Service profiling - a method for data-driven competitive intelligence in service industries

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Abstract: Since Porter's work on competitive strategies in the 1980s, the concept of competitive intelligence has become part of the management mainstream. Currently, two big shifts are challenging the state of the art. On the one hand there is the rise of the ubiquitous servicification in all industries which makes the existing methods for product-oriented industries obsolete. On the other hand there is the rise of big data. Both shifts are driving the development towards data-driven competitive intelligence for service industries. In this paper we demonstrate by examples within the case "IP Industry Base" how data-driven CI for service-oriented sectors can be implemented. We combine the concept of Key Intelligence Topics (KIT) with the approach of reverse service engineering. The resulting vector-based representations of the companies' service profiles allow the user to visualize, compare, retrieve and analyse companies in a formalized and scalable way.

Keywords: data-driven competitive intelligence, reverse service engineering, service profiling, key intelligence topics, KIT models, IP industry, technology transfer

1 Motivation

Competitive intelligence (CI) is turning external, unorganized data about the competitive environment into strategic, actionable insights. It is the basis for strategic decisions of a company. While CI is already an established topic in research and industry, within the last years two major shifts have emerged and are challenging the state of the art. On the one hand there is the rise of smart services and service-orientation in all industries which challenges the CI methods for product-oriented industries. On the other hand there is the rise of big data [Manyika et al. 2011, McKinsey 2012] which opens the way to new dimensions of scalability and speed but also failures. Both shifts are driving the development towards data-driven competitive intelligence for service industries.

In this paper we demonstrate by examples within the case "IP Industry Base" how data-driven CI for service-oriented sectors can be implemented. Here we combine the Herrings' concept of Key Intelligence Topics (KIT) [Herring 1999] with the approach of reverse service engineering. This allows the user to visualize, compare, retrieve and analyse companies based on their service profiles in a formalized and scalable way.

In the following chapter 2 we discuss the need for competitive intelligence methodologies which are targeted to the service industries. In chapter 3 we combine insights with our assumption that the data-intensity of competitive intelligence will drastically increase in the next dec-

ade. KIT models will be introduced as masterpiece of data-driven CI processes. In chapter 4 the need for competitive intelligence in the service-oriented industries for technology transfer is described. In chapter 5 the IP service taxonomy and its application for data-driven service profiling of competitors is introduced. In chapter 6 the application of service profiling is demonstrated in the IP industry base. In the last section a short outlook is given.

2 Competitive Intelligence in service industries

Competitive Intelligence is "the use of external sources of information (news announcements, analysts' reports, patents, company web pages, feedback from clients and suppliers, personality profiling of key individuals) to assess the environment in which a particular organization operates and to predict future political, economic and competitor actions which might affect the organization" [Tsitoura et al. 2012]. Summarized, competitive intelligence is the structured analysis of the company's competitive field by using external, legal sources. Competitive intelligence is not only collecting and analysing data, but also the translation of this information into strategic, actionable knowledge [Rothberg et al. 2004].

Ever since Porter's work on competitive strategies in the 1980s, the concept of competitive intelligence has become part of the management mainstream [Calof et al. 2008]. However, most academic research and applied management literature are devoted to CI approaches for product-oriented manufacturing industries. "All [of them] thoroughly explore ways to study headcounts, capacity utilization, throughputs, shipments, raw materials [but …] they are not suited for studying how one law firm represents clients in court compared to another, how one recruiter finds the best candidates over another, how one market research firm can recruit better employees than another" [Sawyer 2002].

With the on-going rise of smart services and service-oriented business models the need of CI for service industries increases [Nemutanzhela et al. 2011]. In this paper we demonstrate by giving examples within the case "IP Industry Base" how CI for service-oriented sectors can be implemented.

3 Data-driven Competitive Intelligence for service industries

Beside the ubiquitous servicification of industries, CI is faced with a second big shift. Most executives expect big data and analytics as two main trends in digital business to transform their businesses [McKinsey 2012]. As a natural data-driven business activity, CI will profit as part of this transformation. We expect to see the rise of data-driven competitive intelligence in the next decade.

As depicted in **Fig. 1** the CI cycles usually comprise of four key stages: Planning, Gathering Information, Analysis and Dissemination [Tsitoura et al 2012]. These four stages are embedded in a repeated feedback-loop. This very general CI process pattern will continue to exist even under the fundamental changes towards service-orientation and big data. Bose summarized the

existing data-intensives approaches in CI [Bose 2008] and reveals the existing gap between opportunities and reality.

Key Intelligence Topics (KIT) are important and well accepted management and communication tools within the CI processes [Calof et al. 2008]. KITs are mutual agreements between the CI professionals and the company's senior management about the main questions and issues to be addressed by the CI [Herring 1999]. KITs can be understood as requirement definitions against which the CI professionals continuously deliver reports with actionable insights. Usually, KITs follow three functional categories: strategic decisions and actions, early-warning topics, or descriptions of key players [Herring 1999].

We introduce the concept of KITs into data-driven CI. Thus the "KIT models" - as depicted in **Fig. 1** - become the masterpieces of data-driven CI solutions. We define KIT models as shared and agreed data models, based on the KITs to be investigated in the CI processes. If, for example, key personals of the competitors should be analysed, the analysts need to know what kind of information is important to look for and they need tools to store information properly. Not only the data gathering tools but also the analytical tools should be implemented against the KIT models. Finally, even the reports in the dissemination phase should (partly) be generated from the KIT models filled with appropriate data.

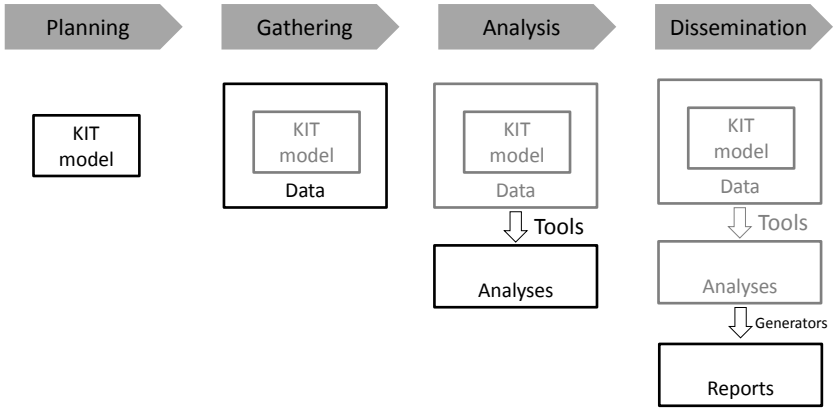

Fig. 1 KIT models in data-driven CI process

In the following section we discuss, how the general approach of KIT models can be adopted to service industries. When investigating service-oriented competitors, one of the main key aspects is the portfolio of provided services. KITs like "Which companies in Brazil are engaged in similar services as we are?" require a KIT model which allows the user to compare different companies based on the quality and quantity of their service profiles.

For the specification of service profiles (and the underlying KIT models) current developments in the field of service engineering can be used. For example [Böttcher 2009] provides a review

of existing approaches to service engineering and summarizes them in a comprehensive architectural model of services. Although this is necessary preliminary work, for the analysis of different companies, new ways of quantitative *reverse* service engineering have to be investigated.

The general concept of reverse engineering is a well adopted method in CI for product markets [Chikofsky et al. 1990, Crane 2004]. Reverse engineering in general "is the process of analysing a subject system to identify the system's components and their interrelationships and create representations of the system in another form or at a higher level of abstraction." [Chikofsky et al. 1990].

In our case of reverse service engineering the subject system is the observable artefacts of the competitors' service portfolios. These observations have to be transformed into one unified layer of abstractions which allows comparison and analysis of the service portfolios with algorithmic means. In data-driven CI the structure of these abstractions is defined through the KIT models.

4 Competitive intelligence along the value chain of the IP industry

In the subsequent section 5 we demonstrate one exemplary approach of reverse service engineering for data-driven CI by the case "IP Industry Base" (IPIB). Within this section we briefly introduce this case.

The IPIB is intended to be an analytical database about the main international market actors within the Intellectual Property (IP) industry. These are not only patent attorneys, but also strategic consultants, insurance companies, database providers, matchmakers, or financial entities.

The societal impact of the IPIB can be drawn from its role in improving technology transfer (which is the value chain from the idea to the product). IP rights and related services have an essential role in employing and transferring technologies under the current law scheme. Improving this technology transfer is urgently required, especially in the field of adaptive and mitigating clean technologies [Nanda et al. 2009].

In the last two decades the IP industry has matured and IP market intermediaries have emerged in order to facilitate more efficient market transactions of technologies, technical knowledge, intellectual property and particularly, patents by developing new models (e.g., patent auctions and patent portfolio funds). However, the current role of these market intermediaries is quite diverse [U St. Gallen 2011]. It is not apparent which intellectual property-related services do exist and how extensively they are used. The IPIB has been developed by the authors in order to investigate the role of IP market intermediaries, and to serve in parallel as CI tool for the market players. Shown in **fig. 2** is a screenshot of the IPIB depicting the current company profile of the company "Ascenion".

5 IP Services Taxonomy for service profiling

In this section we demonstrate how reverse service engineering is implemented in the IPIB as a method of data-driven CI. The most important KIT model within the IPIB is the company profile. Generally, the KIT model for companies comprises data about the following sub-topics:

- people and their roles within the company,
- headquarters and office of the company,
- the services provided by the company (service profile),
- the markets served by the company, and
- the companies belonging to the same corporate group.

In order to analyse long term changes, for the most factual data further metadata is stored, like date of the beginning and the end of the validity as well a link to the source of the information.

In the following section we will concentrate on the service profile. To formalise the service profiles of such diverse companies like patent law firms on the one hand and start-ups for IP management software on the other hand, a standardised taxonomy for service descriptions is needed. To our best knowledge such taxonomy does not exist. The authors have developed the "Intellectual Property Services Taxonomy" (IPST) (see [Maicher et al. 2012] for the full taxonomy). Currently the IPST consists of 6 top categories of services, which are further broken down into 81 sub-categories:

100	IP-related Finance Services
200	Matchmaking & Trading
300	IP Portfolio Processing
400	Legal Services
500	IP Consultancy
600	Media & People

In the example of "Ascenion" (see Fig. **2**) the service profile is defined by the following services "211 Onsite Matchmaking Services", "212 Online Matchmaking Platforms", "230 IP Scouting", "340 Purchase and Sale of IP", and "350 Licensing IP". The IPST is validated through desktop research, expert interviews and its usage for the categorization of already more than 300 companies.

As any taxonomy the IPST is a hierarchy of terms [Garshol et al. 2004]. Formally the IPST is an ordered directed tree. Consequently, each service has a (potentially empty) set of direct and indirect ancestors, as well as a (potentially empty) set of direct and indirect successors. In the IPIB the service profile of a company consists of all directly assigned services and all indirectly assigned services. The indirectly assigned services are the set of all ancestors and successors, both direct and indirect.

Based on this formalisation, a service profile of a company can be transformed into an n-dimensional vector by depth-first traversal. Each dimension represents one service. The value of the dimension is *d* if it the service is directly assigned to the company. The value is *i* if it is indirectly assigned, and *0* for no assignment. For example, the values for the first 37 dimensions of the service profile for "Ascenion" (see Fig. **2**) are:

(0,0,0,0,0,0,0,0,0,0,0,0,0,0,i,i,d,d,0,d,0,0,0,0,0,i,0,0,0,0,0,0,0,d,d,i,i,0, …)

For each company in the IPIB such a vector is generated through manually analysing the observable artefacts of the services provided by the companies. These uniform vector representations are the result of reverse service engineering.

They can be used for further analysis, for example by calculating cosine distances between these vectors to find companies with similar service profiles. A huge variety of methods from data-mining and information retrieval are based on distance-measures for vectors and thus are applicable here. One of the future research challenges is determining appropriate values for *d* and *i* and select suitable methods to yield sufficient results.

6 Using the service profiles in the IPIB

In this section we demonstrate how the service profiles are currently used in the IPIB. The **Fig. 2** below depicts the company profile for the Ascenion GmbH in the IPIB.

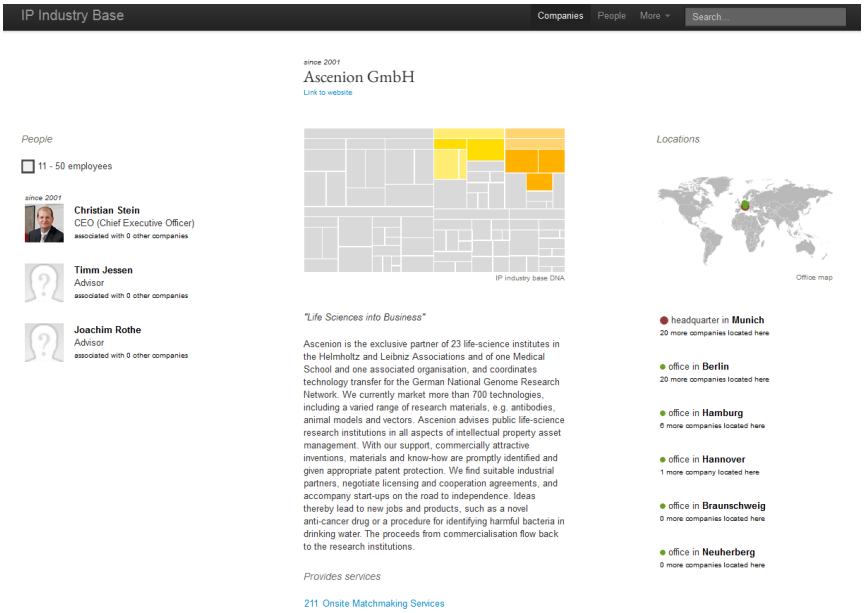

Fig. 2 Screenshot of the company profile for "Ascenion" in the IPIB

The service profile of the company is visualized as coloured treemap [Vliegen et al. 2006]. A treemap uses nested rectangles for the visualisation of hierarchical structures. Two dimensions can be visualised by using different colours and sizes for the rectangles. The automatic layout of the nested rectangles is based on the hierarchy. In the IPIB example colour is used to distin-

guish the different service categories. Each of the six top categories has a different colour. If a service is directly assigned, the according shape is filled in this colour. Additionally all successors and ancestors of the assigned are filled in a lighter shade of this colour. The second dimension - the size of each rectangle – is used to visualise the importance of a service. The more companies provide a specific service, the larger the rectangle for this service is in the visualisation.

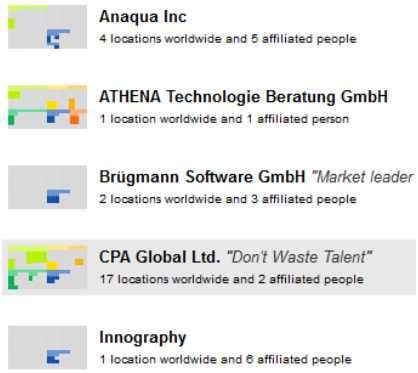

Fig. 3 List of companies providing the service „621 IP Portfolio Management Software"

The visualisation of the service profile allows the users to detect similarities and differences between companies in a fast and efficient way. For example, the screenshot **fig. 3** depicts a list of different companies which all provide the service "621 IP Portfolio Management Software" (visualised as dark blue rectangles in the treemaps). The companies in this list have different levels of specializations. It is obvious that "Innography" and "Brügmann" are specialized as software vendors. On the other hand "ATHNA" and "CPA" provide a broad service portfolio. In between "Anaqua" bundles some specific legal service with the software packages they sell.

The service profiling – in terms of categorizing the service portfolios of the competitors according to a standardised service taxonomy – and the visualisation of the service profiles supports the users of the IPIB to generate actionable knowledge. The analysts can directly see whether the companies' profiles complement or compete with their own service portfolios.

7 Conclusions and Outlook

Competitive intelligence is a good basis for strategic decision making for a company. With the ever increasing importance of the service industries the means and methods of CI have to adapt from product-oriented markets to competition in service-centric industries. In parallel we assume a shift towards data-driven competitive intelligence. As consequence we introduced the concept of KIT models into data-driven CI.

The combination of the above mentioned shifts requires the advent of reverse service engineering. In this paper we demonstrate an example of the service profile in the IPIB. We show how this reverse service engineering can function in the service-oriented industry along the IP value

chain. We have demonstrated how a unified layer of abstraction – the vector representations of service profiles - allows comparison and analysis of the service portfolios with algorithmic means. Regarding this, in future it will be necessary to consider what happens to established company service portfolio vectors when changes to the categories and subcategories of IPST are made, since this cannot be assumed to remain static.

In our future work we will examine by user tests and user interviews, how the implemented service profiling supports the day-by-day work of the professionals. Future improvements of the KIT models and the user interfaces will be driven by the insights gathered in these user studies.

Furthermore we will investigate how the vector representations of the service profiles can be used to further support the users by recommendations or automatic assessments. In example these can be similarity calculations based on the service profiles. Alternatively companies which complement each other into a specific value chain can automatically be detected in order to orchestrate suppliers and purchaser within a sector and a regional focus.

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