

# **BUSINESS DIAGNOSTIC TOOL**

## ***Designing and Programming an Application for Use of SME Partners***

David Plandor and Lenka Landryova

*Department of Control Systems and Instrumentation, VSB Technical University Ostrava  
17.listopadu 15, Ostrava, Czech Republic*

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Abstract: The aim of this paper is to describe a newly designed diagnostic software application for a small and medium enterprise (SME). This application was driven by a need of small and medium sized companies and by a focus on a simple, comfortable and user-friendly interface. The diagnostic process provided by the application consists of 4 main parts – a questionnaire, a processing system, a report and an action plan. The entirely new generic diagnostic system developed according to the functional specifications given by partnering companies in our project includes a system of questionnaires with processing logic conditions, and was tested with end users and upgraded based on end users' feedback. A live version and implementation into a web site on the server is ongoing.

## **1 INTRODUCTION**

Our target is to design a diagnostic software application for a small and medium enterprise (SME). According to the given functional specifications (FutureSME, 2008), the diagnostic process provided by our application consists of 4 main parts – a questionnaire, processing system, report and an action plan. A special module, which is not a part of the end user-interface, is an administration tool. An application is published and can be found when an end user is registered to the FutureSME web portal.

The main objective is a need to focus on a simple, comfortable and user-friendly interface. Other objectives include a support of language versions, system dynamics as it needs to be independent from any programmer's interference with the business diagnostic logic background. All of the actions should be just provided by a system administrator. A very suitable solution seems to be the development of an entirely new generic diagnostic system that includes system of questionnaires with processing logic conditions. The newly created system has to be tested with end users and upgraded on the basis of end users' feedback. Then it should be finalized into a live version and implemented into the web site on the server.

## **2 BUSINESS DIAGNOSTIC TOOL SPECIFICATION**

Most of the leaders on a market with business diagnostic tools offer strategy development for a company during a consultancy session with the help of advisers (Morrison, 2007), recruiting and retaining skilled workers (Building Small Business HR, 2008), or may be oriented specifically at a given industry in order to deal with the highly dynamic circumstances in which industries around the world now operate (Print 21 Action Agenda, 2005). Others are evaluating business performance going through a number of simple questions ranging from sales turnover, productivity and employee performance figures (McAnderson, 2010). The results are offered in a form of an individual or team report supplied during a follow up meeting with a full explanation and advice for advancements, opportunities and clarification (McWilliams & Associates, 1992, Business Diagnostics 2004).

What makes our proposed solution different is the technical aspect and a point of view from the SME end users, who originated the functional specifications and a design. The on-line questionnaire consists of questions and its responses. Responses are linked to a user who is currently logged into the FutureSME portal. All users'

responses have to be stored in a database for further processing. A list of results is generated from users' responses on the basis of logic rules specified by the system administrator. All users' results are displayed in the report web page including graphic items (static or dynamic schemes, graphs etc.). A user is allowed to create his own action list by processing the business diagnostic results. An action list is used for the planning of actions leading to the solution of crucial issues or improving the specific part of company. This list is automatically filled from other sources on the portal as well. The action list should be additionally edited by a company representative including the addition of a time schedule, responsible persons and priorities.

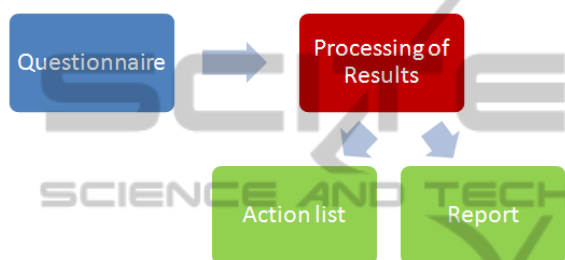


Figure 1: Business diagnostic process.

In order to suit all variables of business diagnostics for different targeted SMEs, we need to have several versions of the diagnostic process. It will be very effective to compare companies' results or create average results for a group of companies according to specific factors (the business area, region, size of a company). All complex data have to be stored for future comparison. For a faster approach we should be able to transfer the results into newly created versions. Particularly in the case we need to edit only a few questions and we do not want to force users to fill out the answers from a previous version again. In case we need just a minor change, we delete particular users' responses and force a user to answer them once again. The system does not require the creation of a new version in the simplest case when we change just text of a question, the response or result without changing the meaning.

System users are divided into groups according to their roles - administrator, facilitator, translator and company representative. We can divide users into these groups with different permitted accesses and available functions:

- Company Representative – is allowed to fill out the questionnaire, view a report and fill the action list from business diagnostic results. This role is default for end users from SMEs. Each company is allowed to have just one

representative for the whole diagnostic process or more representatives from different company divisions.

- Facilitator – has all functions of company representative. A facilitator fills out the questionnaire on behalf on or with a end user, helps him to explain all in detail. A facilitator uses a complex approach across all facilitated companies and has access to other tools on the portal.
- Translator – is allowed to add, edit or delete language versions of texts across the whole diagnostic process. Default language is English.
- Administrator – is allowed to add, edit or delete questions, responses, logic, report, and language translations.

## 2.1 Development Environment and Tools

Since our goal is to develop a web application, we need to choose an appropriate environment and tools for development. On the server side there is ASP.NET and PHP. VB script and Javascript are technologies on the client's side. Due to our rich experience and the simple implementation into Linux or Windows servers, we have chosen PHP version 5.2.17, which generates the XHTML code. On the client's side a Java script and Java script based library called jQuery is used. JQuery offers a wide scale of tools for the creation of a user-friendly interface. As the portal utilizes the Microsoft SQL Express Edition v9 database it appears to be the best choice for business diagnostics as well. For good quality graphs a free version of a pChart library based on PHP is used.

## 2.2 Diagnostics

For the diagnostic template a database table has been created. There are basic data – who and when has the template been created, its brief description etc. This table is the root for other template tables such as questions and responses. At first we have to design a questionnaire part of the diagnostic process then we will continue to data processing and reporting.

## 2.3 Questionnaire

At the beginning we have to design database structures for questions, variants of questions, responses etc. The following tables have been

created:

- Questions
- Question's variants
- Question's responses
- Question's options
- Categories

Each question is filed into a category. Categories are tree structures, so it is possible to create several hierarchical levels. A question can be specified by its display order and a group. Groups of questions are put onto one page in order to improve the questionnaire's arrangement.

Questions are specified by types:

- Customized answer (text box)
- One possible answer (radio group)
- $n$  possible answers (checkbox)
- Choosing from defined options (drop-down list)
- Percentage (0 – 100% in steps of 5)
- Special – i.e. choosing from options with additional customized answers

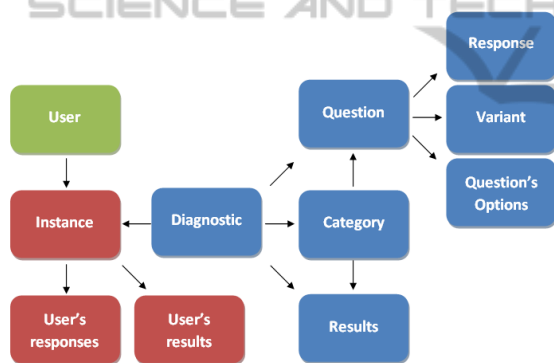


Figure 2: Basic scheme of business diagnostic tool.

The questionnaire always displays one question or one group of questions according to defined groups. The questionnaire keep the question order. Questions from one group are put onto one page. A grouping of questions is used for better viewing similar or simple questions on one page. Question groups are defined in a database table. Each question can have its variants. Variants are necessary in situations when we need to distinguish answers in dependence of a additional factor e.g. we evaluate the number of employees in a company and we are interested not just in this year, but also in the previous two years. So we add three variants to that question. These variants are displayed as columns and a user is provoked to answer all three variants. A particular variant of a question (if exists) has to be specified in the logic condition as well.

On the left side of the screen there is a category

completion table. Categories are always linked to a diagnostic template. Each category includes the name of category, the total number of questions in a category and the number of answered question within a category. It is always obvious how many non-answered questions in a category remain. The total completion status in percentage is placed on the table header. The table serves also for fast navigation across the questions. The first question of a category is offered by clicking on a category's ID and a user is redirected to a first non-answered question by clicking on the name of the category. All links in the category table are improved by tooltips that appear on the hover about the links. Tooltips specify the behavior of a link. Once all questions of the category are complete, a green checkbox icon appears. Once the total completion status reaches 100%, a user is redirected to a guidepost – it is possible to review the answered questions or continue to processing a report generation from the results. If there are still some non-answered questions, the user is forced to complete them.

Completion status	100 %
1 Business context	15 / 15
2 Business performance	1 / 1
3 Strategy	14 / 14
4 Operating model	22 / 22
5 Process management	8 / 8
6 Performance management	7 / 7
7 Leadership	19 / 19
8 Governance	16 / 16
9 Agility	22 / 22
10 Innovation	12 / 12

What industry does your business operate in?  
Select all that apply

- Agriculture
- Chemicals
- Construction
- Design
- Electronics/electrical equipment
- Energy
- Food and drink
- Finance
- Logistics/distribution
- Medical/pharmaceutical
- Other manufacturing
- Paper and packaging
- Precision engineering
- Textiles
- Warehousing
- Other (please specify)

Previous Next Skip

Figure 3: Questionnaire and a completion table.

A question's response is stored into a database after clicking "Next" or "Previous" button. A question can include customized check scripts. Fixed checks of the number of responses are defined for questions according to their specification in a database. There is also a script for percentage counting always assuming a total of 100%. A check condition can be specified by an administrator by using simple language (java script based) or scripts can be generated by the business diagnostic system. Generation is based on choosing options and adding operators for defining relationships between various parts of conditions. If a condition is not satisfied, a user cannot proceed. There is a skip button, so the next question is displayed but no results are stored.

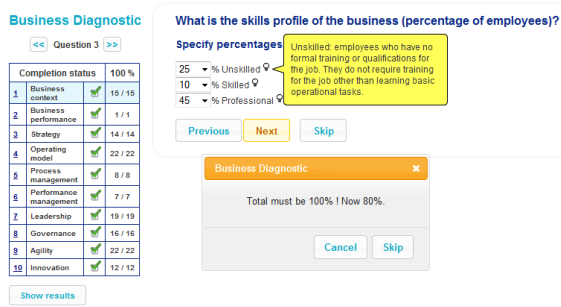


Figure 4: Complex view of web questionnaire.

A user is supposed to return to that question otherwise the result processing and report generation are not available. Every question and response can be extended by a tooltip with the detailed specification or précising the valuation. If a question or response has a tooltip, a small bulb image appears at the end of the text. Additional text is shown after clicking on the image, this way seems to be much more comfortable than showing tooltips on the hover which can be confusing when there are many answers with tooltips very close to each other. When the response is marked as customized a text field is placed into the questionnaire. Sometimes we need a combination of the checkbox and customized text. So another check script is required. When we tick a checkbox we have to require a customized text and when we put a customized text, we need the checkbox to be ticked. Otherwise, we cannot proceed. Similar behavior is applied for other form item combinations.

### 3 PROCESSING OF RESULTS

A user is allowed to start processing the results and generating a report once the completion status is 100%. Now we are going to describe a system for result processing and generating the report. All possible results are stored in a database as a part of the diagnostic template. The results are filed into a category, which can (but does not have to) correspond to the question categories.

Each result includes:

- Text part
  - Gap – description of company’s gap
  - Short recommendation - short recommendation how to improve or eliminate a gap
  - Detailed recommendation– detailed recommendation how to improve or eliminate a gap

- Type of result – i.e. sustain, improve, urgent etc.
- Logic part – simply defined logic condition.

A program processes the data in a cycle - it goes through the list of results and the logic condition of each result is examined. A result is assigned to a user when the condition is satisfied.

The logic formula is internally stored in a specific format. The system administrator does not have to know the exact convention as the administration allows automatic formula generation by going through the questions choosing the answers, variants and adding operators. Symbolic schema is programmatically converted into a simple logic formula.

For example a formula can look like this - (B1.2=2 AND F1.5=0) OR (F2.3>20). It means that this result will be assigned to the current user as long as the condition is satisfied. We have two parts joined by a OR operator, so one of the expressions in brackets has to be true. The first expression – response 2 to question 1 from B subcategory, option 2 and response 5 to question 1 from F subcategory equals zero. Now there is the OR operator followed by a second expression in brackets – response 3 to question 2 from F subcategory is higher than 20.

If the condition is true, the result is written into the database and another procedure, that completes all dynamic data for the result, is invoked.

A recommendation text is generated for each result. The dynamically generated texts are inserted into the static template i.e. a list of ticked responses or responses with a value higher than 10% etc. All dynamic texts are stored in the database.

Appendix 1 – Strategic capability gap analysis and recommendations

Area	Subarea	Result	Gap	Recommendation
Strategy	Guiding vision	Sustain	There is a guiding vision in the business that is understood by everyone	For more information about guiding vision, visit the <a href="#">Strategy</a> information page.
	Customer value proposition	Improve	You seem to lack a focused customer value proposition	The business should have a primary value proposition on which it competes, supported by one or two secondary propositions. You need to define why customers come to the business. For guidance on how to do this, click <a href="#">here</a> .
	Core competencies	Sustain	The business is clear on which processes and resources it should focus on to deliver value to its customers	To learn more about core competencies, visit the <a href="#">Strategy</a> information page.
Operating model	Strategy	Improve	There is room for improvement in your strategy development and implementation process	To ensure that a focused business strategy is developed and implemented, the business should For guidance on how to do this, click <a href="#">here</a> .
	Financial management	Sustain	The profit formula of the business is defined and operates effectively	To learn more about financial management, visit the <a href="#">Finance</a> information page.
	Operations	Sustain	The budget allocation for the business is aligned to its priorities and competitive basis	For more information on budgeting and financial management, follow the <a href="#">links</a> .
Operations	Operations	Sustain	The business outsourcing decisions are in alignment with its competitive basis	For more information about outsourcing, visit the <a href="#">Operatio</a> <a href="#">Model</a> information page.
	Social responsibility	Sustain	The business appears to behave in a socially responsible manner	For more information on social responsibility, click <a href="#">here</a> .

Figure 5: Example of generated results.

#### 3.1 Report

Results are displayed in a report – a classic web page with following types of objects:

- Static object – report header, images, schemes
- Dynamically generated objects – result texts, graphs from results, user dependent data.

The report template is always created by the administrator. For designing the report structure the best a TinyMCE web library is used. Perhaps we can count on a programmer's contribution when we need to add some more complicated objects such as graphs. The report utilizes the pChart library for good quality graphs. At the end of the report a list of questions with responses is printed. The final report is exportable into PDF.

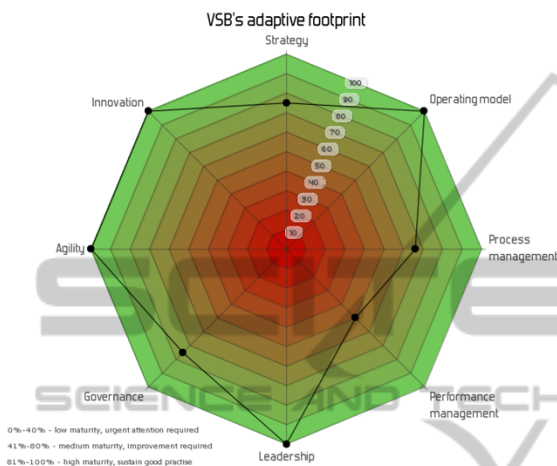


Figure 6: Example of a graph in a report –dynamically generated from user's results using pChart library.

### 3.2 Action List

The filling of the action list is launched from web report. It is a procedure, which uses all already stored user's results and inserts them into an action database table. The action list includes actions that are necessary for company planning in the future. The action list is filled from other sources on the portal as well. Actions can be created manually by a user in different parts of the portal. We will focus on data coming from the business diagnostic. By clicking the button a procedure for filling the action list is invoked. A program goes through all results and stores them into an action table in the database. An overview of all actions is accessible in different parts of the portal. a user can assign other data to an action i.e. responsible person, start and due date etc. A user can fill the action list periodically, always by the insertion of currently valid results.

### 3.3 Instance, Comparing Diagnostic Results

Each system of questions and responses (diagnostic template) is linked to a user using instances. An instance includes the primary key of diagnostic

template followed by user's ID. An instance is also specified by the creation date. An instance is linked to the other two database tables – the user's responses from questionnaire and the user's results generated by processing part of the system. If a user wants to complete the same business diagnostic later, a new instance linked to the same template is created, but with a different ID and creation date and is linked to different user's responses and results. Instances connected to the same diagnostic template are comparable in order to see changes and improvements in a company.

### 3.4 Administration

Administration is a separate part of the business diagnostic for editing currently existing data but also for the creation of totally new diagnostic templates – the defining of questions, responses, results including logic conditions etc. New versions of a diagnostic can be created by copying existing responses or the results from previous versions. Users do not have to answer same question in new versions. All text fields can be defined using a HTML code or WYSWYG editor for text highlighting or adding a link redirecting a user to interesting sites within the portal or somewhere else on the web.

Question		Logic		
ID	Text	Restriction	Tooltip	
A1	Can you clearly communicate why the business exists?	Choose one only		OK Cancel
1	Yes			
2	To some extent			
3	No			

Figure 7: Administration – question texts editing.

## 4 CONCLUSIONS

The required goals for the business diagnostic have been reached. The dynamic system for a general diagnostic process (when a questionnaire followed by the processing of results is required) has been developed. Our diagnostic system is used in the FutureSME project with many end users – small and medium company representatives across European countries. The application is discussed with end users and accommodated according to their feedback. The application has been developed with emphasis on a simple, modern, comfortable and friendly user interface. A web format allows wide scale utilization – not just for small and medium enterprises or the business sector but in general any

self-assessment purpose. The business diagnostic application will be improved and extended in the future and its results will be processed by other external applications such as KPI (key performance indicators) software application. Other parts of the FutureSME portal will display diagnostic results i.e. complex company state overviews, progress in time etc. We hope that this tool will become commonplace not only in small and medium enterprises but also for business facilitators, consultants and in general in situations when self-assessment and result processing is needed.

## ACKNOWLEDGEMENTS

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