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Digital Transformation of Agriculture in Romania: A Change Management Perspective

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Abstract

The purpose of this paper is to further strengthen the belief within the academic, professional and policy making communities about the need to speed up the adoption of Agriculture 4.0 technologies in the Romanian farms as the grassroots constituents of the national agriculture in order to secure their future competitiveness in the context of new European agricultural policies and regulations. A review of the most influential papers and the bibliometric mapping of articles on change management as well as ways to accelerate change processes through change agents is discussed. Agrinnovator is the think tank of young digital agriculture practitioners in the Romanian farms. Their public policy proposal to create The Farm Technology Officers Program in order to accelerate digitalization through relevant change agents is also discussed. Their interviews highlighted the need for government support in creating scale and impetus for the digitalization of agriculture. It is deemed to be a structural countrywide change that will happen faster if the adequate change agents are used.

Key words: digital agriculture, change management, knowledge management, public policies

J.E.L. classification: M50, O33, O35, Q10, R58

1. Introduction

Three global imperatives: food security, better profitability of the farms and enhanced sustainability of the food production ecosystem are favoring the adoption of digitally enhanced agricultural practices (aka Agriculture 4.0).

The foundational pillars of Agriculture 4.0 (Albiero et al., 2020) are: the interconnectivity of devices achieved through Internet of Things (IOT), the cloud computing infrastructure, the gathering and interpretation of Big Data using artificial intelligence (Elijah et al, 2018; Hadad & Bratianu, 2018; Kamilaris et al, 2017; Wolfert et al, 2017). In some more recent papers (Klerkx & Rose, 2020), robotics, nanotechnology, protein synthesis, cell agriculture, genetic editing technology, AI, blockchain, and ML are also already part of Agriculture 4.0 while in the CEMA position paper (CEMA, 2017) robotics and advanced AI were anticipated as characteristics of Agriculture 5.0.

Trendov and colleagues (Trendov et al., 2019) stated that digitalization will affect the agrifood chain making possible more food security, better profitability, and enhanced sustainability. Digital farming (aka Agriculture 4.0) will make possible the better management of resources (technological agricultural inputs, land, water, people), adaptability to changes, even climate changes through the monitoring and traceability of crops. According to the same report, the following conditions are required for a large-scale deployment of digital farming: solid connectivity infrastructure, affordability of the services as well as digital literacy. For the report authors digital literacy will be a requirement in the competence profile of agricultural jobs. The adoption of digital farming technologies and practices is one of the five main thematic clusters in the extant digital agriculture literature (Klerkx et al, 2019) illustrating its role as a major study field. In previous work done by the author (Markovits, 2022b) it was argued that the digital literacy requirement is to be extended to all farm personnel from management and owners all the way to the operators.

In a mirror like situation, the Romanian industrial domain workers also need upgrading of their skills. While analyzing the readiness of the Central European countries for the Industry 4.0 Nedelcu (Nedelcu, 2023) concludes that automation and connectivity, driven by AI, IoT, and robotics, are reshaping production globally, offering economic benefits to Central and Eastern European countries, including Romania. The opportunity for 4.0 investments in Romania is seen especially positively due to the availability of highly skilled yet low-cost labor and proximity to markets, but Romania needs to focus on education, especially digital education besides attracting capital, and fostering innovation to fully leverage its advantages in Industry 4.0 (Bratianu et al., 2021; Hadad & Bratianu, 2018).

As proven also by the COVID19 induced digitalization leapfrog, the double jeopardy rule does apply also to digitalization. Those that started, were more advanced or simply better prepared for digitalization initiatives corroborated with the right leadership capabilities, benefited it the most (Pinzaru & Zbucea, 2022). As a corollary, besides the many positive effects, negative effects are also possible, especially those generated by the uneven distribution of the benefits of digitalization. The possibility for a digital divide to appear between the highly vs. scarcely digitalized farms and farmers raises the chance to generate undesirable economic and social tensions (Rose et al, 2021).

2. Literature review

Change management is an important component of the management studies domain focusing on the change processes of organizations and their need to adapt to the business environment dynamism. It is a multidisciplinary domain of studies involving also knowledge and theories from organizational behavior, psychology, leadership, communication. The below literature review summarizes key themes and trends in change management literature within the management field.

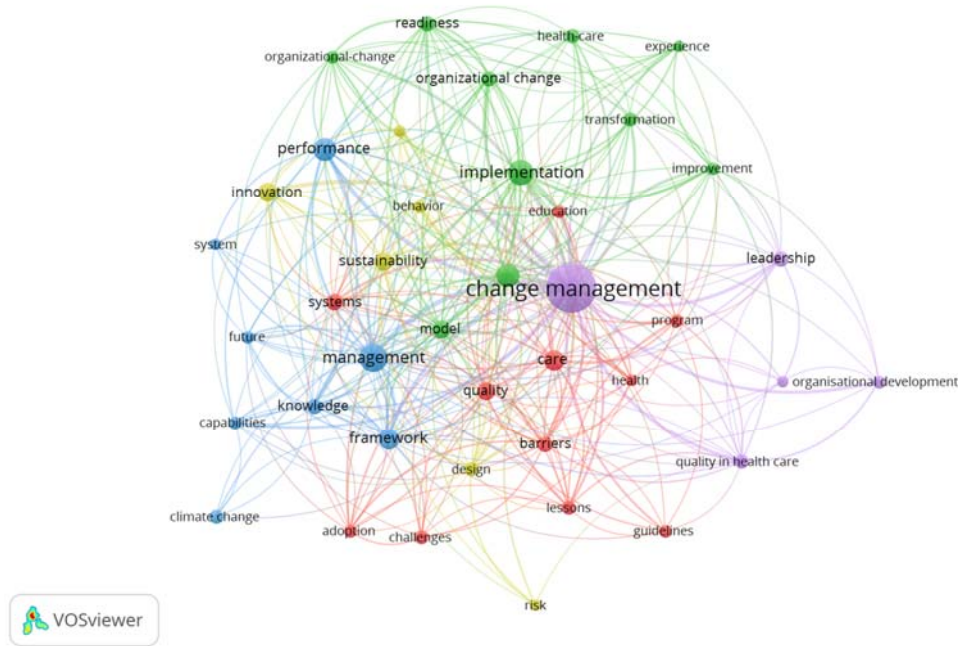
Table no. 1: Change Management topics in the management literature

Literature topic	Content summary of the debates
Approaches to Change	The pros and cons of the top-down (top management lead) vs. bottom-up approaches are discussed and analyzed. The importance of strong leadership vs. distributed leadership and empowerment of employees is also discussed
Communication and Engagement	Effective communication is considered very important during change initiatives. The role of top leaders in this process, and open communication as a way to reduce uncertainty and resistance.
Resistance to Change	The analysis is centered on finding the answer whether employees resistance is a natural reaction to change or is it due to poor communication and engagement.
Organizational Culture	Aligning changes with the prevailing culture is deemed essential, while others propose that culture itself should be transformed to support change.
Change Agents and Consultants	The debate centers on the use of internal and external change agents or consultants, their effectiveness, value ad and compatibility
Sustainability of Change	There's an ongoing debate about how to ensure that changes are sustainable and don't revert to the previous state. This involves exploring strategies for maintaining momentum and preventing relapse.
Measurement and Evaluation	Measuring the success of change initiatives is another debated issue. Metrics to evaluate the effectiveness of change and whether short-term or long-term outcomes are more critical.
Technological Advances and Change	The rapid advancement of technology, raises the question on how technology impacts change management. The studies also discuss digital transformations, remote work, and the role of automation.

Source: Author's compilation

This is reconfirmed by the VOSviewer (van Eck & Waltman, 2010) co-occurrence maps (see figure1) of a corpus of 322 review articles published in WoS under the Management and Business categories and containing the keyword “change management”. A total of 2358 keywords at 7 co-occurrences yielded 5 clusters:

Figure no. 1 Keywords co-occurrence mapping at 7 co-occurrences



Source: Author’s mapping of Web Of Science 322 review articles corpus, November 2023

Over the years, scholars have explored different aspects of change management covering a broad range of topics. During the past two decades, the change management literature has evolved significantly, emphasizing the importance of aligning change efforts with organizational strategies, fostering employee engagement, adapting to technological advancements, and recognizing the intricate interplay of cultural, psychological, and systemic factors:

Table no. 2 Themes in change management literature in the past two decades

Theme	Main argument	Representative authors
Digital transformation and technology adoption	The importance of aligning technological changes with broader organizational strategies, ensuring a seamless transition to a digitally transformed state	Westerman, G. et al., (2014) Bughin, J., et al., (2018) Ross, J. W., et al., (2019)
Agile transformation	An agile dual-operating system that combines a traditional hierarchy with a more agile network. The role of leadership in fostering adaptability	Cohn, M., (2010) Hiatt, J. M., & Creasey, T. J., (2012) Kotter, J. P., (2014)
Employee engagement and empowerment	The importance of creating a positive work environment	Harter, J. K., et al., (2002) Deci, E. L., & Ryan, R. M., (2008) Pink, D. H., (2009)

Sustainability & resilience in change	The need for organizations to build change initiatives that are not only effective in the short term but also sustainable over the long term	Bratianu, C., (2002, 2022) Holling, C. S., (2001) Walker, B., et al., (2004) Folke, C. (2006).
Behavioral economics & psychology	Explore the cognitive biases and irrational behaviors that influence decision-making during change	Ariely, D. (2008); Bratianu, C. & Bejinaru, R. (2018) Thaler, R. H., & Sunstein, C. R. (2008) Kahneman, D. (2011)
Cultural transformation	Organizations are encouraged to assess their existing cultures and align change efforts accordingly, recognizing the impact of cultural dynamics on successful change implementation.	Cameron, K. S., & Quinn, R. E. (2006) Denison, D. R. (1990) Schein, E. H. (1992)
Systems thinking	Organizations exist within interconnected and dynamic environments that require nuanced strategies for managing change.	Senge, P. M. (1990) Wheatley, M. J. (2006) Snowden, D. J., & Boone, M. E. (2007)
Leadership's role in change	the significance of leadership in guiding organizations through change initiatives.	Burns, J. M. (1978) Bass, B. M. (1985) Kotter, J. P. (1996)
Innovation and creativity	that organizations must embrace creativity as a core competency to navigate change in an increasingly competitive and fast-paced business environment	Amabile, T. M. (1988) Christensen, C. M. (1997) Dyer, J. H., et al (2011)
Globalization and cultural diversity	Organizations operating in diverse global contexts must tailor their change strategies to accommodate cultural nuances and differences	Trompenaars, F., & Hampden-Turner, C. (1998) Hofstede, G. (2001) Gudykunst, W. B., & Kim, Y. Y. (2003)
Data-driven change	The authors argue for the strategic use of data analytics to inform decision-making, monitor change progress, and evaluate the impact of change initiatives	McAfee, A., & Brynjolfsson, E. (2012) Davenport, T. H., & Harris, J. (2007) LaValle, S., et al (2011)
Human-centered design	These authors advocate for a user-centric approach to change	Brown, T. (2009) Norman, D. A. (2013) Kelley, T., & Kelley, D. (2013)

Source: Author's compilation

Change agents, are individuals entrusted to lead and facilitate change within organizations. The literature underscores the importance of understanding the characteristics and competencies of effective change agents. According to Kanter's seminal work, (Kanter, 1983) successful change agents possess a combination of leadership skills, strategic vision, and the ability to communicate a compelling narrative that motivates and mobilizes stakeholders. This aligns with the perspective of Conner (Conner, 1992) who argues that change agents need to be versed at managing ambiguity and uncertainty (Bratianu, 2018). The role of change agents most often extends beyond traditional top-down approaches, embracing also more participatory and inclusive styles.

Following the literature streams of the past two decades we may find that each of them had a position on the value of change agents. In digital transformations, change agents play a crucial role in navigating technological complexities and act as translators between tech and business leaders (Westerman et al., 2014). Agile and adaptive approaches are essential for change agents to accelerate business performance (Hiatt & Creasey, 2012) while navigating hierarchies and networks (Kotter, 2014).

Change agents create employee engagement by tapping into intrinsic motivation and creating conditions for open communication (Pink, 2009; Anderson & Anderson, 2010). Change agents need resilience and adaptability to face setbacks and evolving circumstances (Folke, 2006; Holling, 2001). Change agents are learning leaders (Senge, 1990) that stimulate cultural change by aligning initiatives with existing cultures or reshaping them when and where necessary (Cameron & Quinn, 2006; Schein, 1992). Very often change agents are called upon guiding organizations through change, following Kotter's eight-step process (Kotter, 1996) and act as catalysts for fostering a culture of innovation, encouraging experimentation, risk-taking, and lateral thinking (Christensen, 1997; Amabile, 1988; Dyer et al., 2011). Change agents navigate diverse contexts and act as cultural brokers (Gudykunst & Kim, 2003; Hofstede, 2001; Trompenaars & Hampden-Turner, 1998) while leveraging data analytics to inform and assess change initiatives and often also act as data interpreters (Davenport & Harris, 2007; LaValle et al., 2011; McAfee & Brynjolfsson, 2012). Change agents use human-centered design principles, prioritizing the needs and experiences of individuals within the organization (Brown, 2009; Norman, 2013).

In practice, the choice between internal change agents and external consultants often depends on factors like the scope of change, the organization's culture, available resources, and the level of expertise required. The debate continues as organizations adapt to changing business landscapes and explore the most effective strategies for managing change while considering the roles of various change agents.

Adoption of precision farming practices is influenced by both internal and external factors (Bucci et al., 2018) such as size of farms, farmer's experience with technology and their awareness of the precision agricultural practices as well as (the high) cost of initial investment. Other internal factors such as farmers age, education and farmers' perception of the advantages offered by the new technology (the potential to get better profit per ha) were also identified. External factors that influence adoption of agriculture 4.0 include: cost of labor and cost of land, the regulatory and market (clients) pressure for sustainability as well as availability of consultants. If we also consider that precision agriculture requires extensive use of digital tools (software and hardware), farmers' age and education manifested in their knowledge and comfort with technologies becomes an appropriate lens to evaluate the adoption differences between young and old farmers.

3. Research methodology

Thematic clustering of the principal streams of literature in change management was used to identify representative authors and their works with emphasis on the past two decades.

Key words search aiming to identify a corpus of articles in the Web of Science database under the Management and Business categories for "change management" have yielded 322 review articles. VOSviewer bibliometric mapping software (van Eck & Waltman, 2010) was used to plot the key words co-occurrence maps. For a more meaningful mapping the following generic keywords were eliminated from the final list of keywords mapped: "literature review", "systemic review", "systematic review."

4. Results and discussion

The analysis of the strategic options for the development of Romanian agriculture (Panagoret & Panagoret, 2017) identifies several essential support initiatives. Their first recommendation at the time was aimed at solidifying land ownership records (integrated cadastre and land registry) also as means to facilitate access to credits, but they also advocated for policies aimed to stimulate farmers' competitiveness by increasing the efficiency of the agricultural exploitations. The digital agriculture is a very probable and possible mean to increase farm efficiency and competitiveness, thus policies to stimulate digital agriculture adoption should be part of the stimulus package of public policy makers (i.e. Government ministries and Parliament).

By adopting precision agriculture methods farmers move from an experiential decision-making to a data-driven decision-making (Bucci et al., 2018) that requires usage of complex weather forecasts, satellite images, pest alerts, NDVI maps just to name a few of the new tools available in agriculture 4.0.

While assessing ways in which adoption of digital agriculture among Romanian farmers could be stimulated it is useful to exercise a multidisciplinary consideration of the literature bodies on change management, barriers to precision agriculture adoption (Bucci et al, 2018, Pierpaoli et al, 2013, Tey& Brindal , 2012) factors influencing digitalization in Romania (Iliescu, 2020, Pînzaru et al, 2017, 2019, 2022) as well as the decision making methods (Gerli et al 2022), complexity of the problems, and knowledge management (Bratianu, 2022).

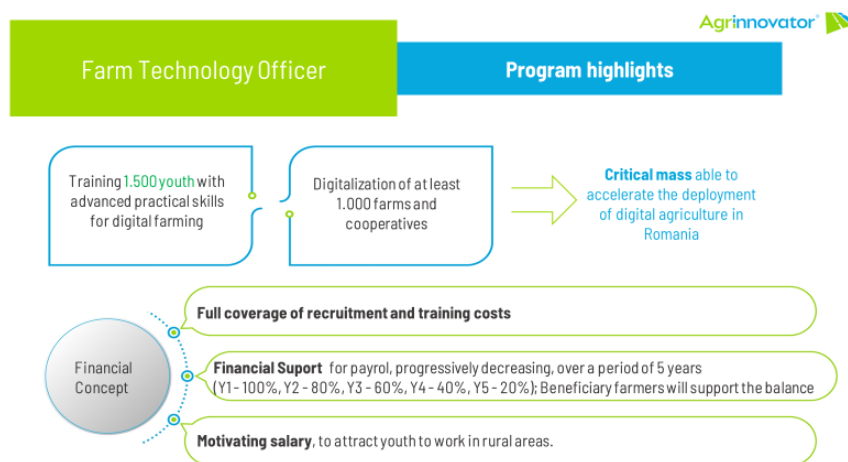
The Romanian rural ecosystem was characterized in the past 30 years by a severe depopulation, aging of the workforce and resident population, as well as workforce migration to follow urban revenues and lifestyles. This was/is degrading the ecosystem and in consequence having an effect also on the food safety (Dumitru et al., 2019, 2021, Iancu et al. 2022, Paul, 2020). Another important particularity of the Romanian agricultural sector, to be considered, is the rather scarcity of strong associative structures that could undertake sectorial policy or vocational initiatives (Bratulescu, 2017; Wolz et al.,2020).

In this context, Agrinnovator (www.agrinnovator.ro) a think tank of young farming practitioners proposed a public policy aimed at creating 1500 Farm Technology Officers (FTO) that would be embedded in pre-qualified farms and act as change agents (Agrinnovator, 2022 a, b). The Farm Technology Officer Program is designed to create an agriculture dedicated vocational education and training stream to achieve sustainable competitiveness and resilience within the Romanian agriculture sector by facilitating the Romanians farmers’ access to digitally enhanced precision agriculture solutions and increasing the number of youths engaged in the sector.

The FTO program is proposed to finance the formation of approximately 1500 rural youth whom are to be recruited and trained, and subsequently employed by qualifying farmers to work as FTO's and help a minimum of 1000 Romanian farms expedite their adoption of digitally enhanced technological solutions. The program will cover the full cost of tuition and will also provide gradually decreasing payroll assistance to the farmers employing the newly formed FTO.

During the recruitment phase preference will be given to the youth from the rural areas of Romania, farmers’ children interested in gaining a short-term qualification (approximately 6 months) in applied digital agriculture. Upon graduation, the newly formed FTO will have assured employment with qualifying farmers (farms will be prequalified).

The participating farmers themselves will receive employment assistance via gradually decreasing payroll assistance decreasing in steps of 20% per year:



The total cost of the FTO program is estimated at €102 million of which approximately €15 million will cover the cost of tuition including accommodation meals tuition study materials while approximately €85 million will cover the cost of payroll assistance component and about two million will cover the administrative costs associated with the program during the five years proposed. Funding for this program is aimed through cooperation of several relevant ministries (Agriculture, Education, Environment, European Funds) and assistance of EU assistance funds.

From both the theoretical substantiality as well as practical perspectives, the proposal is novel and has several strong points. It is leveraging the rural youth as change agents for digitalization (Deac, P. in Agrinnovator, 2022 b) building on their propensity to go for job contents that are modern, relatively well paid and would evolve in time making them motivated to stay. By educating young mid-level technicians from the rural ecosystem, the FTOs fulfill almost all change agents' requirements identified in the literature review of this article.

The gradually decreasing payroll assistance is also a powerful tool to circumvent the eventual non-acceptance of the FTOs on the grounds of cost and would allow for the farmers to witness the benefits of having a team member in charge of technology similar to their today's agronomist or accountant (Prelicean, R. in Agrinnovator, 2022a).

5. Conclusions

Up-skilling and re-skilling of the owners, managers and farm work force all the way to the operators is a key factor for the success of the effort to deploy the digital agriculture methods anywhere in the world and so much so in Romania. This should be done by leveraging knowledge building and sharing methods which are also adapted to the learning methods of the younger farmers in the Romanian farms (Bălan et al, 2019; Bratianu et al., 2021; Germain, 2020; Pinzaru et al, 2016). The use of external change agents that would be embedded in the daily activity system of farms would have a catalyst effect. In the absence of strong agricultural cooperatives or other strong market actors (digital agricultural advisors) the catalytic effect could be initiated via adequate public policies that should provide the initial impetus and scale of such efforts.

The Agrinnovator think tank policy proposal discussed in this paper it is an example of such an initiative. It is also a rather novel approach because beyond stimulating the diffusion of digital agriculture practices it also creates positive social impact in the rural communities by keeping the youth in their extended families and brings knowledge and revenue streams comparable to urban jobs thus limiting the depopulation of the rural ecosystem. These all would have a positive effect on food safety through more efficient, more productive and thus more competitive farms in Romania.

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