the costs related to this type of cooperation are rather hidden inside the OEM, for instance the costs for design warranty or obsolescence management.

D&LCM PARTNER SELECTION

Once the decision is made to look for a D&LCM partner the question is: how do we select the right partner for such a complex cooperation? Part of the answer is: a structure to ensure that all relevant aspects of the partnership are evaluated. Figure 6 proposes the Total Quality Management (TQM) model as a framework, because it captures both the enablers and results of the potential partner and offers a mechanism for continuous improvement once the partnership has been established. It is possible to work with scoring mechanisms and weighing factors for all TQM elements to allow for numeric comparison of potential partners. It is recommended to also 'score' the development organization of the OEM, if applicable. This will help to either confirm or deny the assumption that outsourcing D&LCM was a good idea in the first place. Also, the comparison with the own organization helps to communicate about the rationale of outsourcing.

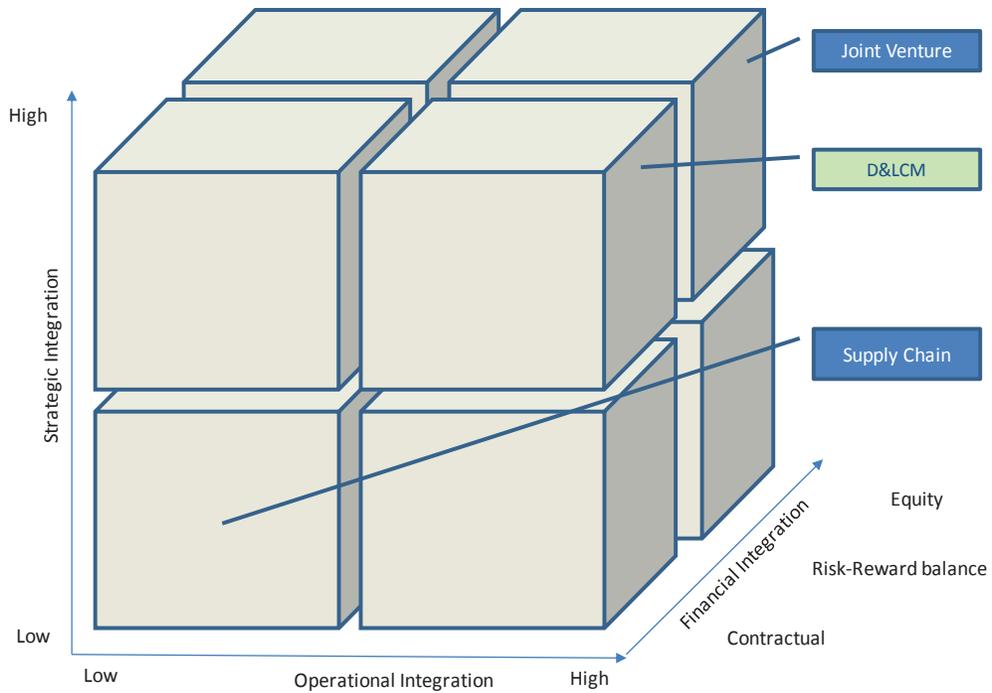


Figure 5. Alliances framework (adapted from De Man, (3), Fig I.1)

Some examples of possible criteria are listed here:

- Strategy: alignment of vision, mission and objectives; balance in win-win between the partners; and sustainability of the D&LCM partner (e.g. financially).
- Resources: leadership skills; technical skills, infrastructure and tools; team distance in terms of geography, language and culture; team maturity (Lencioni, 2002; and alliance maturity (Bell, 2003)).
- Organization and processes: organizational structure and culture, process maturity, governance model for the partnership.
- Results: customer satisfaction in terms of technology, quality, logistics and cost; financial results in terms of (long-term) profitability, creditworthiness and future financial dependency of the partners; employee satisfaction, illness rates, employee turnover; societal results in terms of labour conditions, and the ecological footprint.

Ideally, the possible future partnership should also be looked at from the Total Cost of Ownership perspective. Figure 7 shows an illustrative profit & loss account of the OEM before and after the outsourcing of D&LCM. It highlights the regular costs and the Cost of Risk (CoR), which need to be translated into a risk-reward model in case the supplier accepts the associated risks. After the outsourcing, the D&LCM costs move from the OEM to the supplier. The model shows the

temporary extra transaction costs of implementing the partnership. Somewhere in this model the OEM should be able to identify savings or extra revenue that will allow for a surplus profit margin for the OEM.

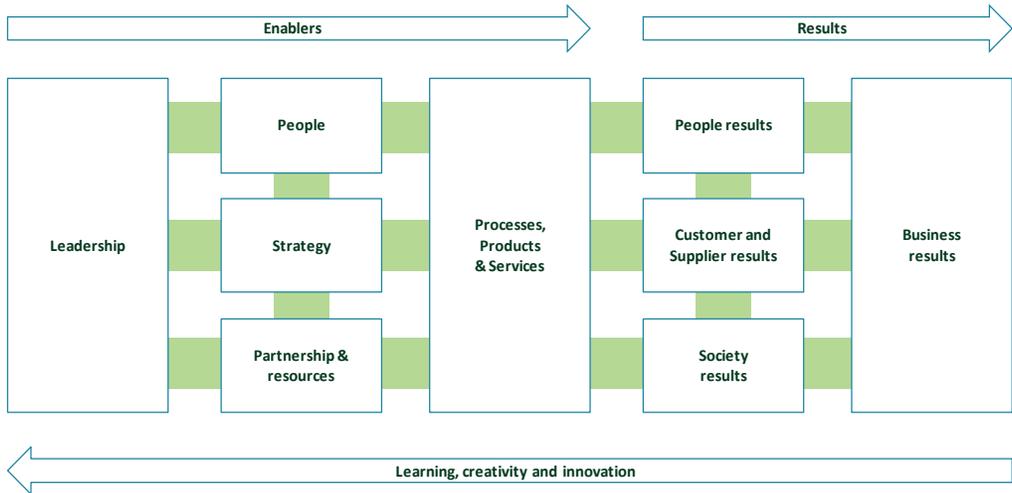


Figure 6. Total Quality Management Model

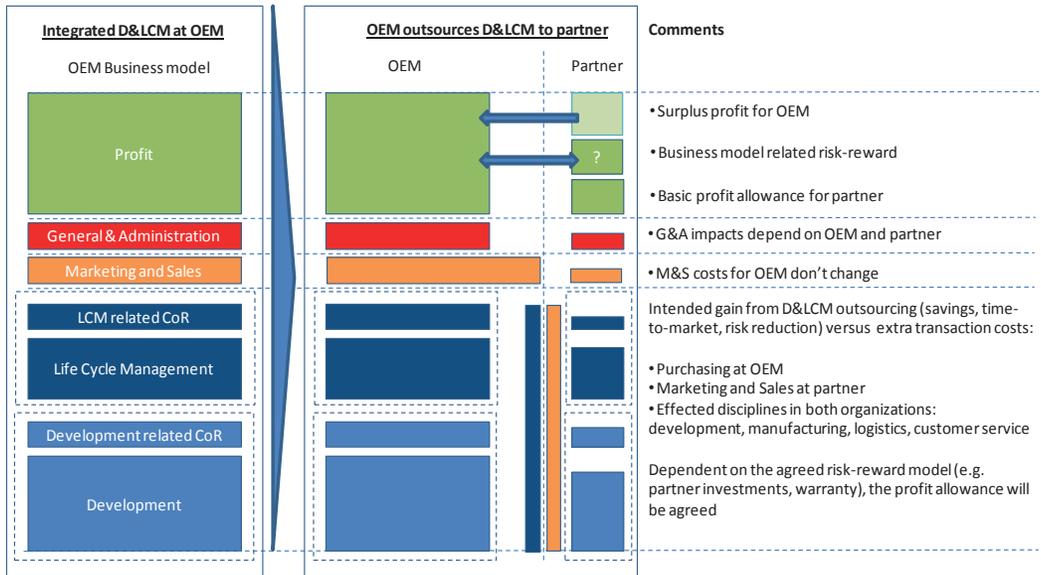


Figure 7. Total Cost of Ownership Model

D&LCM PARTNERSHIP ORGANIZATION

After the selection of the D&LCM partner the challenge to organize the partnership starts. Figure 8 shows the lifecycle of an alliance. It introduces the essential element of trust as a basis for a D&LCM partnership. The previous sections described the first three steps in the lifecycle: the strategic analysis, preparations for the alliance and partner selection. Between the last two steps, trust between the partners will have to be developed as a basis for the organization of the partnership. In this section the highlights of the other steps are introduced.

Building an D&LCM alliance requires two types of agreements and a balance between these two: control and trust (De Man, 2003). The cooperation will often be too complex to manage via strict controls only. There needs to be a basis of trust, which allows the partners to discuss and solve challenges and possibly change the objectives along the way.

Examples of elements in a control agreement include:

- objectives, for instance per development phase,
- evaluation criteria, for instance a test specification to prove that the product complies with the OEM's requirements,
- financial win-win, including business models for life cycle management and risk-reward, and
- a 'transactional change management' program: the many interactions between the two partners may require actions to adapt for instance the organization, processes, tools, or competences.

The trust (or behaviour) agreement may consist of the following elements:

- transparency in for instance cost models and technological challenges,
- insight into the competences of the key people who are part of the cooperation, for instance a system architect, a project manager or the alliance manager, and
- periodic evaluation moments, for instance to compare the actual results of the cooperation with the scores during the partner selection process.

The implementation of the alliance will require strong leadership, both by the alliance managers and the various relevant management levels in both organizations. A governance model will be needed to cooperate at the strategic level (typically executive-level managers), the tactical level (typically the alliance managers) and the operational level (typically the project managers and operations managers). The managers will also have to manage the impact of the alliance at an individual employee level, for instance by minimizing possible fears of uncertainty by creating a 'sense of opportunity'. First and foremost, the leadership will have to manage the balance between control and trust.

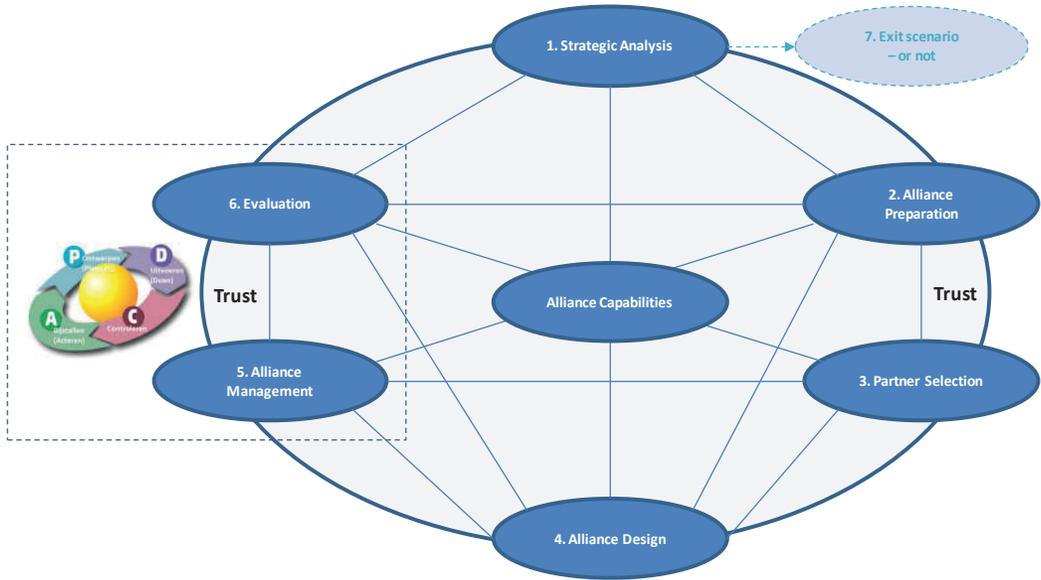


Figure 8. Adapted from Philips Alliance Lifecycle (5)

Once the alliance has been established it needs to be maintained and developed. During periodic evaluations at strategic, tactical and operational level, improvement actions can be defined and monitored. A specific element of this type of alliance management is the periodic alignment of roadmaps for OEM products and supplier competences, infrastructure and tools. Useful sources to learn more about this phase of cooperation are pages 352-355 in chapter 'Supplier Development' of 'Purchasing and Supply Chain management' (Van Weele, 2014) and Chapter 8 of 'Alliances' (De Man, 2003).

The partnership may come to an end for many reasons. Poor performance of one or two of the partners can be a reason. Also changing market conditions or strategies for one or two of the partners are possible. The impact of an exit scenario will be big, probably comparable to the impact of the start of the partnership. For that reason it is recommended to at least redo the strategic analysis before taking such a decision. Even repeating the partner selection exercise may be needed to underpin such an important decision.

KEY TAKE-AWAYS

- The development of an Open Innovation network requires the development of ways of working, fair compensation and risk-reward models between OEMs and suppliers.
- Managing Open Innovation partnerships starts with deep and comprehensive understanding of all the possible implications of outsourcing Development & Life Cycle Management.
- Proven methods for Alliance management are recommended for the selection of a D&LCM partner and the subsequent implementation of the partnership.

TEACHING GUIDELINES

In general

- Discuss the outsourcing of D&LCM from both the OEM and the supplier perspective.

Example assessment questions

- How can mature D&LCM ways of working contribute to the development and growth of Open Innovation networks?
- In what ways are the supply chains for D&LCM not mature yet? Compare with open supply chains for production.
- What are the key challenges in managing outsourced development? Propose solutions.
- Explain how outsourcing development often results in a non-equity alliance between the OEM and the supplier.
- Describe the main elements of the selection process of a D&LCM supplier.
- Implementing and managing a D&LCM alliance requires a balance between Control and Trust
 - Explain why Trust is so important
 - Describe examples of Control agreements in D&LCM alliance
 - Describe examples of Trust agreements in D&LCM alliance
- Just like any long term relationship, a D&LCM alliance requires to be maintained and, ideally, developed: describe how this can be done.

Example case studies

- An OEM who has its own development resources, but considers outsourcing part of its existing, non-core development activities:
 - Describe the relevant Cost of Ownership considerations which can lead to the outsourcing decision.
 - Propose a financial compensation and a risk-reward model for the development.

- o Propose a financial compensation and a risk-reward model for life cycle management services.
- o If possible, present a high-level discounted cash flow calculation with high-level financial assumptions.
- An OEM who does not have its own resources with a given development competence.
 - o Answer the same questions as above.

REFERENCES

- Bell, J. H.J. (2003). Walking the tight rope: balancing between cooperation and competition. sl: Katholieke Universiteit Nijmegen.
- Chesbrough, H. (2003). Open innovation: The new imperative for creating and profiting from technology. 2003. Boston: Harvard Business School.
- De Man, A. P. (2003). Alliances. sl: Wiley.
- Lencioni, P.M. (2002). The five dysfunctions of a team: A leadership fable, 13. John Wiley & Sons.
- Steenbergen, W., (2017). Outsourcing Development & Life Cycle Management. Eindhoven. Retrieved from www.wimsteenbergen.com.
- Van Weele, A.J. (2014). Purchasing and Supply Chain Management - 6th edition. sl : CENGAGE Learning.