Key Success Factors of Innovation in Multinational Agrifood Prospector Companies[1]

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Abstract

The Wageningen Innovation Assessment Tool (WIAT) assesses a company's drivers and barriers to innovation and benchmarks the critical success and failure factors of its innovation projects with data of agrifood prospector companies around the world. The present paper discusses its application in 12 multinational agrifood prospector companies in the Netherlands and France. It is concluded that WIAT by uncovering the tacit knowledge of the innovation project team creates opportunities for substantial improvement of the innovation process, and that agrifood companies should specifically pay attention to market and product related up-front activities.

Keywords: innovation, assessment tool, agrifood prospector companies

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Introduction

Given the rapid development of technologies, the fast changing consumption trends and the ever increasing competition in the agrifood industry, even a large multinational agrifood company's competitive advantage can only be temporary. An important strategic option for companies that want to remain in the top of the industry is to pursue a prospector strategy, defined as a strategy to bring a continuous stream of innovative new products to the market or implement new processes before competitors do (Miles & Snow, 1978). As a consequence, a company pursuing a prospector strategy (in the remainder of this paper referred to as a prospector company) has to innovate continuously, and it has to treat the management of innovation as one of the basic business functions (Burgelman, 1988). This implies allocating substantial resources to the innovation process, more in particular to the Research and Development (R&D) function. Although the innovation process involves different departments, e.g. marketing, purchasing and manufacturing, and other actors along the supply chain, the primary locus of long-term innovation lies at the corporate R&D department. The pivotal role of R&D is to monitor the implementation of innovation projects from pilot testing to industrial scale introduction together with the 'development teams' in the divisions. However, a major risk of such a strategy is that the outcomes of innovation efforts are far from guaranteed. From innovation literature it is known, that only a very limited number of innovation projects will turn out to be successful (Cooper, 1999). It is therefore crucial for prospector companies to pick the right innovation projects and redirect or kill the potentially unsuccessful ones in an early stage of development before they turn into costly failures (Cooper, Edgett, & Kleinschmidt, 1999). However, it is very hard to predict success or failure in such an early stage of development. Up till now the methods available to do so had limited diagnostic value for ongoing innovation projects, and were developed and tested in technology-based industries such as the computer, pharmaceutical and aviation industry (see section 2). It is the aim of the present paper to address the problem of effectively managing the innovation process in agrifood companies by Presenting the Wageningen Innovation Assessment Tool (WIAT). Based on data of agrifood prospector companies around the world WIAT provides a methodology, that enables agrifood companies to compare the self assessments of the drivers and barriers to innovation at the company level and the critical success and failure factors of innovation at the innovation project level with comparable companies in their own sector. In total 46 projects, 11 successfully concluded and 6 failed projects, as well as 29 running innovation projects are discussed. Thereafter we focus on one of the multinational companies to show how the WIAT works in management practice.

The objectives of the present paper can be formulated as follows:

1. To develop an assessment tool that provides relevant, reliable and valid management information for business development teams in the agrifood industry.

2. To provide insight in the key success and failure factors for innovation in the agrifood industry

These two objectives combined can help managers to improve the innovation capabilities of their agrifood prospector company in general, and the start-up, go - no go or redirect decisions of their innovation projects. The theoretical contributions lie in the fact that the diagnostic value of existing tools for the evaluation of agrifood innovation projects is greatly improved and that the existing body of knowledge on critical success and failure factors for innovation (e.g. Cooper, 1985; 1992) is now extended from science-based to supplier dominated industries (Pavitt, 1984).

The paper is structured as follows. In section two we elaborate on different aspects of innovation management. A definition of innovation and the innovation process will be given, the innovation drivers and barriers, and the success and failure factors of innovation will be discussed, as well as the stage gate model. This section ends with a discussion of innovation in the agrifood industry. In section three on the research methodology, we elaborate on the WIAT, the constructs, and the methodology that was used to apply WIAT in the participating companies, consortia and knowledge institution. Section four presents the results at the innovation project level, by showing the Key Success Factors (KSFs) of agrifood innovation, and the comparison with of the successful and failed projects with the running projects. In section five the application of WIAT in one of the prospector companies is shown, to indicate how WIAT works in management practice. The final section includes the main conclusions and discussion.

Innovation

Definition of innovation

The economist Schumpeter (1934) defines innovation as a process of creative destruction, where the quest for profits pushes to innovate constantly, by breaking old rules to establish new ones. For Schumpeter, this implies not only the introduction of new products but also the successful commercialization of new combinations, based on the application of new materials and components, the introduction of new processes, the opening of new markets or the introduction of new organizational forms.

The innovation process

In the present paper a process approach towards innovation has been chosen. Myers and Marquis (1969) describe it as follows: *'Innovation is not a single action but a total process of interrelated sub processes. It is not just the conception of a new idea, nor the invention of a new device, not the development of a new market. The process is all of these things acting in an integrated fashion'.* Hence the innovation process involves activities and decisions from idea generation to the final launch of the product onto the market. The general steps are depicted in Figure 1. However, as indicated by Fortuin (2006), the depiction of the innovation process as a unidirectional sequence does not reflect its inherently iterative and concurrent nature.
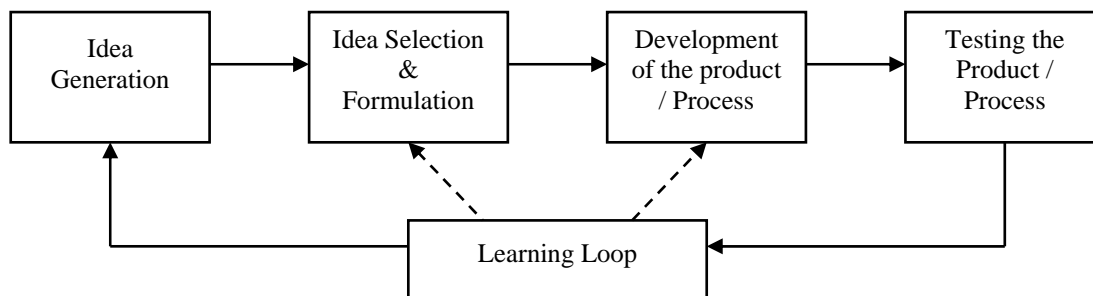
Figure 1: General representation of the R&D process (Tidd, Bessant & Pavitt, 2001)

Most companies organize the innovation process in projects. Innovation projects can be defined as determined plans and routes of development and implementation with the aim to deliver a new product to the market, or new (manufacturing) processes to business. In prospector companies, different functional areas are represented in innovation projects, such as R&D, marketing, manufacturing, and purchasing. As such, so called cross-functional teams are created where the team members co-operate from the early stage of new product development on till the product actually gets introduced to the market. The start of an innovation project is often decided by an R&D committee, and the project itself is led by a project leader who reports regularly to the R&D committee to monitor and keep track of the innovation process. However, the rationale to start an innovation project, as well as the rationale to stop or change it during its execution is not always clear. The go - no go or redirect decisions are heavily build on experience, and there is often no systematic identification of the factors determining success or failure (Cooper, 1999).

Drivers and barriers to innovation

The American Management Association (AMA) conducted a study including 1,396 executives of large multinational companies in North America and Europe and concluded that customer centricity, teamwork and cooperation, together with the appropriate resources (time and money) and organizational communication are the most important drivers to innovation (Jamrog, 2006). The ability to select the right ideas and freedom to innovate are other factors that play an important role. Top management commitment to innovation is a very important driver, as it ensures cross-functional cooperation, and creates an innovative environment. The greatest barriers to innovation are insufficient resources and the absence of a formal innovation strategy. Organizational structures that are not geared to enhancing innovation are also mentioned as hurdles, as well as a company's tendency to continue to invest time and money into unsuccessful projects. A last trap is the one which occurs when a company pursues innovations requiring different competencies than those available within the company (Jamrog, 2006). Successful innovating companies, however, do not have to rely on internal competencies alone when it comes to innovation. Chesbrough (2003) points at the paradigm of open innovation that assumes that companies should not rely only their own R&D competencies, as they do under the closed innovation model, but absorb and utilize knowledge from outside the company by different forms of collaboration with suppliers and buyers or even in some cases with competitors.

Success and failure in innovation

The previous decades have shown a number of studies that identify characteristics and factors leading to innovation success as well as failure. The prominent focus of these studies was to open the black box of innovation and provide in-depth understanding of how products are actually developed within companies (Brown & Eisenhardt, 1995). Some of these studies explicitly compare successful with failed projects and are called Dyadic studies. One of the most commonly known is the SAPPHO study (Rothwell, 1972; Rothwell et al., 1974) in which 43, mainly Brittish, case studies were compared pair wise. Another study was the Stanford project, which was mainly directed to Californian companies (Maidique & Zirger, 1984; Zirger & Maidique, 1990). Perhaps the best known is the NewProd project (e.g. Cooper, 1979; Cooper, 1985; Cooper & Kleinschmidt, 1987, 1993), which was a large study of pairs of product successes and failures. There have been some extensive reviews of these studies (e.g. Brown et al., 1995; Ernst, 2002; Montoya-Weiss & Calantone, 1994). From the reviews we list the most central key success and failure factors:

- Product superiority: the product uniqueness and superiority from the customer's perspective.

- ▪ Proficiency of marketing and technological activities: 'up-front' activities such as initial screening, preliminary market and technical assessment, detailed market study and/or marketing research, and business/financial analysis.

- ▪ Protocol: clear definitions of the target market; the customers' needs, wants, and preferences; the product concept; and the product specifications and requirements.

- ▪ Market potential: market need, growth and size.

- ▪ Organizational relations, cross-functional integration, team communication and cooperation.

Stage gate model

Based on extensive studies of successful and failed innovation projects, Cooper (e.g. 1985; 1992) developed a stage-gate model to improve the control over the innovation activities. The stages represent distinct parts of the R&D process where research, marketing, sales and other activities occur. Gates are points where the decision is made to pass the project into the next stage, end the project, or send it back to the previous stage. Most important evaluation criteria in the early stages are technical feasibility, intuition and market potential. Later on the focus shifts to product performance, quality and staying within the development budget (Hart, Hultink & Tzokas, 2003). However, as Syamil, Doll & Apigian (2004) argue: 'Stage-gate reviews focus on whether the expected outcomes of each stage have been achieved. But, they do not provide a measure of how well the innovation process is conducted. Thus, such stage-gate reviews have limited inherent diagnostic value for identifying what is right or wrong with an on-going innovation process.'

Innovation in the agrifood industry

It is important to realize that most insights in the key success and failure factors of innovation are based on research in high-tech industries, such as the computer, biotech, or pharmaceutical industry, where other industries, for instance, supplier dominated industries such as the agrifood industry remained largely unexplored. An exception is the study of Pannekoek, Van Kooten, Kemp & Omta (2005) of 74 entrepreneurial innovation projects in Dutch greenhouse horticulture. The authors identified product superiority, and cooperation with supply chain partners as the most important success factors for entrepreneurial innovation. Other studies indicated that successful innovating agrifood companies have a strong market orientation (Batterink, Wubben & Omta, 2006), and that economic considerations and insufficient innovation competencies are the main barriers to innovation in this sector (Batterink et al., 2006; Garcia Martinez & Briz, 2000). Costa and Jongen (2006) list as major barriers to agrifood innovation a lack of concrete guidelines for

the effective implementation of consumer oriented food development, the sequential approach of the innovation process and the lack of intra- and inter-organizational coordination or integration of R&D and Marketing's activities and know-how.

Methodology

Wageningen Innovation Assessment Tool

We developed the Wageningen Innovation Assessment Tool (WIAT) to help companies in program selection, project prioritization and execution. As stated in section 1, this tool should be able to provide relevant, reliable and valid management information for business development teams in the agrifood industry. WIAT has tailored insights obtained from earlier studies in the field of innovation (e.g. Booz-Allen & Hamilton, 1968; Cooper, 1985; Hollander, 2002, Jamrog, 2006) to the agrifood industry. Moreover, it enhances the diagnostic value of existing tools by effectively utilizing the rich tacit knowledge of the members of innovation project teams that come from such diverse backgrounds as food science, marketing, engineering and sales and linking these insights at project level to the drivers and barriers of innovation present in the company as a whole.

WIAT starts with structured interviews with a number of top and innovation executives about innovation management in general and the drivers and barriers to innovation. In these structured interviews the following topics are scored using 5-point Likert scales: The importance of innovation to the company; reasons for pursuing innovation; the ability to identify creative people; drivers and barriers for the development of an innovative culture; the external drivers to innovation; creativity and actions taken to support innovation. The scores are then compared with the AMA study discussed in section 2 (Jamrog, 2006).

After the structured interviews about innovation management in general, a number of clearly successful and failed projects are selected, to which the running innovation projects can be compared. Successful projects are defined as projects that not only are a success in terms of engineering/technological accomplishment, but also perform well after market introduction and generate substantial sales for the company. Failed projects are projects that are either stopped before project completion or market introduction, or prove to be a failure in the market. Next, the selected projects are evaluated by the project team members. To this end, first a meeting is organized with the project leader of each project to adapt the WIAT questionnaire to the specific situation of the innovation project at hand. The terminology is checked so that it will be meaningful for the project team, questions can be eliminated that are not applicable for the project, and company specific problem areas can be included in the assessment. Second, the project team members -sometimes extended with external experts familiar with the project - fill out the questionnaire. The project team members are then asked to assess how well

the project performs along a number of dimensions (see below), but also how certain they are about their answer. This implies that for each of the 55 statements the project team members have to provide an assessment between 1 to 10 (1 = I totally disagree with this statement and 10 = I totally agree with this statement), and the level of certainty (1 = I am completely uncertain about my assessment of this statement, and 10 = I am completely certain about my assessment of this statement). Based on the team's response score, the optimism within the team regarding the measured factors can be determined. Based on the team's certainty score, it is possible to determine their confidence in their answers. By looking at the standard deviation among the individual scores per project it is possible to determine the level of consensus within the team. It is assumed that if the team is more certain regarding their assessments, it will have a higher probability of achieving success.

Based on the pivotal work of Cooper (e.g. 1992), further developed by Hollander (2002), WIAT uses the following constructs to assess the change of success and failure of individual innovation projects:

- Two constructs at the company level: project-company fit and project resources. The project-company fit indicates that an innovation project should fit with the company's strategy, if a project is not in line with the company's strategy, the project leader should ask why this project was initiated in the first place (Hollander, 2002; Fortuin, 2006). The project resources construct indicates that success of an innovation project relies on the financial and human resources devoted to it, as well as the technical, managerial and marketing skills of the team members and the company at large.

- One construct at the team level: team communication. Project team members are key to every innovation project, of course. Without them, the best innovation process cannot develop a new product or process successfully. In effect, the project team members all have to line up and work in an integrative way. This necessitates good technical and communication skills as well as sufficient decision making authority.

- Two constructs at the product/process level: product superiority and product aspects. Product superiority indicates that a new product should possess distinctive features compared to competitors' products in order to be successful in the market, such as a higher quality, or unique features. It is assumed that if a new product has a clear economic advantage and meets certain customer demands, it will have a higher probability of achieving success in the market. Furthermore, there are specific product aspects that define the innovation process, such as high product innovativeness and/or technological complexity.

- Three constructs define the market: market competition, market volume, and environment. A new product is developed for a certain market, where volume, size, potential value, and growth of the market determine if a product has possibility to be sold at the numbers predicted. However the new product has to compete with other products or substitute products in the market. The constructs define the level of competition and the market attractiveness as well as the level of hostility of the (institutional) environment.

- Three different time-dependent constructs are used to measure performance: project, product and future performance. Project performance refers to whether the project is within planning, budget, and to which extent the original project objectives are fulfilled. Product performance refers to benefits for end-users and if the project is expected to earn money for the company, and future performance refers to possible spin-off products or processes and the possibility that it improves customer loyalty. The constructs and the individual items are listed in the appendix.

The results of a project assessment along all constructs, including team optimism, consensus and confidence indicate the potentially strong, and, more importantly, weak points of the innovation project. The project assessment results are compared with a database that includes the WIAT evaluation of a growing number of successful and failed innovation projects from the agrifood industry. The results of the WIAT assessment are then the starting point for actions to improve the project.

WIAT application

The present paper shows the results of the application of WIAT in 12 prospector companies in the Netherlands and France, as well as two innovation consortia and 1 research institute closely related to the agrifood industry. All investigated companies were large, multinational prospector agrifood companies, with annual sales ranging between USD$ 100 Million up to over USD$ 1 Billion. This implies they allocate resources to innovation on a structural basis, and have a central R&D department where innovation projects are carried out by multidisciplinary teams. Two projects in the ex post analysis were from relatively smaller companies. However, these companies still have relatively high percentage of employees dedicated to research and development. Leaving out those projects from the analysis did not substantially change the outcomes and subsequent conclusions. However, the minor differences found are mentioned when discussing the results. In total, 46 innovation projects, 11 successful, 6 failed, and 29 running projects were assessed. From the 46 projects, 2 projects were conducted by innovation consortia including a number of companies and knowledge institutions and 2 projects were conducted by a research institute. The running projects assessed were all in a development stage. The minimum number of evaluators of a project was 2 (in the

case of projects that were already concluded), the maximum was 11 and the average was 3.6 (see table1 for the details).

Table 1: The number of innovation projects assessed

| Innovation projects	Number of projects		Number of respondents	
Running	29	63%	99	60%
Successful	11	24%	35	21%
Failed	6	13%	30	18%
Total	46	100%	164	100%

For the projects assessed ex post, the same methodology was applied as for the running projects. To enable a valid comparison, the evaluators were explicitly asked to evaluate the project as if it was still ongoing. Evidently this does not eliminate the response bias, but this approach has proven to be effective (Cooper, 1985). The statement and certainty scores of each respondent per project were combined in order to calculate the project scores. Then, construct scores were calculated by taking the average of the underlying statements. Some negatively formulated statements in the project company fit and market competition construct were reversed before the statistical analysis started. Both parametric (t-tests) and non-parametric (Mann-Wittney) tests were used. In general, substantive conclusions were supported by both statistical techniques. In this paper, we present the results from the t-tests. The results were checked for the following control variables: company size, number of divisions, innovation history and market position. We found no significant effect of these control variables. It should be realized, however, that this was not to be expected because it are all very large prospector companies, often the market leader in their respective sector.

Results: Key Success Factors

Key success factors at the construct level

The consistency of the different constructs was analyzed with a Cronbach's α reliability test. All constructs show a reliability of Cronbach's α > .68, except for the environment factor (Cronbach's α > .52). For this type of explorative analysis, a Cronbach's α larger than .6 is satisfying. The results can be found in the appendix. By comparing the average assessment of the 11 successful (35 respondents) with the 6 failed projects (30 respondents), the key success factors were determined. First, KSFs at the construct level are discussed. Then, we focus on KSFs on the individual statement level. Figure 2 shows the key success factors (the red ovals indicate significant differences). Except for the construct 'project-company fit', all construct scores of successful projects are higher than for failed projects. However, not all differences between success and failure are significant. The constructs 'product superiority' and 'project performance' are significant at the .01 level, whereas 'team

communication' and 'market volume' show p-values of < .05. Finally, the factor 'product resources' has a p-value < .1. Figure 2 further shows that the mean scores for the running projects mainly fall between the successful and failed project means. Exceptions are 'project company fit' and 'market competition'. The mean score on the construct market competition of running projects is higher than that of the successful as well as failed projects. We interpret this finding as a signal that the respondents of the running projects perceive the present level of competition in the market as more severe than the respondents of the successful and failed projects do when looking back at the competition level some years ago. The finding that the average project-company fit of the running projects is assessed even lower than that of the failed projects might be interpreted as a signal that the agri-food companies under investigation tend to shift to more radical levels of innovation.
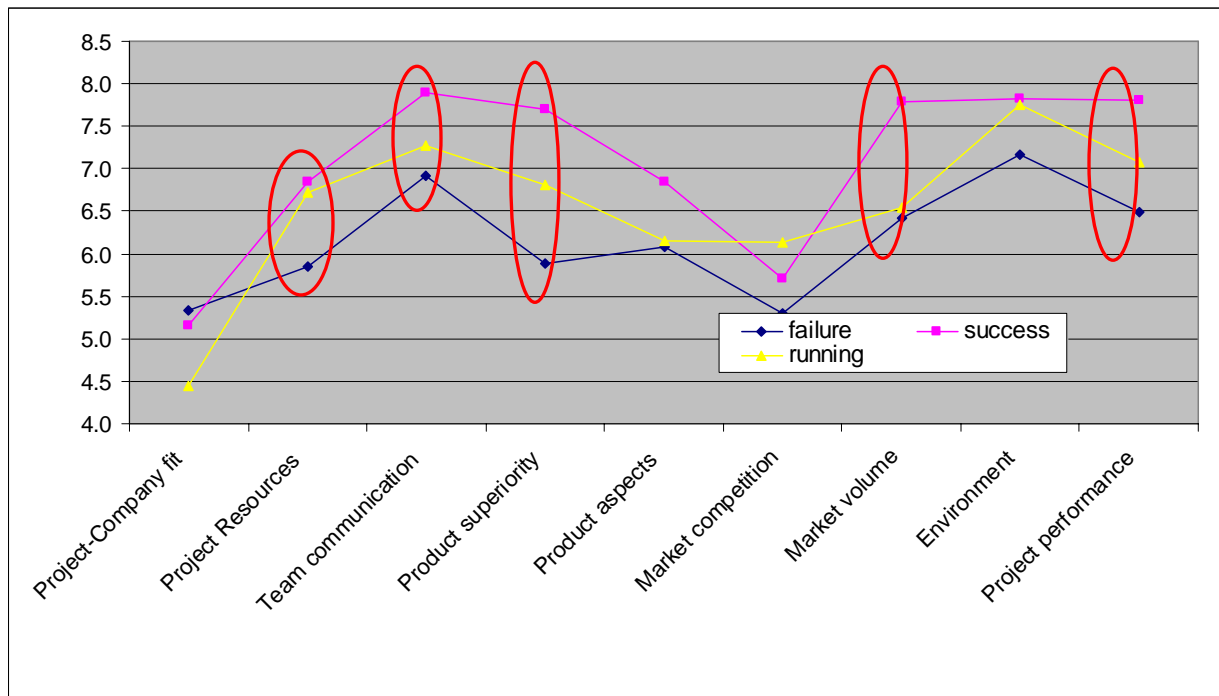
Figure 2: The key success factors in the agrifood industry, including the mean scores for the running projects (statement scores).

In figure 3 the significant construct differences for the certainty scores are highlighted with red ovals. It appears that for successful projects, evaluators are more certain about the team factor ($p < .01$) and the two market factors (market competition and market volume, $p < .05$). Interestingly, figure 4 further shows that certainty levels of running projects are in line with those of failure projects. This might be partly due to the fact that the successful and failed projects were assessed
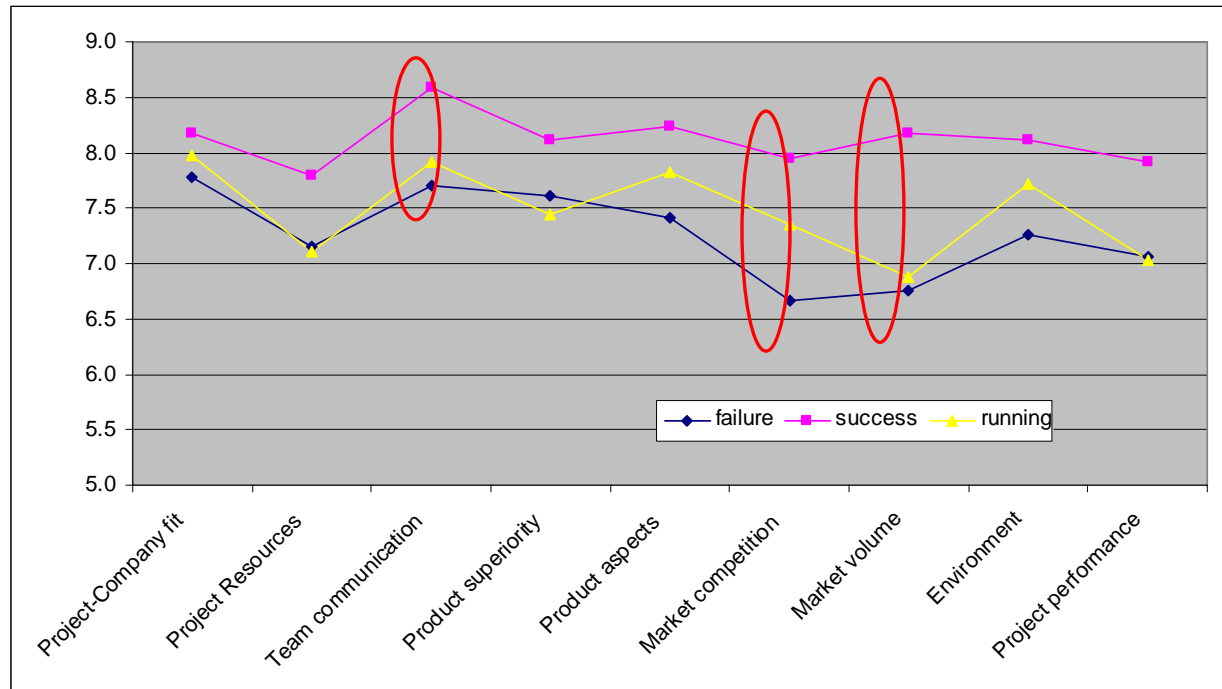
Figure 3: The key success factors in agrifood industry, including the mean scores for the running projects (certainty scores).

ex post, whereas the running projects were assessed ex ante. Hence, in the future WIAT will be further improved by basing the reference values (of successful and failed projects) on ex ante evaluation and ex post performance measurement.

Key success factors at statement level

As the evaluation with WIAT deals with in-depth information concerning the projects, we also did the statistical tests at the individual statement level. In Table 2 the statements showing a significant difference between the means of the successful and failure projects are provided, with the corresponding t-values indicating the level of significance.

Interestingly, three statements concerning the project resources were significant. Successful agrifood projects score higher on sufficient engineering skills and people, sufficient advertising and promotion resources and skills, and a sufficient sales force and/or distribution resources and skills. This result already shows that innovation truly is a cross-functional process. However, surprising are the relatively low scores (also for successful and running projects) evaluators give concerning advertising and promotion and the sales force and/or distribution resources and skills. Apparently, the marketing and sales force of agrifood companies plays an unimportant role in the innovation process in the eyes of the evaluators. The important question here is, if agrifood companies do not underestimate the

Table 2: Key success factors at the statement level

	Failure Mean	Success Mean	Significance Level [1,2]
Project - sufficient engineering skills and people	6.54	8.08	**
Project - sufficient advertising and promotion resources and skills	4.43	5.93	*
Project - sufficient sales force and/or distribution resources and skills	5.32	6.81	**
Team - member wants to participate in a new project with the same team again	6.88	8.44	*
Team - member completely understands the potential problems of the project	6.79	8.02	*
Team - member completely satisfied with the product development process used	6.04	7.50	*
Product - superior to competing products customers needs	5.62	8.23	*
Product - higher quality than competing products	6.35	8.57	**
Product - unique features or attributes	6.64	8.34	**
Product - will definitely be used by the customer	7.25	8.33	**
Product - high potential, can create additional products	6.49	8.33	*
Project will stay within budget	5.93	7.23	**
Project will fulfills the product specifications	5.61	7.52	**
The project will generate money	6.46	8.82	**

[1] One-tailed, 15 degrees of freedom; [2] * p-value < .05, ** p-value < .01.

importance of the relationship with the customer. Three significant differences with respect to the innovation project team are observed. If a project ends successfully, team members are more satisfied with the project team (they want to participate in the same team) and team members indicate to have a better understanding of the problems that have to be solved, than in failed projects. Clearly, successful innovation projects involve superior products in terms of customer needs and quality. This could be expected as product quality plays and important role in the agrifood industry. Successful projects also score higher on the statement that the new product has the potential for line extension and extra features. Finally, in successful projects, evaluators are more positive about the probability that the project will stay within the budget, fulfils its objectives and that the product will ultimately generate money in the market.

Certainty Scores

Table 3 lists the significant differences for the certainty scores of the different statements.

Table 3: Key success factors at the statement level (certainty scores)

	Failure Mean	Success Mean	Significance Level [1,2]
Project - sufficient production resources or skills	7.43	8.27	**
Team - member completely understands the potential problems of the project	7.29	8.48	* [3]
Team - member completely satisfied with the product development process used	7.55	8.82	**
Product - mechanically and/or technically complex	7.34	8.43	*
Market - a highly competitive one	6.79	8.54	*
Market - with many competitors	7.17	8.51	*
Market - characterized by intense price competition	5.94	7.71	*
Market - monetary value of the market for product is large	6.20	8.11	**
Market - potential customers great need for product	6.75	8.23	**
Product - will definitely be used by the customer	6.99	8.29	* [3]
Product - high potential, can create additional products	6.96	8.43	*
The product will generate money	6.65	8.58	* [3]
This product will improve the customer's loyalty	6.50	8.14	* [3]

[1] One-tailed, [2] * p-value < .05, ** p-value < .01.
[3] p-value < .1 for the sample without the two smaller companies

Interestingly, successful projects score higher for the five market related statements. Team members from successful projects were clearly more certain about the market features. This implies that the teams of successful projects were clearly better informed about the market characteristics (e.g. through dedicated market research) then teams from unsuccessful projects. Also, two statements from the team construct turned out to be significant. For instance, team members from successful projects were more confident about the product development process.

Results: WIAT Analysis in a Prospector Company

To show how WIAT works in management practice, we show in this section an example of the WIAT analysis in a multinational prospector food processing company with markets in Europe and the USA. First, the drivers and barriers are given as assessed by three top and innovation managers. These assessments are compared to the AMA study. Then, two running projects are evaluated using the WIAT database.

The sample company is one of the largest multinational agrifood companies with an annual sales volume between US\$ 500 million and US\$ 1 billion. It is a processor company of primary produce, with a strong technology base. It follows a prospector strategy: it aims at staying ahead of competition by introducing new products and implementing new processes faster than its competitors. The sample company is representative for the research population. The selected running projects aim at bringing products to the market in new innovative ways, involving not only new production processes, but also introducing new products that are geared to new ways of food preparation at home.

Analysis of the drivers and barriers to innovation

The scores of the three top and innovation managers of our sample prospector company on the importance of innovation are in line with those in the AMA study (see Figure 4).
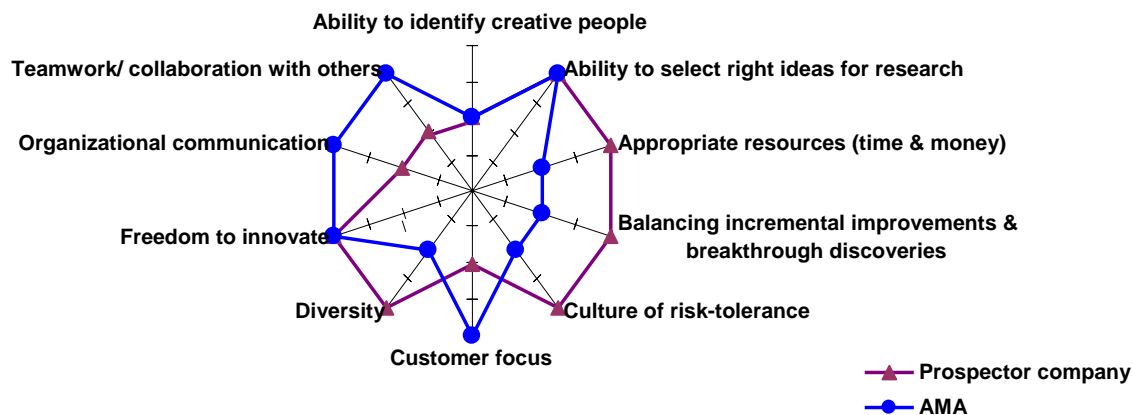
Figure 4: Innovation drivers and barriers of the agrifood prospector company compared with the AMA average

The three top managers recognize the importance of innovation, and have a clear understanding of what innovation means. However, 40% of the AMA respondents and two of our respondents does not have a clear understanding of how the company can become more innovative. Figure 4 shows that the company's managers are as or even more convinced than the average AMA executive about their company's culture of risk-tolerance, diversity, ability to select the right ideas, to provide the appropriate resources, and finding the right balance between incremental improvements and breakthrough discoveries. This is not surprising because our sample company is really at the top of its industry, while the AMA-results are based on the average assessment. However, it is therefore extra surprising that regarding customer focus, organizational communication and teamwork and collaboration with other departments, the company's managers self-assessment is significantly lower than the average assessment of the AMA executives.

The most important barrier to innovation at our sample company, cited by all respondents, is a lack of clear goals and priorities. This barrier were also indicated by more than 50% of the AMA respondents, who rank them in the top three barriers for innovation. Other barriers that were indicated by at least one of the respondents were insufficient resources, company's structure insufficiently geared toward innovation, lack of management support. These barriers also appear in the top three of more than 35 % of the AMA-respondents. Although the sample company considers itself as a prospector company, this assessment clearly points out that the implementation of their innovation strategy can be improved.

The innovation project analysis

The figures 5 and 6 present the assessments of a potentially successful and a potentially failing innovation project from the sample agrifood prospector company. The figures are presented the way they were shown to the project teams. The zero line in the figures represents the mean construct score of successful agrifood companies.
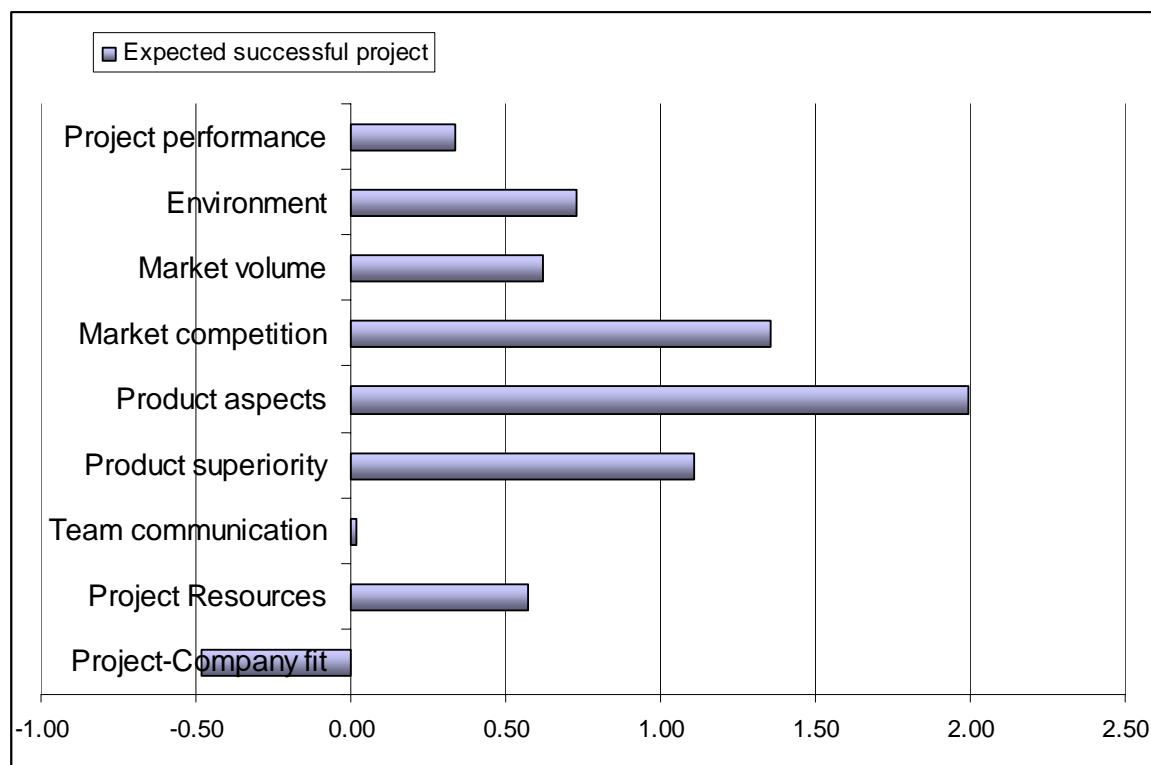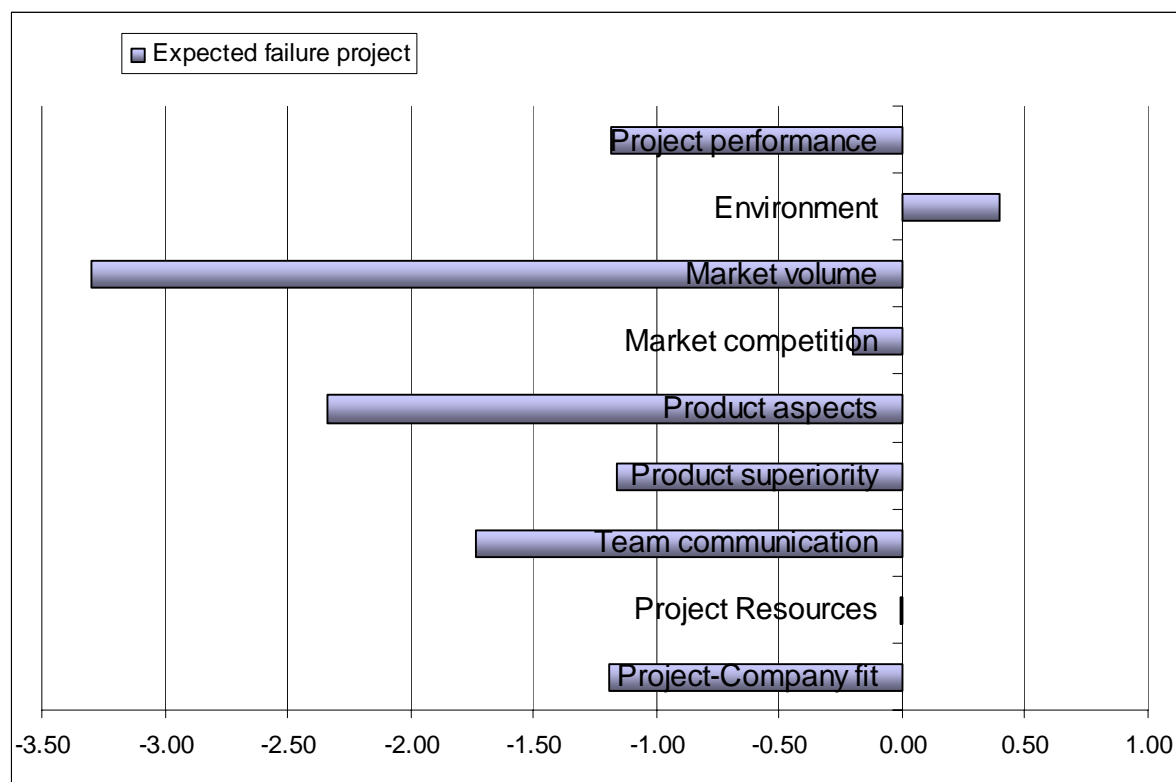

Figure 5: A potentially successful innovation project compared to successful projects[1]
[1] The zero line in the figure represents the mean factor score of successful agrifood projects

Figure 5 presents the results for a potentially successful project. This project scores are high compared to successful projects for almost all constructs. Only for project-company fit the score is lower. It is important to note that the high score for 'market competition' is a potential weakness, as this construct represents the expected level of competition this product will face on the market. The team factor is perfectly in line with successful projects, and the team evaluates the product as superior to competing products. This is important because it is the most important success factor. In addition, the high score for 'product aspects' indicates that this project concerns a relatively innovative product, with highly advanced technologies. As this is a comparison with successful projects, the prospects for this project look extremely good. If we would have compared the assessment with failure projects, the figure would even have looked better.

Figure 6 presents the results of a potentially failing project. Most notable is the low score for market volume. Apparently, the team is not very positive about its market potential (below 5 on a 10-point scale!). Moreover, for key success factors such as product superiority and team communication the scores are low. The management should clearly ask itself whether they should continue this project.

Figure 6: A potentially failing project compared to successful projects1
 1 The zero line in the figure represents the mean factor score of successful agrifood projects

Conclusions and Discussion

Concerning objective 1: *To develop an assessment tool that provides relevant, reliable and valid management information for business development teams in the agrifood industry,* it can be concluded that the innovation process of agrifood prospector companies can be substantially improved by revealing the tacit knowledge of the project team members by use of WIAT. It provides clear criteria for project selection and project evaluation by comparing running projects with a database of successful and failed innovation projects. Moreover, by comparing running projects with the ex-post insights of clearly successful and failed projects in the same company, the ex-ante predictive value of the tool is greatly enhanced. The tool can therefore provide important diagnostic clues that not only help in the go/no go decisions for running projects, but even more importantly, can deliver critical information on strong and weak points of the project as it is being conducted. As such, it enables managers to interfere at a moment that this is still possible. This enables companies to use their scarce resources for the most promising projects and to effectively steer these projects along pitfalls and threats. By connecting the feedback on project level with information on the drivers and barriers to innovation present in the culture of the company as a whole, the instrument deepens the understanding of managers of what underlies innovation success and failure of the company, and how to manage the uncertain innovation process in a more effective and efficient way.

As a tool under development, WIAT has some limitations. The reference database with successful and failed project still relies on historical data, with an inherent evaluation bias by respondents. But, in a rapid pace, running innovation projects are finished. With future performance measurement, evaluating the stopped projects, and the products introduced onto the market, either successfully, less or even unsuccessfully, WIAT can be increasingly based on the ex ante evaluation of innovation projects.

Concerning objective 2: *To provide insight in the key success factors for new business development in the agrifood industry.* With our study, we identified the key success factors for innovation projects in the agrifood industry, namely team communication, product superiority and the expected high market volume are the factors that make the difference between success and failure. The finding that successful agrifood projects score higher than unsuccessful projects on the construct engineering skills as well as on that of resources and skills in the fields of advertising, promotion, and sales, may indicate that innovation in this sector truly is a cross-functional process. It is therefore concluded, that the innovation project teams should be cross-functional and feature a heavyweight leader, who will enhance team communication and provide for a clear product definition.

From the finding that teams of successful projects were clearly more certain about the market and about the way to conduct the innovation process, than teams from unsuccessful projects we conclude that they are better informed about the market

characteristics (e.g. through dedicated market research) and are more confident to direct the innovation process accordingly. The finding that the level of market competition is assessed significantly higher in running projects than in completed projects may indicate that the level of competition that agrifood companies are facing today has risen dramatically, even compared to only a few years ago. If we combine the above findings we may conclude that agrifood prospector companies that could flourish in the past by counting on their technological expertise as driver for business success, nowadays should realize that they need to pay special attention to market and product related up-front activities, such as detailed market studies and clear product definitions prior to product development. Seen in this light, the finding that nearly all respondents, not only those of failed projects, give relatively low scores for advertising and promotion and the sales and/or distribution resources and skills, might be considered as an early warning signal for the industry as a whole. For knowing the customer needs, wants and preferences in the target markets, translated into product specifications and requirements are of essential importance to transform good quality products into superior and unique products.

One of the conclusions presented to the prospector company that was used to show the special features of WIAT in § 5, was that there was a clear disequilibrium with respect to how the innovation process was conducted in the different regions of the world and for the different product areas. As such, there was a high potential for some regions to adapt best practices developed by the company in other regions. Moreover, one critical element highlighted by the WIAT was that the company lacked a well-functioning marketing function. Innovation team members mainly based their decisions on personal assumptions about their customers, and not on thorough market research, while the final consumer was completely overlooked. As a result of this study, the company reorganized its R&D and marketing functions world-wide.

It can be concluded that the diagnostic value of existing tools for the evaluation of agrifood innovation projects is greatly improved and that the existing body of knowledge on critical success and failure factors for innovation is now extended from science-based to supplier dominated industries and can thus become a valuable monitoring instrument to assist agrifood innovation management.

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Appendix

The WIAT Questionnaire with Cronbach Alphas

Construct name and reliability	Items comprising the construct*
Project-Company Fit statements: $\alpha = 0.69$ certainty: $\alpha = 0.85$	The product type is totally new for our company. We have never made or sold products to satisfy this type of customers need or use before. The potential customers for this product are totally new for the company. The technology required to develop this product is totally new to our company.
	The nature of the production process is totally new for our company.
	The distribution system and/or type of sales-force for this product is totally new to our company.
	The type of advertising and promotion required is totally new to our company.
	The competitors we face in the market for this product are totally new to our company.
Project Resources statements: $\alpha = 0.81$ certainty: $\alpha = 0.83$	Our financial resources are more than adequate for this project. Our management skills are more than adequate for this project. Our engineering skills and people are more than adequate for this project. Our production resources or skills are more than adequate for this project.

	Our marketing research skills and people are more than adequate for this project.
	Our advertising and promotion resources and skills are more than adequate for this project.
	Our sales and/or distribution resources and skills are more than adequate for this project.
Team communication	I have enough communication with my team members to do my work efficiently and in an effective way.
statements: $\alpha = 0.78$	The portfolio management has explicit expressed its commitment to the project team.
certainty: $\alpha = 0.82$	The performance requirements for this project are clear for me.
	In a new project I surely want to participate in the current team again. I completely understand the potential problems of the project.
	If I doubt the opinion of a team member I will surely confront this member with it.
	All our team members are focused on "collecting" knowledge for our project.
	I am completely satisfied with the product development process used.
Product Superiority	Our product will be clearly superior to competing products in terms of meeting customers' needs.
statements: $\alpha = 0.76$	Our product will be of higher quality than competing products.
certainty: $\alpha = 0.86$	Compared to competitive products, our product will offer a number of unique features or attributes to the customer. Our product will permit the customer to do a job or do something he/she cannot presently do with what is available.
	Our product will permit the customers to reduce their overall costs, when compared to what they use now.
Product Aspects	Our product is highly innovative totally new to the market.
statements: $\alpha = 0.75$	Our product is a very high technology one.
certainty: $\alpha = 0.74$	Our product is mechanically and/or technically very complex. Our product will be first into the market.
Market Competition	The market is a highly competitive one.
statements: $\alpha = 0.69$	There are many competitors in this market.
certainty: $\alpha = 0.92$	There is a strong dominant competitor – with a large market share – in the market.
	There is a high degree of loyalty to existing (competitors') products in this market.
	New product introductions by competitors are frequent in this market.
	The market is characterized by intense price competition.
Market Volume	The monetary value of the market (either existing or potential market) for this product is large.
statements: $\alpha = 0.68$	The market for this product is growing very quickly.

certainty: α = 0.91	Potential customers have a great need for this type of product.
	The customer will definitely use the product.
	This product has a high potential (i.e can additional products, multiple styles, price ranges).
Environment	This project will contribute to the competitive advantage of the company.
statements: α = 0.52	This new product will surely meet the applicable laws (e.g product liability, regulations, and product standards).
certainty: α = 0.71	This new product will surely have a positive effect on the environment.
Performance	What is the probability that this project will be completed within the original planning?
statements: α = 0.96	What is the probability that this project will be completed within the original budget?
certainty: α = 0.90	What is the probability that this project fulfils all its objectives?
	What is the probability that this project will directly benefit the end-users (either through increasing efficiency or effectiveness)?
	What is the probability that this project will earn more money for the company than it costs?
	What is the probability that this project will have a major spin-off or springboard effect, a step in the development of a new generation of products?
	What is the probability that this project will improve customers' loyalty to the company?

* All items are measured on 1-10 scales. 1 = I totally disagree with this statement and 10 = I totally agree with this statement. For the level of certainty: 1 = I am completely uncertain about my assessment of this statement, and 10 = I am completely certain about my assessment of this statement