Assessment of information-driven decision-making in the SME

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The use of analytics in decision-making processes is a key element for organizations to be competitive. However, experience indicates that many organizations still have not managed to fully understand how to use properly the available data for diagnosing, improving and controlling processes or modelling, predicting and discovering business opportunities. This situation is even more exaggerated among small and medium enterprises (SMEs). An essential first step for SMEs to start using analytics is a correct assessment of their decision-making processes and use of data. This will help them understanding their current situation, seeing the potential of adopting analytical practices and decide their approach to analytics. Therefore, the assessment we propose is managerial and strategic; thus, it is not aimed at detecting problems such as: errors in the data to make an invoice, not having the correct version of a drawing in the shop or a wrong date in a project plan... Undoubtedly, these issues are very important but they are not the objective. The results from applying the proposed assessment tool in several pilot SMEs are expected to serve as the basis for debugging the tool and developing a maturity model and a roadmap for improving their proficiency in information-driven decision-making.

CCS Concepts: •**Applied computing → Enterprise computing • Information systems → Information systems applications → Decision support systems.**

Additional Key Words and Phrases: Information-driven decision-making, Small and medium enterprises.

1. INTRODUCTION

The exploitation of data analytics for predictive and prescriptive applications related to decision making is an increasingly successful practice that have led to a significant improvement in the performance of many companies worldwide [EY 2014; Kiron et al. 2015]. Such technologies have proven to be useful in marketing, development of new products and services, optimization of supply chains, fraud detection, even in recruitment [Davenport 2006; Davenport 2015], and the fields of application are increasing. In a recent survey conducted by Accenture and General Electric, more than eight out of ten enterprises believe data analytics will change the competitive landscape of their industries [Accenture and General Electric 2014]. For instance, GE is deeply involved in the development of applications of analytics to industrial processes based on the internet of things [Winig 2016].

However, it is still often the case that organizations find themselves unable to fully understand how to use analytics to take advantage of their data[LaValle et al. 2011]. The experience of managers struggling with enormous amounts of data and sophisticated analytics is a frequent issue. In the same manner, the effort required to understand the data available and generate data of quality (accurate, timely, complete, accessible, reliable, consistent, relevant, and detailed) while improving data usefulness for decision making is an unsolved challenge. The above mentioned situation was confirmed by a recent survey conducted by the MIT Sloan Management Review and SAS Institute that involved more than 2000 managers [Ransbothan et al. 2016].

In the particular case of small and medium enterprises (SMEs) the use of business and big data analytics is lagging way behind in comparison with larger companies. In 2012, the adoption rate of big data analytics among UK SMEs was only 0.2 %, compared to 25 % for businesses with over 1,000 employees [e-skills uk 2013]. Market studies expect an annual growth rate of the global SME data analytics market by 42 % over the period of 2013 until 2018 [TechNavio 2014]. This can be interpreted as

an intention from SMEs in taking part of the information-driven decision-making breakthrough to leverage their businesses.
Nonetheless, even if SMEs have adopted good information-driven practices into their decision making processes (DMP), their benefits won't be noticeable until they have achieve sufficient maturity in this particular matter. In this regard, it would be helpful for SMEs to count with a framework for diagnosing their proficiency in the use of information for decision-making in a way that provide them insights for company self-knowledge.
This paper presents an assessment tool for analyzing the information-driven decision-making in SMEs and describes the methodology to be used in its application. At this point a pilot application in two SMEs is starting and we will present its results and consequent improvements of the assessment tool in the congress presentation.

2. AN ASSESSMENT TOOL FOR INFORMATION-DRIVEN DECISION-MAKING IN THE SME

An assessment tool inspired by the European Foundation for Quality Management (EFQM) Excellence Model [EFQM 2013] has been developed for conducting a preliminary assessment of the SMEs' proficiency with respect to the use of information in the decisions involved in their daily processes.
The initial requirements we have considered are intended to provide a pragmatic approach to the assessment tool that fits the characteristics of real everyday organizational needs. In consequence, during the design stage we address aspects such as time availability constraints and fast feedback. This was important because it allowed minimizing the irruptions and providing quick and value-added feedback.
Likewise, in addition to a general diagnosis, it is expected to identify specific aspects to be improved with relative ease, "Quick wins". Those benefits would serve as motivational examples for making larger and more structural improvements.

2.1 Criteria and methodology

The conceptual process used to develop this assessment tool involved the following steps and criteria:

(1) Determining the inputs needed for the intended analysis. This enabled focusing the content of the templates to collect the relevant information in a reduced time lapse.
(2) Establish clearly the profiles involved in information-driven decision-making processes, and analyze their interaction within business process (Fig. 1). Hence, this study is oriented towards getting an overall vision and understanding of the behaviour of the decision makers.
(3) Structuring the forms/interview to perform a qualitative and a quantitative assessment of the key aspects that in turn allow detecting remarkable and improvable aspects of the organization.
(4) Establishing the grading criteria to be used for the application of the assessment tool under a pragmatic, simple, objective and quick approach.
(5) Define indicators associated with the assessment tool that would allow graphically representing how well an organization uses information for decision-making.
(6) Analyze the findings of the whole assessment from the perspective of business processes. This is relevant because the interactions business process have been found to impose constrains determinant in decision making [Gómez López et al. 2014; Gómez López et al. 2015].

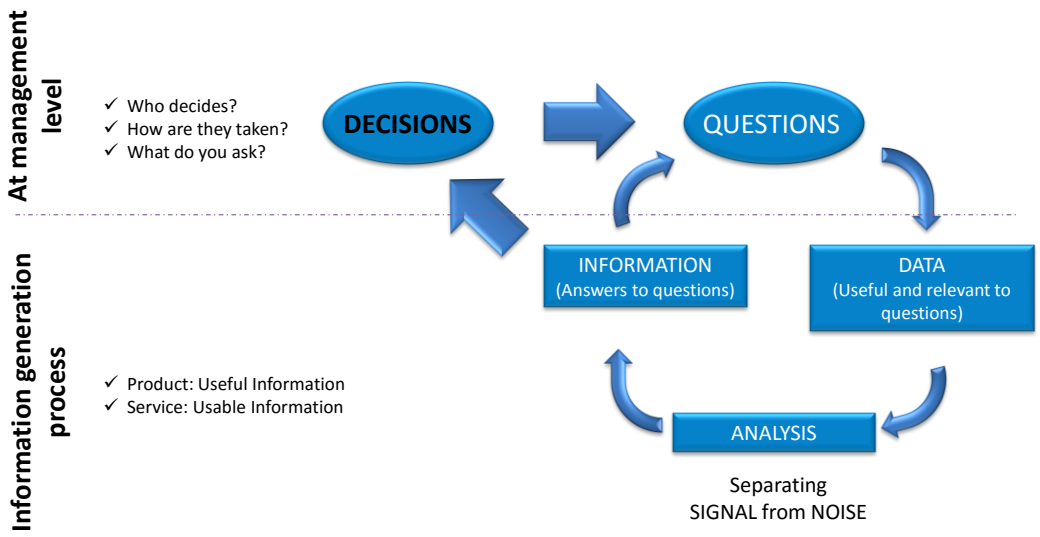


Fig. 1. The information-driven decision-making process.

This assessment tool aims to collect information from the organization to contextualize their situation with respect to information-driven DMP and identify improvement opportunities. The assessment tool shall be filled with the core ideas obtained from the response given to a small number of semi-structure interviews performed to the people involved in the DMP. The result of the interviews constitutes the basis for assessing the performance of the organization, its processes, how they use the information for decision-making, as well as the perception and vision of improvement in this regard by the different stakeholders.

2.2 Structure of the Assessment Tool

The assessment tool is based on conducting semi-structured interviews with between 4 and 6 key critical profiles, plus a short web questionnaire addressed to all the personal. The identified critical profiles are:

(1) *Project Coordinator*. Is the liaison and contact person between the organization and the assessor. Provides an initial and general perspective of the organization and its functioning as well as helps organize the assessment process.

(2) *IT responsible (or equivalent)*. Provides key information regarding the data management technology used, the available databases and the way information is made accessible to users.

(3) *The CEO or a Senior Manager*. Provides the perspective on how well the organization uses information to make decisions and participates in identifying the heads of processes or departments to be interviewed. The interview also allows aligning top management expectations with the scope of the study and the output that will be delivered.

(4) *Heads of processes or departments*. Report how information-driven decisions are made within their specific ambit. Given the intrinsic characteristics of SMEs and the requirement of minimizing the disruption to the companies' normal activities, we consider that it would be sufficient to analyze 2±1 processes or departments. The objectives are to have a better understanding of decision-making at intermediate and operative levels of the organization, and to identify concrete improvable aspects.

The structure of the interview is the same for all profiles. The assessment is divided into phases. Phase I is the face-to-face interview and Phase II is the back office assessor work.

(1) *Phase I:* The assessor conducts a semi-structured interview, with a maximum duration of two hours, with each of the profiles. The interview is structured in thematic blocks adapted to the information needs of the profiles under study. The objective is to gather the information needed to complete the Phase II template. Figure 3 of the Appendix, shows part of the guidelines used in the interview of managers responsible of processes or departments.

(2) *Phase II:* Here the assessor uses the information gathered to fill a template (again part of it is reproduced in Figure 4 of the Appendix). The template consists of a set of aspects, with clear and specified links with the questions in Phase I, rated between 0 (worst) and 100 (best) according to the rules shown in Table I. Afterward, those points are totalized and scaled to a percentage. Table I score rule shall be applied to each question. The template is structured in the same blocks that the interview and the number of items to be scored is proportional to the importance assigned to each block.

Table I. Scoring criteria for Phase II template

Score	Criteria
0	Does not exist
25	Something exist
50	Exist in a minimum acceptable grade
75	Exist in a good degree
100	Exist in an excellent degree

Source: Table based on Pola Maseda [1996].

In addition, the assessor fills a form, for internal use, collecting the strengths and areas for improvement identified in each interview. This information will be used in conjunction with the scores for the preparation of the final report and presentation of results.

Table III of the Appendix shows the blocks into which has been divided each interview, as the number of questions who compose it, and thus the weight it has on the final score.

The information gathering is complemented with a web-based questionnaire of 27 questions addressed to all the personnel. The responses will allow having a different and complementary view of the use of data in decision-making.

3. FINAL REPORT

The assessment result is presented to the management team in a written report and a two-hour meeting.

The main body of the written report consists of summary tables of strengths and areas for improvement. There is one table with general aspects, questions common to the whole company, divided into three main areas: Data management, information use, and decision making. See Table II.

Table II. Table summarizing the general results

Area	Strengths	Areas for improvement
Data Management		
Information Use		
Decision Making		

The areas for improvement are scrutinized to detect "quick wins": concrete aspects that can provide noteworthy improvements with relatively small effort. If some are identified they are highlighted and explained.

Then, there is a particular table for each of the process or department analyzed. The table is similar to the one for general result except that the areas can be more detailed depending on the characteristics of the process. For example, there may be an area of marketing, product design, sales or customer support. Again, the areas for improvement are scrutinized in search of quick wins; something that in this case is easier thanks to the reduced scope.

The report also has a graphical summary, a five vertex radar chart, evaluating from zero to five the following aspects: Data availability, data quality, data analysis, information use and decision-making. The evaluation is based on the scores obtained in Phase II. The idea is to provide a visual profile of the situation. And also, if the evaluation is repeated every year or every two years, depending on the improvement pace, the chart can be a very good tool to visualize progress. Figure 2 shows the chart.

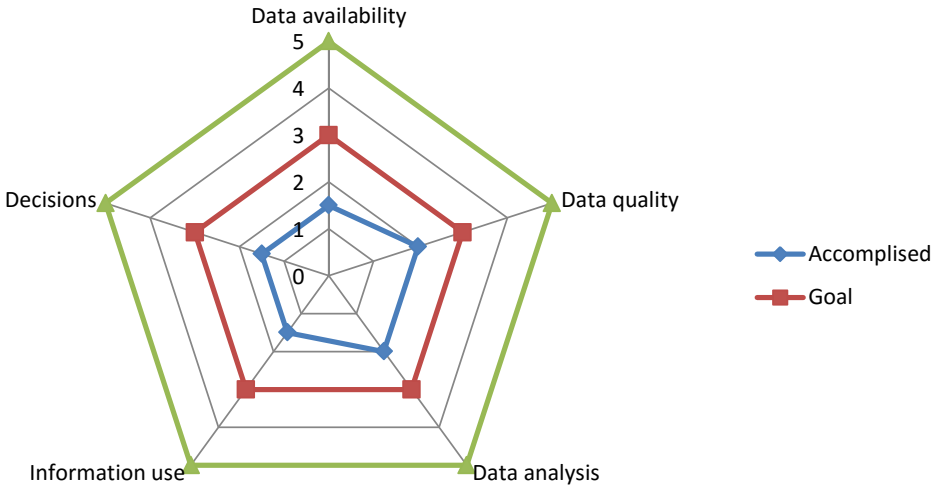


Fig. 2. Radar chart of information-driven decision-making process.

3.1 Management team presentation

We believe that a two hour presentation to the management team and the people involved in the process is a fundamental part of the assessment success. There are several reasons for that, but two are fundamental:

(1) *The assessment touches a very sensitive aspect for management*: how they make decisions, the core of their tasks. It is therefore very important to be able to provide detailed explanations of the findings with especial care to highlight the strengths and provide time to hear management justifications and provide them with plausible excuses. All this without compromising to show that the time to change has come.

(2) *It is an excellent moment to emphasize the quick wins and benefit from having the people that can decide* to start actions towards becoming a data-driven company. Ideally, the meeting would finish planning some of this improvements and programming a second assessment in one or two years' time.

4. DISCUSSION AND NEXT STEPS

The tool presented is part of a research project in progress. The objective is to design an assessment instrument useful to guide SMEs' first steps of recognizing the importance of data-driven decisions and the changes in their organization and management process needed, as well as accompanying them in their journey towards becoming data-driven companies. The assessment has been developed using as reference other assessment tools and methods, among them: the EFQM model [EFQM 2013], the principles of assessment provided by the standard ISO 9004 [2009] some recommendations for conducting audits of [Pola Maseda 1996] and some maturity models that were consulted [ARMA 2013; Jochem et al. 2011; IBM 2007; Becker et al. 2009] with the aim of providing a easy to use and inexpensive tool in terms of time and resources needed.

The immediate next step is to run a pilot test with 2 o 3 companies and gather feedback in two aspects: the usefulness of the reports and conclusions reached and the assessment process. This feedback will be gathered from two points of view: the assessors and the companies. This will be the main source, as well as the comments provided from the referees and the conference attendees to improve the tool. To conduct the pilot test we count with the support of the "Cátedra de Empresa Familiar y Creación de Empresas" from the "Universitat Abat Oliba CEU" and through them of the "Instituto de la Empresa Familiar" (The largest Spanish business organization of this area). In all probability this will be finished by the time the congress takes place and thus, we will be able to present the results of the pilot test.

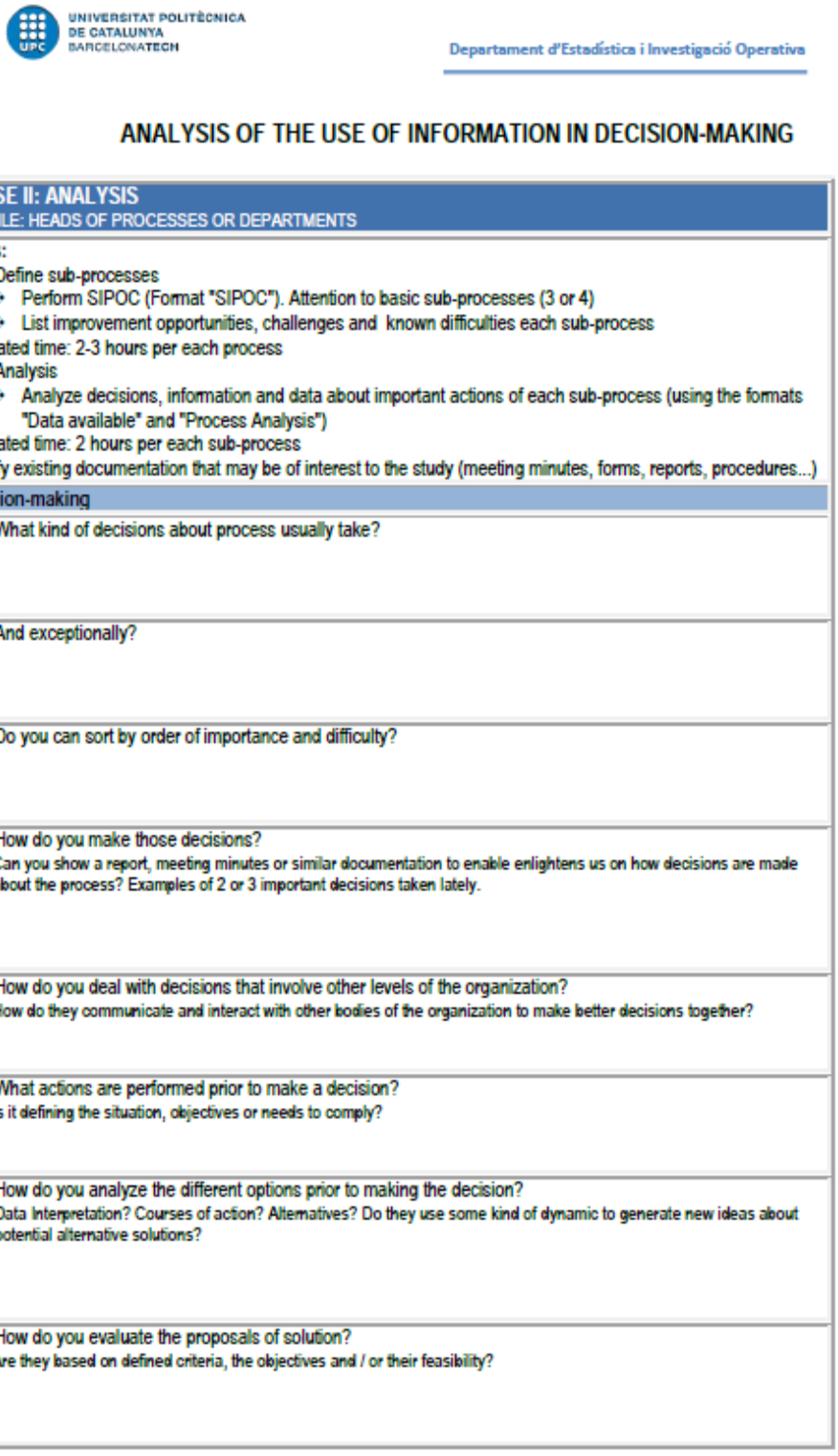
In the midterm the research aims to develop methodologies to measure, evaluate and determine the level of sophistication of DMP in organizations regarding their readiness and maturity towards the use of data. This can be made in a systematic way by adopting a proper reference system that contemplates a gradient of well-characterised scenarios: from ad hoc practices to highly structured and optimized processes, as a first step to identify and implement improvement actions. Maturity models could be an alternative to this end. In this sense, the results obtained with this study will provide greater notions for consolidate a model to determine the maturity of the organization in their information-driven DMP. This will lay the foundation for the development of a roadmap that establishes guidelines and actions to improve and move up the different levels of the model.

Mayor challenges to a successful implementation of the proposed assessment approach are the time constraints imposed by the workload and the distribution of tasks in SMEs. Even if the methodology is intended to be as unobtrusive as possible with the business processes, it cannot be fully automated. This is because the assessment at this stage is mainly knowledge intensive and focused on reflexive analysis rather on plain statistics.

APPENDIX

This appendix shows as examples, part of the templates used for the semi-structured interviews (phase-I), the quantitative assessment of phase II and the relationships between both of them (Figures 3 and 4). They are presented in Spanish.

Table III, shows the structure which will be applied to the assessment tool developed.



UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

Departament d'Estadística i Investigació Operativa

ANALYSIS OF THE USE OF INFORMATION IN DECISION-MAKING

PHASE II: ANALYSIS
PROFILE: HEADS OF PROCESSES OR DEPARTMENTS

Goals:

- Define sub-processes
  - Perform SIPOC (Format "SIPOC"). Attention to basic sub-processes (3 or 4)
  - List improvement opportunities, challenges and known difficulties each sub-process

Estimated time: 2-3 hours per each process

- Analysis
  - Analyze decisions, information and data about important actions of each sub-process (using the formats "Data available" and "Process Analysis")

Estimated time: 2 hours per each sub-process

Identify existing documentation that may be of interest to the study (meeting minutes, forms, reports, procedures...)

Decision-making

1. What kind of decisions about process usually take?
2. And exceptionally?
3. Do you can sort by order of importance and difficulty?
4. How do you make those decisions?
   Can you show a report, meeting minutes or similar documentation to enable enlightens us on how decisions are made about the process? Examples of 2 or 3 important decisions taken lately.
5. How do you deal with decisions that involve other levels of the organization?
   How do they communicate and interact with other bodies of the organization to make better decisions together?
6. What actions are performed prior to make a decision?
   Is it defining the situation, objectives or needs to comply?
7. How do you analyze the different options prior to making the decision?
   Data Interpretation? Courses of action? Alternatives? Do they use some kind of dynamic to generate new ideas about potential alternative solutions?
8. How do you evaluate the proposals of solution?
   Are they based on defined criteria, the objectives and / or their feasibility?

Fig. 3. Part of the Phase I of the assessment tool developed.

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ASSESSMENT. ANALYSIS OF PROCESS AND SUB-PROCESSES						
Elements to consider	Status/Score					Observation / Evidence
	0	1/4	1/2	3/4	1	
Decision-making						
1. Are decisions taken following a structured and systematic process with clearly defined steps?						(4)
2. Are decisions taken in a planned way?						(1, 2, 5)
3. Are discriminated the types of decisions about the process in order of importance and difficulty?						(3)
4. Do the decision-makers of the various instances hold regular meetings to analyze the data to define and evaluate joint strategies framed in the objectives of the organization?						(5)
5. Is promoted an effective communication at all levels of the organization to make better-informed decisions?						(5)
6. ¿Is identified and defined previously to a decision the situation to be resolved and the objectives or needs to comply?						(6)
7. Does it proceed to collect and analyze data and information necessary and relevant, in a prior way to make decisions?						(7)
8. Are analyzed the different options taking into account: the interpretation of the data, and alternative courses of action?						(7)
9. Do they use group dynamics to generate ideas about potential alternative solutions?						(7)
10. The different proposals are analyzed and evaluated on the basis of defined criteria, the objectives, and their feasibility?						(8)
11. The risks, potential problems and consequences that entails to a choice are considered and evaluated before making the decision?						(9)
12. Does it ensure the commitment of all stakeholders during the implementation of the decisions taken?						(10)
13. Does it ensure the proper allocation of resources required during the implementation of the decisions taken?						(10)
14. It is objectively assesses the effectiveness of made decisions?						(11)
Existence and use of data						
15. Are decisions taken on the basis of reliable and good quality data?						(12, 13)
16. Are there processes to evaluate and continuously improve data quality management?						(13)
17. Can users easily access to metadata embedded, date and relevant?						(13)
18. Are the technological tools used in the company to manage and analyze data are part of the organizational culture and staff uses them to support their activities?						(12, 14)
19. Do the data and analytical tools are proactively used to support business strategy?						(12, 14, 16, 28)
20. Do the employees, managers and teams at all levels of the organization have the power and						(15)

Fig. 4. Part of the Phase II of the assessment tool developed.

Table III. Implementation structure of the assessment tool

Profile	Blocks	Number questions	Weight in the final score (%)
Project Coordinator	Organizational structure and general operation	4	18.1
	Policies, objectives and strategies	6	27.3
	Assets	6	27.3
	Capacities	6	27.3
IT responsible (or equivalent)	Technology	24	64.9
	Knowledge Management	5	13.5
	Information Governance	8	21.6
The CEO or a Senior Management	Decision-making	16	30.2
	Existence and use of data	13	24.5
	IT Support	11	20.8
	Knowledge Management	5	9.4
	Information Governance	8	15.1
Heads of processes or departments	Decision-making	14	38.9
	Existence and use of data	14	38.9
	IT Support	8	22.2

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