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Development trends in agricultural apps – an interim review

Globalisation, volatile markets and the increased withdrawal of agricultural policy from market regulation leads to increasing complexity in decision-making processes for farm businesses. Applications offer through their mobility and individual design options to assist the farmer in his daily work. In this context, this study makes an inventory and categorisation of native agriculture-related applications. The results reveal a focus on e. g. crop production and commonly occurring demand-related combinations of functions (e. g. planning and analysis).

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Abstract
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Recent years persistently demonstrate an increasing globalisation, volatile markets and an increasing retreat of agricultural policies from market regulations, and, as a consequence, increasingly complex decision-making processes and rising demands on senior agricultural management [1; 2]. Studies indicate that Mobile Business could cover a wide variety of applicable areas as well as services related thereto (e. g. mobile shopping) for agricultural enterprises [3; 4; 5]. In this context, Mobile Business offers unique selling propositions such as location independence and/or continuous accessibility [3], which makes it stand out from alternative technologies. In addition, mobile applications (apps) allow the respective users individual customisation of their smartphones. Users can customise their smartphone functions according to their personal interests and needs. That applications are no short-term phenomenon is evidenced by their increasing global sales figures and forecasts for the years to come. Accordingly, global app download figures have already risen from 2.516 billion (2009) to 63.98 billion (2012), and for the future, until 2017, a worldwide growth to 268.69 billion downloads is expected [6].

Mobile applications also become more interesting for upstream and downstream sectors because, in this manner, they could contribute towards greater customer loyalty in agriculture. This assortment already grants the user disposition of a broad spectrum for the most diverse tasks. This ranges from simple "information apps" which provide information about agricultural commodity prices and market novelties, such as the "Farm Progress" app, to complex applications, such as the "JDLink" app for agricultural machinery monitoring or for complete documentation [7].

The fact that the use of smartphones among farmers is steadily rising, indicates that mobile applications in an agricultural context are becoming increasingly important [8]. This is also validated by the results of the present studies from 2012. Therein, it was, inter alia, determined that about half of the surveyed agricultural enterprises in Germany (76 out of 135 enterprises) already use Internet-enabled mobile devices (smartphones or the like). These enterprises had a total of 128 wireless mobile devices available. This corresponds to a quota of 1.68 devices per enterprise [9].

In this context, this article aims to capture and categorise agricultural applications, taking the following questions into consideration:

- How many native applications are available to farmers, differentiated by production branches, in order to support operational management?
- What specific functional areas do the applications cover?
- What developmental and potential trends could be perceived from a categorisation of apps?

Methodology

In order to clarify these questions, an inventory of existing native applications on the market follows below: Compared to web applications that run on online browsers, these are written in native programming languages and are available for download at the respective shops of those operating systems. In order to accomplish this work, the world's proportionaly two largest app stores, Apple App Store and Google Play-Store, were searched. Together, both operating systems (Apple iOS and Android) last year covered 95 % of all globally marketed smartphones [10].

Table 1

Result matrix: Combination of selected main and sub categories by the categorisation of Apps

Hauptkategorie *Main category*	**Unterkategorien/*Sub category***																			
Plattform/*Platform*	Apple										Android									
Sprache/*Language*	Englisch/*English*							Deutsch/*German*						Spanisch/*Spanish*					Andere/*Further*	
Anbietertyp *Provider type*	IT *IT*	Maschinenhersteller *Machinery*	Zeitung oder Magazine *Newspaper or magazine*	Agrochemie *Agrochemical*	Privat *Private*	Handel *Trade*	Universität *University*	Beratung *Consulting*	Vereinigungen *Associations*	Weitere (z.B. Banken) *Others (e.g. Bank)*	Saatgutunternehmen *Seed*	Futtermittelunternehmen *Feed*	Ministerium *Ministry*	Chemie oder Pharma *Chemical or Pharma*	Stallausrüstung *Stable equipment*	Versicherungen *Insurance*				
Produktionszweig *Production type*	Pflanzenbau *Plant production*			Milch *Milk*				Tierhaltung (entweder Rind, Geflügel oder Schwein) *Animal production (eather beef, poultry or pork)*				Gemischt (Pflanzenbau und Tierhaltung) *Mix (plant and animal production)*				Tierhaltung (mehrere Tierarten/-produkte: Rind, Geflügel, Schwein und/oder Milch) *Anmial Production (several animals or animal products: beef, poultry, pork and/or milk)*			
Funktion *Function*	Dokumentation *Documentation*	Analyse *Analysis*	Beratung *Consulting*	Planung *Planning*	Finanzplanung *Financial planning*	Flottenmanagement *Fleet management*	Einkauf *Purchase*	Disposition *Disposition*	Wettermanagement *Weather management*	Information *Information*	Kartierung *Mapping*	Qualitätskontrolle *Quality control*	Vorhersage *Forecast*	Messung *Measurement*	Soziales Netzwerk *Social network*	Fernsteuerung *Remote control*				
Downloadzahlen *Number of downloads*	1–5	6–10	11–50	51–100	101–500	501–1000	1001–5000	5001–10000	10001–50000	50001–100000	100001–500000	Nicht verfügbar *Not available*								

The inventory takes place in the form of a structured store search. In order to ensure a structured and comprehensible mode of operation, techniques from empirical content analysis were used. For the qualitative content analysis used in this study, several task areas (classifications, hypothesis identification and examination, pilot studies, case studies and process analyses) were defined, where classification for this work was the most important item [11]. The aim of classification is to sort the data according to classification criteria in order to allow a structured description of the data collected [11]. In this case, systematisation takes place by means of categorisation of objects (apps) according to several criteria, such as – for example – the allocation of functional areas or classification into available operating systems or languages.

In order to search the mentioned app stores, definitions were used that cover the complete spectrum related to the "agriculture" subject area. To that extent, thematic keywords were defined in German, English and Spanish. The apps encountered this way were described by means of elucidated content analysis through categories.

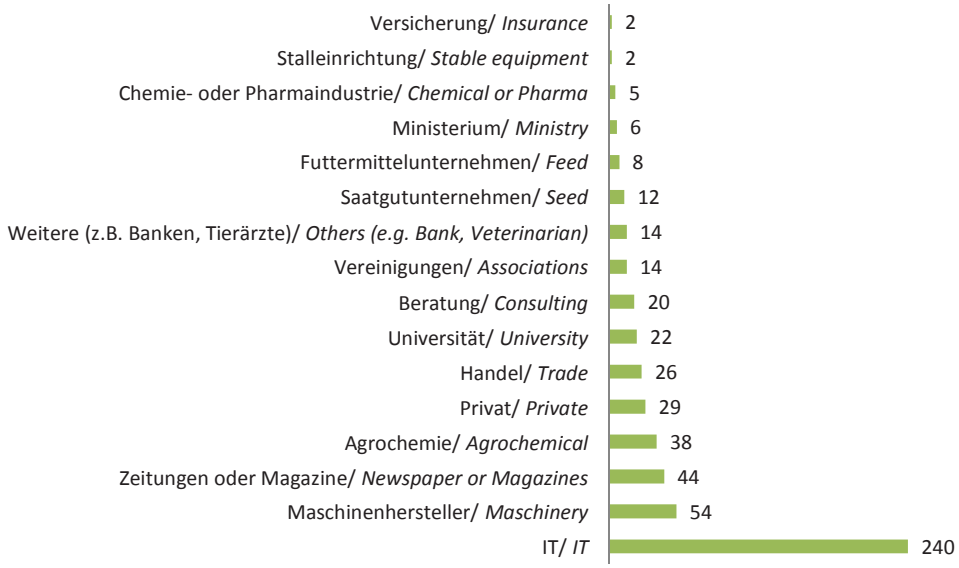
The examination periods were limited from June through August of 2013 and from April through June of 2014, where – unless otherwise indicated – the descriptions set forth below originate from the 2014 examination period. Especially in the app stores, new versions and updates were released continually, which broadens the app range offered. Therefore this work represents only a snapshot of the apps offered. Game apps related to agriculture were explicitly not considered. Furthermore, especially for weather apps, restrictions were applied. The only ones considered were those offered by providers active in the area of agriculture and/or those that offer special agricultural functions (e. g. soil temperature). In general, attention was paid to evidence a current reference to agriculture at all times.

Accumulated, in the 2014 examination period, n = 521 apps with the agricultural enterprise as a reference could be determined and were categorised accordingly.

Results Matrix

A total of six main categories were formed for the categorisation of native applications, which are described in greater detail

Fig. 1



Provider of agricultural native Apps (n = 534, multiple answers possible)

in this article (**Table 1**). These are attributable to the platform for which the app is programmed (Apple or Android). Furthermore, the apps can be distinguished according to the applicated languages, namely English, German and Spanish as well as others, when mentioned separately. As a result, three large and important global language areas for agricultural production are covered. The third category records the provider types. These, for example, include IT or consulting firms. Different production branches (plants, milk, etc.) also form a distinguishing criterion between individual apps. The individual functions characterise each individual app in detail. Within this group, a total of 16 subcategories are distinguished. Lastly, the proliferation of apps can be recorded based on the download figures. Further criteria used for categorisation are: Name, description, link, price, provider name, rating and comments.

Platform, Language and Provider Type

The results of the study indicate that the applications on both platforms, Android (346) and Apple (409), are relatively evenly distributed. It should hereto be noted that nearly half (234) of all examined apps are offered on both platforms. Most apps (425) are available in English, followed by German (210). The majority of apps, 75 %, are free of charge. When paid apps are analysed more closely, then often "pro" versions can be found among those offered (e. g. Control Ganadero Pro). Founded on a free app, these offer complimentary functions (e. g. special evaluation tools).

When analysing providers of apps for the agricultural production, it was expected that a broad spectrum would be found here (**Figure 1**). Several classic provider types are nevertheless significantly more likely to be found than others; these are primarily IT companies (240), but also machinery manufacturers (54), newspapers/magazines (44) as well as providers from the agrochemical industry (38). With the machinery and agrochemical industry, two stakeholders from the supply industry dominate the app market. This is not surprising since agriculture, as a customer, is of considerable importance to the supply industry in terms of total sales.

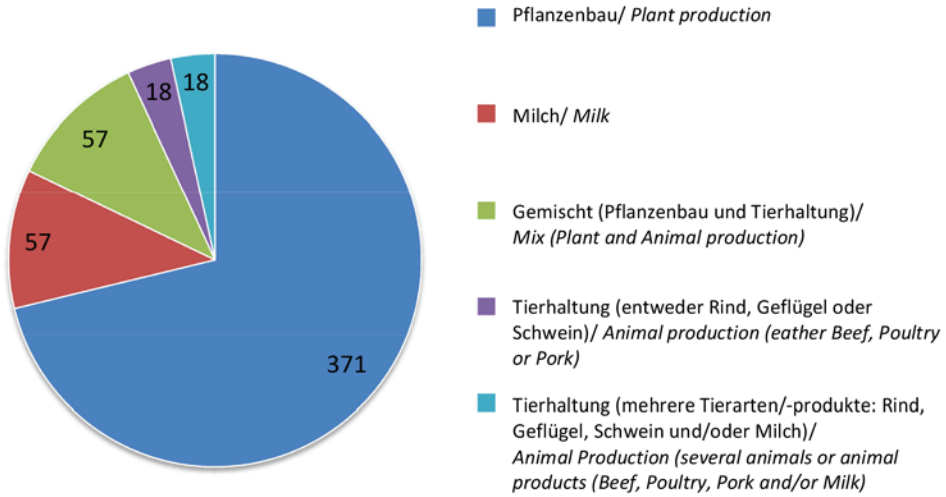
Production Branches, Functions and Function Clusters

The underlying data for the study provides the opportunity to cluster the apps into individual agricultural production branches. It is noteworthy that apps for crop production (371) are by far offered the most (**Figure 2**). In this recording, apps that assist livestock farming are under-represented. For individual production branches such as pure beef, poultry or pig farming, so far there are only relatively few applications in the analysed languages (18). For farms which have different production activities, such as forage production and livestock farming for example, the high amount of 57 available apps is gratifying.

When, in addition to the mentioned production areas, the content of the app is analysed, a wealth of functions that are covered by those applications for agricultural enterprises is revealed. Four core functions are prominent (**Figure 3**): Information (285), planning (204), documentation (129) and analysis (132). With regard to the increasing product quality requirements on food, quality control is an important function as well.

Within the individual production branches, certain functional clusters become apparent, in other words, a combination of functions that frequently occur commonly. In crop production, information is the most common function. It is offered in 52 % (193) specialised applications for crop production. Within the same agronomic application, primarily the planning and analysis functions (56) as well as planning and documentation (58) appear clustered. However, fewer applications are found

Fig. 2



Allocation of the applications into production line; year 2014 (n = 521)

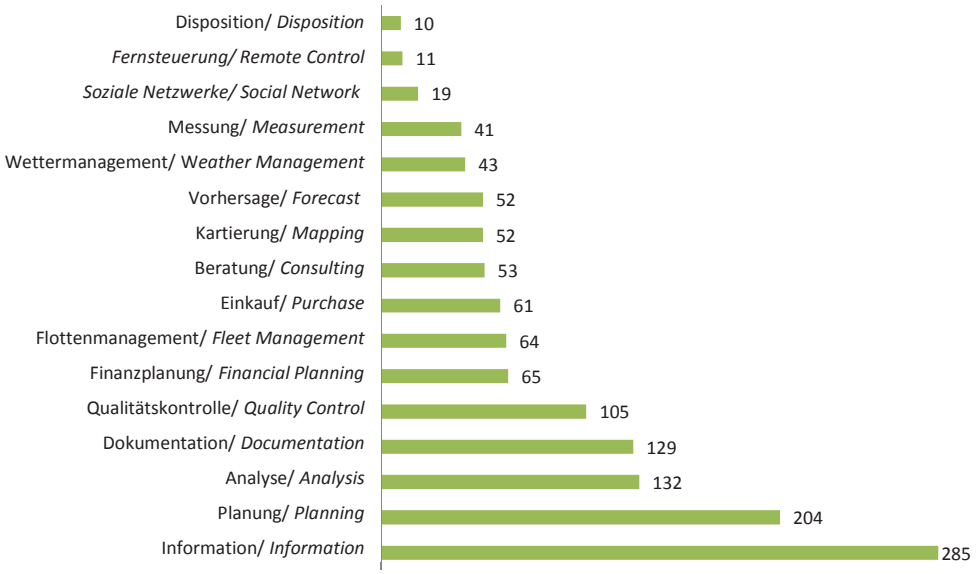
in combinations containing information (e.g. information and planning: 34). Detailed further correlations in the area of horticultural apps could be recorded. When considering the applications with a focus on weather management (30), it is noticeable that this function frequently, that is in approx. 5 out of 6 cases, appears combined with forecasts and/or information. A similar impression emerges when considering quality management as an application's core function (63). This function is combined with analysis tools in 2/3 of the cases.

In livestock farming (across all animal species and products), there are similar patterns. Although here, in comparison to crop production, no particular function stands out, the combination of documentation and planning functions also occurs relatively frequently in the totality of these production areas (in 35 out of 93 in total). In livestock farming, certain function combinations are observed in detail as well. The quality control function (39), for example, is paired with a documentation and/or planning tool in 2/3 of the cases.

Development Potential and Trends

The total download figures of apps recorded may not reflect the actual use of the applications, but they provide an indication of the attractiveness and magnitude of the potential user group. Download figures could be recorded for 343 apps. The largest group consists of 104 apps that were downloaded 1,001 to 5,000 times each. Another 90 apps were downloaded more than 5,000 times; some of which (3) even between 100,000 and 500,000 times, such as for example the Swiss weather

Fig. 3



Allocation of the applications into area of operation; year 2014 (n = 1 326))

app LANDI Wetter. All other apps were downloaded less than 1,000 times. These results indicate that for many apps, the user group to date is rather small, which provides an argument for niche areas, or else for existing growth potential.

The short time span between de examination periods (from the summer of 2013 until the summer of 2014) only permits conditional, comparative results. Moreover, due to the rapidly growing app market, adjustments in certain categories (e. g. in operating systems or production areas) were needed, so the comparison between these years was hampered. Nonetheless, certain trends in agricultural apps can be derived. The total amount of native apps increased from 379 to 521, which, like before, suggests that this is due to a growing market. The proportion of apps in foreign languages has increased as well, which points towards a progressive expansion into new markets. The supply ratio of apps between production branches (arable versus livestock farming) has, however, barely changed from 2013 to 2014. The seven most common functional areas of the applications (information, planning, etc.) appear in the same order in both years too, which illustrates their dominant position in management support of agricultural enterprises.

Conclusions

The global market for applications is very dynamic, knows continuous growth and has great potential [6]. This study has basically demonstrated that the same also applies to agricultural apps. The categories listed here demonstrate the existing diversity. Production and functional areas, and particularly function clusters point towards certain patterns in the conception of applications and confirm that they can offer support in very different global tasks and decision making processes in agriculture as well [3; 4; 5]. The study has demonstrated that the offers for individual production areas so far greatly differ, especially crop production is being served here. Significant potential is therefore observed, particularly for livestock production.

Provider recordings have indicated that there are many stakeholders in this market. Widely differing motivations can be assumed here. Since many have a direct customer or supplier relationship towards agricultural production (e.g. machinery manufacturers), the facilitated and mobile communication, and thus a certain degree of customer loyalty, are of importance to many. This, however, is to be examined in further studies.

Overall, the evaluation of the downloaded figures has demonstrated widely differing demands for individual applications. In order to obtain even more overall insight into further correlations and potentials, detailed analysis of the data is necessary. A repeat of the survey in the years to come would also be useful so more concrete statements can be made concerning global trends in the agricultural app sector, e. g. with regard to linguistic expansion and possibly new markets.

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