A Detailed Summary Development System through e-Document Computation: A Case of Panyapiwat Institute of Management’s Student IT Competency

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Abstract

In the past, the process of developing detailed reports from corrected data from tools such as questionnaires tended to be rather inefficient and time consuming. The multiple questions, many respondents and data analysis can cause complication and frustration. Such issues can be eliminated through the use of technology by having the system compute and process data automatically. Quality and quantity of work can be increase effectively and efficiently. This paper proposes an approach to improve document development though document computation by employing open standard. The document computation can lead to reducing the tasks of users in the process of developing the report. This also helps in reducing redundancy of work and human error from occurs. The case study of Panyapiwat Institute of Management’s “Student IT Competency” is presented to verify the result of using document computation in developing a document.

Keywords: Automated Document Generator, Document Accessibility, e-Document Computation, Information Technology Competency

1. Introduction

One of the tools that many organizations use in their research is questionnaire. A questionnaire consists of a series of questions that are related to the topic or research. The advantage of questionnaires is that the cost of using it to collect data is low and is fast to gather data from respondents. Currently there are various online questionnaire developer tools available which enable organization to create questionnaire quicker and easier. The online questionnaires help the organization to be able to contact large number of people at low cost. Also, it helps the organization distribute questionnaires and collect data faster from a large number of respondents. This helps organization be able to gain essential data and take action quicker. Online open source questionnaire developer such as Google also store data from respondents in spreadsheet. The users will be able to analyze and compute data in spreadsheet form to complete their tasks.

However the data that collect from questionnaire can be enormous, especially in quantitative questionnaire. The number of respondents can be as much as thousands. The data that is collecting from questionnaire can also be enormous depending on how detailed the organization would like it to be. There can be as much as 80 questions or more in a single questionnaire. With large amount of data, it can be time consuming to analyze and interpret. Some of questionnaire tool are offering to summarize after collection or to import data into the system to show overall data summary to help organization analyze the data. The problem is that sometimes, the organization would like to get the detailed report for each respondent to be able to understand and respond to the need individually. Such issues, developing individual report from questionnaire tool can be time consuming. The process can also be redundant in which user has to extract the data from each attribute and put in the report form over and over again.

The objective of this research is to develop a system that can develop the detailed report from the summary data that was collected to fasten the time and process using Open Document Format (ODF). The system aims to increase the efficiency and effectiveness of the process to develop individual report for organization to understand and be able to respond to the need individually. The system will also help reducing redundancy of process where users have to develop a detailed report for each respondent.
By using the proposed system, users will be able to create detailed reports from collecting data in the spreadsheet effectively and efficiently. The system can turn a hundred or thousand records of data to be individual detailed report with less time consuming while ensuring correctness.

2. Problem in Developing Detailed Summary from Questionnaires

The questionnaire helps an organization to collect data from respondents much faster and is able to reach a large number of respondents at low cost. Questionnaire tool also allow users to develop questionnaire in various ways to suit the need of users. The user can construct any number of questions with no limitation. However the problem might occur after the questionnaires have been collected. First, to analyze collected data might be difficult. Some of the questionnaire such as Multiple Intelligence can contains up to 80 questions. With the large number of questions this means more data for the user to analyze. Also the number of respondents can be a large number depending on the data that the organization would like to collect which can range from ten to a hundred or more. Such a problem can lead to redundancy of work or process which user might have to extract data and put those data in specific fields to generate summary and report.

The second issue is that the tool that is used to generated questionnaire might offer a basic overall summary of collected data. However the basic overall summary might not suit or meet the needs of the organization. Some organization prefers the summary in the graph or various formats, which the organization is required to purchase for additional function.

The third issue is that the tool that used to developed questionnaire might not be compatible with other or created by it owns format which cannot be used with other. This can cause difficulty in the process especially in collaboration where data needs to be exchanged to process. For example the research department use specific tool to develop questionnaires. Once the data was collected, it was transferred to analytical department. However the analytical department does not have the tool that supports the format which makes them unable to access the data and process it.

The forth issue is that some organizations need more than just the summary of collected data. They need to compute the collected data as well to be able to complete the tasks such as calculate certain data and match the result with specific information from the organization. This can be a burden and extra work for the user. Also the human error can occur in the activities that require users to complete the task. Such problem can result in wrong information and data and can lead to inefficient decision making.

3. Related Work

There are three areas of related work that involved in this research study. The first area is the competency evaluation model that will be used to evaluate the student’s competency. Competency can be used as a guideline for student development to develop student to meet the career requirements following the work based learning program. There are many competency models available including United Nation Competencies for the Future [11] which focused on core values, core competencies, and managerial competencies. The model covered wide area of aspects, however the model did not cover the Information Technology aspect which is the core that is needed to evaluated the student. There is also an Information Technology Jobs and Skill Standard [2] that focused on 3-tiers; fundamental skill, technical skill, and Industry specific skill. The model still did not break down each skill that suit for different job in IT field. Finally there is Information Technology Competency Model [12] which developed purposely for IT field. The model consists of 4-tiers; personal effectiveness competencies, academic competencies, workplace competencies, and industry-wide technical competencies. On the forth tier which is industry-wide technical competencies, the model break down to specific characteristic of work in IT field including principles of IT, database and application, network, software development, etc. This model can be used to check the potential of the students and match it to career path. As a result, in this research study the questionnaire will be developed based on Information Technology Competency Model.
The second area is the tool to developed questionnaires. There are currently many questionnaires developer tools available. Some of them are free to use while others require purchasing. The online questionnaire has been chooses because it can be distributed to many responders and gather and store a large number of data. Some of online questionnaire tool only offer the result in online platform which can be complicate for the users to reused data later on. Some limited the number of questions that could be created in one questionnaire. In this research study the questionnaires developed by using Google Document Online which can be use to create a large number questions for the questionnaires.

The third area is the system that processes to complete the task. There are several researches on e-document computation including Enhanced e-Government Transparency through Linked Open Data: A Case Study of Provincial Budgeting in Thailand [7]. The research present the idea that the upload document from various organizations can be computed by the system automatically and generated the report based on the user’s preference. Also there is research on Content Modeling for Automatic Document Summarization [13] that presents the model of text summarization and content modeling for multi-document summarization. Due to the system need to account for multiple data submission for evaluation on the single student. Another related work is Automatic Document Indexing in Large Medical Collections [4] which deal with large amount of data. This is needed because the system needs to deal with large amount of number of questionnaires and large number of student. To be able to index and categorized data into group based on evaluate skill is important.

4. Approaches and Architecture

This research proposes an approach to solving problems in computing questionnaires, by developing a system that supports document compatibility. The system’s design would enable it to understand the data, compute and provide the result for the user. The system will consist of two parts. A component that allows user to upload the document that contain collected data. This will enable user to upload data and allow the system to process and produce the report automatically. The second part focuses on developing the detailed report based on user preferences.

4.1. Document System Supporting Multi-Platforms

The system has to be able to accept documents uploaded by users and to process it regardless of version and format. This is because different users or different departments might create document format differently. This can be achieved by using standard document formats. In this research the Open Document Format (ODF) [1] has been chosen for the all the document creation and representation in the proposed system which guarantees the accessibility to a document even user use different platforms. ODF is an open standard from OASIS [9] which is an independent file format. By using ODF, this will solve the issue of document compatibility and enable the users to upload collected data document without the concerned of file version or format differences. The report after the computation will also be generating in the ODF format to ensure accessible to the document.

4.2. Understanding Content

In order for the system to be able to compute and generate the result from collected data, the system needs to be able to understand the content from upload document. This is vital because the questionnaires can be developed in various ways and the collected data can be different. By fix variable, form, and format, this might work in specific questionnaires but the problem might occur when questionnaires have been adjusted, modified, added, or deleted. The data that the system will automatically extract and compute might be wrong which can lead it to be unable to generate the result and report from upload document.
4.3. Document Computation

The system developed to help redundancy of work and human error for the user. In the old process after collection of data, users need to extract data from specific field then use those data to compute and generate result based on users’ preferences for each respondent. If the number of respondent is a hundred record then users are requires doing it a hundred times as show in figure 1.

The old process is redundant and prone to human error. As a result the proposed system will automatically extract the data and compute the result for the users. This will fasten the process and the users can receive the result quicker to help with decision-making. The process of the proposed system is show in figure 2.
With the proposed system the task that users are required to do is only uploading the document. The rest of process will be completed automatically by the system. The system will go to each record in the document and extract data then compute the data based on the report design. The computed data can be used to generate a graph automatically in the report or used the data to cluster or match information based on prepared information as show in figure 3.

**Figure 2. Process of Proposed System**

**Figure 3. The system generated detailed report for all respondents**

The detailed report for each individual respondent’s data will be generated by the system for each respondent for users. As a result, the report can be generated faster and ensure the correction of data by reduce human error that might occurred. The system computes and makes use of result after computation automatically to reduce any redundancy of work. The system also ensure that the report that generated by the system can be accessed regardless of platform.
5. A Case Study of IT Competencies for Panyapiwat Institute of Management’s Engineering and Technology Student Major

5.1. Background

Panyapiwat Institute of Management or PIM is one of a few institutes that emphasizes on work-based learning program. The work-based learning program is the program where students not only gain academic knowledge but they also gain practical experience through on-the-job training. The work-based learning helps prepare the student to be able to work effectively and efficiently like a professional after the students have graduated. One of the advantage of work-based learning program is that the companies that students undergo in job training will get to know the student and see their potential which will give them the higher opportunities in working in that company.

One of the core faculties of PIM is Engineering and Technology. Similar to other faculties, the students need to go under the work-based learning program to gain practical experience from organization in the information technology and computer engineering fields. One of the activities that the faculties have to do is to evaluate student competency in the Information Technology field. The model that used to evaluate the students is Information Technology Competency Model from the Employment and Training Administration of United States Department of Labor [12]. The reason for choosing this model is that the model evaluates soft skill and hard skill in various aspects including personal effectiveness competencies, academic competencies, workplace competencies, and industry-wide technology competencies (principle of information technology, database and application, Network, and so forth). The competency evaluation is needed for the company to understand the potential, strength, and weakness of the students that applied for the position. The questionnaires was created in an online format to collect data from faculties that involved in teaching students and also the company that the student have undergoes on-the-job training.

5.2. Current Problems in developed IT Competencies for Engineering and Technology Student Major

The problem that currently occurs is that the number of questions in the questionnaire that needs to be analyze and the number of student that need to be evaluated are too many. The questionnaires that developed based on IT Competency model contains more than a hundred questions in likert-scale format. The large numbers of questions greatly impact data analysis for the faculty to handle which can be time consuming. The data in not only need to be summarize but also need to be able to compute as well. The faculty needs to compute the collected data inorder to develop the detailed report for student. Then the data needs to be compared then match to specific detail to provided full description of result. After that the data will be used to generate graph to provided alternative ways of data representation. The process can take up to ten to fifteen minutes or more for each data set.

The number of students that need to be evaluated also can be a problem. The number of students that need to be evaluated at one time is around a hundred and the evaluation can be up to four to five times for each students. This can create confusion and a work load for the faculty to analyze and summary detail to develop report. This process can take up five to ten minutes to summarize the data and develop report for student’s IT competency. In this case study, the number of student that needs to be evaluated is 104 students and the number of question in the questionnaire is 120 questions as shown in figure 4. The students need to be evaluates 3-4 times based on the job training that student participated
The process for developing the report is a repeated process which faculties have to continue working repeatedly. The process includes:

- Automatically extract data from uploaded documents
- Sum the data in certain groups of questions to get the total number
- Use the result to create tables
- Use the result to create graphs
- Match the result with the definition of each skill
- In case of more than one evaluation for a student, then the result will need to be averaged.

The final report will consist of the student’s name, student’s ID, student’s major, Personal Effectiveness Competencies, Academic Competencies, Workplace Competencies, Industry-specific Competencies, and also the weaknesses that the student needs to improve as feedback for the student as shown in Figure 5.
The computation and graph generation is quite simple however due to the large number of data and respondents this can be time consuming and can cause frustration for the faculty to complete the tasks. Furthermore, human error can occur in the process which might create big impact to the data analyzed and student evaluation.

5.3. Document Computation

One of the key elements in the process of report generation is through document computation which extracts and computed the result from data automatically. The process is as follows:

- Once the document uploaded, the system will go to each row and extract the data for computation. Each row represents each respondent. The system will go through the entire respondent and find the similar student ID. This is in case that student has been evaluated more than one time, then average the number of the total data.
- The system sums the data in a specific group of question such as writing, reading, and communication skill to get the total point. The system will continue the process with all the group of question in the questionnaires.
- After the system computes the sum from uploaded document. The system then uses the result from each group of question to create the table and graph to provide alternative view of information for users.
- Then the system will check the score which one is the lowest which means student need improvement in that areas. The score of the lowest one will then use to get the description information.
- After complete one evaluation of student then the system continues repeat the process for the rest of the students.

After the process, the system will generate detail reports on the IT competency for individual student after the job training which the faculty can use to improve student. The report also can be used for the company to see the potential of the student which help with the decision making whether the student skill meet the job requirement.

6. Experiments, Evaluation, and Results

6.1. Experiments

The proposed system was tested by the faculty of Engineering and Technology from Panyapiwat Institute of Management. The questionnaires were developed in the online format to gather information quicker and the responders could complete the questionnaires anytime. The responders included student, faculty, and company that student were training at. The students were asked to complete the questionnaires online to evaluate themselves while the faculty and company will evaluate the student based on their performance and knowledge. The numbers of students evaluated were 104. After all the students had been evaluated, the faculty that is responsible for analyzing and developing detail report for individual students will use the system to generate the report. Then the user was requested to evaluate the system performance after completing the task. The result from the evaluation will determine the performance of the system on whether the system helps reduce redundancy of work and workload for the faculty while producing an error free report.

6.2. Evaluations

The evaluation is based on Criteria for measuring and comparing information systems [10] which focused on six areas:

- Systems quality: The performance of the system whether system help the user completed the task effectively and efficiency.
- Information quality: The information that system generates meets the requirement in term of accuracy, relevancy, up to date, and able to help user complete the task.
- Use: The use of system is easy and simple.
- User satisfaction: Whether the user satisfied with the performance of the system and information.
- Individual impact: Whether the system impact the individual user that involved in the process.
- Organizational impact: Whether the system impact the organization.

These criteria will be use to evaluate the system whether the system reduce the workload and redundancy while ensure quality of work. Also the system will be evaluate whether the use of system is support multi-platform for various users.

The data for the performance of system evaluation will be collected via questionnaires where the respondents who are the faculty will be evaluating in likert-scale format. The scale ranges from 1 to 5 which represents strongly disagree to strongly agree. The questionnaires also contain the quantitative part where responder can give comments and opinions about the system and how to improve it.

### 6.3. Results

The result of evaluation based on six criteria from Criteria for measuring and comparing information systems was summarized in table 1. The feedback from respondents was mostly on the positive side which shows that the majorities of user are satisfied with the performance and the result of the system.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Respond (%)</th>
<th>Positive (Strongly Agree and Agree)</th>
<th>Neutral</th>
<th>Negative (Disagree and Strongly Disagree)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems quality</td>
<td>80%</td>
<td>80</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Information quality</td>
<td>100%</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Use</td>
<td>70%</td>
<td>70</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>User satisfaction</td>
<td>80%</td>
<td>80</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Individual impact</td>
<td>85%</td>
<td>85</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Organizational impact</td>
<td>90%</td>
<td>90</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

On the issue of system quality, the majority of users are on positive side that the system can help fasten the process and ensure the correctness of data of report that generate by system. The system helps increase effectiveness and efficiency of work for the users. The work process of users has been reduced to only upload data document.

On the issue of information quality, all of the users are on positive side that the data that was generating by the system is correct and effective. The system help reduce human error occurred in the process of developing detailed report for student. The system help developed the report faster so the information can be used quickly. When the student got another evaluation, the users’ only need to upload the new document and the system will do the process automatically.

On the issue of use, the majority of users are on positive side that the system was easy and simple to use. The only task that users are required to do is to upload document into the system. There are some concerns with whether the system will still be able to perform if the questions have been adjust or modified.

On the issue of user satisfaction, the majority of users are on positive side. The system meets the need of users. Compare to the traditional process where users have to do all the tasks, the system answers all the needs of the users. The workload and process have been reduced. The report can be generated faster which can be used to improve or submit to the company faster.
On the issue of individual impact, the majority of users are on positive side. The system helps users to complete the task faster with high quality of work. The system also reduces complicated task and redundancy of process to produce the report. The system also helps reduce frustration and confusion of computing data for students that have been evaluated a couple of times.

On the issue of organizational impact, the majority of users are on positive side. They strongly agree that the system is needed in the organization which will be benefiting many parties including faculty, student, and company. The faculty can complete the task fast and simple which they can use the result to improve student right away. The detail report can also submit to the company that the student interest to see whether the student potential match the requirement of company.

Overall the users are strongly agreed that the proposed system is what they need in the process of work which will benefit them in many ways. Not only that the system can reduce the workload for the faculty, the system also ensure correctness of data by reduce human error that might occurred. The process of using the system is simple but the result that the system generates is fully detailed as produce by user.

7. Discussions and Conclusions

The process of developing the detailed report for student’s IT Competency have been enhance effectively and efficiently due to the system automatic computed the data and reduced human error. The questionnaires developed in the online format for faster distribution and data collection. Due to the large number of questionnaires, the responders are able to complete it on their own time. The process of work has been reduced to only uploading the document and the system will do the rest. By computing the data automatically, the human error will be reduced which reduce the workload and frustration for users while ensure quality of work. By using ODF, the system ensures that the document can always be accessible to all the users. This helps all the parties that involved in student development to be able to access and process the document.

The majority of Engineering and Technology’s faculties are satisfied with the proposed system. The proposed system is able to develop detailed report for student’s IT competency correctly. The developed report is not only provided in text data but also provided the graphic data in the form of graphs which provides alternative way to present information. The system also check the skill that the student received the lowest score in the evaluation and puts it in the report to present to the faculties on the area that the students need to be improved. The report that was developed by the system can be accessed by all the faculties which help ensure accessible for all the faculties that involved in the student improvement process.

In conclusion, the detailed report which developed by gathering data from various parties can be enhance effectively and efficiency through the use of the proposed system. Through e-Document computation, the detailed report can be developed faster while ensuring correctness of data. By developing report based on ODF, the output document will be able to access to all regardless of platform, application or version.

8. Future Plans

The next step that could improve the proposed system includes developing various dimensional views in the detailed report for users. Some users prefer to view graph in other format such as bar, line, or pie chart for better understanding. So the system can prompt which type of graph that users prefer then the system can generated the graph based on user’s preference. The system can improve to match the student with job description from the partner company to help the support decision making and able to match the student’s skill that suit for the job.
9. References


