Towards a Generic Goal Model to Support Continuous Improvement in SME Construction Companies

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Abstract. Small and medium sized (SME) construction companies are often good at bricks, mortar and carpentry but not at management. However, it is often bad management that hinders companies to become financially sustainable over time and to grow. This paper presents a generic goal model aiming to support SME construction companies to systematically work with continuous improvement towards the overarching goal of becoming thriving businesses. The goal model has been developed based on the principles of lean, balanced scorecards and the business canvas, as well as on a management consultant's experiences from working with this kind of companies for many years.

Keywords: Goal model · Enterprise modeling · Continuous improvement · SME construction companies

1 Introduction

Small and medium sized (SME) enterprises are a key driver for economic growth in Europe [1]. In order to stay competitive and profitable, SMEs, like larger organizations, must meet the requirements and demands of a rapidly changing market. SME construction companies are no different. For many years, construction companies have had a poor reputation for coping with the adverse effects of change with many projects unable to meet deadlines, cost and quality targets [2]. Even more serious is the fact that many companies, particularly small ones, are going bankrupt in an industry that has a great influence on nations' gross domestic product [3].

Due to this, top-level concerns for both business executives and national authorities are how to turn construction companies into profitable and well-run businesses and to keep them that way over time. Particularly the SME construction companies, struggle with low profits and many are going bankrupt, adding people to the unemployment lines. In many cases this is due to lack of control systems and proper information for decision-making.

In the work leading up to this paper we have noticed that for a small construction company one or two problematic projects can actually tip the scale towards severe

J. Ralyté et al. (Eds.): PoEM 2015, LNBIP 235, pp. 27–42, 2015.
DOI: 10.1007/978-3-319-25897-3_3

financial crisis. Practitioners have reported to us that many SME construction companies are good at "bricks, mortar and carpentry", but not at management. This becomes devastating in a situation where companies not only have to manage each project individually, but must also be able to handle project portfolios with complex dependencies between projects. Hence, the potential for improving the management aspect of construction companies is great. Such improvement should, however, be done orderly and with a long-term perspective, which implies setting up orderly schemes for continuous improvement.

In this paper we propose a generic goal model that is aimed to somewhat alleviate this problematic situation in SME construction companies by providing a framework for continuous improvement. The model is the backbone of a method for continuous improvement to be used in SME construction companies, the SmallBuild + method. The method has been developed within a EUREKA Eurostars project.

The remainder of the paper is organized as follows. Section 2 provides the theoretical background of the work. In Sect. 3 the approach to developing the proposed goal model is described. The generic goal model is presented in Sect. 4, together with some suggestions on how to use it, also in relation to tool support. Finally, some aspects of further evaluation and future outlook are discussed in Sect. 5.

2 Theoretical Background

In this section we describe the background to the work presented in this paper. We describe the situation of SME construction companies and some challenges they face in their continuous improvement efforts. The approach proposed in the paper is based on a generic goal model. The use of such models to support continuous improvement is also discussed.

2.1 Challenges of SME Construction Companies

The building and property industry is a large, fragmented and complex industry. It is also an important policy area affecting all sectors of the society. The wealth creation of society is among others dependent on the construction industry delivering well-functioning buildings and infrastructure to businesses, industry, public entities, private individuals and society [4]. As an example, in 2014 the construction of 25,404 homes was initiated in Norway alone.

Continuing with Norway as an example, the following list indicates some major challenges facing the industry [4]. We believe that it is fair to assume that the situation is similar in other countries.

1. Productivity growth seems to be too weak.
2. Building and construction processes are characterized by many quality deviations, errors and omissions.
3. The industry is characterized by fragmented purchasing and low procurement expertise leading to a non-holistic overall cost focus, contributing to short-term investments.

4. The industry has a too low rate of innovation. There is broad consensus in the industry that the industry must get better at taking innovations in use.
5. Parts of the industry are characterized by too many unethical practices.
6. Production processes are characterized by weak interaction. Widespread use of detailed contracts, selecting suppliers based on the lowest price, combined with split purchasing, provides many changes, additions and conflicts that generate distrust and weakened interactions.
7. The construction process is hampered by too many delayed and costly regulations and rules and different interpretations of these.

In addition to this, a sector study by e-Business W@tch [5] identified the issues of improving ICT skills, increasing the awareness of ICT benefits and potentials, and facilitating interoperability are identified as relevant construction sector policy initiatives. Although the study is 10 years old, our experience shows that this is still the case.

Olawale and Sun [6] conducted a survey of 250 construction project organizations in the UK, which was followed by face-to-face interviews with experienced practitioners from fifteen of these organizations. They found that the top five factors inhibiting effective project cost and time control, are all project internal elements and that quite often programs are drawn upon gut feeling. This is in contrast to previous studies where many external aspects are cited as the most important factors, such as inflation, material shortage, unforeseen ground conditions, inclement climate, etc. [6].

For many years construction companies have had a poor reputation for coping with the adverse effects of change with several projects unable to meet deadlines, cost and quality targets [2]. Even more serious is the matter that many are going bankrupt within an industry that possibly influences an economy's gross domestic product more than any other [3]. This is particularly the case with small and medium sized companies (SME). Due to this, top-level concerns for both business executives and others are how to turnaround the construction companies to profitable and well-run businesses and keep them that way.

Morris and Pinto [7] investigated data on project overruns from 3600 projects and concluded that project managers also need to look into the organizational business contexts within which projects are managed. This aspect is highlighted by Aarseth [8] who presents findings from interviews conducted with hundreds of project managers and project team members suggesting that the task perspective, time schedule and scope, is not sufficient when the context of the project is complex. Just as important are focus on business relationship management, cooperation between the project, the people and companies in the project and the external environment, organizations and context [8].

Obviously, construction projects seldom can be handled one by one along a timeline. Instead they are usually parts of project portfolios where a number of projects continually must be analyzed, invested in and developed in concert [9]. Within these portfolios each project are likely to be subject to uncertainty and risk as regards cost, time and quality [2]. Therefore, managers must know which projects the company is involved in, which stage each project has reached, who is involved in each project, capital-binding in each project, and how each project is related to and dependent on other project schedules. As regards the highest ranked factor inhibiting both cost and

time control it is obvious that there is a need for controlling and restricting the influence of this factor.

In summary, SME construction companies face big challenges, not only in Norway, which means that the potential for improving the management aspect of construction companies is great. Such improvement should, however, be done orderly and with a long-term perspective, which implies setting up orderly schemes for continuous improvement.

2.2 Challenges to Continuous Improvement in SME Enterprises

SME enterprises are a key driver for economic growth in Europe [1]. In order to stay competitive and profitable, SMEs, like larger organizations, must meet the requirements and demands of a rapidly changing market. One strategy to achieve this is to implement different continuous improvement initiatives, such as, e.g., Lean. However, despite the well-known theories, only a few SMEs succeed in their continuous improvement initiatives [10].

Ogunbiyi, Oladapo and Goulding [11] have done an empirical study of the impact of lean construction techniques on sustainable construction in the UK. Results from their study indicate that there are many benefits associated with implementation of lean construction and sustainable construction such as improved corporate image and sustainable competitive advantage, improved productivity and process flow, improvement in environmental quality and increased compliance with customer's expectations. The study also identifies several areas of linkage between lean and sustainability such as waste reduction, value maximization, environmental management and health and safety improvement among others.

SMEs are generally defined by their number of employees, but there are other variables than size that influence leadership, strategic planning and culture in companies [12]. A majority of SMEs are privately held and family-owned. Research has shown that this affects how the company is managed and operated. Family firms are run by reasons other than financial and rational and reflect a different view of ownership, based on the owner's values and beliefs [13]. This implies that non- economic (family) goals may take precedence over economic goals in family firms [14]. These circumstances have implications both on the design of business support services and SMEs' willingness to participate in continuous improvement as well as their objectives to do so [15].

There are several factors that have shown to be critical for a successful implementation of different continuous improvement initiatives. The most common are management and leadership [16], but also performance evaluation [17] and supporting information systems have shown to play an important roll particularly now with the growing use of business intelligence [18].

Performance Measurement Systems (PMS) support performance management by communicating and transforming different performance measurements between different organizational levels and employees. Ukko et al. [19] conclude that association between goals on the strategic level and on the operational level is important in order to achieve the strategic goals, and that performance measurement should be enabled on

the operational level. They also state that since many companies today apply performance measurement on the operational level, one of the major challenges for managers is to achieve understandable and accessible communication about the goal of the organization. There is also a need to better understand challenges in transforming performance measurement on the operational level to usable information on the strategic level. It is critical that managers on different levels have relevant decision support of good quality.

2.3 Using Generic Goal Models to Support Continuous Improvement

Goals have been important to businesses for a long time. In 1954 Peter Drucker published the book *The Practice of Management*, being recognized as the first book to write about *objectives*, to define *key result areas*, to outline how to set objectives, and to describe how to use them to direct and steer a business and to measure its performance while looking at management as a whole [20]. The time dimension is essential in management because management is concerned with decisions for action, and action is always aimed at results in the future [20]. This clearly points to the need to take a continuous improvement perspective when working towards goal achievements.

A goal model is a structure of interrelated goals that describe the strategic direction of an enterprise towards a desired state of the enterprise. Goals models provide an analytical instrument for a number of purposes, e.g. decision-making and planning in order to achieve consistence, coherence and increased understanding among [21].

Goal models are often considered to be a part of the enterprise modeling process, where a number of integrated models capturing and representing different aspects (focal areas) of an enterprise, for example business processes, business rules, concepts, information, data, vision, goals and actors [22]. The systematic use of process models for various purposes is a quite common practice in all types of organizations. We have observed, however, that the systematic use of goal models in practice is less common even though goals are needed as a driver in all kinds of organizational development work.

A number of goal modeling techniques are described in the literature. Some examples can be found in [22–25]. They are reported to have a number of weaknesses, e.g. being complex to understand, requiring a huge amount of time to implement and as such being unable to support business analysts in a rapidly changing business environment [26] Nevertheless, since goals are essential for business development, there is a need to find fairly simple and practical approaches that support businesses in working with goals.

One of the more critical aspects in goal modeling is the creative process of formulating the goals, negotiating them between the stakeholders involved, defining relationships between goals, and documenting the model. It takes quite a bit of competence to manage this process [27]. Using reference goal models or generic goal models can be a useful starting-point to alleviate some of the risk in such situations. The aim of reference models typically is to unify and integrate the body of knowledge or best practice in a certain area. In the work reported in this paper, this approach was considered relevant, since the level of management maturity in SME construction

companies is relatively low. A reference goal model in this case then provides learning and insight into which elements make up an enterprise and which areas must be in focus to ensure long-term survival and company growth.

3 Approach to Develop the Proposed Generic Goal Model

In a pilot study carried out in a Norwegian SME construction company [28] enterprise modeling was used in a turnaround operation together with business management methods in an effort to change the way of working in the company. The company was at the time at severe risk to go bankrupt. The combination of these approaches yielded some very encouraging results (Fig. 1).

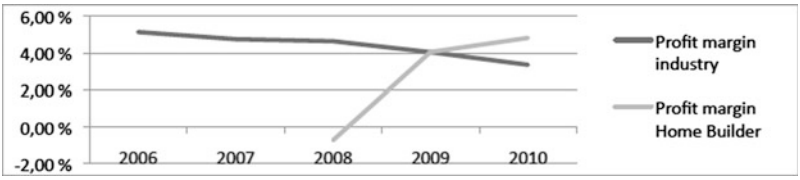

Fig. 1. Profit margin in industry in Norway compared to that in the SME construction company [28]

These results motivated an initiative to develop a process surveillance and control method that combines enterprise modeling and business management methods, the SmallBuild + method. The aim of the method is to support companies in their continuous improvement towards sustainability and economic growth. It has been developed in collaboration between practitioners and researchers in a project funded by the EUREKA Eurostars programme[1].

The Norwegian SME construction company previously mentioned has been involved as a case study setting for developing and testing the method. During the project, the company needed to carry out a second turnaround project to save the company from going bankrupt, again. This shows that awareness of the status of a company and related risks needs to be part of day-to-day business.

During that work, the need for defining relevant goals related to various business areas became a central theme to ensure survival and growth after a period where most of the energy had been put into handling urgent issues and putting out fires, due to the danger of bankruptcy. Motivated by the writings of [9] and the work by [6], relevant goals for ensuring long-term sustainability were formulated. The goals were documented in the form of a simple hierarchical goal model. The goal model was developed in close cooperation between practitioners and researchers in the SmallBuild + project. The manager of the company experienced great value in putting the goals and objectives into an orderly "system". He stated that it helped him to get an overview of the

[1] https://www.eurostars-eureka.eu.

situation: "When everything is burning around you, it is difficult to raise your head and look at the situation from a bird's eye perspective."

This specific goal model was generalized to be applicable to other SME construction companies and then became the backbone of the SmallBuild + method for continuous improvement (Fig. 2).

Fig. 2. Goal oriented continuous improvement in the SmallBuild + method

The development of the goal model was built on the following three approaches: (1) Lean [29], (2) Balanced Scorecard [30], and (3) the Business Model Canvas [31]. It also builds on a management consultant's experiences from working with this kind of companies for many years. The consultant participated in the project.

4 The Generic Goal Model and its Use

In this section the developed generic goal model is presented. Since the model targets improving the effectiveness of the organization as a whole, including various focus areas, its subcomponents are many and varied, corresponding to the common target components addressed in change literature [32] and targeted by consultants with years of experience as change facilitators. To address this complexity in an orderly fashion and to increase readability of the model, we chose to present each focus area in separate sub-models.

In the top-level model (Fig. 3), the main goals are presented that need to be achieved in order to ensure sustainable SME construction companies. Each of them represents an essential focus area. Each of these top goals are decomposed in a separate sub-model (Figs. 4, 5, 6, 7, 8 and 9), except for the goal focusing on health and safety, which are covered in national regulatory documents.

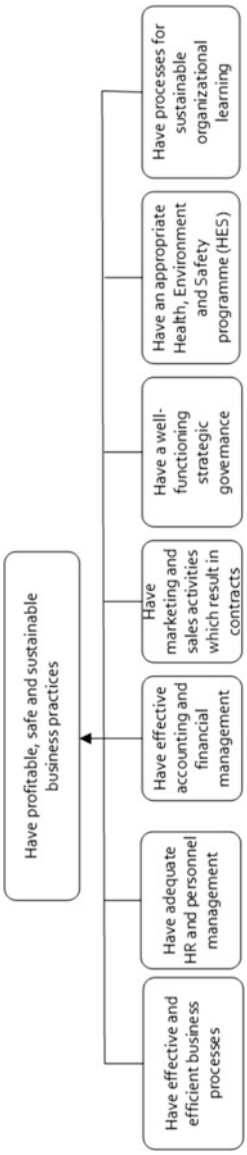

Fig. 3. Top-level goal model

When assessing the status of a specific SME construction company, the goals of each focus area assessed one by one. The status is set to red, yellow or green. Red means that the goal needs urgent attention. Yellow means that the status of the goal is partially satisfactory and needs attention but not urgently. Green means that the status of the goal is satisfactory. For each of the goals needing attention Fig. 10 provides an example of defined criteria for setting the status of a goal, in this case a goal concerning

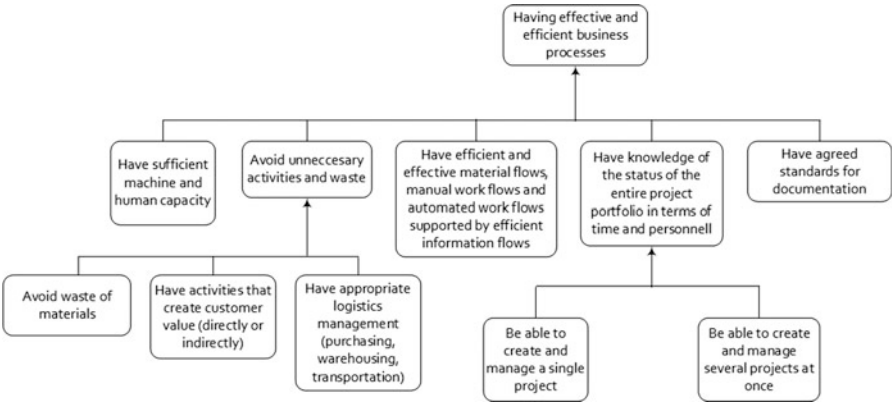

Fig. 4. Sub-model on having effective and efficient business processes

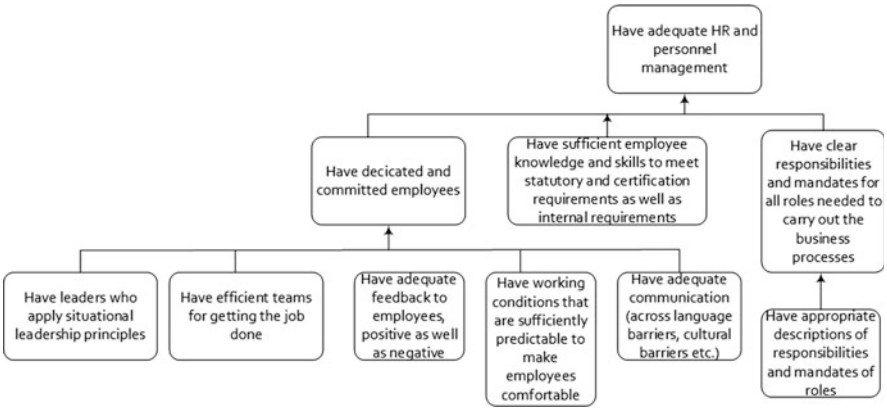

Fig. 5. Sub-model on having good HR and personnel management

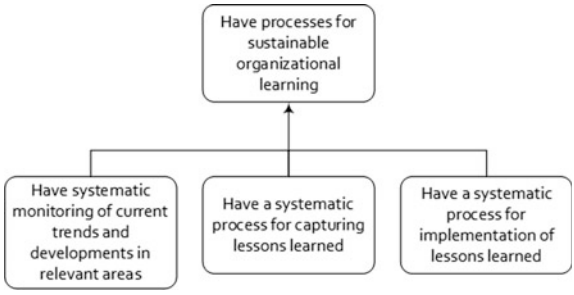

Fig. 6. Sub-model on having sustainable organizational learning

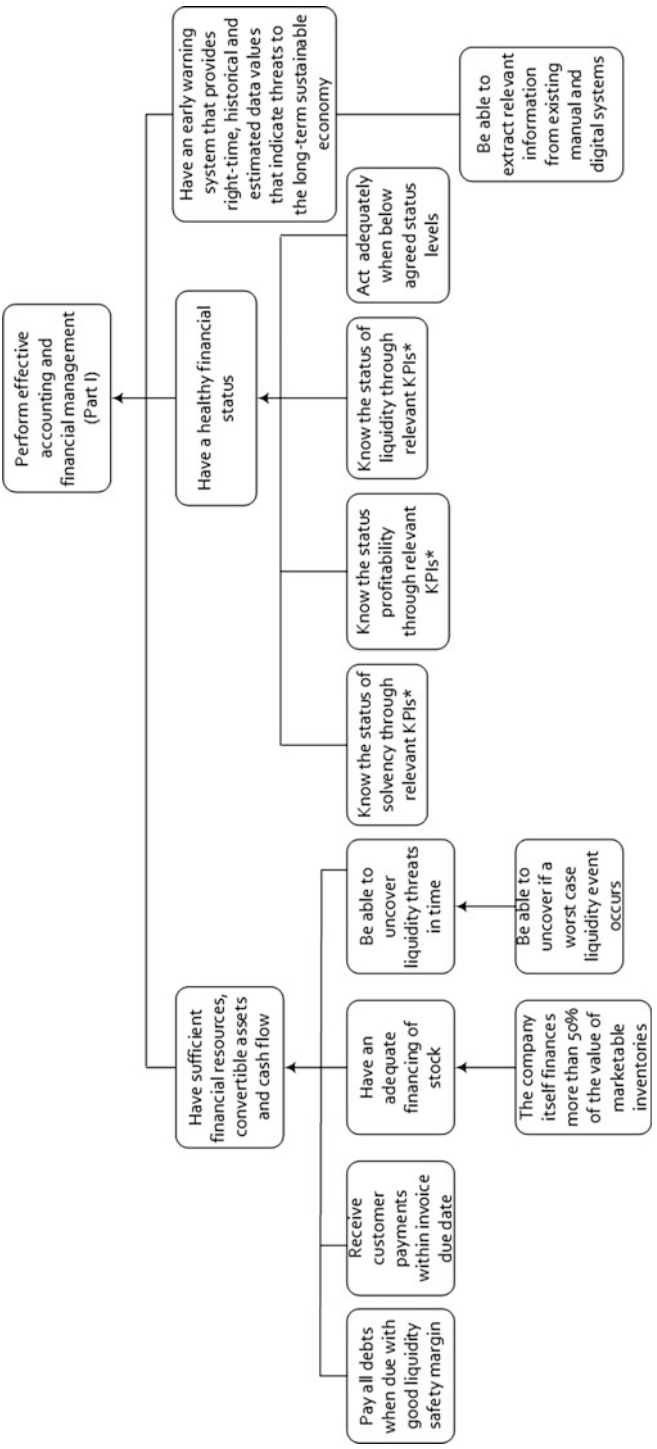

Fig. 7. Sub-model on having effective accounting and financial management

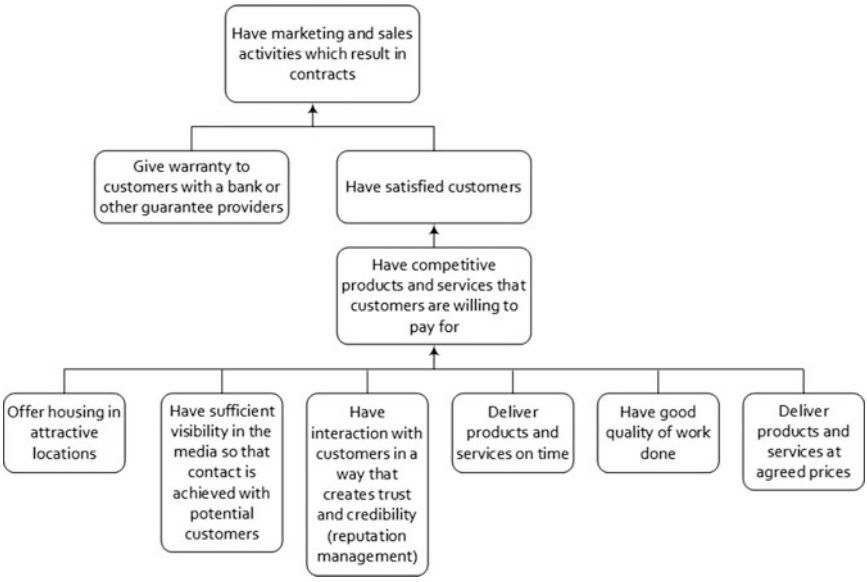

Fig. 8. Sub-model on having marketing and sales activities, which results in contracts

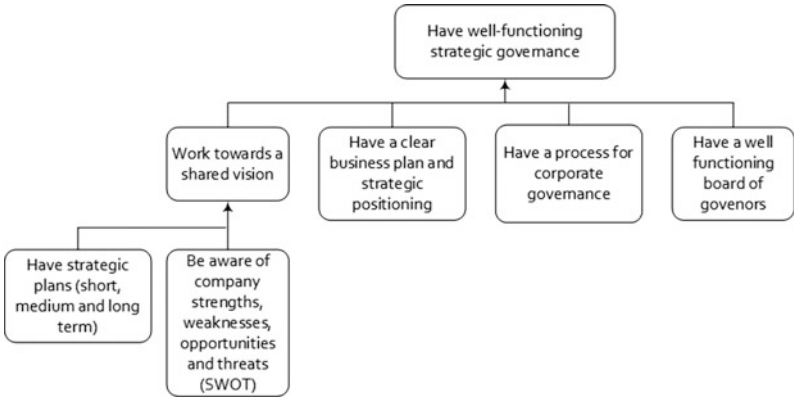

Fig. 9. Sub-model on having well-functioning strategic governance

the liquidity of the company. This supports the user of the model in estimating the status of the company in question. Similar criteria are developed for the other focus areas. Goals specific the company in question can be added to model. After the assessment of each of the goals, the model becomes a specific goal model relevant for the company in question.

In order to ensure that goals were followed by relevant improvement initiatives, a paper-based scheme was developed in the project where each goal was listed, categorized due to the status of goal achievement, linked to an improvement initiative with a start and end-date and motivated by strategy and other formal company decisions.

Liquidity			
Measurement Parameter	Indicator of satisfactory or good condition	Indicator weak condition	Indicator serious condition
Payment of debt when due	Pay all your debts when due and has a good safety margin	Paying almost all debt when due, but has almost no reserves to meet unforeseen events	Paying almost never debt when due. Often receive threats of debt collection experience last peak
Payments received from customers	The company's customers mostly pay when due, and now have few or no old Debts	The company has some claims where the customer rightfully hold back payment	The company has large amounts tied up in accounts receivable, where the customer refuses to pay before ... (Average credit more than 30-40 days)
Inventories	The company finances even more than 50% of the value of marketable inventories	The company finances itself ca. 40-50% of the value of marketable inventories.	The company has large amounts tied up in stocks without construction financing, where it may be expected to be a long time before it can be sold for cash receipts from customers
Discovering liquidity threat Describe a "worst case" liquidity event for the enterprise	If the incident occurs the company will now go into a weak liquidity condition	If the event occurs, the company will immediately go into a severe liquidity condition	If the incident occurs the company is now unable to pay its debts

Fig. 10. Example of criteria to support setting the status of a goal (Color figure online)

After having used the paper-based scheme in the field for some time, it became evident to the manager of the company that it was useful to ensure follow-ups of a variety of business areas, but it proved difficult and cumbersome to keep the paper-based scheme up to date, due to status changes, schedule changes etc. Evidently there are huge dynamics related to goal achievements in business so this problem needed a solution. Hence, a computer-based tool was developed to help keeping track of this dynamicity. The tool is presented in [33]. In the tool, each goal and related improvement initiatives can be documented, reviewed and refined, which is illustrated in Fig. 11. In the tool, the

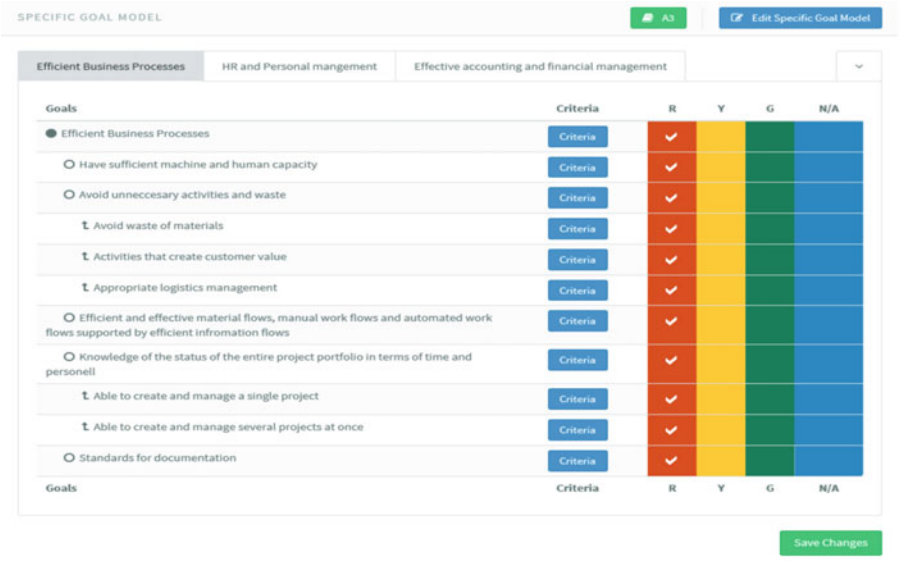

Fig. 11. Managing the goals of a specific company (Color figure online)

columns to the right are colored red (serious condition), yellow (weak condition), green (good condition) and blue (not applicable), starting from the left.

An overview of the company status can also be generated (Fig. 12), where the wheel on the right hand side illustrates the portion of red, yellow and green goals. In this case the portion of red goals is about half and the portion of red goals is the smallest.

Note that Figs. 11 and 12 are only meant to illustrate how the status of goals are presented to the user.

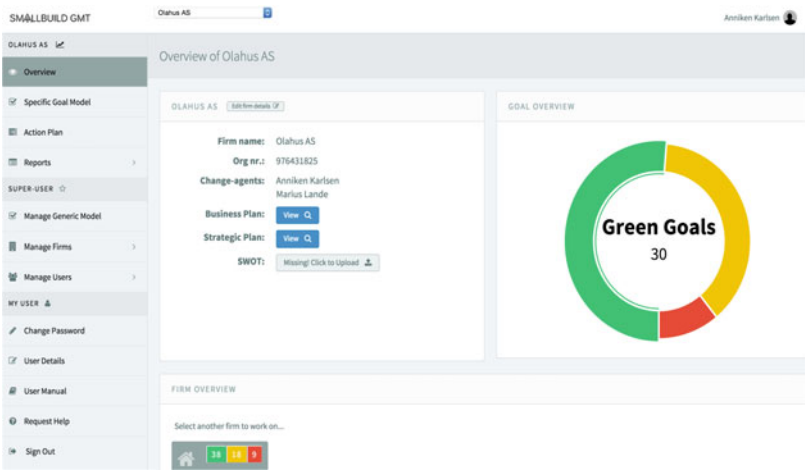

Fig. 12. Overview of goal status for a company (Color figure online)

5 Further Evaluation and Outlook

The SmallBuild + project is soon to be finished. The SmallBuild + method and tool has been tested, with positive results, in the SME construction company involved in the project. The positive results have in turn encouraged a consultancy company that is also involved in the project to start preparing for commercialization of both the method and the tool. In fact, they have founded another company aimed to support SME construction companies with capital and other support for making them sustainable over time. The SmallBuild + method and related tool will be an important part of the services offered.

The generic goal model has not only been tested in the SME construction company involved in the project. It has also been tested by the consultancy company in a turnaround operation involving another SME construction company, with positive results.

Although there are positive indications of the usefulness of the goal model and related tool, we foresee that further testing and consequent adjustments will be needed before they can be put into more widespread use.

One example of remaining work is that in the current version of the generic goal model, there is no weighting of the goals. During the use of the tool it has become evident that this needs to be done because not every goal can realistically be equally important. However, this is something that will require some research in order for such a weighting to be reliable. E.g. in initial discussions, it has turned out that the goal of having good financial management is a critical goal for SME construction companies. In any case, the complex relationships between goals in the model need to be the basis for such a weighting.

In terms of applicability of the goal model beyond the construction industry, we speculate that, since most of the goals are quite generic, it should be useful to other types of companies as well. One could also imagine that the goal model could be complemented with advice how to adapt it to other types of companies. This would hugely improve on the usefulness of the model, which is why we see it as a natural step to move forward, after further improvement and validation of the current model in the construction industry.

An additional improvement could be to extend the model with guidelines on how to integrate the model with a company's existing management practices concerning Lean, the Business Canvas and the Business Scorecard.

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