Management for Professionals

Stephan Lunau (Ed.)
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Design for Six Sigma+Lean Toolset

Mindset for Successful Innovations

Second Edition

UMS+ ENABLING SUCCESS

Springer

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Foreword to the Second Edition

Innovation has been developed to a key focus of our work. Driven by this focus we have upgraded, refreshed and extended our advice about the mind and tool set for the Design for Six Sigma methodology within the new edition of the DFSS^{+Lean} Toolset.

In the future, the Toolset will help you identify and select good ideas and transform them into commercially successful product and process innovations. We have added some topical new elements to the Toolset and developed a common guideline so that you will find it easier to solve those more complex challenges. Still based on the popular DMADV model we have created a question based approach which will help you select the best tools for your purpose thus avoiding getting lost in the "Tool Jungle".

What we hope will be a very useful addition to this edition are the practical tips drawn from our project work which serve to reinforce the tools contained within each phase. There is also one example that is carried through the duration of the text to provide the continuity that is so important to building understanding.

New to this edition are some reflections on items that need to be taken into account during the process development, chief among these is the "Process Design Workout" which is designed to accelerate process development projects.

Migrating from a tool based approach to a question based approach is a decisive success factor in our opinion enabling firstly, increased efficiency of project work for the Project Leader, his team and the associated Stakeholders, and secondly, significantly increasing the probability of success for the respective innovation projects.

Try it out – we are looking forward to sharing your experiences and incorporating them into future editions of this book.

We, the authors of the UMS Team, hope you will have fun and success when applying the methodology.

Frankfurt am Main, August 2013

Stephan Lunau

Foreword to the First Edition

Every company relies on innovation to compete globally. However, creative ideas are mostly insufficient if you want to translate an innovative spirit into commercial success. The ability to put a new product or a new process on the market as quickly as possible is becoming increasingly important.
Systematic management is necessary for developing cost-effective and successful products based on market realities and customer requirements. Especially open innovation, which is currently intensively discussed and widely implemented, requires consideration. Only a sensible interface and information management is capable of generating overall success from a variety of good ideas.

Design for Six Sigma^{+Lean} is an approach for such a systematic innovation management.
This concept was developed to achieve a target-oriented realization of innovations and is strongly associated with the Six Sigma^{+Lean} methodology, currently applied globally to optimize existing processes. DFSS^{+Lean} synthesizes a number of key factors, including the active integration of employees, customer-oriented development, the reduction of complexity in products and processes, and controlling of innovation in terms of a standardized procedure.

The present toolset represents the proven approach UMS takes when putting Design for Six Sigma^{+Lean} into practice. Its individual tools are assigned to the process model Define, Measure, Analyze, Design, and Verify in a clear and manageable structure. This structure can be considered as a red thread and makes it easier to apply the tools in practice and organize an innovative product and process development that is target-oriented and efficient.

Besides the whole UMS team, I would like to thank the authors, who along with their expertise and experience have shown enormous commitment in putting this book together. My thanks also go to Mariana Winterhager for the graphic layout of the material and Astrid Schmitz for the translation work.

I wish everyone great success in implementing innovations.

Frankfurt am Main, October 2008

Stephan Lunau

DESIGN FOR SIX SIGMA+LEAN TOOLSET

INTRODUCTION

C. Staudter et al., *Design for Six Sigma+Lean Toolset: Mindset for Successful Innovations*, Management for Professionals, DOI 10.1007/978-3-642-41455-8_1,

Introduction

“The capacity to innovate determines our fate.”
(Federal President Roman Herzog in his speech "Emergence into the 21st Century" on April 26, 1997)

Today, the capacity to innovate is one of the key success factors of a company. According to a benchmarking study carried out by American Productivity and Quality Control (APQC), companies that display strong growth rates generate one third of their turnover from products which are less than three years old. Moreover, over the last 50 years there has been a drastic reduction in product life cycles.[1)] Those who don't improve continuously and quickly enough are shaken off by global competition. This applies particularly to companies from the key industrial nations since they cannot stand up to competitors from Asia in terms of costs let alone the fact that these companies are also working at full speed on their own innovative strength.[2)] Whilst most companies recognize this circumstance, many have not yet instigated action plans which focus on innovation to a sufficient extent. In a study from the year 2008, 87% of the medium to large sized companies surveyed evaluated innovative strength as the key value driver. In their own opinion only 60% of them reacted to this situation appropriately.[3)] Politicians also heeded the pressure to act. The European Commission provided a budget amounting to $ 8 billion to support innovative strength in the year 2011 an increase of 12% compared to 2010.[4)]

Pursuing excellence in innovative capability is the goal of this book. However, the activities connected to this pursuit, must be put in a wider context, since excellent innovative strength is only possible in a successfully functioning corporate structure. Business Excellence, i.e. the maximizing performance capability in all areas of economic affairs, must be the prime goal. Operational Excellence which realizes effective and efficient business processes, must be combined with Commercial Excellence i.e. optimal market development and exploitation of customer potential, before Business Excellence can be achieved. People Excellence ultimately underpins all of this. It ensures competence and motivation of employees and thus enables best performance for a company's success in all areas.

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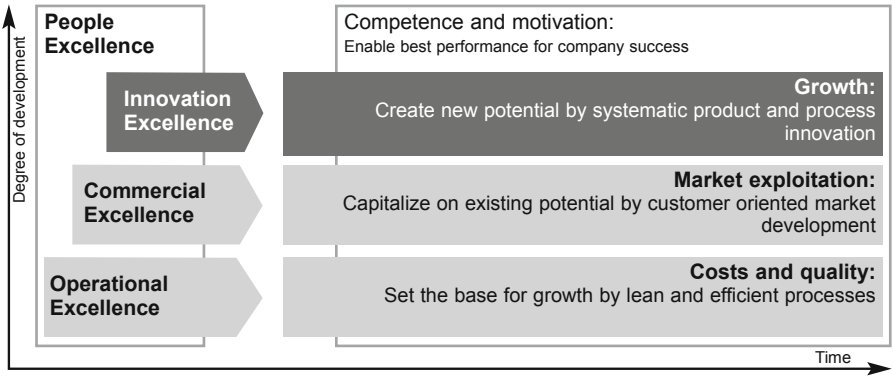
1 American Productivity & Quality Center (2003): Improving New Product Development Performance and Practices. Houston (TX): APQC

2 Cf. Der Spiegel, Issue 34/2010: Die Rivalen. China gegen Deutschland – Kampf um die Weltmärkte

3 Christoph Wamser/Klaus Deimel/Karsten Heinrich: Studie über Werttreiber in Unternehmen, MBA Research Institute at Bonn-Rhine-Sieg University of Applied Sciences, 2008

4 Press release by the European Commission: http://ec.europa.eu/research/fp7/index_en.cfm as of 09/13/2010

Illustration: Overview Business Excellence



How far away most companies are from the excellence claim is exemplified by the fact that for every 100 research and development projects only about 37 are concluded with a successful market launch and from which only two out of three reach the set targets for time and cost.[5)] What is needed to overcome this state of resource waste can be described by five success factors.

Illustration: Action fields of Innovation Excellence

Focus	• Which goals are pursued? • How is innovation measured? • How is the climate for innovation supported?
Process	• What must the innovation process deliver? • How is the innovation process controlled? • How is the process anchored in the company?
Tool	• Which methods are used in the course of innovation management? • How are old and new methodologies linked?
Skill	• Does the corporate culture promote innovation? • Do the employees have everything necessary for developing and implementing innovations?
Structure	• Have responsibilities and mechanisms for decision making been defined? • Have resources been assigned to the topic?

5 Horváth & Partner: Benchmarking study: "F&E-CONTROLLING", reference period 2008

The company and/or the respective business unit, determines the innovative strategy by the **focus** applied. First, the basic decision for a generic strategy must be made. This should take into account their technology's life cycle, their competence as well as the company's competitive position.

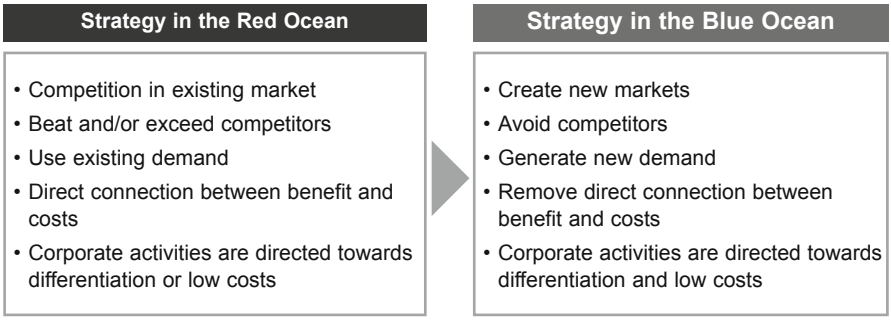
Illustration: Alternative technological strategies

Generic Technology Strategy	Implication for the technology and competence portfolio
Technological Leadership	• Innovative leader in the industry (first mover) • Setup of a leading position in all technologies of the industry • Pronounced strength in all key and pacemaker technologies • If possible own developments in key and pacemaker technologies
Technological Presence Strategy	• Presence/strategy of the fast follower • Capacity to maintain at least a medium position in all technologies • If possible leadership position in one/few key technologies
Technological Niche Strategy	• Focus on limited number of industry critical technologies • Niche strategy in market segments, in which these technologies have a strong influence on the critical success factors
Technological Acquisition	• Strong market presence which is jeopardized by lack of technological strength • Acquisition of skills by acquiring companies/teams
Technological Joint Venture	• High degree of technological innovation but with limited implementation skills • Collaborative technology implementation with partners possessing complementary strengths
Technological Streamlining	• Medium to low innovation progression and defensive technology development • Maintenance of a presence only in the critical technologies of an industry
Technological Withdrawal	• To the greatest extent possible external procurement of know-how and reduction of own development resources

Only on the basis of the selected strategy can the specific development goals and respective key performance figures be derived. These provide the reference points for determining the specific development activities and budgets.

Especially for companies having a medium to weak competitive position with respect to a specific technology or business field, should the approach for finding a strategy be supported by the Blue Ocean Theory.[6)] The basic idea of this approach originates from the realization that during the past 20 years European companies focused primarily on optimizing the parameters of quality, cost and time. Subsequently, numerous industries have been characterized by excessive supply and falls in demand that then lead to prices wars. They represent the so-called "Red Oceans". Those who want to escape from this circle of competitive and cost pressure must create new markets, where they themselves make the rules, the so-called "Blue Oceans".

Illustration: Red vs. Blue Ocean



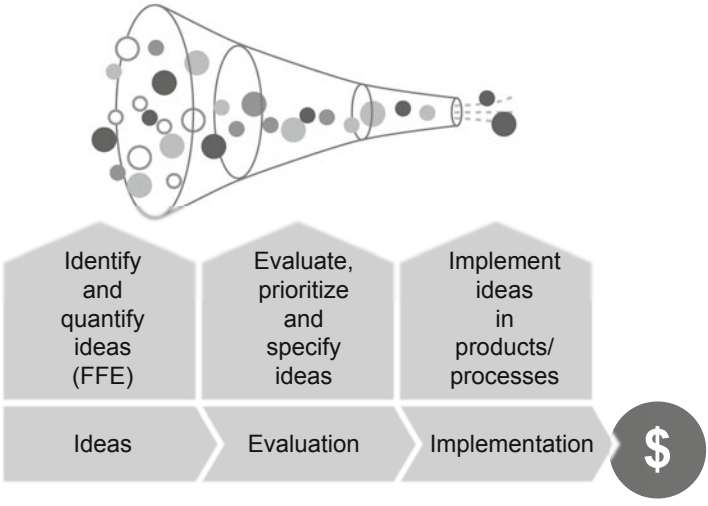
In order to open up a “Blue Ocean” a company must identify the factors characterizing the competition in its industry and decide when to leave the field to its’ competitors. Resources freed up in this way can be used by the company to increase its performance with respect to other targeted factors and developing Unique Sell Propositions.

Once the focus has been set, suitable **processes** are required in order to, systematically, get from generating the idea, selecting and implementing the right innovation projects, to successfully marketing the new development. The DMADV

[6] Kim, W. Chan and Mauborgne, Renée, 2005. Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant. Boston: Harvard Business School Publications

phased approach (DMADV = DEFINE, MEASURE, ANALYZE, DESIGN, VERIFY) within the context of Design for Six Sigma^{+Lean} (DFSS^{+Lean}) offers a best-in-class approach for effectively and efficiently realizing ideas. The approach is an open framework into which new developments can be integrated. Thus, especially agile development methods such as SCRUM can be integrated into the ANALYZE and DESIGN phases in order to organize the development of a basic concept and the detailed design quickly and successfully. Prior to the start of the actual DMADV approach comes the so-called "Frontend of Innovation" which is also referred to as "Fuzzy Frontend" (FFE) due to its low degree of structure. During this, the relevant innovation key figures must be defined based on the innovation strategy and respective target values (e.g. target turnover in target market with new products) set. The generation of innovative ideas can take place during a period of information collection and evaluation (e.g. trends in the target market and in the respective industry). These must be evaluated with respect to their conformity with the strategy as well as their prospect of success. They are to be prioritized and integrated into the innovation project portfolio. The most promising ideas are designed and implemented systematically with the help of DFSS^{+Lean}. After a successful implementation benefit collection commences and the economic impact of the development can be assessed.

Illustration: Process of Innovation Excellence



A coordinated procedural model provides an indispensable framework. This is enriched with a series of tools and the specific instructions necessary to make it work.

Illustration: Tools for Innovation Excellence

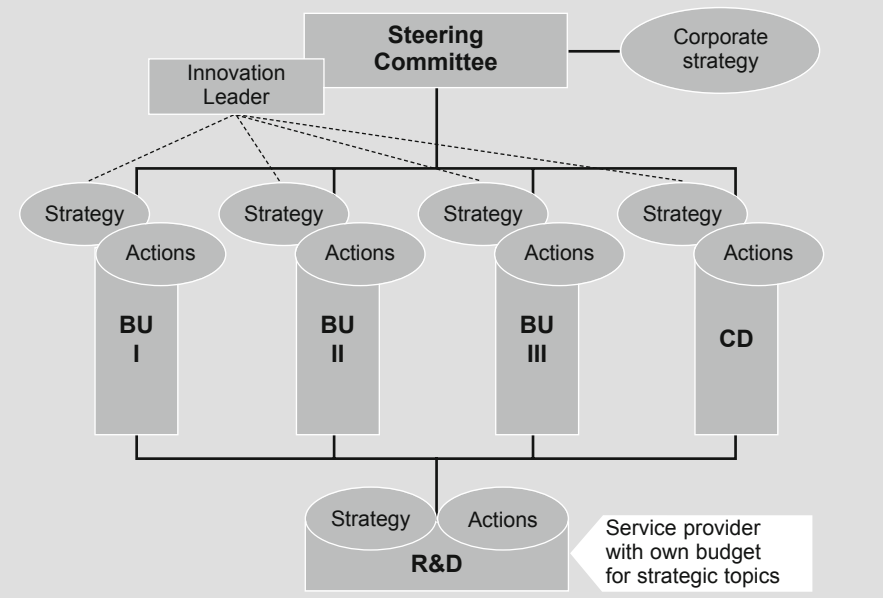
SCOUT			Imple-mentation
Define search fields	**Generate ideas**	**Develop business opportunities**	
Procedure: • Define idea Scorecard • Analyze patents • Analyze markets • Evaluate technologies • Analyze competitors (Benchmark) • Analyze trends	**Procedure:** • Look for jobs to be done • Identify unfulfilled needs • Analyze functions • Compare unfulfilled needs and functions • Derive ideas • Prioritize ideas	**Procedure:** • Display unfulfilled needs • Describe offer for the customer • Define business model • Identify value contribution • List assumptions and prerequisites which are essential for success • Evaluate risks • Prioritize business opportunity	**Design for Six Sigma^{+Lean}** • DEFINE • MEASURE • ANALYZE • DESIGN • VERIFY

DFSS^{+Lean} provides a comprehensive toolbox for the project team which is presented in detail in this book. A great number of these tools can be used to facilitate decisions and actions in the "Fuzzy Frontend" – i.e. the generation and evaluation of ideas – in order to effectively fill the innovation pipeline. Some of these will be considered in the chapter titled "Scout".

However, the DMADV process and tool set must be deployed and applied by capable employees. In order to reach the goal of Innovation Excellence the correct people, with the relevant **skills**, must cooperate under suitable basic conditions. Suitable individuals must be selected and supported as the composition of the innovation team is critical to success. What would Apple be, if the creative visionary Steve Jobs hadn't had Tim Cook at his side, to put the enterprise's innovative projects to the acid test of economic reality? Both characters – the creator as well as the analyzer – are needed in the correct combination. Moreover, efforts for innovation in companies frequently meet resistance. Taking new directions, off common paths, brings out the skeptics who seem to know without doubt that the goal will never be achieved that way. Not being discouraged by these critical voices and generating acceptance of innovative undertaking in spite of them, requires the Project Leaders to become Change Agents. If one also takes into account, that innovation projects are usually conducted by multifunctional and cross-departmental teams, the importance of sound training for the Project Leaders becomes even more apparent. They must be capable of selecting the right tool for the respective task in a targeted way and to apply it together with the team effectively and efficiently. For this purpose they need not only methodological competence but also leadership and facilitation know-how.

Finally, the fifth success factor is the consistent anchoring of the topic of innovation to the organization's **structure**. The way in which this takes place, sends a clear signal to the employees. Top Management must show that its' commitment to the increase of innovative strength is really to be taken seriously. If the respective roles and/or responsibilities are lacking within the upper management level, and the topic is not supplied with the necessary resources, success attributable to innovation will be left to chance. A real innovation culture, one that shapes the company permanently,cannot emerge in this way. If innovation activities are to be supported systematically and their strategic conformity made permanent role in the organizational structure must be provided. The task of such an "Innovation Leader" is to coordinate and promote innovation activities across the whole company. He/she supports the corporate divisions in the development of their own innovation strategy and derivation of respective actions. A Steering Committee consisting of representatives of Top Management ensures that the planned activities also match the company's strategic aspiration. A suitable organizational structure is shown in the illustration below.

Illustration: Organizational structure



BU = Business Unit
CD = Corporate Development
R&D = Research & Development

Irrespective of how mature a company is with respect to the above mentioned success factors, every company can advance further in the direction of Innovation Excellence with the help of the DFSS^{+Lean} approach presented in this book. The organization cannot avoid dealing with the success factors such as focus, skill and structure. Inevitably the following questions will emerge: Which ideas do we want to implement within the framework of a DFSS project? Which executive will function as the project's principal or Sponsor? Which employees are to form the project team and receive the necessary training? Decision processes which reliably lead to the correct answers must be institutionalized in the next step.

A further advantage of the DFSS^{+Lean} approach is that the phased, structured, tool-based procedure minimizes the typical risks experienced in development projects.

Illustration: Development risks vs. DFSS^{+Lean} approach

Development Risks	DFSS^{+Lean} Approach
Customer needs are not, or are incompletely, identified and products/services are developed without taking the customer into account.	The customer requirements for the product or process are studied intensively – the true needs of the target customers are the starting point for the development work.
Important aspects are ignored or forgotten throughout the development work.	The entire value chain from the idea to the final development is taken into consideration.
The development work is driven by R&D alone and important input from other functions is not taken into consideration or done too late.	In the core development team all relevant functions are represented and contribute their own point of view to the development work in a structured way.
The development resources are deployed based on incorrect priorities and not in a focused way (resource waste).	The development resources are deployed in a focused way according to the priorities of the target customers.
The development work takes place in an unstructured way and without comprehensible documentation.	The development work takes place through clearly defined phases and is documented in a standardized way.
Features are added to products/services which the customers don't want at all (Over engineering).	Customers are encouraged to give feedback at set points in time thus ensuring that the focus will remain on their requirements.

Moreover, DFSS^{+Lean} can be used not only for product but also for process development. The differences in application will be shown in the relevant sections of this book.

If a company already utilizes an established development process the DFSS^{+Lean} toolbox can nevertheless offer valuable inspiration and enhancement (cf. illustration 9). Although phase models often prescribe the basic steps of development work and define interim goals, they provide little specific assistance for the project team with respect to their realization. In such cases the existing procedural model can usually be combined, without problems, with the DMADV phase approach. Components and tools of DFSS^{+Lean} can be integrated where the existing development process displays gaps or weaknesses. These are all tools which have been tried and tested over many years and which are linked within the framework of DFSS^{+Lean} consistently. In this way the Development Team is provided with a Common Guideline for its next steps.

Illustration: Overview DMADV phase approach

	Tools	Goal
DEFINE	• Project Charter • Project Scope • Multi Generation Plan (MGP) • Gantt Chart • RACI Chart • Budget Calculation • Stakeholder Analysis Table • Communication Plan • Risk Analysis • SCRUM – Agile Project Management	• The project has been defined. • Problem and goal have been defined and a Multi Generation Plan has been created. • The project has been clearly scoped and the influence on other projects has been assessed. • Activities, Time and Resource Planning have been defined. • Potential project risks have been estimated.
MEASURE	• Portfolio Analysis • Customer Value Analysis • Customer Interaction Study • Questioning Techniques • Affinity Diagram • Tree Diagram • Kano Model • Benchmarking • House of Quality • Design Scorecard	• The relevant customers have been identified and segmented. • The customer needs have been collected, sorted and prioritized. • CTCs and measurements have been derived based on the customer needs. • Assign priorities to measurements; target values and quality key figures have been defined.

Continued on the following page

Illustration: Overview DMADV phase approach (continuation)

	Tools	Goal
ANALYZE	• Function Analysis • QFD 2 • Lead User Approach • Cross Innovation • Creativity Techniques • TRIZ • Benchmarking • Pugh Matrix • QFD 3 for target costs • FMEA • Early Prototyping (SCRUM) • Process Modeling • Advance Marketing	• The best concept has been selected from alternative high-level concepts. • Conflicts and contradictions in the selected concept have been resolved and requirements for necessary resources have been derived. • The residual risk has been defined, customer feedback has been collected and the concept has been finalized.
DESIGN	• Design Tree • Cost Breakdown Structure • Statistical Methods (Tolerancing, Hypothesis Tests, DOE) • Trimming • Design for X • Anticipatory Failure Determination • Process Design Principles • Lean Toolbox (Value Stream Map, 5S, SMED, TPM, Process Balancing) • Process Charts • Process Monitoring • Process Simulation • Piloting	• The detailed concept has been developed, optimized and evaluated. • The production process has been planned and optimized according to Lean guidelines. • The implementation of the process design has been prepared, involved employees have been informed and customer feedback was collected.
VERIFY	• Implementation Strategy • Transition Plan • Scale Up • Pilot Marketing • Process Documentation • Standard Operating Procedures (SOPs) • Implementation Teams • Process Performance • Project Documentation	• The transition to serial production has been conducted. • The production process has been implemented. • The market launch has been finalized. • A suitable process control mechanism has been developed. • Process and project documentation have been completed. • The process has been handed over completely to the Process Owner, the documentation was handed over and the project has been closed officially.

Even though the course of a project should always follow the same essential steps, it remains the team's responsibility to select suitable tools from the DFSS^{+Lean} Toolbox within these steps and, then, apply them in a targeted way based on the prevailing conditions. Industry and project specific aspects must be taken into consideration. The specific requirements for development activities e.g. of the pharmaceutical or the automotive industry must also be considered as well as the differences between the development of an IT application and a material. Therefore the methods listed in this book must not be seen as mandatory tools. Many of them can be applied within a different context or on a stand-alone basis. Methods and tools will be presented as we go through the phases DEFINE, MEASURE, ANALYZE, DESIGN and VERIFY. First, an overview will be given of the phase and then the tools which can be potentially used within it will be explained with the help of a uniform structure. Each essential tool will be exemplified with the help a practical example which will develop through each phase.

Moreover, the first chapter of this book, “Scout”, deals with the identification of suitable innovation projects. Before the realization of ideas can take place using the DMADV phase model, the product and/or service ideas must be generated and the most promising ones must be selected for implementation. Even though most companies don't lack creative ideas there should still be a systematic approach to the setup of an innovation portfolio in order to minimize the risk of false investments in the area of new product development.

DESIGN FOR SIX SIGMA+LEAN TOOLSET

SCOUT

C. Staudter et al., *Design for Six Sigma+Lean Toolset: Mindset for Successful Innovations*, Management for Professionals, DOI 10.1007/978-3-642-41455-8_2,

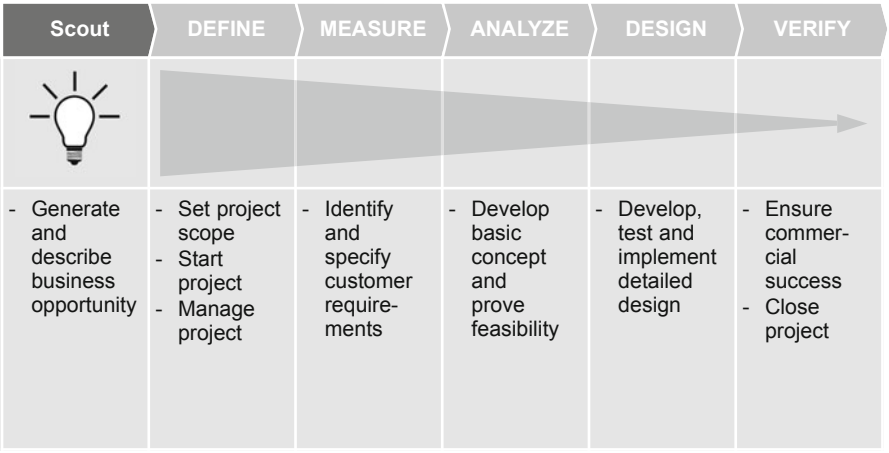
Scout

Term
Scout, Scout phase

When
Before embarking on a DMADV project

Goal
- Find, evaluate and develop promising business opportunities
- Create prerequisites for a quick and successful implementation of innovation projects with DMADV

Overview Scout



The Scout Phase serves the purpose of finding new and attractive business opportunities which are likely to lead to commercially successful products and services. In order to discover and evaluate them, the procedure in the Scout phase is adopted as follows:

SCOUT		
Define search fields	**Generate ideas**	**Develop business opportunities**
Central question: In which search fields are ideas for business opportunities to be generated?	**Central question:** Which ideas are to be developed into business opportunities?	**Central question:** Which business opportunities are to be implemented with DMADV?
Procedure: • Define Idea Scorecard • Analyze patents • Analyze markets • Evaluate technologies • Analyze competitors (Benchmark) • Analyze trends	**Procedure:** • Search for jobs to be done, identify unfulfilled needs • Analyze functions • Compare unfulfilled needs and functions • Derive ideas • Prioritize ideas	**Procedure:** • Display unfulfilled needs • Describe offer for the customer • Define business model • Identify value contribution • List assumptions and prerequisites which are critical for success • Evaluate risks • Prioritize business opportunity
Result: • Criteria for idea selection • Relevant search fields	**Result:** • Prioritized list of ideas	**Result:** • Prioritized business opportunities

The development of a business opportunity starts with the definition of a search field. It is analyzed and determined in which market and technology segment the most interesting opportunities and potential are available at the time.

The second step is then within this search field to generate a number of specific ideas with the help of different approaches. These ideas are then developed into business opportunities in the third step.

In all three steps the results are developed systematically and prioritized repeatedly with the help of the same criteria so that the result of the Scout phase is an attractive and completely documented business opportunity. All required information necessary for the ensuing innovation project has been compiled in a compressed way.