Classification of Agriculture IT-Technologies for Farm Management – a global approach

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ABSTRACT

The use of modern technologies in agriculture, such as sensors or farm management systems, generates a growing number of data on farms worldwide. These technologies as well as the mentioned big data from it, have high potentials for several scopes of applications (e.g. consulting, communication, marketing). With this background in consideration, this study aims on a screening, classification and evaluation of IT-Technologies in Agriculture - focussed on seven technologies (Application, Web-Based technology, Sensor, Satellite, Hardware, Software, and SMS) with farms as reference area. The classification of the solutions based on 31 criteria (i.g. archetype or provider type) and subgroups. At the end of our research a total number of 1684 entries were counted; most of them Applications or Software solutions. The paper will focus on selected results presenting potentials for several scopes of applications on the global market of IT-Technologies for farm management.

Keywords: IT-Technology, plant production, farm management, application, hardware, software

1. PROBLEM STATEMENT

The ongoing developments in the field of Precision Farming such as sensors and the use of other Information and Communication Technologies (ICT) like farm management systems generates a growing number of data on farms worldwide. Additionally, the ongoing global spreading of mobile devices (e.g. global Smartphone sales: 305 Mio Smartphones (2010), ~1500 Mio (2017, expected)) generates a new dimension of mobile data generation; for instance with Applications (Statista, 2014). Following these trends it becomes clear that there is no lack of available data in modern agriculture (Fountas et al. 2006). Today's challenge is the interpretation and target-

oriented use of the collected Big Data for a sustainable farm management (Brook, 1988; Kay and Edwards, 1999; Stafford, 2000; Thysen, 2000). Therefore the mentioned technologies as well as the Big Data from it, have high potentials for several scopes of applications (e.g. consulting, communication, marketing) and different target groups (e.g. farmer, consultant, consumer). With this background in consideration, this study aims on a screening, classification and evaluation of IT-Technologies in Plant Production worldwide. It focussed on seven technologies (Application, Web-Based technology, Sensor, Satellite, Hardware, Software, and SMS) with farms as reference area.

2. METHODOLOGY

The results are based on our research done from July to November 2013. All findings are saved in a Microsoft Access database. The data was generated by an internet research on the companies' homepages as well as by screening the main science databases (like scopus) and congress proceedings (like EFITA and AFITA) in German, English, Spanish, and Portuguese language. To sort and structure the list of Technologies the content analysis as a method based in the empirical social sciences was an adequate tool to accomplish this task (Steigleder, 2008). While the quantitative content analysis focuses on an approach based on quantifiable numbers and numerical functions, the qualitative content analysis aims at the classification (Mayring, 2010). Due to this for this study the latter was the appropriate solution for a classification of the technologies. The classification of the solutions based on 31 criteria (i.g. archetype or provider type) and subgroups.

3. RESULTS

At the end of our research a total number of 1684 technologies were counted. The analysed technologies are divided into seven subgroups: Application (App), Web-Based technology, Sensor, Satellite, Hardware, Software, and SMS (Fig. 1). Most of them are Applications (507) or Software solutions (525) followed by Web-Based Technologies (400) and Hardware (394). SMS-Services have a minor relevance with just 25 entries. Some of the entries fulfil the requirements of more than one group (e.g. ArcGIS: App, Software, Web-based).
The provider market is dominated by IT companies. Almost half of the recorded entries are offered by them (923). Also Machinery companies (458) play an important role in the market. Due to the fact that they sell machines for plant production to the farms, the providing of additional technologies, like Hardware components is in many cases self-evident. Fewer products are provided by Advisors (125), Associations (149) and Crop Protection Producers (CPPs) with 160 entries. Less than 50 products are provided by Fertilizer companies, Seed companies, Traders or Financial Services. Some technologies are provided by cooperation's of several providers.
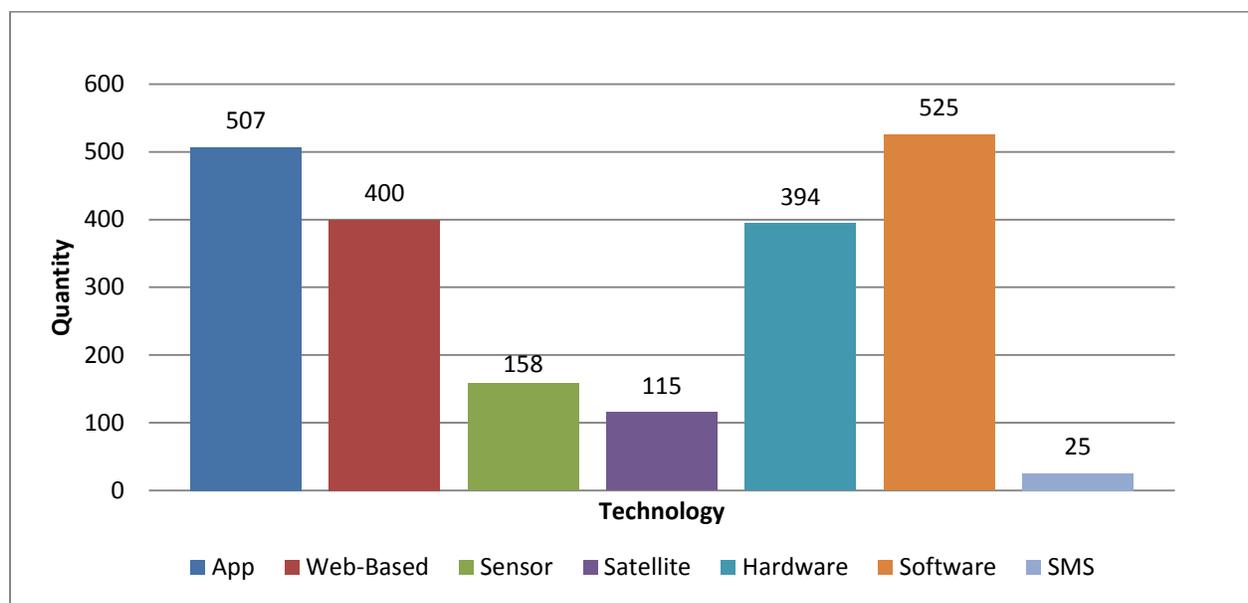
Figure 1: Frequencies of Ag-IT Technologies in clusters according to the type of technology
(n= 2124, multiple responses)

This study is based on research activities in German, English, Spanish, and Portuguese language. The research activities show, that most of the technologies are available in more than one language (Fig 2). For this reason also technologies in French, Hindi, Polish, Russian and Ukrainian language could be found. The dominant Language is English (1453); according to a large number of technologies is promoted in English speaking countries, like the USA and Canada. Further important languages on the global market of agriculture IT are German with 502 entries and French with 370 entries. Due to the fact that this study just focussed on some preselected languages we expect further technologies in the ignored language areas (e.g. Chinese).

Finding new scopes of applications, beside the languages the focus archetypes of the technologies are very important. In this study we divided between Farm management, Information, Learning, Precision agriculture, Trading Platform, and Others (Fig. 3). The two most important categories are Precision Agriculture (622) with tools like "System 350" and Farm Management (604) with tools like „ScoutPro Corn" followed by Information with 487 entries. In the last group are many tools with information about the weather, like the tool "climate center". The three subcategories Learning (20), Trading Platform (43) and Others (62) are underrepresented compared to the before mentioned archetypes. A few technologies fit in more than one archetype.
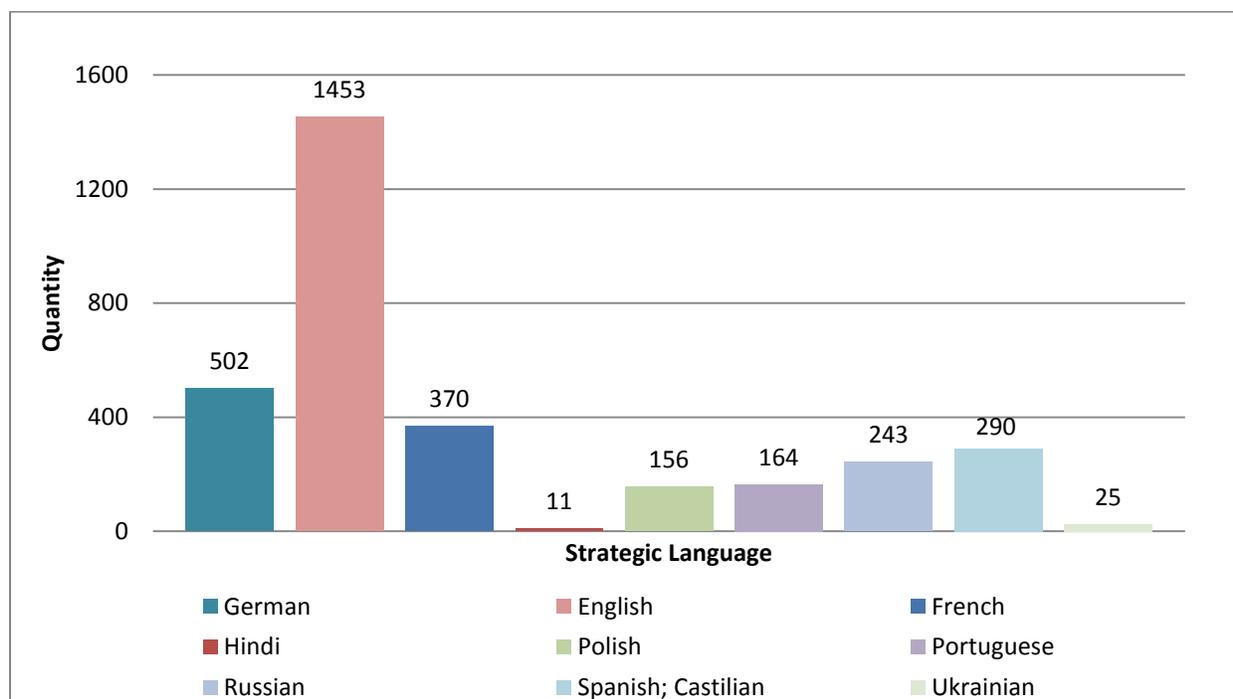
Figure 2: Frequencies of Ag-IT Technologies in clusters according to the Language
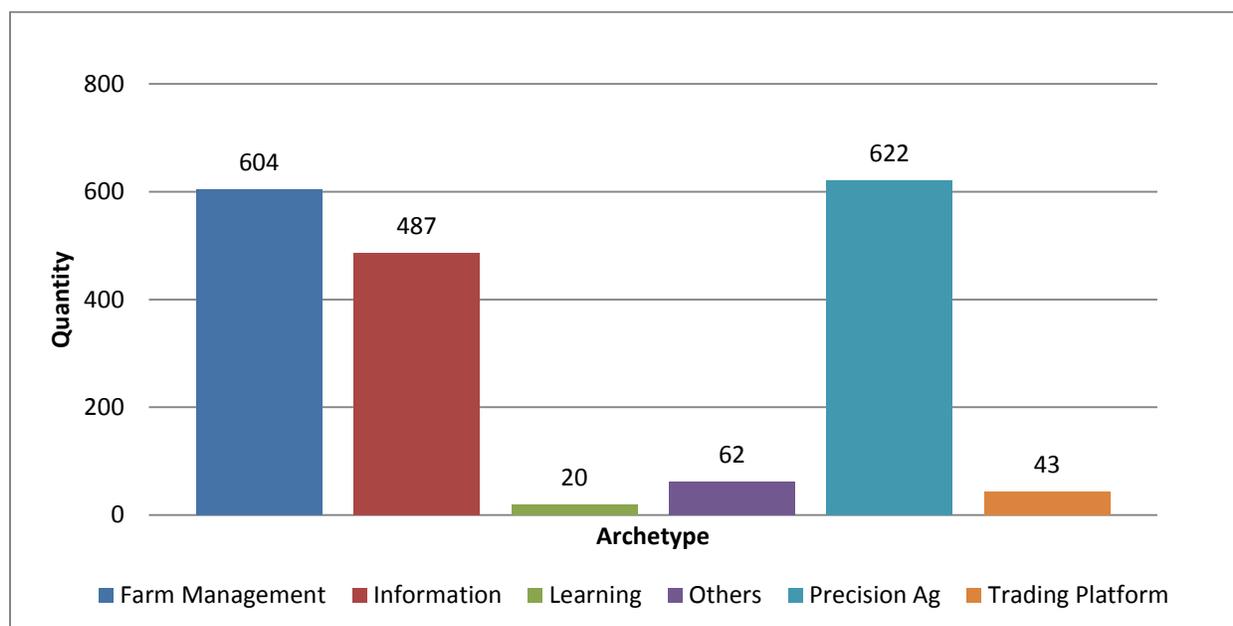(n= 3214, multiple responses)

Figure 3: Frequencies of Ag-IT Technologies in clusters according to the Archetype
(n= 1838, multiple responses)

The criterion Cluster Key Activity characterises the technologies more in detail. It indicates the different core phases during plant production and is divided into nine activities (Fig. 4). Six focus activities can be dedicated for the agriculture IT Technologies: Crop Protection (784), Fertilizing (642), Seeding (548), Harvesting (517), Soiling (489) and Season preparation (462).
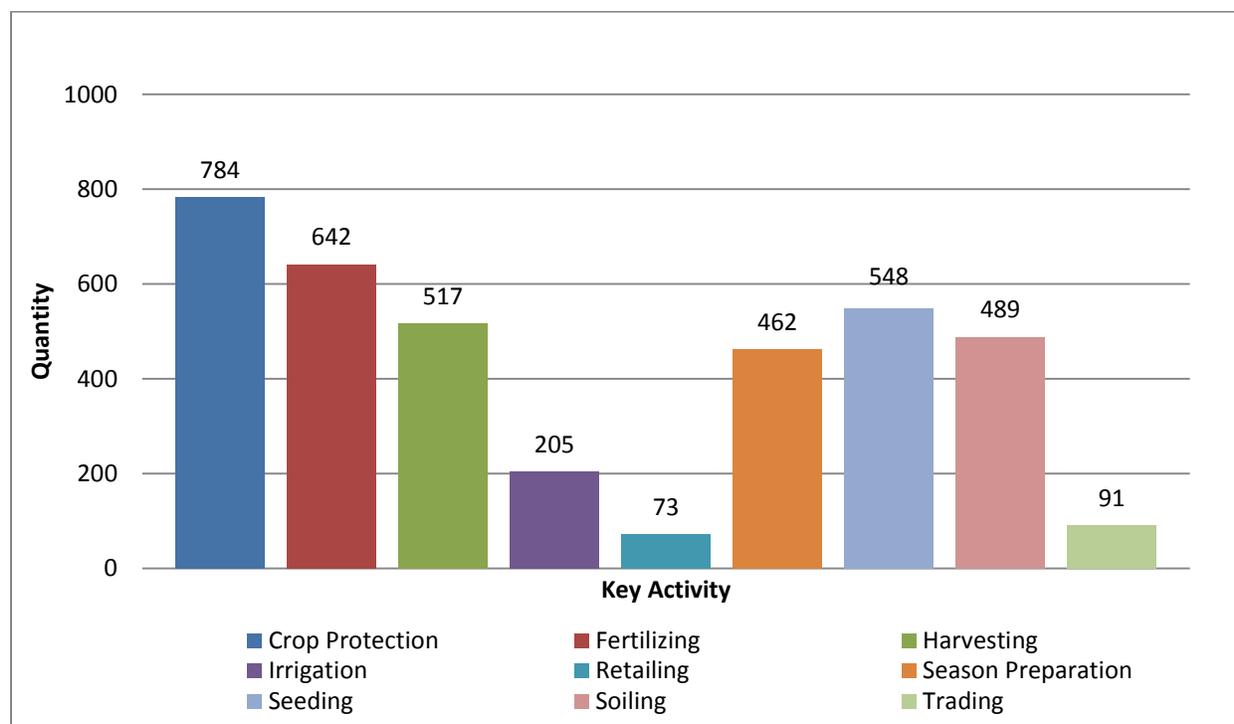

Figure 4: Frequencies of Ag-IT Technologies in clusters according to the Cluster Key Activity
(n= 3811, multiple responses)

Due to the main focus of this study on farmer's activities Retailing (73) and Trading (91) are underrepresented. Most of the technologies have several key activities and assist the farmer through the whole plant production process. One example for this is the software tool "AO Gemüse- & Obstbau".

Furthermore we found a lot of unexpected relations in between the data. In some cases the same technology is used or offered by different companies. They just changed the name of the product. Otherwise some entries seem to be not maintained. In these cases web pages are not updated or they offer products for old operation systems (e.g. Windows 3.1).

4. CONCLUSION

Screening and classifying Agriculture-IT Technologies on a global level is a big challenge. In this context this study can just be a snap-shot. Nevertheless, the results help to understand the market, the market dynamic and the core areas of importance. The market of Agriculture –IT-Technologies is a very dynamic market; this has been seen in some changes. For instant, in some

cases at the end of the three month period, some technologies were not available anymore. To summaries, the data analysis indicates a tendency that Agriculture IT-Technologies include several or all phases of plant production and assist the farmer through the whole season. Due to widespread island-solution technologies for single activities, going along with data exchange problems, this is a good result. Also the important role of mobile devices, mentioned in the problem statement, can be confirmed according to the high quantity of applications counted. Finally, the next years will show more trends in the Agriculture IT-Technologies and the potentials for several scopes of applications on the global market of IT-Technologies for farm management.

For future research definitions and system boundaries must be specified to avoid misinterpretation. At the end one of the most difficult points is the subjective evaluation of the criteria, it really depends on the personal experiences of the data collector or evaluator. Nevertheless, the results show the global importance of this study area.

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