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# CRITICAL SUCCESS FACTORS OF CHANGE MANAGEMENT IN SOFTWARE PROJECTS

*Markets, technologies, and the business environment change in shorter cycles, and organizations need to transform. Often transformations in organizations include new software systems. ITIL defines change as the process of moving from one defined state to another. The introduction of software systems within change projects fail in a large number of cases. What are the success factors for a thriving change project? A systematic literature review leads to 22 critical success factors of change management. Sixty-one articles were read. Ten of them are relevant for this contribution. Twenty-two critical success factors for change management have been described. Analysis of critical success factors for change management is a crucial part of successful implementation of software systems in organizations since such factors are relevant for successful changes.*
Keywords: *change, change management, success factors, software, organization.*

## Introduction

When the business model is obsolete or the software system is outdated, a change is necessary. This is the reality in the majority of German companies, and they need to transform [1].

Markets, technologies, and the business environment change in shorter cycles, and organizations need to change, too. It is necessary to evaluate familiar procedures, and approved practices need to be substituted. The Information Technology Infrastructure Library (ITIL) defines change as the process of moving from one defined state to another [2]. Change is critical for organizations [2]. Surveys from 1996 in the USA and Europe show that 33 percent of organizations assume their re-engineering projects to be a success, but 25 percent think that the results did not justify the effort [3].

It is always the crossover which is difficult. The new one isn't familiar and the old one couldn't be rejected easy [3].

By transposing a consequent change management, there is the possibility to realize change as a chance. With change management, there is the possibility to create a culture where transformation is understood as natural development [4]. But what are the success factors for a thriving change? Based on a literature study, the success factors of change management are presented in this contribution.

This article contributes to theory and practice. It fills the gap in the current literature explaining the success factors of change management in software projects.

Following this section, the article proceeds with a description of the change management models of Lewin [5] and Kotter [6]. After that, the research methodology is presented. Then the findings are presented, and the single success factors are described. The contribution ends with a discussion of the findings and finally presents the conclusions of this study.

## Change management

To manage change successfully is a core competence of organizations [7]. Change management is one of the key factors to be successful when making a transformation [1]. The change management process has the goal to document, plan, and implement all changes in the IT-infrastructure [3].

Change management serves to the holistic and systematic planning, initiating, realizing, reflecting, and stabilizing of change processes in organizations. Transitional change, the crossover from an unsatisfying initial state to a jointly supported final state, and transformational change, supporting individuals in their own learning processes, both are meant by the term "change management". The goal of change management is an organization with a higher value adding by a superior culture and a common effort [3].

Change management starts but never ends because it is the starting point of an improvement process to realize an agile and learning organization. Change management is elementary to successful entrepreneurial acting because the ongoing altering framework conditions characterize our lives increasingly [3].

As a basic explanation for the design of transition processes, the action research (3-phase-model) from Kurt Lewin [2, 3, 5, 6, 7, 8] is used, and John P. Kotter's international bestseller *Leading Change* [6] with his 8-step-change plan is cited [3].

In his article, Lewin [5] provides a model for change management (see Figure 1). This model is the most popular model for explaining change processes.

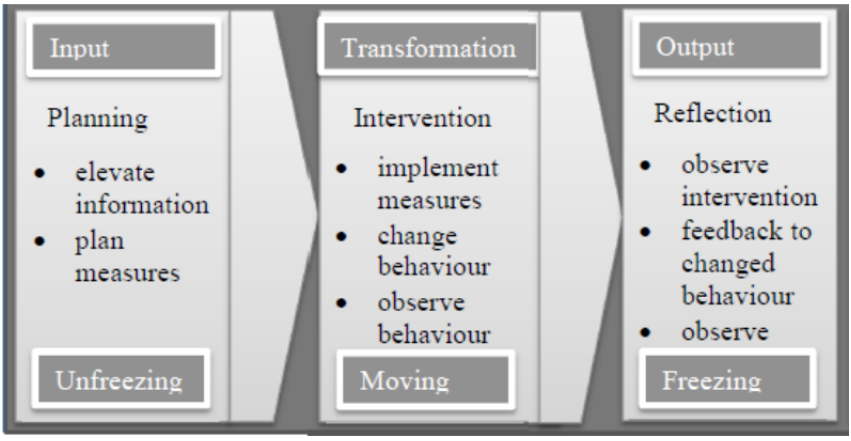


Figure 1. Lewin's 3-phase-model [8]

In the first step or phase, information gathering and planning measures are the activities. In this phase, the "unfreezing" of the organization takes place. That means traditional procedures are questioned and the organization structure is set up for assessment. Human behaviour relies on an equilibrium of field forces (see Figure 2) [2]. It is necessary to break up the equilibrium of behavioural routines before the introduction of new routines can start [7].

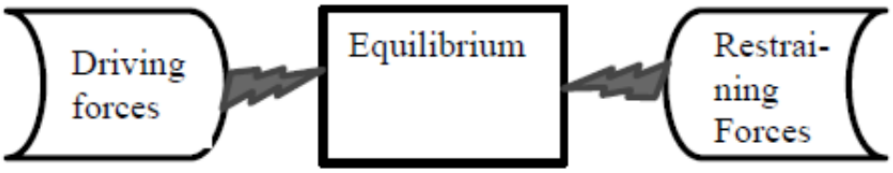


Figure 2. The equilibrium of field forces [8]

The second phase "moves" the organization. It is the step of transformation. In this phase, new behaviour and procedures are implemented. Therefore, all forces, driving and restraining, must be taken into account [2].

The last step is the "freezing": new procedures, structures, and groups are stabilized.

Kotter's stage model is a progression of the popular Lewin's 3-phase-model. Only when all eight steps of change are performed and tutored by management, change can be successful.

The eight steps to transforming an organization are (obtained from [6]):

- Establishing a sense of urgency:
  - examining market and competitive realities,
  - identifying and discussing crises, potential crises, or major opportunities.
- Forming a powerful guiding coalition:
  - assembling a group with enough power to lead the change effort,
  - encouraging the group to work together as a team.
- Creating a vision:
  - creating a vision to help direct the change effort,
  - developing strategies for achieving that vision.
- Communicating the vision:
  - using every vehicle possible to communicate the new vision and strategies,
  - teaching new behaviour by the example of the guiding coalition.
- Empowering others to act on the vision:
  - getting rid of obstacles to change,
  - changing systems or structures that seriously undermine the vision,
  - encouraging risk taking and nontraditional ideas, activities, and actions.
- Planning for and creating of short-term wins:
  - planning for visible performance improvements,
  - creating those improvements,

- recognizing and rewarding employees involved in the improvements.

- Consolidating improvements and producing still more change:
  - using increased credibility to change systems, structures, and policies that do not fit the vision,
  - hiring, promoting, and developing employees who can implement the vision,
  - reinvigorating the process with new projects, themes, and change agents.
- Institutionalizing new approaches:
  - articulating the connections between the new behaviours and corporate success,
  - developing the means to ensure leadership development and succession.

These are the most used basics of change management.

According to Digitaler Mittelstand [9], a study shows that 70 percent of all change projects fail, and most of them collapse already in the beginning. But why do change management sometimes succeed and sometimes not? Which are the influential factors and circumstances that lead to a successful transition of an organization?

## Method

A systematic literature review leads to the identification, evaluation, and interpretation of all relevant scientific literature on the research question.

Kitchenham and Carters [10] suggest a method to proceed a literature research in software engineering. It includes the identification of the need of the systematic literature review, the assignment, the research question, the protocol of the literature review, and evaluation of the protocol.

In this case, the question of why some software projects are successful and some are not was the need and the assignment of the literature study. Reading on this question led to literature about project success factors and the relevance of changing human behaviour to achieve the intended project goals. Thus, change management moved in the focus as the main success factor for software projects.

The next step is the formulation of the research question: “What are the success factors of change management?”

With this, the protocol and its evaluation was designed and proceeded as follows. Along the suggestion of Kitchenham and Carters [10], the databases of IEEExplore, ACM Digital Library, Google Scholar, Citeseer Library, Inspec, ScienceDirect, El Compendex were searched. The search string was “change management success factors”. This request led to 76,800 hits. To reduce the number, the headlines and the short descriptions of the articles were read. By this, the enormous number was reduced, and, after checking the online availability, 61 articles were left. The available articles were read and 10 articles were classified as relevant for this study.

## Relevant literature

Yeoh and Popovič [11] describe the critical success factors for the implementation of business intelligence systems. In their context, they see the implementation of a business intelligence system as a change project where organizational factors play the most crucial roles. So, they see committed management support and sponsorship, a clear vision, a well-established business case, business-centric championship, a balanced team composition, a business-driven iterative development approach, user-oriented change management, sustainable data quality and integrity, and a business-driven scalable and flexible technical framework as the critical success factors.

The critical success factors for the implementation of lean production is the theme of Netland's article [12]. He provides a list of 24 success factors, which are: lead actively, participate personally, educate employees, educate managers, communicate, inform and discuss, set and follow-up targets, involve and support employees, dedicate human resources, use lean tools and methods, integrate lean in everyday business, develop vision and road map, use rewards and recognition, monitor and audit implementation, standardize and manage discipline, find and share best practices, step wise approach, focus on areas and prioritize activities, invest time and money, benchmark others, emphasize team concept, use external experts, hold regular implementation meetings, emphasize safety and job attractiveness. and commit corporate management.

To execute a successful business transformation, in Uhl and Gollenia [13], the following management principles are suggested: define clear and comprehensible goals, communicate and "live" the vision, leadership, define values, and facilitate internalization.

Alrasheedi and others [14] identify organizational commitment, organizational learning and change management as the critical success factors of mobile learning from the perspective of the university management.

With a literature review, Tabak [15] found management support, user participation, clear vision/objectives, change management, data quality, technical capabilities, and scalability/flexibility as the critical success factors for spend analytics.

Parkes [16] derived eight out of 27 success factors as the critical success factors for business process implementation. These eight factors are motivation for the project, obtaining of a meta-view of the process, management commitment to the project, accessing of domain knowledge, end-user participation, the planning and execution of change management, communication, and end-user ownership.

The result of an online survey by Tyagi and others [17] is that management commitment, involvement and participation, customer satisfaction, specialized team for six sigma, culture change, linking of six sigma to customers, project planning and management, understanding of six sigma methodology, communication, understanding of six sigma tools and techniques, linking of six sigma to business strategy, project prioritization and selection, linking of six sigma to employees, project management skills, uses of innovative techniques, leader-

ship, customer involvement, and linking of six sigma to suppliers are the critical success factors for the implementation of six sigma in small and medium sized enterprises in the auto component industry in India.

Alshibly and others [18] found 37 critical success factors for the implementation of electronic document management systems (EDMS) in governments. They grouped the factors in six groups. Technological readiness contains architecture and infrastructure readiness. Top management support includes leadership and commitment, encouragement, and top management support. Adequate information, adequate training, job-specific training, involvement of end users, involvement of all stakeholders, and participation in EDMS decisions build together the training and involvement group. Resource availability consists of sufficient financial resources, human resource availability, sufficient technical resources, and requirement driven procurement. System related factors are EDMS functionality, efficiency of EMDS, effectivity of EDMS, user-friendliness, usability, integration of technology, and demonstrated benefits. Work environment and culture is composed of policies and guidelines, communication, clear agenda, change management, cooperation and teamwork, and team problem solving.

Totla and others [19] identify top management support, team composition and teamwork, interdepartmental cooperation and communication, business plan and vision, project management, project champion, vendor support, architecture and technological infrastructure, software development, testing and troubleshooting, user involvement, business process re-engineering, change management, partnership, legacy systems knowledge, and deliverable dates as the critical success factors for ERP systems.

Five main categories of the critical success factors for ERP are described in the paper of Altamony and others [20], namely, change management, top management support, business process re-engineering, vendor support, and user involvement.

## Results

Several terminologies and varying granularity were used in the different papers. After harmonizing granularity and terminology, the success factors, which were more than once mentioned with regard to change management, are registered as critical success factors. So the result of the literature research is a list of 22 success factors for change management. The list includes stakeholder involvement, culture, communication, training, top management support, teamwork, leadership, vision, testing, technical infrastructure, champions, resource availability, audit, incentive system, team efficiency, feedback, cross-departmental cooperation, project management, partnership, knowledge management, process re-engineering, and the organization structure. The following subjects discuss each.

***Stakeholder involvement***

The involvement of the stakeholders (shareholder, owner, management, clients, customer, supplier, employees) is an essential factor for the success of a change project. Stakeholder involvement should start with the beginning of the project and last

until its end [20]. The involvement starts with a stakeholder analysis [21] to identify the particular stakeholders respectively the stakeholder groups and to describe their roles and tasks in the project. Stakeholder involvement is for the management of expectations, the understanding of stakeholder requirements, a better understanding of the system by stakeholder, the increasing of the stakeholder acceptance, the overcoming of resistances, and the preparation of change.

***Culture***

Organization culture is an essential element in the settings of change. An environment giving time and space to learn about something new is substantial for successful implementation of change [22]. Culture is a set of ideas, assumptions, beliefs, standards, principles, behaviours, and values like responsibility, customer orientation, willingness to change, teamwork and nature of decision-making [14, 22, 23, 24, 25, 26, 27, 28].

***Communication***

Communication serves the generation, dissemination, and configuration of information [29]. In the team, communication is needed for information transfer and interaction in the social environment of the project [30]. Also, role clarity is enhanced by communication [31. Communication should concern all direct and indirect involved stakeholders [13]. Information should be given in a clear, concisem and understandable manner at the right time [30, 32]. Therefore, it makes sense to create a role for communication in the organization that fosters communication and collects requirements, reaction, comments, agreements, and reports regularly on activities, progresses, change of goals, visions, and strategies [13, 20, 30, 31, 31]. All this is documented in the communication strategy.

***Training***

The team responsible for the change and the team responsible for trainings in the organization need to create a training strategy, concept, and schedule for the change affected people. They have to inform the line and top managers and get their commitment [33]. For the execution of the trainings, a sufficient budget is necessary [20].

***Top management support***

Top management support is an important success factor for changes. The top management helps to overcome resistance; provides technical, monetary, and human resources; takes the leadership; gives strategies; is a role model; causes decisions and takes the responsibility for them; communicates change to all the stakeholders; is member of the steering board; provides incentives and rewards; takes part on assessment meetings and improvement workshops; monitors the project and governs the project by the dimensions of project process, project management, and change management [11, 15, 19, 20, 34, 35, 36]. The top management needs a basic understanding of the project [15, 20], and support is needed from the initiation until the closing of the project [11, 19, 20].

***Team composition***

It is necessary to have the right skills and qualifications in the project team, also the team members must be able to work together. They have to have unique goals, opinions, and methods [19, 37].

***Leadership***

Leadership is definitely essential to change for it is the idea of encouragement and involvement. The leader helps the employees to understand the change, show plans and perspectives for new jobs [13].

***Vision***

Visions, mission statements, and goals are the basics of change processes and organizational improvements. They are fundamental to innovation and transition. Visions are a realistic draft of the future [38]. Vision is the leading component of the strategic planning; it combines strategic planning and change management [22]. Therefore, vision needs clear, measurable goals, expectations, and advantages [15, 19].

***Testing and troubleshooting, development process***

Test and troubleshooting are important development activities to get a system that is as error-free as possible and has a high user-acceptance. The premise for successful testing and troubleshooting is an effective software development process [19, 20].

***Technical infrastructure***

The technical infrastructure is the technology, and the equipment (hardware, operating systems, database management systems, network, etc.) which enable the operation of the application [39, 40]. Also, the process, roles, responsibilities, and structures are elements of the technical infrastructure [40, 41]. When implementing the new system, it is necessary that the new system and the technical infrastructure fit together [19].

***Championship***

The champion leads the project with a focus on the business of the organization. This role includes the management of political and organizational problems that occur during the project [11]. Normally, the project leader is a champion [19].

***Change management***

The most import factor in change management is change management itself.

***Resources availability***

Resources in a change are the necessary infrastructure, a sufficient budget, proper technical equipment, enough adequate skilled staff, and a demand driven external procurement [18]. Conflicts because of concurrent priorities, overlapping tasks, or unforeseeable circumstances can cause a re-planning [16, 22].

***System dependent factors***

These factors depend on the concrete system that will be implemented by the change. The description of these factors on an abstract, general level is impossible.

***Audits***

Audits are an independent assessment of a single work result, or a set of results, as to compliance with specifications, standards, contracts, and other criteria [42, 43, 44, 45]. Audits support external assessments [44].

***Incentive systems***

Incentives are motives for collaboration and behaviour changes. Managers have to ensure that the incentives address the goals of the change project. Incentives are for role models, they are messages from the management to appreciate

individual performance as well as contributions to the advancement of the organization [30, 46].

***Team effectivity***

Specialists, project managers, and most talented staff members should be in the team. Technical and business know-hows are necessary in the team. The team should know the process, requirements and demands. In the informal structure of the organization, the team should have a network and individual team members ought to be recognized as experts [11, 13].

***Feedback***

Feedback conduces the enhancement of self-efficacy and self-control of one individual as well as the improvement of system and/or process design and behaviour [45, 47]. Change management projects ought to have feedback mechanisms to monitor performance and results. Feedback can be informal and/or formal reports, but they all should be regularl.

***Interdepartmental cooperation and communication***

Important factors for the social integration of a system and to behaviour changes are communication and cooperation. To implement new processes in an organization, interdepartmental communication and cooperation are necessary [19].

***Project management***

Project management and change management are corresponding but different disciplines. They can overlap, but they are independent. The degree of overlapping and mutual dependencies is different in organizations and depends on factors like organization structure, type of change, used methods, competencies, and productivity [22]. With project management, there is a better insight in operations, the risk management is optimized, the quality rises, human resource management improves, and the culture is more motivating [48].

***Partnership***

There are internal and external partners. External partners are, for instance, suppliers, consultants, and customers. Internal partners are, for instance, experts, internal providers, decision-makers. Partners offer technical assistance, training, experience, tools, resources, application, data, and more. For a successful transformation of an organization, it is necessary to involve the whole supply chain to consider the requirements of all stakeholders and to have their acceptance for problems, failures, and delays when implementing the change [31].

***Knowledge management***

Knowledge management is the process of collecting, organizing, managing, distilling, presenting, sharing, using, and storing of knowledge. Teamwork and integration are typical for knowledge management processes. This form of collaboration promotes the understanding of organization-specific themes and enables experience sharing. The exploit and effective use of knowledge is fundamental for help desks, customer support, and IT-departments. The systematic process of collecting, organizing, managing, distilling, presenting, sharing, using, and storing of knowledge gains a deep understanding of the themes, processes, experience, and informal procedures of an organization. Knowledge management serves to reach strategic goals of an organization. It is an audit of

the intellectual assets of the organization and reveals unique sources, critical functions, and potential bottlenecks. Knowledge management protects intellectual assets against decay. It promotes intelligence, flexibility, and value of services, products, and decisions. Knowledge management can be an addition, and extension of total quality management, business process re-engineering, and organizational learning [49].

***Process re-engineering***

Lower costs, higher quality, and better services are the goals of business process re-engineering. Therefore, business processes are radically re-designed, with a focus on costs, quality, services, but also on product design, flexibility, and speed. Business process re-engineering not only optimizes the production process, it also improves administrative processes and internal services. The focus of business process re-engineering is on system improvement [50].

***Organization structure***

Internal procedures, hierarchy, etc. are examples for organization effects. This organization effects are important aspects in a change project. Alreemy and others [41] cite a study that shows that change of an organization structure and culture is the second important factor in a change project. Often it is a lack of understanding of the (informal) organization structure and culture that leads to the failing of projects [51]. Also, it is difficult to assess if technical advances drive organizational changes or vice versa [52].

## Ranking of the factors

The systematic literature study revealed 22 critical success factors for change management in software projects. The most often mentioned factors are stakeholder involvement (7 times), culture (6 times), top management support, communication, training, team effectivity (5 times each), vision, leadership, test and troubleshooting, technical infrastructure (4 times each).

The most important factors seem to be stakeholder involvement, top management support, and communication, not only because they are among the most mentioned factors. The kernel of each change project is the change of individuals' behaviour. Therefore, the most important factors of a change project are factors which are important for the behaviour change of individuals. Individuals are stakeholders, so they must be involved to change their behaviour. Top management acts as role model in a change project and is important for behaviour changes. The basis of all these actions is communication, speaking to and with the people.

## Conclusions

Organizational transitions are necessary, and the ability to change efficiently and effectively is a core competence and a real competitive advantage for most organizations. The process of change and change projects are described by Lewin [5] and Kotter [6]. The literature research shows 22 critical success factors

relevant for successful changes. Quantitative and qualitative factors referring to people, like stakeholder involvement, and top management support, appear to be the most important.

The analysis of the critical success factors for change management is a crucial part of successful implementation of software systems in organizations.

Future research is to develop a maturity model for change management in software driven change projects.

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**Факторы успеха управления изменениями в проектах по разработке программного обеспечения**

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**Ключевые слова:** изменение, управление изменениями, факторы успеха, программное обеспечение, организация

Рынки, технологии и бизнес-среда меняются в рамках более коротких циклов, что приводит к необходимости изменений в организациях. Частью трансформаций становятся новые системы программного обеспечения. ITIL определяет изменение как процесс перехода из одного определенного состояния в другое. Внедрение систем программного обеспечения в проекты изменений во многих случаях не приводит к успеху. В результате анализа литературы по теме исследования выявлены и описаны 22 решающих фактора успеха управления изменениями.