



The Multiple Influences on the Future of Work in Agriculture: Global Perspectives

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In this introductory paper, we discuss changes in work in agriculture arising from the influence of a wide variety of factors: global food chains and societal controversies about farming models, the status of agricultural work as a profession alongside others; the progress of rural development; issues of precariousness in work and in health. We summarize these influences and their implications to introduce the Special Issue “Work in agriculture: which perspectives?”, and outline the seven papers that contribute to understanding of the future trajectories for work in agriculture.

Keywords: work, agriculture, change, influences, society, profession, chains

OPEN ACCESS

Edited by:

Molly D. Anderson,
Middlebury College, United States

Reviewed by:

Judith Janker,
Regio Frauenfeld, Switzerland

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Specialty section:

This article was submitted to
Social Movements, Institutions and
Governance,
a section of the journal
Frontiers in Sustainable Food Systems

Received: 04 March 2022

Accepted: 13 May 2022

Published: 23 June 2022

Citation:

Dedieu B, Contzen S, Nettle R, Schiavi SMA and Srairi MT (2022) The Multiple Influences on the Future of Work in Agriculture: Global Perspectives. *Front. Sustain. Food Syst.* 6:889508. doi: 10.3389/fsufs.2022.889508

INTRODUCTION

Work in agriculture is changing and the future trajectory of agricultural work will certainly be influenced by multiple factors which we would like to draw out as an introduction to this special issue “Work in agriculture: which perspectives?”. We consider agricultural work as multifaceted (Dedieu, 2019; Malanski et al., 2019, 2021) involving a large range of themes including: labor markets, farming systems, work organization, gender equity, professional standards, skills, health, employment relations and rural development. A wide range of scientific disciplines contributes to these themes, encompassing social sciences (rural sociology, agricultural economics, human and social geography, psychology) and medical sciences as well as biotechnical sciences (ergonomics, agronomy, farming systems’ sciences, livestock sciences). We posit that it is the relation to the natural world that characterizes the farming professions. From this postulate, agricultural work is conceived as an activity requiring skills and professional norms and connecting men, women and a large variety of tasks, some being repetitive and regular (e.g. animal husbandry) and others being seasonal (sowing, fertilizing, harvesting, etc.) (Cournut et al., 2018). Agricultural work connects owners of capital, family workers, wage earners, contractors, mutual help and volunteers, in the organization of work. Work in agriculture contributes to food, fiber and fuel value chains and provides incomes and food security to households or individuals. Work in agriculture affords a position, identity and dignity in society. Work in agriculture is thus a specialist concern involving human, social, economic and food systems’ dimensions.

Considering the complexities in understanding the future trajectories for agricultural work, it is crucial to consider the key influences on change. We discuss these influences and their implications for work in agriculture and then introduce the papers gathered in the special issue illustrating these influences. The papers were selected from those presented in the 2nd International

Symposium on Work in Agriculture (ISWA, 2021) held between March 29th and April 1st 2021. The multi-disciplinary understanding of the influences on changes in work was a key feature of the ISWA. Another feature was the sources of scientific contributions from both OECD and non-OECD countries, reflecting very different characteristics of agriculture, employment and work throughout the world. *De facto*, the place of agricultural employment within active population varies from less than 1% (USA, Canada or UK.) to 72% (Uganda) (World Bank, 2018). In addition, the level of mechanization varied with only 1% of the global agricultural workers using tractors, 29 % using animal labor and 70% relying exclusively on manual work (Losch, 2016). On the one hand, there are regional peculiarities [such as the contractors' contribution to work that is rapidly increasing in the OECD context (Nye, 2018)], and on the other hand we confirmed some common issues such as gender (in)equality or migration (Dedieu et al., 2022). The final feature of the ISWA involved bringing together scientists, practitioners, agricultural advisors, and policy makers to share experiences, knowledge and tools in understanding change and accompany the working conditions improvement.

THE AGRICULTURAL MODELS AT STAKE

Society has always required farming to secure food supply in quantity and quality at relatively affordable prices. Farming is therefore recognized as a critical activity highlighted more recently by the Covid 19 pandemic, with food production and agricultural work categorized as essential services and essential work (Stephens et al., 2020; Keifer, 2022). Sustainability and the negative impacts of intensive agriculture, promoted through the first green revolution, have been of increasing focus in agriculture for the last decades (Bruntland, 1987; Thompson, 2007). The loss of biodiversity at different scales (soil, domestic animal and crop species, landscape with the deforestation of native forests), the decreasing water quality because of nitrates and pesticides concentration, and the competition between the increasing demand for water (agriculture, human consumption, industrial needs), the negative consequences of meat consumption on environment and health, are severe criticisms on intensive agriculture practices' impacts (Dudley and Alexander, 2017; Bonnet et al., 2020; EEA, 2020). The negative impacts of agriculture and livestock on GHG emissions are also well documented even if the carbon sequestration opportunities linked with agroforestry, grasslands or conservation agriculture are now also better acknowledged (Crippa et al., 2021). The impacts of industrial indoor breeding and of slaughtering conditions on animal welfare are also regularly exposed in the media (Almiron et al., 2018).

From the value chain perspectives, farming is an economic activity and thus affected by pressures from operators within the chains, engaged in a competitive world, put pressure on lowering production costs and push increasing labor productivity in farms with the help of mechanization and of standardization processes. The industrialization of the production with the substitution of labor by capital (land, machinery, etc.) is the

dominant structure that has developed in OECD countries. In developing countries, such capitalist options are proposed as an alternative to the dominant low capitalized family farming, with arguments of efficiency, productivity and scale benefits (Le Thi Thanh et al., 2019). However, alternative options exist and are being explored including modes of production and marketing toward product differentiation (geographical indication, high-value products, organic, locally produced, etc.), greater self-reliance and autonomy in production inputs and decision making and nature-based farming (e.g., agro-ecology) (Lamine, 2015; Berti and Mulligan, 2016). More and more, consumers' associations in the North wants insurances about the impacts of the production processes: forced labor and security of wages, gender discrimination and harassment, health and safety risks at work and in transport to work, etc. (see Alestig and Banerji, 2022 - for the specific example of citrus exports from Morocco).

All these considerations are summarized in production models controversies, notably between industrial farming and sustainable intensification on one side; peasant farming and agroecology on the other side (HLPE, 2016). Sustainable intensification aims at increasing the yields and minimizing the negative impacts on environmental parameters through a higher level of precision on input uses, adapted genetic selection, including robustness parameters (resistance to illness notably) and a close monitoring of production processes. In this sense, sustainable intensification appears to some authors as an improvement of the Green Revolution scheme (Leach et al., 2020). In rich OECD countries, land and animal intensification process goes in hand with the enlargement of farms, a decreasing number of workers (Dorin, 2021), and the promotion of the industrial organization (technical efficiency, labor division, mechanization, labor productivity), supported by large investment in research and development. Agroecology explores an alternative way of farming, dealing with ecosystem services stimulation, an autonomous way of farming with very low external inputs, peer discussions and self-experimentation as major resources for a transition. The "strong" agroecology (Therond et al., 2017) is associated with peasant or family farming.

Considering work in agriculture, the sustainable intensification vs. agroecology controversy has several implications:

- on the workforce composition within farms. Industrial farming requests highly skilled managers, machinery and low skilled – low wage employees. Labor productivity is one major indicator leading to more and more land or herd managed by worker. Peasant farming is more or less linked to family farming. It does not exclude wage earners and the emergence of patronal family farming (Aubron et al., 2022), but family workforce dominates.
- on the skills and know-how requested to manage farming systems. Peasant agroecology supporters put emphasis on the importance of local knowledge, and the observations on animals and crops. They consider that the agroecological transition is a change not only in practices but also in farming norms and objectives, i.e. on professional standards (Coquil et al., 2017). Industrial sustainable intensification is

not considered as a major change of professional standards, but an explicit inflection of the intensification process, with a multi-criteria evaluation of the benefits of the process in order to include production and environmental parameters of sustainability together.

- on the working durations and working conditions. Literature on industrial - sustainable intensification does not explicitly comment on the changes in work duration or conditions (Nettle et al., 2018), except those in relation with the enlargement and the implications of labor productivity gains (Deming et al., 2019), which require more capital, more wage-earners, and sometimes more work for the farmers themselves (Delecourt et al., 2019). Agroecology is supposed to increase the duration of work and the nature of tasks, with more diversity and complexity on operational sequences (Dumont and Barret, 2017; Laske, 2021). More recently, concern has been expressed about the impacts of agroecology on women's burden (Bezner Kerr et al., 2019). Other parameters of working conditions are considered to be improved, such as greater meaningfulness at work on extensive beef cattle production (Duval et al., 2021) and quality of life in dairy farming (Contzen and Häberli, 2021).

TECHNOLOGIES

The digital revolution changes farmers' lives in different areas of work. The development of precision agriculture supported by sensors, GPS and software is well documented (e.g. Moyes et al., 2014). Precision agriculture is a change in the decision process (content and autonomy) and in the monitoring tasks. When coupled with robots, it has an impact on the tasks to be done and leads to changes in working duration and work flexibility. There is an ongoing debate on whether precision agriculture is devoted only to the intensification process or if it contributes to the emergence of a diversity of models. For example: milking robots imply deep changes in the routine work, the saved time is reinvested in the observations of the animals or sometimes in other tasks not directly related to the herd (Hostiou et al., 2017). In addition, information and communication technologies have supported the rise of virtual social networks contributing to farmer-to-farmer learning. The application of technology in supporting social learning has been found to be key to a transition to agroecology (Prost et al., 2018).

PUBLIC OUTRAGE AND SOCIETAL CONSIDERATION OF FARMING PROFESSIONS

Society puts pressure on the profession of farmers, through what the French Ministry of Agriculture called in 2019 "the agri-bashing", a French term meaning a political criticism of intensive farming, a very deep critique on the values of this profession. Farmers are denounced as environment poisoners (e.g. perceived pesticides dependency; perceived hesitance to remove problematic pesticides from use); bad employers (e.g. poor working conditions to some workers; exploitation of

children and migrants; inequity for women); and insensitive persons to the animal welfare considering animals like machines in intensive farms (Vanhonacker et al., 2007; Cassuto, 2013; FAO, 2021).

Considering work, such criticisms have consequences on the attractiveness of farming occupations and on the rationalities attached with "becoming a farmer". The importance of economic and intrinsic factors in agricultural work is therefore important and sometime in tension. Intrinsic factors associated with agricultural work have been identified as being free, working with one own land, with animals, in the nature, or relations to others - peers, wage earners, other value chain operators - is therefore essential (Fiorelli et al., 2010) as farming is not only producing agricultural goods but also producing oneself (Porcher, 2002).

Linked to the attractiveness of jobs and to the severe criticisms on working conditions of young and migrants, the emergence of the concept of decent work has been noted recently, supported by the International Labor Organization (ILO). Decent work is promoted as one of the sustainable development goals (SDG) by the United Nations [SDG 8: "decent work and economic growth" (United Nations, 2021)]. While it has originated from deep concern for production modes in developing nations, the concept now has broader application to all workers given their mobility and global labor markets, global value chains and examples of breaches to decent work expectations in developed nations including modern slavery and the prevalence of segmented labor markets for migrant workers (Augère-Granier, 2021). The promotion of decent employment in the agricultural sector is an important goal of the Food and Agriculture Organization's programs (FAO, 2017). Decent work is defined as summing up the aspirations of people in their working lives, encompassing productive work, with correct remuneration, respect of the social laws including social protection for the family, equitable working conditions between men and women and the rights for oneself to weigh on his/her future. The agricultural sector is not the only economic sector targeted by the SDG but is certainly one sector where concrete actions have to be developed to improve working conditions and to ensure the attractiveness of work.

AGRICULTURE AND RURAL DEVELOPMENT

The contributions of farming activities to the rural-territorial development are one of the major topics attached to work in agriculture studies (Santhanam-Martin and Nettle, 2014; Malanski et al., 2019). The family farming model appears everywhere as the "social" form of production in the rural areas (Bosc and Sourisseau, 2019). Interactions between farm workforce, farming activities and territories are multiple:

- the questions of labor allocation to on- and off-farm activities and the implications of off-farm work demands on the workforce availability for farming and on work organization (Malanski et al., 2019).

- the public authorities and NGOs pay increasing attention to the rural – urban interactions and to the place of suburban and local agriculture as levers to develop sustainable local food systems. They support short value chains such as direct selling, or forms of community supported agriculture (Fomina et al., 2022). The implication of these policies on work in the agricultural sector include not only the operational sequences and tasks linked with the food basket the farmers have to produce but also the demand for new tasks and skills related to the selling of products and the direct interaction with consumers.
- the level of infrastructure and resources for employees in different territories has been associated with attracting and retaining an agricultural workforce. For instance, if there is appropriate housing available, the costs of living, whether there are schools for children and social activities for family members and if there are jobs for non-farming partners (Santhanam-Martin and Nettle, 2014).

PRECARIOUS WORK AND OCCUPATIONAL HEALTH: A PUBLIC POLICY CONCERN

Policies and public institutions play a role either on preventing illnesses and accidents or by recognizing professional illnesses due to some farming practices. It is difficult to get an overview of prevention policies at the global level but there are evidences that farming is associated to high suicide rates, which has been recognized as higher than for equivalent profession in many countries. Suicide rates raised recently as an indicator of the difficulties to be a farmer in many situations, due to the mix of insufficient income and unbearable debts, excess of work duration and social isolation (Deffontaines, 2014; Perceval et al., 2019), similar to the risk of burnout (Reissig et al., 2019). Keeping the workplace attractive for skilled staff implies also to consider the worker comfort and to continuously improve the safety of the workers, notably when the tasks require heavy machinery and animals (Edwards and Kuhn-Sherlock, 2021). The impacts of pesticides applications on the development of chronic diseases (lymphomas, Parkinson's) are also documented in medicine (e.g. Hu et al., 2017) as well as musculo-skeletal problems concerning various production system (Fathallah, 2010).

There are increasing considerations for migrants and more generally the precarious status of workers in agriculture, often invisibles (Saldanha, 2022). In France, more than 13 wage-earners statuses have been defined by Magnan and Laurent (2018), and there is a development third-party recruitment modes, with the farmer, the wage – earner and labor hire (i.e. intermediary employers, employers' groups, replacement services, detached workers within Europe etc.). Further, migrants may leave the farms for better jobs in the cities [e.g. in China (Huang et al., 2009)] or may provide workforce to the farms for generally low skilled – low wage and sometimes low social protection work (Preibisch, 2010; Arcury and Mora, 2020). However, migrants have sometimes become farmers in the countries where they have settled, e.g., Parodi (2018).

WHAT DO THE FARMERS' REPRESENTATIVES DEFEND?

Although agricultural work is often invisible behind other professional claims concerning market regulations, product prices, incentives and subsidies, farmers' representative associations and trade unions increasingly consider work (duration, rhythms, holidays and weekends ...) and advisory on working conditions (Dockès et al., 2019). Traditionally, questioning working conditions was a taboo for the farming profession as a whole as well as for the individual farmer. However, the ethics of "working hard, working a lot" are increasingly in debate, and being a farmer for a lifelong is no longer the only option. In addition, the young generations do not want to work only but to have a certain quality of life, including meaningful work, modernity, time with family and friends, dignity and recognition by the others (Elias et al., 2018). As employers belonging to the "very small enterprises" category, farmers' representatives have also influence on the regulations for agricultural work and the standards in workplaces.

Farming representatives also contribute to defining the professional competencies to which education and training providers must adhere. In OECD countries, where the decrease of the agricultural population has been a long-term process, one important concern is the renewal of farmers' skills and the recruitment of qualified wage earners. This includes the facilitation of farms settlement with adapted training to the diversity of newcomers (Monllor i Rico and Fuller, 2016). Further, there is an expansion in the type of training required such as entrepreneurial freedom on one hand, or decisional autonomy and new relations to nature on the other hand, depending on the models farmers' organizations are supporting. The need for more qualified wage-earners is notably linked with the emergence of the integral delegation of work in some farms (Nguyen et al., 2021) which request highly skilled workers, notably on farm and human resources management. In contrast, non-OECD countries, seek more opportunities for job creation in the rural areas and the attractiveness of farming occupations for the youth (FAO, 2014), which includes remuneration of work, equity for women, meaningfulness, modernity, security and preservation from hazards (Meena et al., 2020).

Women's organizations play a specific role in advocating for increased recognition of women status at work, equality of remuneration and possibility to develop, with responsibility and autonomy, separate activities within the farm or in direct relations with the consumers (direct sales, processing...). Unfortunately, voices of women are less audible than men's. In the global North, where farmers organization are powerful, women are underrepresented in the decision process (Ressia et al., 2022). In the global South, women have difficulties to be heard in mixed men and women cooperative our community organizations (Sachs et al., 2020). Thus, we need robust statistics and qualitative research to understand what men and women experience, what they do, and what they value. We need context-specific understanding of men's and women's roles, resources,

and constraints avoiding simplistic appreciations of gender issues (Doss et al., 2018).

INTRODUCTION TO THE SPECIAL ISSUE

The inter-relationship between these influences and the effect on the dynamics of work in agriculture are profound. They provoke changes in work, either the skills or the professional norms (through entrepreneurship and technology mastering), or organization (the workforce composition, the delegation of tasks to contractors). All these changes have implications on working rhythms, work duration, working conditions (including health), job satisfaction and wellbeing (Janker et al., 2021) and employment generation. These changes have an effect on individuals and at the farm (and beyond?) level.

Turning to the papers in this special issue, we illustrate some influences and interplay of influences in agricultural work. The first paper highlights the value chain, which is one of the less considered drivers of change in the general literature on work in agriculture. Malanski et al. (2022) detail what is considered in the value chain operations as “work” and the influence of these actions on employment regulation, workforce composition (family farming. . .) and labor efficiency. The second paper, by Losch (2022), criticizes the concept of “decent work” as transformative concept for the future of work in agriculture. For Losch, what is at stake is our capacity to orient the socio-structural dynamics, notably through policies that integrate societal and business drivers, and support alternative ways than the “green” modernization scheme.

The changes in family farming are very important to consider, because it is the dominant workforce style in the world and because of the interplay of influences. As mentioned before, the delegation of tasks to contractors in OECD countries is a response to the enlargement of farms. In India, Aubron et al. (2022) illustrate the emerging figure of patronal family farming associating new ambitions to contribute to the markets and changes in the workforce, with wage-earners.

REFERENCES

- Alestig, M., and Banerji, S. (2022). The Workers Behind the Citrus Fruits: A Focused Human Rights Impact Assessment of Coop Sweden’s Moroccan Citrus Fruit Supply Chains. p. 101. doi: 10.21201/2022.8762
- Almiron, N., Cole, M., and Freeman, C. P. (2018). Critical animal and media studies: communication for nonhuman animal advocacy. *Routledge*. 25, 296. doi: 10.4324/9781315731674
- Arcury, T. A., and Mora, D. C. (2020). “Latinx farmworkers and farm work in the eastern united states: the context for health, safety, and justice”, in *Latinx Farmworkers in the Eastern United States: Health, Safety, and Justice*. Cham: Springer. p. 11–40. doi: 10.1007/978-3-030-36643-8
- Aubron, C., Bainville S., Philippon, O., and Dorin, B. (2022). *Neither corporate, nor family: the Indian “patronal” farm*.
- Augère-Granier, M. L. (2021). “Migrant seasonal workers in the European agricultural sector”, in *European Parliamentary Research Service, PE 689-347*. p. 12.
- Berti, G., and Mulligan, C. (2016). Competitiveness of small farms and innovative food supply chains: the role of food hubs in creating sustainable regional and local food systems. *Sustainability*. 8, 616. doi: 10.3390/su8070616

Two papers examine gender issues and the evolution of farming models. For Australia, Ressa et al. (2022) describe the modest participation of women as leaders in farmers’ organization at a moment where the number of women farm entrepreneurs is increasing. The authors suggest levers to strengthen their contribution to organizations that discuss the future of the profession. The case study of Serpossian et al. (2022) details the way women, participating in peer groups in France, play an important role in the agroecological transition of their farms.

Lucas and Gasselin (2022) discuss agroecological practices and collective farming in France. There, rather unique forms of cooperation between farmers either for farming (shared farms) or for work (machinery cooperative) exist. The authors analyse how the long-standing use of peer cooperation, particularly for managing resources (mainly labor, equipment and knowledge) in machinery cooperatives facilitates the process of change toward the development of agroecological practices.

Dedieu et al. (2022) conclude the special issue by an overview of the issues that were discussed during the 2nd International Symposium on work in agriculture (2021), that aimed at analyzing the changes in work in a global and pluridisciplinary perspective and provide guidelines for a research agenda for the scientific community.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

BD lead the paper and contributed to the writing. SC, RN, SS, and MS reviewed the paper and contributed to the writing. All authors contributed to the article and approved the submitted version.

- Bezner Kerr, R., Hickey, C., Lupafya, E., and Dakishoni, L. (2019). Repairing rifts or reproducing inequalities? Agroecology, food sovereignty, and gender justice in Malawi. *J. Peasant Stud.* 46, 1499–1518. doi: 10.1080/03066150.2018.1547897
- Bonnet, C., Bouamra-Mechemache, Z., Réquillart, V., and Treich, N. (2020). Viewpoint: Regulating meat consumption to improve health, the environment and animal welfare. *Food Pol.* 97, 101847. doi: 10.1016/j.foodpol.2020.101847
- Bosc, P. M., and Sourisseau, J. M. (2019). Sustainable rural livelihoods to analyse family farming dynamics: A comparative perspective. *Nat. Res. Econ. Rev.* 35–49. Available online at: <http://hdl.handle.net/2433/240911>
- Bruntland, G. H. (1987). *Our Common Future*. Environmental and Development Commission of the United Nations.
- Cassuto, D. N. (2013). *Environment, Ethics, and the Factory Farm, South Texas*. Law. Rev. p. 579, Available online at: <http://digitalcommons.pace.edu/lawfaculty/969/> (accessed September 25, 2014).
- Contzen, S., and Häberli, I. (2021). Exploring dairy farmers’ quality of life perceptions—A Swiss case study. *J. Rur. Stud.* 88, 237–238. doi: 10.1016/j.jrurstud.2021.11.007
- Coquil, X., Dedieu, B., and Beguin, P. (2017). Professional transitions toward sustainable farming systems: the development of farmers professional worlds. *Work*. 57, 325–337. doi: 10.3233/WOR-172565

- Cournut, S., Chauvat, S., Pastora, C., Dos Santos Filho, J. C., Diéguez, F., Hostiou, N., et al. (2018). Analyzing work organization on livestock farms by the Work Assessment Method. *Agron. Sust. Dev.* 38, 6. doi: 10.1007/s13593-018-0534-2
- Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F. N., and Leip, A. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food*. 2, 198–209. doi: 10.1038/s43016-021-00225-9
- Dedieu, B. (2019). Transversal views on work in agriculture. *Cah. Agric.* 28, 8. doi: 10.1051/cagri/2019008
- Dedieu, B., Nettle, R., Schiavi, S. M. A., Srairi, M. T., and Malanski, P. D. (2022). Which perspectives for work in agriculture? Food for thought for a research agenda.
- Deffontaines, N. (2014). La souffrance sociale chez les agriculteurs. Quelques jalons pour une compréhension du suicide. Social suffering among farmers: toward an understanding of suicide. *Et. Rur.* 193, 13–24. doi: 10.4000/etudesrurales.9988
- Delecourt, E., Joannon, A., and Meynard, J. M. (2019). Work-related information needed by farmers for changing to sustainable cropping practices. *Agron. Sust. Dev.* 39, 45–49. doi: 10.1007/s13593-019-0571-5
- Deming, J., Kinsella, J., O'Brien, B., and Shalloo, L. (2019). An examination of the effects of labor efficiency on the profitability of grass-based, seasonal-calving dairy farms. *J. Dairy Sci.* 102, 8431–8440. doi: 10.3168/jds.2018-15299
- Dockès, A. C., Chauvat, S., Correa, P., Turlot, A., and Nettle, R. (2019). Advice and advisory roles about work on farms. A review. *Agron. Sustain. Dev.* 39, 1–14. doi: 10.1007/s13593-018-0547-x
- Dorin, B. (2021). Theory, practice and challenges of agroecology in India. *Int. J. Agric. Sust.* 20, 153–167. doi: 10.1080/14735903.2021.1920760
- Doss, C., Meinzen-Dick, R., Quisumbing, A., and Theis, S. (2018). Women in agriculture: four myths. *Global Food Secur.* 16, 69–74. doi: 10.1016/j.gfs.2017.10.001
- Dudley, N., and Alexander, S. (2017). Agriculture and biodiversity: a review. *Biodiversity*. 18, 45–49. doi: 10.1080/14888386.2017.1351892
- Dumont, A. M., and Barret, P. (2017). Why working conditions are a key issue of sustainability in agriculture? A comparison between agroecological, organic and conventional vegetable systems. *J. Rur. Stud.* 56, 53–64. doi: 10.1016/j.jrurstud.2017.07.007
- Duval, J., Cournut, S., and Hostiou, N. (2021). Livestock farmers' working conditions in agroecological farming systems. A review. *Agron. Sust. Dev.* 31, 2. doi: 10.1007/s13593-021-00679-y
- Edwards, J. P., and Kuhn-Sherlock, B. (2021). Opportunities for improving the safety of dairy parlor workers. *J. Dairy Sci.* 104, 419–430. doi: 10.3168/jds.2020-18954
- EEA (2020). EEA European Environment Agency. *Water and agriculture: towards sustainable solutions. EEA Report No 17/2020.*
- Elias, M., Mudege, N., Lopez, D. E., Najjar, D., Kandiwa, V., Luis, J., et al. (2018). Gendered aspirations and occupations among rural youth, in agriculture and beyond: a cross-regional perspective. *J. Gen. Agric. Food Sec.* 3, 82–107. doi: 10.19268/JGAFS.312018.4
- FAO (2014). Food and Agriculture Organization of the United Nations. *Youth and agriculture: Key challenges and concrete solutions.* Rome: Food and Agriculture Organization of the United Nations.
- FAO (2017). Food and Agriculture Organization of the United Nations. *FAO Work to Promote Decent Rural Employment.* Rome: Food and Agriculture Organization of the United Nations.
- FAO (2021). Food and Agriculture Organization of the United Nations (2021). Child labour in agriculture. Available online at: <https://www.fao.org/childlabouragriculture/en/> (accessed December 12, 2020).
- Fathallah, F. A. (2010). Musculoskeletal disorders in labour-intensive agriculture. *Appl. Ergon.* 41, 738–743. doi: 10.1016/j.apergo.2010.03.003
- Fiorelli, C., Porcher, J., and Dedieu, B. (2010). "Improving farm working conditions: a proposal to characterise the individual relationship to work. A case study based on French multi-job-holder sheep farmers", in I. Darnhofer et M. Grötser (Eds) *9ième IFSA Symposium, Building sustainable rural future: The added value of systems approaches in times of change and uncertainty.* Vienna, 4-6 Juillet 2010. p. 1117–1128.
- Fomina, Y., Glinska-Newes, A., and Ignasiak-Szulc, A. (2022). Community supported agriculture: Setting the research agenda through a bibliometric analysis. *J. Rur. Stud.* 92, 294–305. doi: 10.1016/j.jrurstud.2022.04.007
- HLPE (2016). *Sustainable agricultural development for food security and nutrition: what roles for livestock?* A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome.
- Hostiou, N., Fagon, J., Chauvat, S., Turlot, A., Kling, F., Boivin, X., et al. (2017). Impact of precision livestock farming on work and human-animal interactions on dairy farms. A review. *Biosci. Biotechnol. Biochem.* 21, 1–8. doi: 10.25518/1780-4507.13706
- Hu, L., Luo, D., Zhou, T., Tao, Y., Feng, J., and Mei, S. (2017). The association between non-Hodgkin lymphoma and organophosphate pesticides exposure: a meta-analysis. *Environ. Pollut.* 231, 319–328. doi: 10.1016/j.envpol.2017.08.028
- Huang, J., Wu, Y., and Rozelle, S. (2009). The farm and intensifying agricultural production in shandong: a case study of rural labour market linkages in China. *Agric. Econ.* 40, 203–218. doi: 10.1111/j.1574-0862.2009.00370.x
- ISWA (2021). International Symposium on Work in Agriculture. Available online at: <https://symposium.inrae.fr/workinagriculture-iswa/> (accessed June 15, 2021).
- Janker, J., Vesalab, H., and Vesalac, K. (2021). Exploring the link between farmers' entrepreneurial identities and work wellbeing. *J. Rur. Stud.* 83, 117–126. doi: 10.1016/j.jrurstud.2021.02.014
- Keifer, M. (2022). Two Perspectives: Agricultural Employers and Their Essential Workers. *J. Agromed.* 27, 1–3. doi: 10.1080/1059924X.2022.2007652
- Lamine, C. (2015). Sustainability and resilience in agrifood systems: reconnecting agriculture, food and the environment. *Sociol. Ruralis.* 55, 41–61. doi: 10.1111/soru.12061
- Laske, E. (2021). *Mesure du Contenu en Emploi de Différents Modèles Agricoles au Sénégal, Doctorat,* Economie, Université de Montpellier.
- Le Thi Thanh, H., Duteurtre, G., Cournut, S., Messad, S., and Hostiou, N. (2019). Diversity and sustainability of pig farm types in the northern mountain of Vietnam. *Trop. Anim. Health and Prod.* 5, 2583–2593. doi: 10.1007/s11250-019-01973-4
- Leach, M., Nisbett, N., Cabral, L., Harris, J., Hossain, N., and Thompson, J. (2020). Food politics and development. *World Dev.* 134, 105024. doi: 10.1016/j.worlddev.2020.105024
- Losch (2022). Special Issue.
- Losch, B. (2016). *Structural Transformation to Boost Youth Labour Demand in Sub-Saharan Africa: The Role of Agriculture, Rural Areas and Territorial Development.* Geneva: ILO. p. 78.
- Lucas, V., and Gassel, P. (2022). *A style of farm work, intensive and collective, conducive for the agroecological transition.* Available online at: <https://hal.inrae.fr/hal-03195232/document>
- Magnan, A., and Laurent, C. (2018). "Les publics cibles du conseil santé-sécurité au travail en agriculture", in *Rapport INRA-IRE.* p. 115.
- Malanski, P. D., Dedieu, B., and Schiavi, S. (2021). Mapping the research domains on work in agriculture. A bibliometric review from Scopus database. *J. Rur. Stud.* 81, 305–314. doi: 10.1016/j.jrurstud.2020.10.050
- Malanski, P. D., Schiavi, S., and Dedieu, B. (2019). Characteristics of "work in agriculture" scientific communities. A bibliometric review. *Agron. Sust. Dev.* 39, 36. doi: 10.1007/s13593-019-0582-2
- Malanski, P. D., Schiavi, S. M. A., Dedieu, B., and Damasceno, J. C. (2022). *International research on labor in agri-food value chains: a bibliometric review from Web of Science-Unable to find.*
- Meena, D. K., Meena, V. S., and Dubey, L. R. (2020). Perception of Students towards Rural Agriculture Work Experience in College of Agriculture, Bharatpur. *Res. J. Agril. Sci.* 11, 1175–1177. doi: 10.20546/ijcmas.2017.610.402
- Monllor i Rico, N., and Fuller, A. M. (2016). Newcomers to farming: towards a new rurality in Europe. *Doc. Anal. Geogr.* 62, 531–551. doi: 10.5565/rev/dag.376
- Moyes, K. M., Ma, L., McCoy, T. K., and Peters, R. R. (2014). A survey regarding the interest and concern associated with transitioning from conventional to automated (robotic) milking systems for managers of small-to medium-sized dairy farms. *Prof. Anim. Sci.* 30, 418–422. doi: 10.15232/pas.2014-01327
- Nettle, R., Kuehne, G., Lee, K., and Armstrong, D. (2018). A new framework to analyse workforce contribution to Australian cotton farm adaptability. *Agron. Sust. Dev.* 38, 38. doi: 10.1007/s13593-018-0514-6
- Nguyen, G., Pursegile, F., and Brailly, J. (2021). « The rise of A-to-Z farm outsourcing in France: a marker of contemporary changes in agricultural labour organization », in *2nd Int. Symposium on Work in agriculture Clermont Fd (France).* Available online at: <https://symposium.inrae.fr/workinagriculture->

- iswa/content/download/4977/70337/version/1/file/WS6_S3_Nguyen_Long%20paper.pdf (accessed April 1, 2021)
- Nye, C. (2018). The 'blind spot' of agricultural research: Labour flexibility, composition and worker availability in the South West of England. *Cah. Agric.* 27, 35002. doi: 10.1051/cagri/2018018
- Parodi, G. (2018). Agroecological transition and reconfiguration of horticultural work among family farmers in Buenos Aires, Argentina. *Cah. Agric.* 27, 35003. doi: 10.1051/cagri/2018020
- Perceval, M., Kolves, K., Ross, V., Reddy, P., and De Leo, D. (2019). Environmental factors and suicide in Australian farmers: a qualitative study. *Arch. Environ. Occupat. Health.* 74, 279–286. doi: 10.1080/19338244.2018.1453774
- Porcher, J. (2002). *Éleveurs et Animaux: Réinventer le Lien*. Paris, France: PUF 2002. doi: 10.3917/puf.porcher.2002.01
- Preibisch, K. (2010). Pick-your-own labour: migrant workers and flexibility in Canadian agriculture. *Int. Migr. Rev.* 44, 404–441. doi: 10.1111/j.1747-7379.2010.00811.x
- Prost, L., Reau, R., Paravano, L., Cerf, M., and Jeuffroy, M.-H. (2018). Designing agricultural systems from invention to implementation: the contribution of agronomy. Lessons from a case study. *Agric. Syst.* 164, 122–132. doi: 10.1016/j.agsy.2018.04.009
- Reissig, L., Cramer, A., and von Wyl, A. (2019). Prevalence and predictors of Burnout in the context of interrelation of work and household. *Ment. Health Prev.* 14, 200157. doi: 10.1016/j.mph.2019.200157
- Ressia, S. E., Strachan, G. J., Rogers, M., Ball, K., and McPhail, R. (2022). *Farm Businesswomen's Aspirations for Leadership: A Case Study of the Agricultural Sector in Queensland, Australia*. Available online at: https://symposium.inrae.fr/workinagriculture-iswa/content/download/4962/70292/version/1/file/WS4_S3_Ressia_Long%20paper.pdf
- Sachs, C. E., Jensen, L., Castellanos, P., and Sexsmith, K. (2020). *Routledge Handbook of Gender and Agriculture*. London: Routledge, p. 486. ISBN: 978-0-429-19975-2. doi: 10.4324/9780429199752
- Saldanha, K. (2022). The invisibility of farmworkers: implications and remedies. *Latino Stud.* 20, 28–49. doi: 10.1057/s41276-021-00349-w
- Santhanam-Martin, M., and Nettle, R. (2014). Governing Australia's dairy farm workforce: a new terrain for negotiating rural community sustainability. *Int. J. Sociol. Agric. Food.* 21, 31–50.
- Serpossian, E., Coquil, X., and Annes A. (2022). *Involvement of women farmers in the agro-ecological transition and transformation of their work: Chronicle of the Women Group 44*. Available online at: https://symposium.inrae.fr/workinagriculture-iswa/content/download/4960/70286/version/1/file/WS4_S1_Coquil-Serpossian_Long%20paper.pdf
- Stephens, E. C., Martin, G., van Wijk, M., Timsina, J., and Snow, V. (2020). Editorial: Impacts of COVID-19 on agricultural and food systems worldwide and on progress to the sustainable development goals. *Agric. Syst.* 183, 102873. doi: 10.1016/j.agsy.2020.102873
- Therond, O., Duru, M., Roger-Estrade, J. J., and Richard, G. (2017). A new analytical framework of farming system and agriculture model diversities: a review. *Agric. Syst. Dev.* 37, 24. doi: 10.1007/s13593-017-0429-7
- Thompson, P. B. (2007). Agricultural sustainability: what it is and what it is not. *Int. J. Agric. Sustain.* 5, 5–16. doi: 10.1080/14735903.2007.9684809
- United Nations (2021). *17 Goals to Transform Our World*. Available online at: <https://www.un.org/sustainabledevelopment/> (accessed September 19, 2020).
- Vanhonacker, F., Verbeke, W., Van Poucke, E., and Tuytens, A. M. (2007). Do citizens and farmers interpret the concept of farm animal welfare differently? *Liv. Sci.* 116, 126–136. doi: 10.1016/j.livsci.2007.09.017
- World Bank (2018). *Agriculture for Development*. Washington, DC: World Bank.
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