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MODEL FOR EVALUATION OF SERVICE-MANAGEMENT TOOLS IN THE OIL AND GAS INDUSTRY

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ABSTRACT

Companies providing services for customers on-site require appropriate scheduling of employees and technicians. The availability, skills and experience of employees and travel times need to be considered. In addition, the required information should be made available as efficiently as possible. As a result of an increasing rate of digitalization, companies are changing from manual planning in Microsoft Excel or on planning boards and printed documents to integrated workforce management tools that automate planning steps and provide relevant documents. The market for these software tools is growing rapidly. In addition to established software providers such as SAP and Oracle, there are also small vendors on the market. Companies that decide to deploy their field service planning with an appropriate tool are faced the challenge of choosing a suitable method for the evaluating and analyzing the market. The paper is devoted to development of the model for the evaluation of software tools in the context of field service management in the oil and gas industry. The first step of proposed methodology involved market screening to identify suitable software tools. In the next step, criteria were defined that needed to be tested to compare the tools. Finally, the outcome of the evaluation and additional requirements allowed for a benefit analysis. After the evaluation model was developed, it was applied on five selected software tools. SAP Field Service Management was ranked as the best product for a defined use case. The tools from *Odyssee* and Salesforce ranked similarly in the categories that refer to the functional aspects. The field service management tools from Fergus and *ReachOut* are both available for free with very limited functionalities, and reached rank four and five, respectively. The result of this work can be used by companies providing services in the oil and gas industry to evaluate field service management tools. Following the model, a structured process is provided to reduce the time needed for software evaluation. Future studies can build on this work and focus either on different software tools or a different industry.

Keywords: software tools; field service; software evaluation; service management

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INTRODUCTION

Workforce Management Systems have faced significant changes as a result of the ongoing digitalization affecting all sectors and disciplines in industry. This has led to the new, long-term challenges for employee relations that could affect the oil and gas industry for 20 years and longer. Work schedules have shifted from the classic nine-to-five office routine to more flexible working hours. The freedom of employees to independently structure their working hours increased and nowadays staff can work from home, arrive earlier at work or leave later. Furthermore, the number of part-time employees doubled between 1994 and 2018.

These changes also affect Workforce Management systems in that staff need to be scheduled according to productivity and qualification requirements, ensuring that workers are present and available in sufficient numbers. This is no simple task because the availability and requirement of workforce can vary seasonally or fluctuate short-term.

One of the challenges employers face in the current economic environment is managing workforce availability and assigning staff to tasks matching their skills and experience. In light of the lockdown measures enforced as a consequence of the global SARS-COVID-19 pandemic, many employees have to work from home, which affects workplace availability, particularly in case of emergencies. Even organizing meetings can represent a challenge if employees are not fully equipped with the required hard- and software or broadband internet infrastructure. A variety of Workforce Management tools is available on the market with the aim of helping the responsible managers to schedule their employees. The origin of

such professional tools is the simple manual planning function in an excel sheet or on a whiteboard. Often, planning with such methods cannot meet the target of covering all aspects needed. The required information and planning parameters can vary between enterprises or even from one manager to another, but generally, an overview of the available workforce according to their respective schedules and skills is the basic requirement of such a system. When implementing such a tool, first, the company must make the decision which one to choose. The challenge starts with criteria of selecting a software tool and continues with the evaluation if the defined tool represents a significant improvement to the company's existing processes and software landscape.

The purpose of this paper is to provide a model that can be used to evaluate field service management tools. The evaluation model will focus the needs from companies providing field service to the oil and gas industry.

To achieve this goal, methodology will follow the following steps:

1. Define a use case that can be the basis for the development of an evaluation model.
2. Make a market overview of potential software tools that can be evaluated.
3. Study existing software evaluation models from the literature.
4. Based on software evaluation models, develop the specific for a defined use case evaluation model.
5. Apply the developed evaluation model for the selection of a software tools.

1. USE CASE DEFINITION

From the perspective of a company that provides field services in the oil and gas industry, it is assumed that a standard use case is the planned maintenance of an industrial compressor. Compressors provide machines with energy in the form of compressed air for chemical processing, gas storage or transportation. They can be differentiated between continuous flow compressors, e.g. centrifugal or axial compressors, or intermittent flow compressors such as reciprocators. These machines require regular maintenance either after a set operating time or in the pre-defined intervals. The degree of service can vary depending on the maintenance plan of the manufacturer. In the case of reciprocating compressors, piston rods, rings, and valves need to be checked or replaced according to the set maintenance schedule. Since industrial compressors are uneconomical to transport due to their size, the equipment has to be checked and fitted on-site by contractually obliged and qualified technicians directly in the field.

The scheduling of maintenance and servicing need to be planned as far ahead as possible, as a shutdown of the equipment may lead to a complete halt in operations. Additionally, in the case of failure or outage, such machines need to be repaired as quickly as logistically and feasibly possible. Since the criteria these two scenarios imply, enormous demands are placed on field service management systems. Depending on the operator, the compressors are frequently in use on sites in remote locations, meaning that travel management should also be covered by the field service tool. Other assignments such as servicing and maintenance contracting in urban areas, servicing technical oil and gas production equipment in countries like Russia, Canada or Saudi Arabia entail air travel to remote areas. This means that spare parts cannot be carried by the technician and need to be shipped in advance so that they are already available on-site upon arrival of the maintenance staff. This functionality must be covered by shipment tracking and material management in the management tool, besides travel and expense monitoring for the respective employee. When it comes to the work itself, such services may take up to several days/weeks to make a long travelling feasible. Furthermore, in the oil and gas industry the whole plant is shut down for a certain period to do all the maintenance and repairs on all machines. Therefore, the software must be able to record working hours over a prolonged period and the transfer of this data must be ensured for a monthly payroll and accounts statements.

2. MARKET OVERVIEW OF FIELD SERVICE MANAGEMENT TOOLS

The market for field service management tools can be allocated between the customer service and support software tools. The aim of such tools is to support processes for dispatching service employees to remote locations to provide service like repairs, maintenance, upgrades or monitoring. Typical tasks of a dispatcher involve managing the demands of the duties for field service work, planning the workforce accordingly, informing and supporting technicians, debriefing work orders and conducting performance analysis. In the *Gartner Magic Quadrant for Field Service Management* [1], some of the major vendors are categorized according to their strengths and potentials. Fig. 1 shows the report of 2019, which allocates the considered vendors.

Fig. 1. **Gartner Magic Quadrant for Field Service Management**
***Source*: compiled by the author**

The allocation to "Niche Players" means that they offer strong field service management products, but may not incorporate functional components or a customer service and support structure on a global level with more than 1,000 field service employees. "Visionaries" have a great advantage when it comes to technology. They have a significant influence of the way a technology is used and what functionalities are considered as gold standard. The categorization "Leader" means that these vendors have a market-defining vision of the technology they offer and are well established in the market compared to the visionaries. In addition to these categorizations the *Gartner Report* also briefly describes the strengths and potentials according to customer surveys. Since the report only considers vendors that fulfill certain inclusion criteria, a total market overview is not provided. The inclusion criteria consist of reference customers in certain regions, revenue with field service management tools, a functional breadth, etc. Vendors not fulfilling these criteria would also be categorized as niche players. A brief research via several commercial search engines and social networks (like LinkedIn) shows that there are many more vendors to consider than those mentioned in the Gartner report.

This first market overview demonstrates the challenge of picking one of these vendors. Therefore, an evaluation model needs to be applied to structure the selection and bring the right functionalities and most useful process advantages for an enterprise.

3. DEFINITION OF THE EVALUATION MODEL

In general, the market potential for software solutions can range from a single product to hundreds of products. The first step is to define the precise needs the software has to meet before compiling a broad outline of the available software. In order to identify relevant products, suitable search terms (keywords) must be defined and combined. These keywords then are used at the second step of the search in specific technical reports, published books, journals and conference proceedings. Important source are the reports from consulting companies. Furthermore, a search in search engines like Google can result in a set of potential software tools.

In addition to secondary information, primary information sources can be found in attending specific fairs and other events to become acquainted with potential products and vendors [2]. Depending on the outcome of this step, it is necessary to filter the results by doing a rough examination of the software in terms of suitability for the end user and the defined use case. Knock-out criteria can be defined that automatically exclude a vendor if certain criteria do not meet the customer's requirements.

A follow-up procedure involves a benefit analysis. This analysis compares the aims of a software product and the processes it should support and then identifies functionalities that are conducive to achieving the defined objectives. The first phase of the benefit analysis involves listing all important criteria and then weighting them according to their potential benefit against the aims of the software. After that, each criterion is rated for each individual decision option [3].

The first step of the evaluation is a market screening. Market screening is originally a technique that comes from sales management to define and delineate potential new markets [4]. However, it is also a highly effective technique for identifying new suppliers and supplier markets for procurement [6].

Once a pool of potential software vendors has been found, a use-case is developed along with definition of the main purpose that the software needs to fulfill. Many vendors are only specialized on specific industries and should be excluded from the search [3]. In the next step, must-have criteria are defined, which is completed by analyzing the existing software solutions. The next stage includes a test to check how well the software tool manages the most important functionalities, key requirements and identified criteria. To maintain a consistent degree of comparability, measurement procedure has

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to be defined in advance and must be the consistent for all testing modalities.

The criteria used for measuring software efficacy and functionality have been incorporated in a benefit analysis. They define the rating of each criterion in advance to create transparency and traceability of the decision-making process. As procurement decisions can be subject to bias, it is important to systematically find and weight criteria that support the selection [7]. How the criteria are weighted and ranked is the responsibility of the company which requires the software tool, and also depends on the use-case. Once the criteria have been rated, a ranking is compiled, containing the scores for each option.

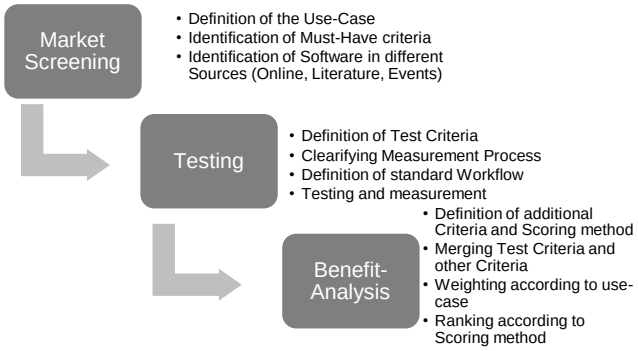

Fig. 2. **Proposed Evaluation Model**
***Source*: compiled by the author**

4. APPLICATION OF THE EVALUATION MODEL

Once the results of the market screening have been collated and the use case is defined, the evaluation model can be applied. Vendors that were taken into consideration are *SAP Field Service Management* [8], *Salesforce Lightning* [9], and *Odyssee Field Service* [10] (listed in the Gartner Magic Quadrant of Field Service Management [1]). An additional online search was performed to consider smaller vendors. The search strings "field service management tool", "field service management software" were used, which resulted in selection of two additional vendors – *Fergus [11]* and *ReachOut Suite* [12].

Considered use case assumes that the main benefit of a tool should be the reduction of working hours spent on operative processes. Therefore, a standard workflow was developed an applied for every software tool.

The workflow includes the steps:
1. Creating customer master data.
2. Creating equipment master data.
3. Creating the service job.
4. Dispatching of the service job.

Next, the time to complete the workflow was measured. The Table 1 gives an overview of the measured times.

Table 1. **Measurement of the time to complete the workflow**

Tool / Process Steps	Creating Customer (+ Saving)	Creating Equipment (+Saving)	Creating Service Job (+Saving)	Dispatching (+Saving)	Total Process Time
Sap FSM	01:01 (00:09)	01:13 (00:10)	01:19 (00:07)	04:05 (00:00)	**08:04**
Salesforce Lightning	01:28 (00:03)	01:27 (00:02)	01:07 (00:02)	00:49 (00:00)	**04:58**
Odyssee Field Service	00:37 (00:00)	01:22 (00:00)	01:55 (00:04)	00:26 (00:00)	**04:24**
Fergus	00:57 (00:01)	NA	01:47 (00:07)	00:35 (00:04)	**03:31**
ReachOut Suite	00:54 (00:03)	NA	01:16 (00:05)	00:00 (00:00)	**02:18**

***Source*: compiled by the author**

In the next steps, additional criteria were defined, and rating conditions were described. After that, the individual criteria were weighted according to their importance and fed into a benefit analysis.

1. *Recordings:* Software tools that support recording time, material consumption expenses and mileage receive 10 points. Software tools that support recording of at least time receive 5 points. All other tools receive zero points.

2. *Analytics:* Software tools that offer analytics and charts that can be customized receive 10 points. Software tools that offer at least pre-configured reports receive 5 points. All others receive zero points.

3. *Asset Management:* Software tools that offer maintenance of assets or equipment, fields for service history or possibilities to attach documents receive 10 points. If assets can be maintained without relevant service information, the software tool is rated with 5 points. If none such functionalities are available, the tool is rated with zero points.

4. *Attachments:* If attachments can be added to different master data levels (at least for a customer, equipment, or service order or service job) the tool is rated with 10 points. If an attachment can be added to at least one of these, the software tool is rated with 5 points. Otherwise, the tool receives zero points.

5. *E-Signature:* If the customer can sign documents at different stages of the workflow, the software tool will receive 10 points. If a signature can be added at least in one step of the workflow, 5 points are given. If no signature options are provided, the software tool receives zero points.

6. *APIs:* If the Field Service Management Tools offers APIs that can be individually configured to extract master and transaction data, the software tool receives 10 points. If the data extraction is provided but limited, the tool receives 5 points. If no APIs are configurable, the software tool

is rated with zero points.

7. *GPS Integration:* If technicians, service jobs and their locations can be tracked on a map the software tool receives 10 points. If one of these can be viewed on a map, the software tool receives 5 points. If none of these options are available, the tool is rated with zero points.

8. *Estimations:* If there is an integrated functionality to estimate service jobs with time efforts and costs, the tool is rated with 10 points. If this estimation is limited, the tool receives 5 points. If no such functionality is available, the tool is rated with zero points.

Table 2 shows the results of the benefit analysis according to the described rating procedure.

The tool with highest score and the highest weighted score is *SAP Field Service Management* with 6,85 weighted points followed by *Odyssee* with 5,75 weighted points. The tool with the lowest score is the product from Fergus with 3,7 weighted points. When looking at the software tools in ranked order the weighting made no difference in this specific case. So, if the weighting for all criteria would be 0,1 (concerning all 10 criteria, each 10 % importance) the ranking would not change. An individual analysis of the tools shows that *SAP* has the highest possible ratings in six categories, which are combined weighted at 60 % overall. In three categories – that are weighted with 35 % – SAP achieved the lowest possible score. The second ranked tool, *Odyssee*, had two categories where it scored the highest. These categories made up 10 % of the total score according to the weighting criteria, which in turn counted against Odyssee. In all the other categories *Odyssee* had a medium rating.

An almost identical pattern shows the result for *Salesforce*, scored in two categories worse than Odyssee, and having identical ratings in others. In the category with the highest weighting (the total process time), two free-to-use software tools scored the highest, but nevertheless they only achieved the fourth (ReachOut) and the fifth (Fergus) rank. Both had the worst rating in four criteria (Recordings, Asset Management, APIs, and GPS Integration). This shows that the tools are still efficient within their functionalities. Note that this evaluation is focused on the oil and gas industry, so the well-established vendors scored highly, because they offer the advanced functionalities.

CONCLUSIONS

This paper considered a use case of a field service job, performed for a service of an industrial compressors in the oil and gas industry. This type of services is specific and needs more planning, because e.g. the duration of a service takes up to several days depending on the complexity of the equipment.

For the market overview the *Gartner Magic Quadrant of Field Service Management* was the starting point to identify major providers. Also, the Gartner Report provides first results for strengths and potentials for the listed tools. A disadvantage of the Report itself is that it considers tool only from well-established vendors that already have a vivid customer structure. Therefore, smaller vendors were described to extend the range of considered software tools.

Based on the requirements that come with the defined use case a new evaluation model was created.

The evaluation model defines a process that consists of three steps:

1. Market Screening: Depending on the use case of the company, the software tools to be selected and included in the evaluation process [2; 4].

2. Testing: Key criteria that represent the most important functionalities of software tools need to be defined and measured during a test process [4].

Table 2. **Outcome of the rating**

	Weighting	Alternatives									
Criteria		SAP	Score	Sales-force	Score	Odys-see	Score	Fergus	Score	Reach-Out	Score
Total Process Time	0,25	2	0,5	4	1	6	1,5	8	2	10	2,5
Loading Time	0,05	2	0,1	8	0,4	10	0,5	4	0,2	6	0,3
Recordings	0,15	10	1,5	5	0,75	5	0,75	0	0	0	0
Analytics	0,1	10	1	5	0,5	5	0,5	5	0,5	5	0,5
Asset Mgmt.	0,15	10	1,5	5	0,75	5	0,75	0	0	0	0
Attachments	0,05	10	0,5	5	0,25	5	0,25	5	0,25	5	0,25
E-Signature[125]	0,05	5	0,25	5	0,25	5	0,25	5	0,25	10	0,5
APIs[128]	0,1	10	1	5	0,5	5	0,5	0	0	0	0
GPS Integration[127]	0,05	10	0,5	10	0,5	10	0,5	0	0	0	0
Estimations[128]	0,05	0	0	5	0,25	5	0,25	10	0,5	10	0,5
Total	1	69	**6,85**	57	**5,15**	61	**5,75**	37	**3,7**	46	**4,55**

***Source*: compiled by the author**

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3. *Benefit Analysis:* The outcome of the testing phase is used together with additional criteria. The potential software tools are compared and the one with the highest rating is selected [3; 5].

The model can be used by industrial companies that intend to find a suitable field service management tool. Additional research would lead to elaborating key differences to other field service areas. Since servicing compressors is a very specialized discipline with highly specific requirements that differ greatly from other service and maintenance work, other industries and areas of the petroleum industry should be investigated separately. The outcome of such an investigation might lead to another approach for the evaluation of software products being more suitable than the model presented in this paper.

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МОДЕЛЬ ДЛЯ ОЦІНКИ ІНСТРУМЕНТІВ СЕРВІСНОГО УПРАВЛІННЯ У НАФТОГАЗОВОЇ ГАЛУЗІ

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АНОТАЦІЯ

Компанії, що працюють в області field service, вимагають відповідного планування роботи співробітників та технічних працівників. Необхідно враховувати наявність, навички та досвід співробітників та час поїздок. В результаті збільшення темпів дигіталізації компанії переходять від ручного планування в Microsoft Excel та друкованих документів до інтегрованих інструментів управління робочою силою, які можуть автоматизувати кроки планування та надати відповідні документи. Ринок цих програмних засобів швидко зростає. На додаток до відомих постачальників програмного забезпечення, таких як SAP та Oracle, на ринку також є невеликі фірми. Компанії, які вирішили застосувати планування виїзних служб за допомогою відповідного інструменту, стикаються з проблемою вибору відповідного методу оцінки та аналізу ринку. Стаття присвячена розробці моделі для оцінки програмних засобів у контексті управління польовими послугами компресорів у нафтовій і газовій промисловості. Перший крок методології передбачав перевірку ринку для виявлення відповідних програмних засобів. На наступному кроці було визначено критерії, які потрібно протестувати для порівняння інструментів. Нарешті, результат оцінки та додаткові вимоги дозволили провести аналіз вигод. Після того, як модель оцінки була розроблена, вона була застосована до п'яти вибраних програмних засобів. SAP Field Service Management було визнано найкращим продуктом для випадку використання. Інструменти від Odyssee та Salesforce мають подібні оцінки у категоріях, що стосуються функціональних аспектів. Інструменти управління field service від Fergus та ReachOut доступні безкоштовно з дуже обмеженими функціональними можливостями та та отримали місце 4 та 5 відповідно. Результат цієї роботи може бути використаний компаніями, що надають послуги в нафтовій і газовій промисловості, для оцінки інструментів управління польовими послугами. Модель передбачає структурований процес для зменшення часу, необхідного для оцінки програмного забезпечення. Основані на даній роботі майбутні дослідження будуть стосуватися різних програмних засобів та інших галузей.

Ключові слова: інструменти планування; оцінка програмного забезпечення; управління послугами.

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МОДЕЛЬ ДЛЯ ОЦЕНКИ ИНСТРУМЕНТОВ СЕРВИСНОГО УПРАВЛЕНИЯ В НЕФТЕГАЗОВОЙ ОТРАСЛИ

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АННОТАЦИЯ

Компании, предоставляющие услуги в области field service, требуют соответствующего планирования работы сотрудников и технических специалистов. Необходимо учитывать доступность, навыки и опыт сотрудников, а также время в пути. В результате растущих темпов дигитализации компании переходят от планирования вручную в Microsoft Excel и печатных документов к интегрированным инструментам управления персоналом, которые автоматизируют этапы планирования и предоставляют соответствующие документы. Рынок этих программных инструментов быстро растет. Помимо известных поставщиков программного обеспечения, таких как SAP и Oracle, на рынке есть также небольшие фирмы. Компании, которые решили развернуть свое планирование обслуживания на местах с помощью соответствующего инструмента, сталкиваются с проблемой выбора подходящего метода оценки и анализа рынка. Статья посвящена разработке

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модели для оценки программных средств в контексте управления полевыми услугами в нефтегазовой отрасли. Первый шаг предложенной методологии включал проверку рынка для определения подходящих программных инструментов. На следующем этапе были определены критерии, которые необходимо оценить для сравнения инструментов. Наконец, результат оценки и дополнительные требования позволили провести анализ выгод. После того, как модель оценки была разработана, она была применена к пяти выбранным программным инструментам. SAP Field Service Management был признан лучшим продуктом для данного варианта использования. Инструменты от Odyssee и Salesforce оцениваются одинаково в категориях, относящихся к функциональным аспектам. Инструменты управления выездным обслуживанием от Fergus и ReachOut доступны бесплатно с очень ограниченными функциями и оказались на четвёртом и пятом месте соответственно. Результат работы может быть использован компаниями, оказывающими услуги в нефтегазовой отрасли, для оценки инструментов управления полевыми услугами. В соответствии с моделью предоставляется структурированный процесс, позволяющий сократить время, необходимое для оценки программного обеспечения. Основанные на этой работе будущие исследования могут сосредоточиваться на различных программных инструментах, либо на другой отрасли.

Ключевые слова: программные средства; оценка программного обеспечения; управление услугами.

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