

## Modeling the links between evolutions in employees' career and changes on livestock farms: evidence from permanent employees on dairy farms in Auvergne, France

Priscila Duarte Malanski <sup>a</sup>, Stéphane Ingrand <sup>b</sup>, Nathalie Hostiou <sup>b</sup>,

<sup>a</sup> State University of Maringa, Department of Management, Jd. Universitário, Maringa, Brazil

<sup>b</sup> Université Clermont Auvergne, INRAE, AgroparisTech, VetAgro Sup, UMR Territoires, Clermont-Ferrand, France

**Abstract:** Hiring employees in agriculture has become more common during the last forty years, especially permanent employees. Despite the increasing importance, precarity characterizes the socioeconomic status of employees in farms. This condition is against stable employment of hired workers and improve turnover in farms. However, developing employees' career and providing attractive working conditions are essential to retaining employees working in farms and decrease turnover. In this sense, modeling the changes on employees' career and the changes on farms can provide an overview of the links between them, since the previous studies considered these two elements separately. Based in the advances in the literature in livestock farming systems and human resources management, we developed and tested an original model linking the evolutions on employees' career with changes in livestock farms. This is a new way to represent changes, since it is not structured by a timeline, but rather by a set of elements in which the analysis is based: 1) three dimensions of employees' career – tasks assignment, specialization/versatility, autonomy; 2) the drivers of changes related to the farm, the team, and the employee him-self; 3) three rhythms of evolutions – progressive, sudden, stable. The capacity of our model to represent the diversity of careers evolution was tested in five types of career evolution of employees working in dairy farms in Auvergne, France. Our model can be used by researchers to better understand trade-offs between human resources management and livestock farms characteristics in order to better understand the how motivate employees either to stay working in the farm or leave the farm according to changes in working conditions overtime.

**Keywords:** model, employees, livestock farms, changes, France

**Acknowledgements:** This work was carried out with the support of Science without Frontiers, from CAPES and Ministry of Education of Brazil. Partners of this work are as follows: RMT Travail, Fédération Nationale des Syndicats d'Exploitants Agricoles, and the Syndicat Interprofessionnel Saint Nectaire.

**Funding:** This study was funded by CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) (grant number 99999.001251/2013-09).

## Introduction

Hiring employees in agriculture has become more common during the last forty years, especially non-familiar permanent employees. The progress of employees is related to several factors, such as strong structural transformations in agriculture (e.g. the enlargement of farms), the decrease of family workforce - principally in developed countries (Lobao and Meyer, 2001), the diversification of revenue sources of small farmers - principally in developing countries (Bouchakour and Saad). Hired employees represents 40% of the global agricultural workers (International Labour Organization, 2007).

Despite the importance, precarity characterizes the socioeconomic conditions of employees, which is linked to low wages, high working hours, physical-intensive tasks, high informality and low social protection (World Bank, 2008). All these conditions are against stable employment of hired workers in agriculture, including livestock. Therefore, providing good employment and working conditions are essential to retaining employees working in farms and decrease turnover (Staelens and Louche, 2017; Nettle, 2018; Hobbs *et al.*, 2020). Better understanding how employees' career is developed in farms is a fundamental condition to identify ways to support farmers and employees to face this challenge (Wesarat *et al.*, 2014; Staelens and Louche, 2017; Hobbs *et al.*, 2020). In this sense, several studies

have been developed in order to increase the attractiveness of this job, such as the design of attractive workplaces for employees (Eastwood *et al.*, 2018), modeling employment relations in farms (Nettle *et al.* 2005), theorizing and understanding the career of employees in farms (Madelrieux *et al.* 2010a; Moffatt 2016). On one hand, these studies indicate that we have to consider both the employees' career and the workplace (*i.e.* farm) to retain employees in farms. On other hand, the focus of analysis were either a specific moment of the employees' career (*e.g.* recruitment), or employers' actions to improve working and employment conditions. Thus, these studies did not considered the dynamic aspects of employees' career and workplace.

Developing employees' career by changing their work and skills along their career is an important way to motivate them to stay working in a farm (Wesarat *et al.*, 2014; Staelens and Louche, 2017; Hobbs *et al.*, 2020). Working conditions evolve due to changes on the livestock farm (*e.g.* herd size, land size, equipment and buildings) (Moulin *et al.*, 2008; Alves *et al.*, 2012; Aubron *et al.*, 2016). Although the literature shows evidences that employees' career and the working conditions in farms change, the links between them and how it changes overtime are not considered.

In livestock farming systems approach, links between elements and changes have been analyzed, and models have been developed to support and summarize finds (Landais, 1994). Modeling is a tool to represent, in a simplified way, the complexity of interactions between the elements composing a system. In this paper, we consider that the employees' career and the livestock farm compose a system, and modeling this system provide an overview of its links and their changes overtime. In order to fill these gap, the aim of this paper was to develop a model to design the evolutions in permanent employees' career linked to the changes in livestock farms.

The conceptual development of the model was based in the combination of three approaches: 1) farms' pathways; 2) work organization in livestock farm systems; and 3) human resource management. These approaches brought different contributions related to how understand and represent the changes in livestock systems and employees' career. A brief literature review of these approaches is presented in the next session by focusing in their complementarities and limits in order to develop a conceptual model to design the links between changes on livestock farms and employees' career evolution.

## **Building a conceptual base to understand and design changes on livestock farms and employees' career**

The aim of this session is to provide a literature review by focusing in key factors to build the model: 1) the temporal length of analysis (long or short term); 2) the analysis of changes (center of analysis or not); 3) the work perspective analysis (productivity, organization); and 4) the analysis of employees' career and work performed by then (considered or not).

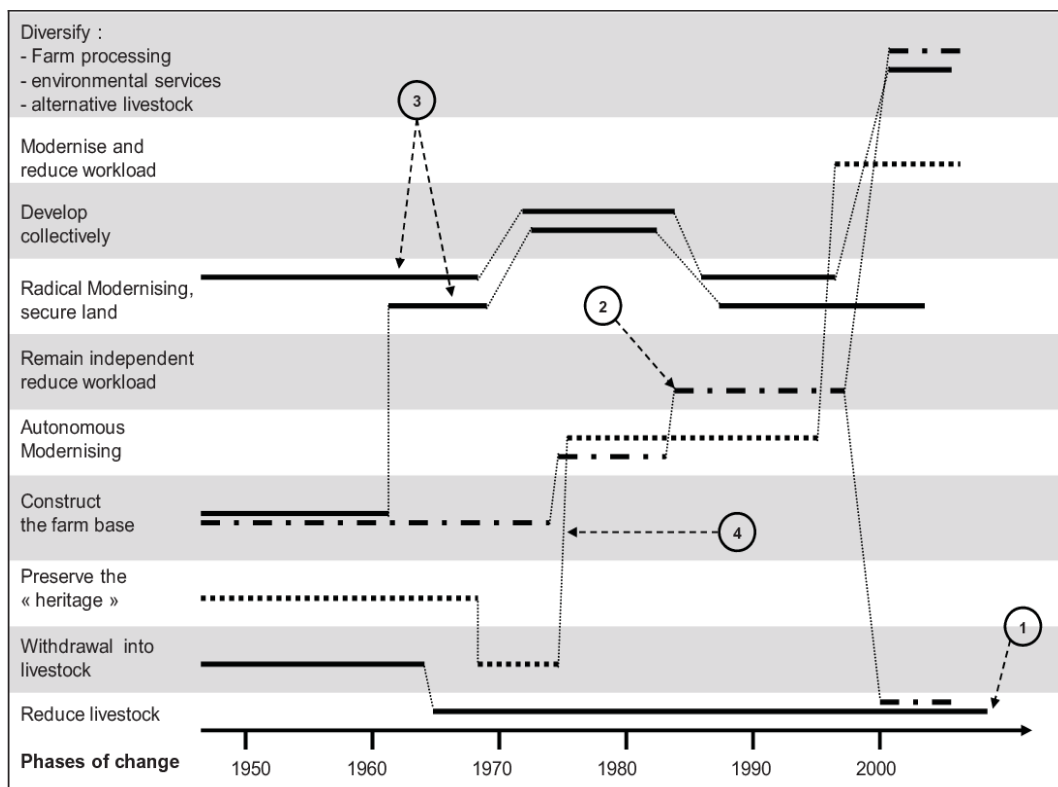
### **The “farm pathway” approach: focus on structural and technical changes on farms**

Frameworks to understand and represent how farms change overtime were significantly developed by the French “farm pathway” approach. The aim and how changes are analyzed and represented are diverse among these approaches. At first, frameworks were based in typologies to compare and classify farms according to three factors: 1) structure (*e.g.* size), 2) technical characteristics (*e.g.* agronomic techniques, equipment), and 3) production (*e.g.* specialized, diversified) (Capillon *et al.* 1988; Perrot *et al.* 1995). The farm pathway is represented by the sequence of types in the time, but no temporal length is considered in the analysis (*e.g.* long or short term). Changes on farms are identified by the passage from on type to another. However, the changes and how they take place are not the focus of these

analysis, and in addition, work is not considered. Clearly, these are limitations regarding the aim of this paper.

These limitations of “farm typologies” framework are no longer identified in frameworks focusing in the changes on both farm and family. The aim of “family farm-farm” framework is to identify and represent how structural and technical changes on the farm are connected to family’s life cycle (Moulin *et al.* 2008; Madelrieux *et al.* 2010b; Terrier *et al.* 2012). Changes and how they take place in the long-term are the focus of the analysis. The changes are designed by a model structured by a timeline. For example, a representation of changes overtime in a goat farm indicating changes on herd size and workforce (annual work unit) (Moulin *et al.* 2008).

Moreover, the drivers of change are classified according to their position in two types of context: 1) drivers from internal context is delimited by the boundaries of the farming system (e.g. changes in farm size, herd size, technical management of herd and land, family composition); 2) drivers from external context are located in the environment beyond the farming system (e.g. changes in market, policies). Periods that remain unchanged are defined as stable.



**Figure 1. Representation of livestock farming paths in France structured by a time-line.**  
Source: Cialdella *et al.* (2009).

The “family farm-farm” framework provide two key concepts to build our model. First, changes on farms are not isolated, since they are linked to two contexts (*i.e.* internal and external). We considered two levels of analysis in this study, the employee level and the farm level, therefore, beyond farm level was not considered. In this sense, we assumed that the evolution of employees’ career is linked to the work they perform in the farm overtime (e.g. internal context), and the changes on their work environment overtime, which is the livestock farm (e.g. external context). Second, this approach considers both

changes and stability to analyze and represent a “family farm – farm” pathway alternating periods of change and stability. Thus, we assumed that the evolution on employees’ career can be characterized by periods of stability or changes according to the action of the drivers of changes. In your turn, drivers of changes can be either a trigger to speed up changes or a blocker to avoid changes.

Finally, the “farm pathway” approach are strongly focused in technical and structural changes at farm level, including long-term temporal analysis represented by a time-line (see for example, the paths of French livestock farms (Cialdella *et al.*, 2009) (Figure 1). Work is a variable that was progressively take into account in the different frameworks described above, as well as the diversity of tasks performed (Moulin *et al.*, 2008; Cialdella *et al.*, 2009; Madelrieux *et al.*, 2010b; Alves *et al.*, 2012; Terrier *et al.*, 2012 Ryschawy *et al.*, 2013; Aubron *et al.*, 2016).

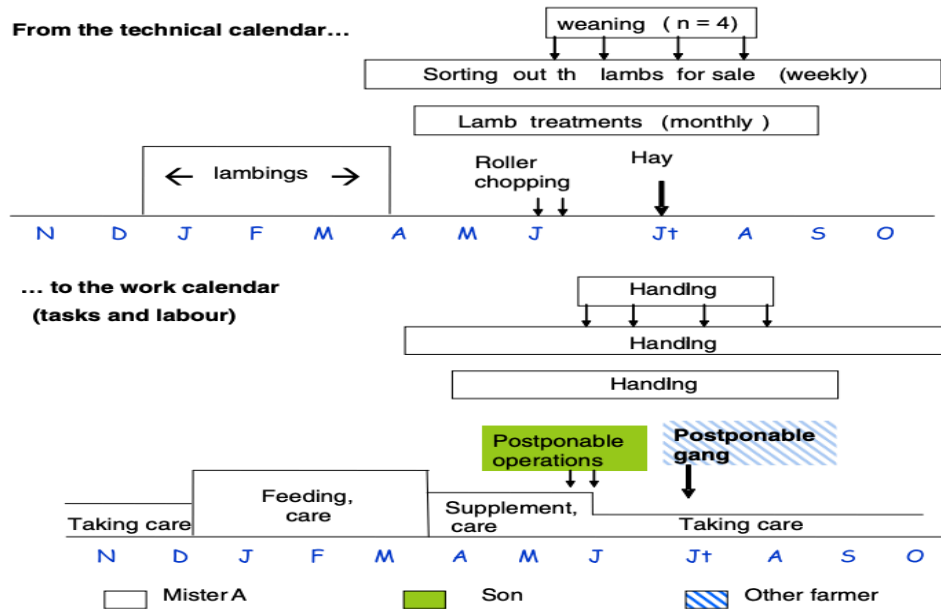
However, only the work performed by family members was considered in the analysis, due to the development of frameworks strongly linked to the familiar-based type of farm. Therefore, employees, the work they perform and how it evolves remain absent in the “farm pathway” approach, which is a major limitation regarding the aim of this paper.

### **The “work organization” approach: principles and concepts to analyze work in livestock farming systems**

Work is a variable to understand changes on farms in the “farm pathway” approach. On the contrary, changes on farms are used to understand the work organization in livestock farms in the “work organization” approach.

The work organization approach was developed by livestock farming scientists to analyze changes on work, since changes on livestock farms impact the farming work, and work is a factor considered by livestock farmers to decide herd and land technical management (Dedieu *et al.*, 2006). Work organization is defined as a system of activities articulating the farm team, herd and land technical management, and others activities performed by workers (agricultural or not) (Madelrieux and Dedieu, 2008; Madelrieux *et al.*, 2009), and it is represented as a combination between different tasks performed by different workers (Cournut *et al.*, 2018). In a year round, changes on work organization are characterized by the passage of a organizational period to another (Madelrieux *et al.*, 2009).

Three frameworks were developed to analyze and represent the forms of work organization in livestock farms: work assessment method (Madelrieux and Dedieu, 2008; Cournut *et al.*, 2018), ATELAGE model (Madelrieux *et al.*, 2009), and QuaeWork method (Hostiou and Dedieu, 2012). These frameworks share the common conceptual basis composed by three principles. The first principle is that the farming work is composed by diverse tasks performed with different rhythms following the animals’ productive cycle, agricultural seasonality, and farmers technical choices. Two concepts are used to classify the tasks: 1) routine tasks – characterized by tasks performed (almost) everyday, such as milking, feeding, animal care; 2) seasonal tasks – characterized by tasks performed according to a period, such as haymaking in summer. The second principle is that farm workers are not equivalent, since they have different levels of responsibility and perform different tasks. Two concepts are used to classify the farm workers: 1) the basic group – composed by permanent workers responsible for the work organization, which almost all time working is used in the farm and revenue strongly depends on the farm (e.g. farmers); 2) the workers outside the basic group – composed by all the other farm workers (e.g. employees, mutual assistance, contractors). The third principle is that work organization changes overtime. The work organization is identified by an organizational period through the combination between different tasks and different workers (see for example, the work organization calendar in a sheep livestock farm in France, Figure 2).



**Figure 2. Work organization calendar of a sheep farm. Different tasks are combined with different workers in a year round. Source: Malderieux and Dedieu (2008).**

Work organization is modeled by sequences of organizational periods over a year. Changes on work are showed by the passage from an organization period to another. However, the driver of changes are not represented in the model.

Although work is the focus of analysis in the work organization approach, changes and its drivers are less considered. In addition, the temporal length of analysis is the short term (*i.e.* calendar year). These are the two main limitation of this approach considering that the aim of this paper is to design changes and its drivers in the long-term.

Despite the limitations, the work organization approach provides us some pertinent advances to build our model. First, the labor performed by the employee is framed by the livestock system, considering that the tasks to perform in specialized farms are different from those in diversified farms. Second, the sociotechnical division of labor is highlighted. It indicates that family farmers and employees do not perform the same tasks, and the responsibility level of employees varies according to centralization of decision-making in family workers. However, employees are almost “invisible” in this approach, since the analysis is focused on the family worker and family members are in the center of decisions to organize work and to manage the farm. The tasks performed by the team are considered, it means that the collective level is highlighted in the model. This is a limitation when the tasks performed by the employee since their recruitment (*e.g.* individual level) is the focus. In addition, technical skills and professional experience of employees are not considered to understand the tasks assigned to them and how they change overtime.

Finally, other concepts are necessary to deal with the limitations of the approaches presented above and to build a model that integrates long-term changes on farms and changes on employees' career based in the tasks performed.

### Human resource management and development of employees' career

Human resource management (HRM) is defined as the management of people working in organizations (Martory and Crozet, 2008). The HRM approach was developed in non-agricultural organizations. However, researchers in agricultural economics were the first to use this approach in agricultural sciences. The aim was to enhance both performance and competitiveness of farms in a context characterized by increasing competitiveness, changes on farms (e.g. increasing size of land and herd, increasing hired labor), and changes beyond farm-level (e.g. market and agricultural policies) (Howard and McEwan, 1989; Howard *et al.*, 1991; Hutt and Hutt, 1993; Mugeru and Bitsch, 2005; Bitsch, 2009; Ullah and Zheng, 2014). Therefore, people are resources that must be optimized by human and work management.

The HRM has two functions: first, the operational functions regarding administrative and bureaucracies of employees management (e.g. hiring, wages, formation...), second, the strategic functions regarding the enhance of employees performance on work (e.g. working conditions, skills, motivation...), the development of employees' career and their adaptation to the organizations' aims (Martory and Crozet, 2008; Cadin *et al.*, 2012). In this paper, the focus is the strategic function of HRM, considering that we are interested by the evolution of employees' career.

Career is defined as the sequence of work experiences within and between organization (Gunz and Paiperl, 2007). Since the focus of this paper is permanent employees in livestock farms and turnover reduction, we considered the work experiences of the employee in the farm he/she is currently employed. The tasks assigned to the employee is the key point to understand his career, since the tasks assigned determine the tasks to perform and the power to take decisions (Vafaï and Anvar, 1998 ; Wesarat *et al.*, 2014). Tasks assignment has two structures. The centralized structure is characterized by the concentration of the tasks and decision power on one person, while the decentralized structure is characterized by the distribution of tasks and dispersion of power decision between people (Mintzberg 1979). The decentralized structure is more common in non-agricultural organizations than in agricultural organizations (i.e. farms) (Hutt and Hutt, 1993), principally in family farms (Barthez, 1996). However, employees in farms are increasingly assuming job positions requiring decision-making skills related to technical management (Bitsch *et al.*, 2007). In this sense, tasks performed by employees has two natures: operational tasks and responsibility tasks. The operational tasks are related to manual or physical tasks required to keep the farm running (e.g. milking, feeding, haymaking, harvesting), most employees perform operational tasks, as the farmhands (de Menezes *et al.*, 2012; Moffatt, 2016). The responsibility tasks are related to management tasks required to adjust farm management or solve problems, as the middle managers (Bitsch *et al.* 2007). Therefore, we assume that the structure of tasks assignment can change through the employee career, since changes on tasks and responsibilities assigned to employees on livestock farms can increase or decrease over their career.

The tasks performed by employees characterize their job profile. Specialization and versatility are two forms to organize work developed in non-agricultural organizations. Specialization is related to the division of production activities on several tasks, and each task is performed by one employee in a regular basis according to strict prescriptions (Everaere, 2008). Thus, the employee remain in the same job position. This is the case of milkers in large dairy farms that exclusively perform milking (Harrison and Getz, 2015). While versatility is related to flexibility and mobility, since employees perform different tasks in different job positions (Toumen, 2007; Everaere, 2008). This is the case of employees in small farms that perform several tasks, such as silage, haymaking, harvest, milking, feeding (Madelrieux *et al.*, 2010a; Dupré, 2010). Two ways to increase versatility are identified: 1) by increasing the number of tasks performed without change the nature of the tasks performed; 2) by increasing the number of tasks



performed with changes on the nature of tasks (Everaere, 2008). Therefore, we assume that trends between specialization and versatility take place in employees' career according to changes on the quantity and nature of tasks performed.

Employees do not have the same conditions to perform their tasks according to their job profile. Autonomy level varies between employees. Autonomy is defined as the room maneuver to perform tasks. Two types of autonomy are identified: 1) procedural – indicate the room maneuver on how to perform a task when comparing to task prescription; 2) management – indicate the room maneuver to organize work (e.g. evaluation, indicators, prescription, control) and power to take decisions (Alexandre-Bailly, 2001). The level of autonomy varies between these two types of autonomy according to the competencies of employees and the tasks prescription. The lowest level of autonomy represents the incompetency, the employee do not know how to perform a task, frequently demand assistance and he must to follow strict prescriptions. The highest level of autonomy indicate employee competency, initiative and liberty to decide how to manage his work and perform his tasks (Everaere, 1999). Thus, we assume that changes on the prescriptions to perform tasks on farms may lead to more or less autonomy in employees' career.

## **Methodology design**

### **Designing a model to understand links between evolutions in employees' career and changes on livestock farms**

The design of the model was supported by advances in the previous literature review. The first advance is the content of employees' career and its changes. Three aspects have to be considered: 1) the tasks performed, its nature and changes overtime; 2) the trend between specialization and versatility overtime; and 3) the level of autonomy overtime, considering prescription and power of decision-making. Second, the labor performed by the employee is framed by the livestock system, since the type of tasks and jobs assumed by the employee depends on the productive activities of the farm, that in its turn depends on the level of specialization of the farm. The third advance is that tasks performed by the employee and by the family workers are not the same due to the social and technical division of labor. Fourth, evolutions of employees' career is not isolated, it is linked to the internal and external context. The internal context is related to the evolution of the three aspects of employees' career (e.g. tasks, specialization/versatility, autonomy). The external context is linked to the employees' workplace (e.g. livestock farm). The fifth advance is that evolution is composed by changes and stability. The action of drivers of changes produces changes or block them. The changes or stability take place overtime with different temporalities.

Therefore, our model must represent 1) the evolution of employees' career based in the tasks performed, specialization/versatility, autonomy; 2) the drivers of changes linked to the livestock farm and the employee; 3) the temporalities of changes.

### **Using empirical data to complete and test our model**

The description of evolutions in employees' career was based in the framework developed to analyze changes on permanent employees' work in livestock farms (Malanski *et al.*, 2019). The framework was composed by 8 variables describing how work evolves since employee recruitment in a farm according to three dimensions of employees' work (Table 1).

Dimensions	Variables	Categories
Task assignment	Evolution in the number of tasks	1 - Increasing
		2 - Stable
	Evolution in the frequency of task execution	1 - From recurring to recurring and occasional
		2 - Recurring tasks since recruitment
	Evolution in the nature of tasks	1 - Increasing number of execution and responsibility tasks
		2 - Execution tasks since recruitment
Versatility/ specialization	Evolution in the number of jobs	1 - From one job to multiple jobs
		2 - Stable
	Evolution of the job	1 - Progressive
		2 - Sudden
Autonomy	Evolution in the type of task instructions	3 - Stable
		1 - Room to manoeuvre to perform most tasks since recruitment
		2 - Strict instructions at recruitment but afterwards room to manoeuvre to perform responsibility tasks
	Evolution in working in a pair with a farmer	3 - Strict instructions for most tasks since recruitment
		1 - Especially at recruitment and afterward for some employee tasks
	Evolution in the frequency of controlling which tasks are performed	2 - Since recruitment for most employee tasks
		1 - From recurring to occasional
		2 - From recurring to regular
		3 - Recurring since recruitment

**Table 1. Dimensions of employees' work, variables by dimension and categories.** Source: Malanski et al. (2019).

Three groups of drivers of changes that trigger or block evolutions in employees' career were previously identified (Table 2): 1) farm – drivers were linked to changes on farm structure (e.g. farm size, herd size); 2) team – drivers were linked to the quantity of workers and their availability to work (e.g. arrival/departure of a worker; temporary absence of farm due to meetings or illness); 3) farm worker – drivers were linked to the employee himself (e.g. development of technical skills, wish to become a farmer) (Malanski et al. 2019).

Dimension	Group of driver of changes	Drivers of changes
Task assignment	Farm	Increasing herd size Increasing farm size
	Team	Arrive/departure of worker Temporary unavailability of a worker
	Farm worker	Demand of worker Developing technical skills Became a farmer
Versatility/specialization	Farm	Increasing herd size Increasing farm size
	Team	Arrive/departure of worker Temporary unavailability of a worker Workload
Autonomy	Team	Workload
	Farm worker	Developing technical skills Became a farmer

**Table 2. Group of driver of changes acting by dimension of employees' work.** Source: Malanski et al. (2019).



In order to identify the different employees career, empirical data were collected through individual semi-structured interview with 14 non-familiar permanent employees and 8 farmers (their employers) on dairy farms in Auvergne, a mountain region in center of France (Malanski *et al.*, 2017). Farmers interview were related to the composition of the team, farm trajectory (changes on structure, the herd, equipment, and team), division of tasks over time, task instructions, employee recruitment, and changes on employees' work. Employees interview were related to technical education in agriculture and professional experience, tasks performed since recruitment, task instructions, changes on their work. Employees (nine men and five women) were aged 22–50 and were hired from 1998–2014. Seven were full-time employees, three were full-time employees working in an employer group, and four were part-time employees. Eleven employees had technical education related to agriculture, livestock or farm machinery, and professional experience. Three employees had neither technical education or professional experience in agriculture or livestock. Herd and farm sizes of the sample (93 cows and 150 ha, respectively) were twice larger than dairy farms in France. Four farms were specialized dairy farms, and four farms were diversified farms, including milk, crops and cheese production. Therefore, our sample is mainly characterized by young, male employees working on large farms, in agreement with regional and national characteristics of the employee workforce in agriculture (Forget *et al.*, 2019). Data analysis was performed into three steps. First, a qualitative content analysis of interviews were performed through coding with NVivo 10 software (Hutchison *et al.*, 2010). Codes emerged from the literature review and from our empirical data. Second, coded data were analyzed in detail in monographs describing for each employee the three dimensions of work (task assignments, versatility vs. specialization, and autonomy), the factors driving the evolutions, and the rhythm of these evolutions. Third, a comparative analysis were performed between the employees to identify the types of employees career (Bertin, 1977).

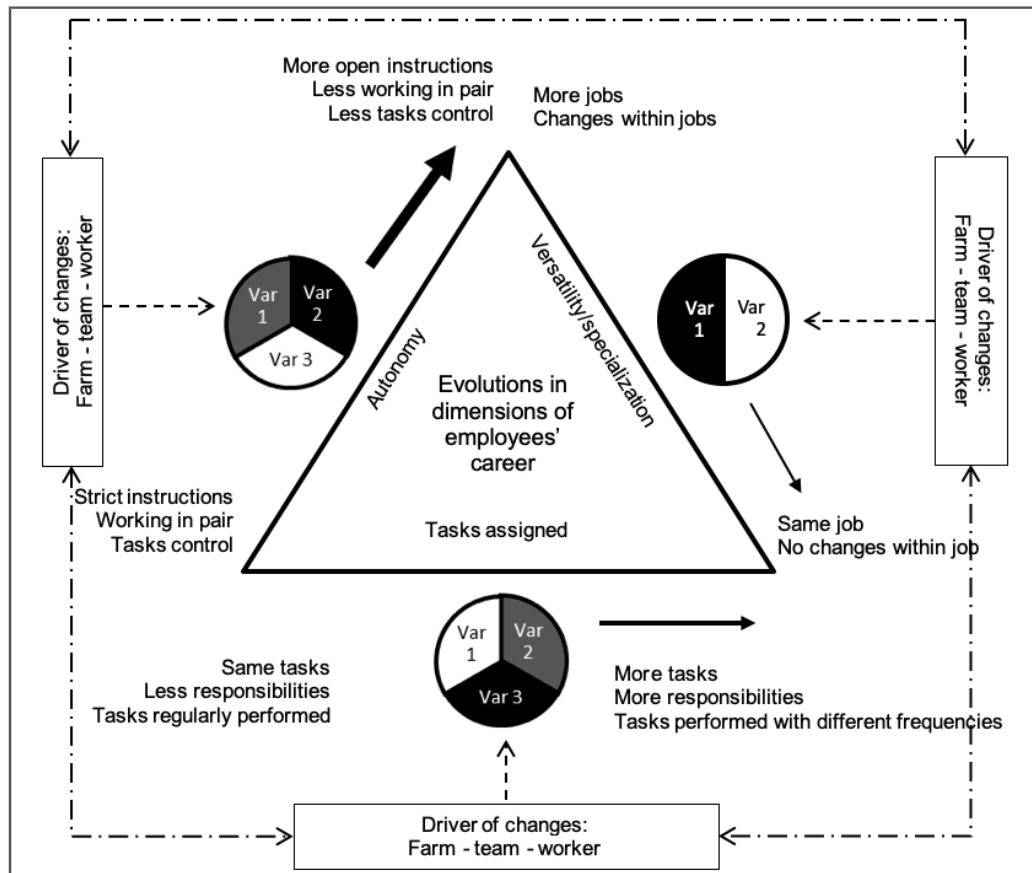
## Results

### A model to represent links between evolution in employees' career and livestock farm changes

We developed the model linking evolutions in employees' career and changes on livestock farms (Figure 3), which was composed by: 1) three dimensions of employees' work that described their career evolution in the farm: tasks assignment, versatility/specialization and autonomy. Eight variables with 19 categories that detailed the career evolution for each dimension; 2) three types of drivers of changes on the career related to: farm, teamwork and the employee him-self; 3) three rhythms of changes on the career: progressive, sudden and stable. All the components are detailed below.

#### *The conceptual basis of the model: three dimensions of employees' career evolution*

Tasks assignment, versatility/specialization and autonomy are the three dimensions of employees' career evolution that compose the triangular basis of the model. The evolution of tasks assigned represents the changes overtime of the tasks performed by the employee in the livestock farm. A task is defined as a set of operations executed by the employee. The evolution of versatility/specialization is represented by the changes overtime on the job(s) assumed by the employee. A job is composed by a task or by a set of tasks with characteristics that distinguish it for other tasks or set of tasks. The evolution of autonomy is represented by the changes overtime on employees' room of manoeuvre to perform tasks. The evolution of each dimension is described by eight variables and 19 categories (Table 1).



**Figure 3. Graphic representation of framework of work evolution at individual level: its items and types of relations.** The synergies (arrows) between motors acts on the variables of each dimension (circles). It makes the evolution of work. The evolutions are described by categories (e.g. text next to axes extremity associated to gradient colors in the circles). The ways of evolutions are indicated by arrows according the different rhythms of evolutions: progressive (arrow), sudden (thick arrow) and stable (thin arrow).

*The conceptual basis of the model: three types of drivers of changes and rhythms of employees' career evolution*

The factors that make changes or maintain stability are defined as drivers of changes. The drivers are mechanisms that promote more or less changes on the employees' career. These changes are indicated by the impact of the driver of change in the three dimensions of employees' career evolution (Table 2). The temporality of evolutions is not represented by a sequence of periods, thus our model is not represented by a temporal line. However, our model is focused in the key-drivers of changes that push the employees' career evolution. In this sense, the action of these drivers on the three dimensions of employees' career produces changes or stabilities overtime.

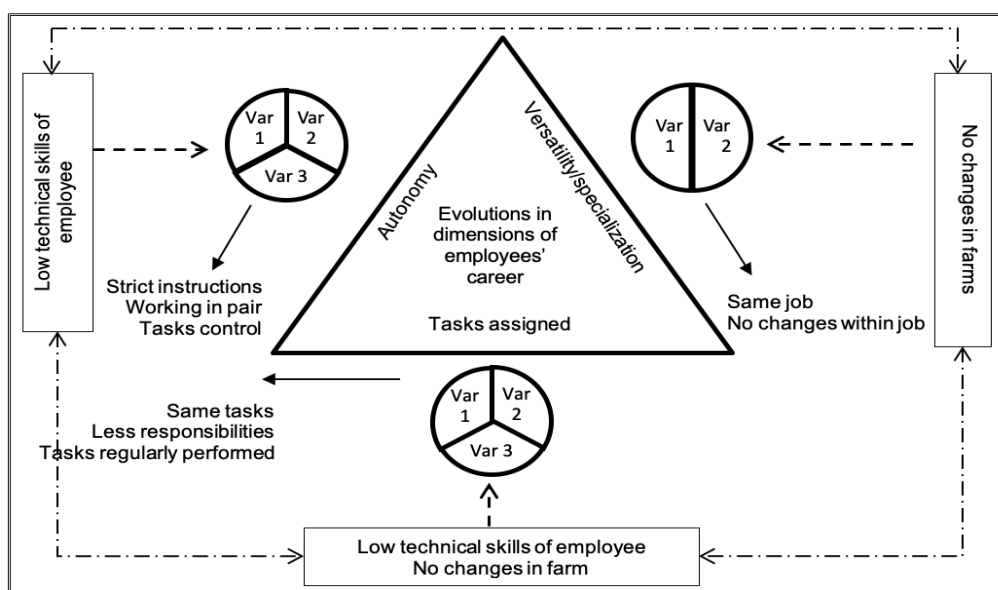
Three rhythms of employees' career evolution were identified based in the qualification of the frequency of changes overtime: 1) progressive: characterized by several changes on the work performed by the employee overtime; 2) sudden: characterized by concentrated changes on a period or one change; 3) stable: characterized by absence of changes overtime.

### Modeling five employees' career in French dairy farms

The capacity of our model to represent the diversity of careers evolution was tested and, finally, was able to generate different representations for each type of employees' career evolution working in dairy farms in Auvergne.

The five types of employees' career in dairy farms in Auvergne were: 1) continuing to perform daily tasks; 2) increasing versatility to perform all routine tasks; 3) becoming a versatile employee to occasionally replace the farmer; 4) becoming a highly skilled dairy farm technician; and 5) becoming a farmer. Differences between careers depended on stability or changes (progressive or sudden) in the three dimensions of work analyzed (e.g., assignment of tasks, versatility vs. specialization, autonomy), the increasing size of both herd and farm over time, the availability of workers to work, and the development of employees' technical skills.

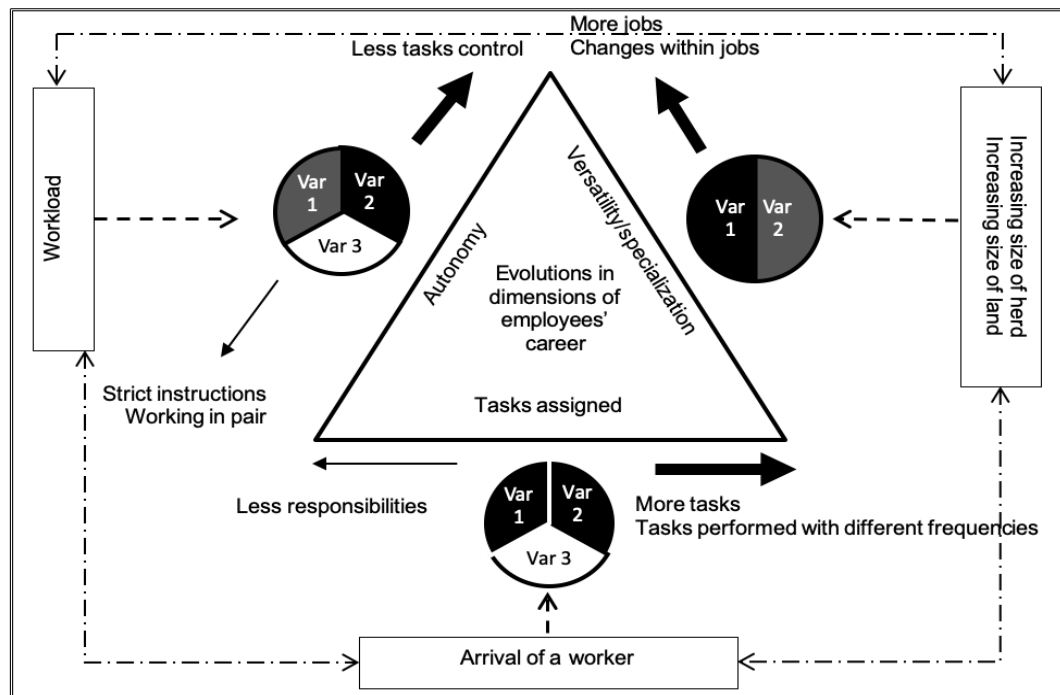
Career 1 – "Continuing to perform daily tasks" (3 employees) is the most stable career of the five types. The stability is due to limited technical skills of employees to diversify their tasks and the absence of changes on the livestock farm since their recruitment. This career is characterized by specialized employees executing few routine tasks (e.g. milking, feeding, cheesemaking). The autonomy level is low, since employees had to follow strict task prescriptions and they worked in pair with family members. In this career, the role of the employee is to share the workload of daily tasks (Figure 4). Employees worked in the same dairy farm that produced cheese in the mountains.



**Figure 4. Model of the career 1 "continuing to perform daily tasks".** Specialized employee perform few daily tasks with low level of autonomy since recruitment. Low technical skilled employee and no changes on farms make a stable career and farm overtime.

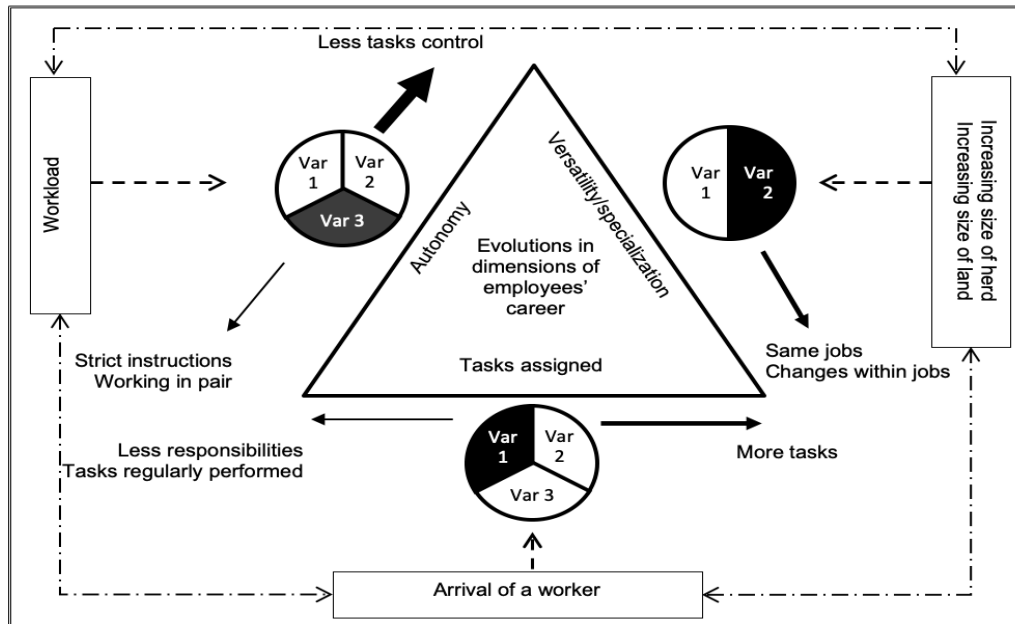
Career 2 – "Becoming a versatile employee to occasionally replace the farmer" (4 employees). This career is characterized by recurring punctual and temporary change in the work performed by the employee overtime. At recruitment, the specialized employees perform few tasks, such as daily cheesemaking. However, their jobs suddenly changes when they have to occasionally diversified the tasks performed. Become a versatile employee was necessary to replace the farmer in specific tasks that cannot be delayed, such as milking and feeding. Replacement occurred when the available workforce occasionally

decreased due to farmers' health problems and off-farm activities. Despite the diversification of tasks performed overtime, autonomy level remained low, since employees followed strict prescriptions and often work in pair with family members. In this career, the role of the employee is to share the workload, and be able to occasionally perform specific tasks (Figure 5). Employees worked on specialized dairy farms producing cheese in the mountains or on diversified farms in the lowlands.

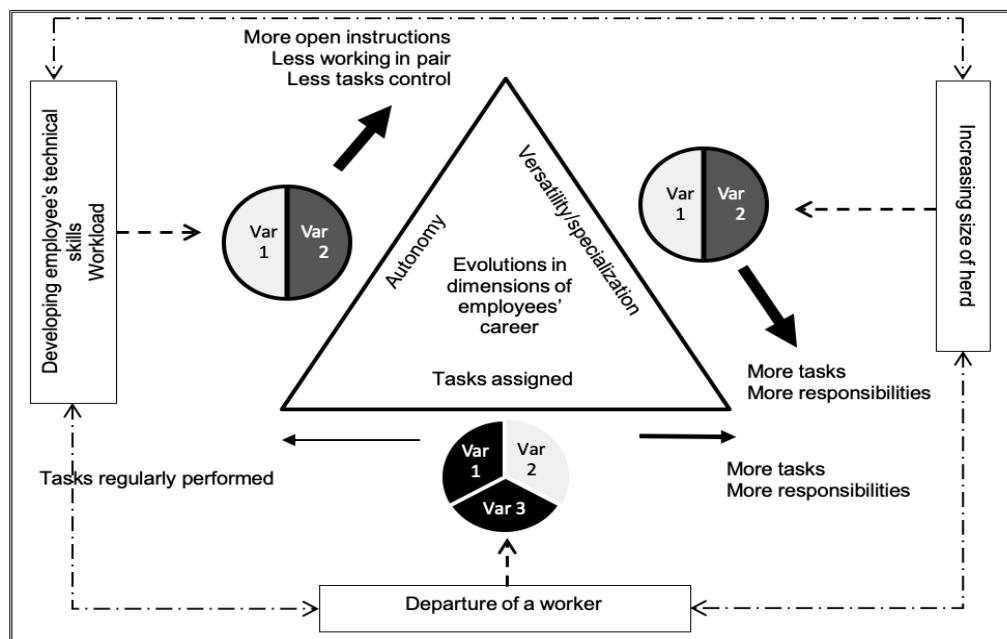


**Figure 5. Model of the career 2 "becoming a versatile employee to replacement".** Specialized employee becomes versatile to occasionally perform additional few tasks. Driver of changes are linked to changes in the team and the need to share workload.

Career 3 – "Increasing versatility to perform all routine tasks" (2 employees) is characterized by the increasing flexibility of the employees' work. Since recruitment, employees are versatile and perform several tasks to keep the dairy farm running, such as daily tasks (e.g. milking, feeding, cheesemaking) and seasonal tasks (e.g. haymaking, crop harvesting). Overtime, they execute more tasks in a regular basis, such as soil preparation, sowing, application of chemical products. Their autonomy level remains low along their career, since they follow strict prescriptions to perform tasks and often work in pair with family members. This evolution is related to the increasing size of both herd and farm. In this career, the employees' role is to share the increasingly workload by performing several tasks (Figure 6). Employees worked on diversified farms producing milk in the lowlands.

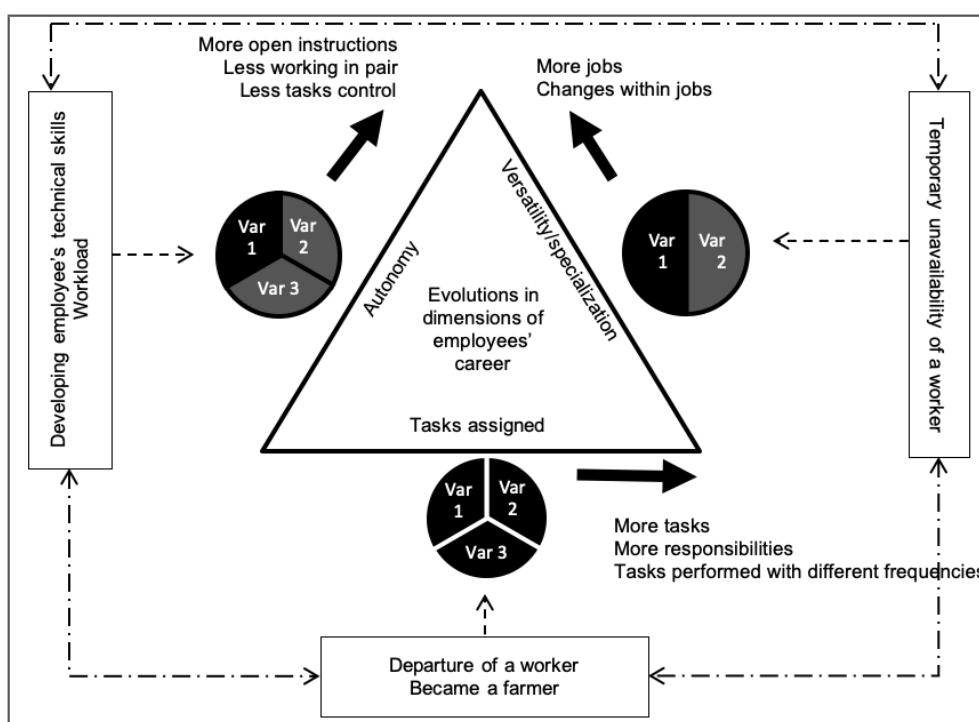


**Figure 6. Model of the career 3 "increasing versatility to perform all routine tasks".** Changes on the farm and the team increase the versatility of employee during his career in a farm. The role of employee is to share the workload by performing several tasks.



**Figure 7. Model of the career 4 "becoming a high skilled dairy farm technician".** Specialized employee perform few tasks at recruitment. However, due to changes in the farm, the team and the employee him-self, the employee's career evolves to increasing specialization and autonomy. The role of the employee is assume the technical management of dairy production.

Career 4 – “Becoming a highly skilled dairy farm technician” (4 employees). This career is characterized by the sudden increase of specialization related to technical skills and responsibilities. At recruitment, employees are specialized in few daily tasks related to the animals (e.g. milking, feeding). Their specialization as dairy farm technician increased when farmers assigned them tasks with technical responsibilities, such as monitoring herds’ health, identifying cows in heat, performing some veterinary care. Autonomy level increases overtime, since employees often work alone or with other employee, while farmers perform other tasks (e.g. crops cultivation, cheese production, sells in local market). These evolutions are linked to the development of employees’ technical skills, increasing herd size and decreasing family workforce (e.g. retirement). In this career, the employees’ role is to assume the herd management with low interventions of the farmer (Figure 7). Employees worked on specialized dairy farms with or without cheese production in the mountains or on diversified farms in the lowlands.



**Figure 8. Model of the career 5 "becoming a farmer".** At recruitment, specialized employee performs few tasks. However, due to sudden changes in the team and the employee's wish to become a farmer, farmer assigned more tasks and responsibilities and autonomy to employee. The employee's technical skills are developed and tested to become a farmer.

Career 5 – “Becoming a farmer” is the career that most evolves (1 employee). At recruitment, versatile employees perform several tasks to keep the dairy farm running. Tasks related to the animals (e.g. milking and feeding) and the crops (harvesting, haymaking) are frequently performed with low autonomy according to strict prescription and in pair with a family member. However, autonomy suddenly increases when employees’ technical skills and responsibilities increase. This situation is characterized by the reinforcement of versatility and increasing technical responsibilities linked to the increase number and diversity of the tasks performed by the employee, such as manure spreading, silage, soil preparation, sowing, monitoring herd’s health, identifying cows in heat, support for calving, and selection of breeding bulls for reproduction. In addition, employees perform administration tasks linked to herd management,



such as declaration of insemination and calf birth. These evolutions are linked to decreasing family workforce (e.g. retirement, farmers illness), farmers and employees wish to become associate farmers, and the development of employees' technical skills. In this career, employees' role is to develop technical and decisional competencies linked to herd and farm management, while the farmer can test the employee as a possible associate (Figure 8). Employee worked on a specialized dairy farm in the mountains.

## Discussion

We developed and tested an original model linking the evolutions on employees' career with changes on livestock farms. This is a new way to represent changes, since it is not structured by a timeline, but rather by the dimensions of work that is the basis of the analysis. In this sense, our model could be useful for processual analysis of longitudinal changes on work organization, since this type of analysis is focused in the major elements that characterizes changes or stability in a pathway (Pettigrew 1997). In addition, our model highlights changes by qualifying the changes on employee career in a farm, since the variables in the model describes how it evolves (e.g. changes on the nature of tasks performed, progressive increase o employee autonomy, etc). At contrary, the farm pathway approaches highlight changes by quantifying them in a time sequence, since the variables describe how much farm changes on a period (e.g. number of cows, number of workers, number of working hours, number of tasks, etc.) (Moulin *et al.*, 2008; Ryschawy *et al.*, 2013; Madelrieux *et al.*, 2010a).

Several originalities of our model can be indicated. First, we introduced a new perspective of work organization for livestock farming scientists, since we proposed a model based in a multidisciplinary approach by combining key-concepts from human resource management, principles from work organization approach, and concepts from farm pathway approach. Others work organization approaches were developed by using concepts from ergonomics (Madelrieux and Dedieu, 2008; Chizallet *et al.*, 2018) and psychodynamics of work (Fiorelli *et al.*, 2010).

The second originality is the analysis of work at individual level (*i.e.* employee) by focusing on the employees' career. Work organization in livestock systems considers the division of labor at the team level (Madelrieux and Dedieu, 2008; Madelrieux *et al.*, 2009; Terrier *et al.*, 2012; Hostiou and Dedieu, 2012), without any consideration of the type of worker.

The focus on the employee and its career is the third originality. Most models and approaches are centered in the farmer, since he/she is the person who take decisions about technical management and work organization (Delecourt *et al.*, 2019), labor division and strategies to compose the farm workforce (Nettle *et al.* 2018), and actions to manage farm staff (e.g. attracting, retaining, managing people) (Bitsch *et al.*, 2006; Eastwood *et al.*, 2018).

The fourth originality is that employee himself plays a key-role in the development of his career on livestock farms. We confirmed that improving technical skills is a strong way to develop employees' career and avoid turnover (Sanders and Grip, 2004; Wesarat *et al.*, 2014). Several studies highlighted the role played by the farmers as responsible for developing employees' career (Howard *et al.*, 1991; Hutt and Hutt, 1993; Bitsch *et al.*, 2006; Ullah and Zheng, 2014; Eastwood *et al.*, 2018). In addition, our results confirmed that employees play a key-role in critical moments of household life cycle, by replacing relatives after their departure, or by assuming a farmer position in a farm succession (Dupré, 2010; Madelrieux *et al.*, 2010b),

The dynamic approach is the fifth originality of our model. Previous models of work organization on livestock farms (Madelrieux *et al.*, 2009), frameworks of workforce management (Nettle *et al.*, 2018; Eastwood *et al.* 2018), and empirical studies about employees' career (Madelrieux *et al.*, 2010a; Moffatt,

2016) only considered the synchronic approach to analyze work and human resources management in farms.

Despite the original contributions of our model, three limitations are identified. First, the changes on technical management were not identified as a driver of changes of employees' career. Although, technical management is related to changes on work overtime (Aubron *et al.*, 2016). The focus on tasks as the entry point to identify the evolutions on employee's career can explain this limitation, since changes on technical management can change the way tasks are performed. Second, changes beyond farm level were not identified as driver of changes, since the focus of analysis was the evolutions of employees' career linked to changes on livestock farms. Including non-farm factors that stimulate changes on farms and employees' career could fill this gap, such as labor market dynamics (Chand and Srivastava, 2014; Richards, 2018), development of value chains (Dolan, 2004; Riisgaard and Hammer, 2011), and agricultural policies (Mantino, 2017). Third, our model cannot describe evolutions by period, since it allows to describe the major evolutions since employee recruitment. However, it is possible to build the sequence of evolutions of employees' career linked to the changes on livestock farm by using the model in regular periods.

These limitations are guidelines for further researches on work organization in livestock farming systems for three reasons. First, technical management of herd and land is a core variable to analyze work organization in livestock farms. Second, current approaches do not consider factors beyond farm level to understand farmers' strategies of work organization. Third, work analysis is restricted to short-term (*i.e.* year round).

Our model can be used by researchers to better understand trade-offs between human resources management and livestock farms characteristics, such as to analyze how different types of farms (*e.g.* small vs. big farms; specialized vs. diversified) influences the motivation of employees either to stay working in the farm or leave the farm. In this sense, our model could be adapted in a tool to be used in advisory services in order to better plan with farmers and employees the future investments in farms (*e.g.* increasing land and herd, new equipment and technologies) in association with employees' career advancement. This could improve working conditions in farms, while avoiding staff turnover.

## Conclusion

We developed and tested an original model linking the evolutions on employees' career with changes on livestock farms. This is a new way to represent changes, since it is not structured by a timeline, but rather by a set of elements in which the analysis is based: 1) three dimensions of employees' career – tasks assignment, specialization/versatility, autonomy; 2) the drivers of changes related to the farm, the team, and the employee him-self; 3) three rhythms of evolutions – progressive, sudden, stable.

This model can be used by researchers to better understand trade-offs between human resource management and changes on livestock farms, such as to analyze how technical changes impact the tasks and the workload of employees. Regarding advisory services, however, it is necessary to adapt the model in a tool. This tool could be used by advisors to plan together with farmers and employees the best way to develop the farm while developing employees' career, which could motivate the employee to stay working in the farm.

## References

Alexandre-Bailly F., 2001. *L'autonomie des individus dans l'entreprise : essai de conceptualisation et regard sur les pratiques*, Gestion et management, HCE Paris.

- 
- Alves L.N., Pocard-Chapuis R., Huguenin J. *et al.*, 2012. Grassland deterioration linked to farm trajectories in the eastern Amazon, *Outlook on Agriculture* 41, 195-201, <https://doi.org/10.5367/oa.2012.0100>
- Aubron C., Noël L., Lasseur J., 2016. Labor as a driver of changes in herd feeding patterns: Evidence from a diachronic approach in Mediterranean France and lessons for agroecology, *Ecological Economics* 127, 68-79, <https://doi.org/10.1016/j.ecolecon.2016.02.013>
- Barthez A., 1996. Les relations de l'agriculteur avec son travail. Une longue histoire de forts changements actuels, *Travaux et Innovations*, 25, 15–18.
- Bertin J., 1977. *La graphique et le traitement graphique de l'information*, Paris, Flammarion, 277 p.
- Bitsch V., 2009. *Personnel Management Research in Agribusiness*, International Food and Agribusiness Management Association, Available at [https://www.ifama.org/resources/files/2009-Symposium/1067\\_paper.pdf](https://www.ifama.org/resources/files/2009-Symposium/1067_paper.pdf) [cit. 2012-05-22].
- Bitsch V., Kassa G.A., Harsh S.B., Muger A.W., 2006. Human Resource Management Risks: Sources and Control Strategies Based on Dairy Farmer Focus Groups, *Journal of Agricultural and Applied Economics* 38:123–136. <https://doi.org/10.1017/S1074070800022112>
- Bitsch V., Yakura E.K. *et al.*, 2007. *Middle management in Agriculture: roles, functions, and practices*, International Food and Agribusiness Management Association, 10, 1-28.
- Bouchakour R., Saad M., 2019. Farm and farmer characteristics and off-farm work: evidence from Algeria, *The Australian Journal of Agricultural and Resource Economics*, vol. 64, Issue 2, <https://doi.org/10.1111/1467-8489.12349>
- Cadin L., Guérin F., Pigeys F., Pralong J., 2012, *Gestion des ressources humaines : Pratiques et éléments de théorie*, 4<sup>e</sup> édition, Dunod ;
- Capillon A., Legendre J., Simier J., Vedel G., 1988. Typologie et suivis technico-économiques d'exploitations : quels apports pour l'amélioration des systèmes fourragers, *Revue Fourrages*, numéro 115, « Adaptation des systèmes fourragers », septembre 1988, 33–55.
- Chand R., Srivastava S.K., 2014. Changes in the Rural Labour Market and Their Implications for Agriculture, *Economic & Political Weekly* 49:47;
- Chizallet M., Barcellini F., Prost L., 2018. Supporting farmers' management of change towards agroecological practices by focusing on their work: a contribution of ergonomics, *Cahiers Agricultures*, Volume 27, n° 3, Mai-Juin 2018, <https://doi.org/10.1051/cagri/2018023>
- Cialdella N., Dobremez L., Madelrieux S., 2009. Livestock farming systems in urban mountain regions: differentiated paths to remain in time, *Outlook on Agriculture* 38, 127-135.
- Cournut S., Chauvat S., Correa P. *et al.*, 2018. Analyzing work organization on livestock farm by the Work Assessment Method, *Agronomy for Sustainable Development* 38, <https://doi.org/10.1007/s13593-018-0534-2>.
- de Menezes M.A., da Silva M.S., Cover M., 2012. Migrant Workers in Sugarcane Mills: A Study of Social Networks and Recruitment Intermediaries in Brazil, *Agrarian South: Journal of Political Economy* 1, 161–180, <https://doi.org/10.1177/227797601200100202>.
- Dedieu B., Servière G., Madelrieux S. *et al.*, 2006. Comment appréhender conjointement les changements techniques et les changements du travail en élevage ?, *Cahiers Agricultures*, CIRAD, 1, 506–513. <https://doi.org/10.1684/agr.2006.0028>.
- Delecourt E., Joannon A., Meynard J.-M., 2019. Work-related information needed by farmers for changing to sustainable cropping practices, *Agronomy for Sustainable Development*, Vol. 39, Article number: 28, <https://doi.org/10.1007/s13593-019-0571-5>.
- Dolan C.S., 2004. On Farm and Packhouse: Employment at the Bottom of a Global Value Chain, *Rural Sociology* 69, Issue 1, 99-126, <https://doi.org/10.1526/003601104322919928>

- 
- Dupré L., 2010. Spécificités du salariat permanent en élevage laitier de montagne : une première approche dans les Alpes du Nord, *Cahiers Agricultures* 19, 366-370, <https://doi.org/10.1684/agr.2010.0423>.
- Eastwood C.R., Greer J., Schmidt D. *et al.*, 2018. Identifying current challenges and research priorities to guide the design of more attractive dairy-farm workplaces in New Zealand, *Animal Production Science* 60(1), 84-88, <https://doi.org/10.1071/AN18568>.
- Everaere C., 2008. La polyvalence et ses contradictions, *Revue Française de Gestion Industrielle* 27, 89-104.
- Everaere C., 1999. L'autonomie dans le travail : sens et contresens, *La GRH : contrôle et autonomie*, Paris, 469-480.
- Fiorelli C., Dedieu B., Porcher J., 2010. Un cadre d'analyse des compromis adoptés par les éleveurs pour organiser leur travail, *Cahiers Agricultures* 19, 383-390.
- Forget V., Depeyrot J., Mahé M. *et al.*, 2019. *Actif'Agri. Transformations des emplois et des activités en agriculture, Centre d'études et de prospective*, Ministère de l'agriculture et de l'alimentation, la Documentation française.
- Gunz H.P., Peiperl M., 2007. *Handbook of Career Studies*, SAGE Publications;
- Harrison J.L., Getz C., 2015. Farm size and job quality: mixed-methods studies of hired farm work in California and Wisconsin, *Agriculture and Human Values* 32, 617-634, <https://doi.org/10.1007/s10460-014-9575-6>.
- Hobbs M., Klachky E., Cooper M., 2020. Job satisfaction assessments of agricultural workers help employers improve the work environment and reduce turnover, *California Agriculture* 74(1), 30-39.
- Hostiou N., Dedieu B., 2012. A method for assessing work productivity and flexibility in livestock farms, *Animal* 6, 852-862, <https://doi.org/10.1017/S1751731111002084>.
- Howard W.H., McEwan K.A., 1989. Human resource management: a review with applications to agriculture, *Canadian Journal of Agricultural Economics* 37 (4), 733-742.
- Howard W.H., McEwan K.A., Brinkman G.L., Christensen J.M., 1991. Human resource management on the farm: attracting, keeping, and motivating labor, *Agribusiness* 7, 11-26.
- Hutchison A.J., Johnston L.H., Breckon J.D., 2010. Using QSR-NVivo to facilitate the development of a grounded theory project: an account of a worked example, *International Journal of Social Research Methodology* 13, 283-302, <https://doi.org/10.1080/13645570902996301>.
- Hutt M.J., Hutt G.K., 1993. Organizing the human resource: A review of centralization, decentralization and delegation in agricultural business management, *Journal of Dairy Science* 76, 2069-2079.
- International Labour Organization, 2007. *Agricultural workers and their contribution to sustainable agriculture and rural development*, ILO-FAO, Geneva.
- Landais E., 1994. Système d'élevage : d'une intuition holiste à une méthode de recherche, le cheminement d'un concept, In Blanc-Pamard C., Boutrais J. (eds), *Dynamique des systèmes agraires : à la croisée des parcours : pasteurs, éleveurs, cultivateurs*, ORSTOM, 15-49.
- Lobao L., Meyer K., 2001. The Great Agricultural Transition: Crisis, Change, and Social Consequences of Twentieth Century US Farming, *Annual Review of Sociology* 27, 103-124, <https://doi.org/10.1146/annurev.soc.27.1.103>.
- Madelrieux S., Dedieu B., 2008. Qualification and assessment of work organisation in livestock farms, *Animal* 2, 345-446, <https://doi.org/10.1017/S175173110700122X>.
- Madelrieux S., Dedieu B., Dobremez L., Girard N., 2009. Patterns of work organisation in livestock farms: The ATELAGE approach, *Livestock Science* 121, 28-37, <https://doi.org/10.1016/j.livsci.2008.05.014>.
- Madelrieux S., Dupré L., Hostiou N. *et al.*, 2010a. Liens entre salariat et activité agricole : itinéraires professionnels de salariés d'élevage, *Cahiers Agricultures* 19, 354-358.
- Madelrieux S., Nettié B., Dobremez L., 2010b. L'exploitation agricole, la famille et le travail : nouvelles formes, nouvelles régulations ?, In Journées d'étude INRA-Cirad: *Le travail en agriculture dans les sciences pour l'action. Parent*.

- 
- Malanski P.D., Hostiou N., Ingrand S., 2017. Evolution pathways of employees' work on dairy farms according to task content, specialization, and autonomy, *Cahiers Agricultures* 26, Article number 65005, <https://doi.org/10.1051/cagri/2017052>.
- Malanski P.D., Ingrand S., Hostiou N., 2019. A new framework to analyze changes in work organization for permanent employees on livestock farms, *Agronomy for Sustainable Development* 39, Article number 12, <https://doi.org/10.1007/s13593-019-0557-3>.
- Mantino F., 2017. Employment Effects of the CAP in Italian Agriculture: Territorial Diversity and Policy Effectiveness, *EuroChoices* 16, 12-17, <https://doi.org/10.1111/1746-692X.12175>.
- Martory B., Crozet D., 2008. *Gestion des ressources humaines : Pilotage social et performances*, 7th ed., Dunod
- Mintzberg H., 1979. *The structuring of organizations*, Prentice-Hall, Englewood Cliffs, N.J.
- Moffatt J., 2016. Understanding career pathways in agriculture: Theorising the farmhand career, *Australian Journal of Career Development* 25, 12-138, <https://doi.org/10.1177/1038416216676605>.
- Moulin C.H., Ingrand S., Lasseur J. et al., 2008. Comprendre et analyser les changements d'organisation et de conduite de l'élevage dans un ensemble d'exploitations : propositions méthodologiques, *L'élevage en mouvement. Flexibilité et adaptation des exploitations d'herbivores*, Éditions Quae, Paris, 23-36.
- Mugera A.W., Bitsch V., 2005. Managing labor on dairy farms: a resource-based perspective with evidence from case studies, *International Food and Agribusiness Management Review* 8, 79-98.
- Nettle R., 2018. International trends in farm labour demand and availability (and what it means for farmers, advisers, industry and government), *International Agricultural Workforce Conference*, Cork, Ireland, 8-16.
- Nettle R., Kuehne G., Lee K., Armstrong D., 2018. A new framework to analyse workforce contribution to Australian cotton farm adaptability, *Agronomy for Sustainable Development* 38, Article number 38, <https://doi.org/10.1007/s13593-018-0514-6>.
- Nettle R., Paine M., Petheram J., 2005. The Employment Relationship: a conceptual model developed from farming case studies, *New Zealand Journal of Employment Relations* 30, 19-35.
- Perrot C., Landais E., Pierret P., 1995. L'analyse des trajectoires des exploitations agricoles. Une méthode pour actualiser les modèles typologiques et étudier l'évolution de l'agriculture locale, *Économie Rurale* 228, 35-47, <https://doi.org/10.3406/ecoru.1995.4744>.
- Pettigrew A.M., 1997. What is a processual analysis?, *Scandinavian Journal of Management* 13, 337-348, [https://doi.org/10.1016/S0956-5221\(97\)00020-1](https://doi.org/10.1016/S0956-5221(97)00020-1);
- Richards T.J., 2018. Immigration Reform and Farm Labor Markets, *American Journal of Agricultural Economics* 100, 1050-1071, <https://doi.org/10.1093/ajae/aay027>;
- Riisgaard L., Hammer N., 2011. Prospects for Labour in Global Value Chains: Labour Standards in the Cut Flower and Banana Industries, *BJIR International Journal of Employment Relations* 49, 168-190, <https://doi.org/10.1111/j.1467-8543.2009.00744.x>
- Ryschawy J., Choisis N., Choisis J.P., Gibon A., 2013. Paths to last in mixed crop–livestock farming: lessons from an assessment of farm trajectories of change, *Animal* 7, 673-681, <https://doi.org/10.1017/S1751731112002091>.
- Sanders J., Grip A. de, 2004. Training, task flexibility and the employability of low-skilled workers, *International Journal of Manpower* 25, 73-89, <https://doi.org/10.1108/01437720410525009>.
- Staelens L., Louche C., 2017. When the farm-gate becomes a revolving door: An institutional approach to high labour turnover, *Human Relations* 70, 1464-1485, <https://doi.org/10.1177/0018726717702209>.
- Terrier M., Madelrieux S., Dufour A., Dedieu B., 2012. Saisir la diversité des formes d'articulation entre la famille et l'exploitation agricole : une grille de lecture, *Revue d'Études en Agriculture et Environnement* 93, 299-322.
- Toumen C., 2007. Activité, tâche, poste, métier, profession : quelques pistes de clarification et de réflexion, *Santé Publique* 19, 15-20.

- 
- Ullah A., Zheng C., 2014. The Impact of Strategic Human Resource Management Practices on Australian Dairy Farm Performance, *In* Machado C., Davim P.J. (eds), *Work Organization and Human Resource Management*, Springer International Publishing, 55-72.
- Vafaï K., Anvar S., 1998. Délégation et hiérarchie, *Revue Économique*, Volume 49, number 5, 1199-1225, <https://doi.org/10.2307/3502771>.
- Wesarat P., Sharif M.Y., Majid A.H.A., 2014. A Review of Organizational and Individual Career Management: A Dual Perspective, *International Journal of Human Resources Studies*, Volume 4, number 1, 101-113, <https://doi.org/10.5296/ijhrs.v4i1.5331>.
- World Bank, 2008. *Agriculture for development*, Washington.