

How to Model Work Organisation in Livestock Farms Implementing a Combination of Economic Activities?

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Abstract

The viability of mountain livestock farms often involves the implementation of combinations of economic activities (farming, farming diversification or services, non agricultural activities), which raises other problems, notably of work organisation. Starting i) from contributions to work analysis by livestock research and ergonomics ; ii) from 15 cases of livestock farms surveyed in the Northern Alps, we are seeking to model work organisation as a system of activities. For this, in reference to Knowledge Engineering, we formalise i) a model of the domain or ontology, which defines the concepts used (activities -task/workers entities-, relations between activities...) and their relations to each other ; ii) a model of reasoning to qualify forms of work organisation from the data of a case (who does what, when, where). Here we detail the approach at the scale of the period, an interval of time characterised by a particular form of work organisation. The study of the different forms of daily work organisation is the basis for the qualification. Three forms of work organisation at period level are described using case studies: a stable form of organisation over the period, a variable form on a day-by-day basis, a variable form according to a weekly rhythm. The identification of the factors playing on these forms of organisation adds to our understanding of them.

Key Words: work organisation, modelling, livestock farm, combination of economic activities

Introduction: sustainability of mountain farms and the challenges of modelling the work organisation in livestock systems

Many mountain farmers have developed systems based on combinations of activities: i) farming activities (one or more); ii) farming diversification or services associated with the farm; iii) non agricultural activities (employment in ski resort for example) (Blanchemanche, 2000). Such combinations are encouraged because they are seen by politicians as the way to sustain small farms. They do provide acceptable incomes for households, while settling a minimum of economic activities in rural areas, and allowing land to be maintained in the least productive areas (Laurent et al., 2000). However studies concerning these complex systems emphasize that their sustainability can be brought into question for reasons of work. If the duration of work is one of the first points touched, farmers discuss also problems of work organisation. Beyond the changing content of the farming tasks and workforce all over the year, the farming households express their difficulty in articulating within periods:

- tasks that follow different rhythms (daily, weekly, seasonal rhythm);
- tasks that are either imperative or able to be postponed at a later date (Dedieu et al., 1999);
- fluctuations in the composition of the work group, which could in no way be reduced to «farm worker units».

Analysing and qualifying the various forms of organisation implemented by farmers to face the different work situations during a year constitute an essential line of investigation into the sustainability of small

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farms. In this paper, we introduce the main elements of a qualitative modelling of *work activities systems* in livestock farms, we are working on. The purpose of the modelling is to serve as an exploratory tool with a view to integrating the « work organisation » dimension into diagnoses of the functioning of farm systems (specialised or not) and to help advisors in their accompanying of technical or organisational changes in farms. As the tasks to be done and the manpower are not the same all the year, our modelling must enable work organisation to be analysed taking into account the various forms of organisation per period. We will present and illustrate the modelling framework and results at the scale of a period of the year.

I- Modelling framework

The data used to construct our modelling come from two sources of information: fifteen cases of mountain livestock farms where we carried out surveys ; existing theoretical frameworks that we adjust to take account of the concrete work organisation in the cases studied.

1- Disciplinary contributions to work analysis

Work is studied by several disciplines (Dedieu and Servièrè, 2001). Our proposal places two of them in relation: livestock research into farming systems and ergonomics.

Livestock research into farming systems proposes a temporal characterisation of tasks and a cutting up of the farming year into periods

Echoing Valax (1986), livestock farming systems researchers consider that studying the temporal management of activities requires a typology of tasks not in relation to the nature of the work, but to their temporal characteristics. Dedieu et al. (2000) distinguish i) obligatory routine work (TA for “*travail d’astreinte*”) - work that has to be done every day, repetitive from one day to the other, not easy to postpone or to concentrate, such as the daily care of animals (milking, feeding, cleaning out...); ii) seasonal work (TS for *travail de saison*), that can be postponed and/or concentrated over a given period, such as work in the fields, or handling animals..., iii) interstitial work that is defined as not imperative (it doesn’t concern directly the management of the herd or of the land). Laurent et al. (2000) proposed an extension of this categorisation to other economic activities. This led them to specify that obligatory routine work, that by definition cannot be deferred, can be of two rhythm types : daily obligatory work (such as milking) has to be distinguished from non daily obligatory work (such as selling on the market twice a week).

To take account of the linking up of different work periods, associated with ways of organising plant and animal production cycles together, Dedieu et al. (2000) also propose to cut up the farming year with reference to obligatory routine work. A period is an interval of time for which the TA is of constant duration. Then the TS are positioned in the calendar, which situates periods of strong competition between tasks and specifies how combinations of farming tasks to be done at each period evolve.

Ergonomics places the activity at the centre of work analyses

Tasks take on a different meaning according to the context in which they are carried out. For example, the task of maintaining the farm areas is interstitial for some farmers: it is carried out when they have the time. It becomes a structuring feature of work organisation when farmers have hired a worker to carry out this function (Chabanet et al., 1999): slots in the worker’s timetable are reserved for it. So for a same

task content, the temporal characteristics allotted by the farmer differ because of the association he makes between the task to be carried out and the workers available. What is more, farming work is subject to hazard, notably climatic hazard and availability of manpower, causing frequent adjustments to the work organisation. This is why we were interested in ergonomics and especially i) in their concepts of work activity, system of activities, and regulation; ii) in representations of relations between activities.

The subject of ergonomics is how people function at work, with work analysis as its method. The theoretical foundations of work analysis are based on the distinction between: i) the task, which is the work to be done; ii) the activity, which is the work actually done. The non correspondence between the two comes from the intervention of an operator or a work team, who with their own characteristics, will adapt the work to be carried out to the situation (Leplat, 1994). Assuming this concept of activity enables us to understand how a combination of economic activities is implemented via a system of *work activities*¹ (Curie and Hajjar 1987), in other words, via a set of entities [task*team], relations between these entities and regulations. The relations between activities concern orders of priority, temporal orders (succession,...) at different scales of time. Regulation is considered as the making up of perturbations by the search of new balances. Benchekroun and Weill-Fassina (2000) differentiate regulations of an i) individual type: substituting one activity for another, postponing it, anticipating it, modifying the operating mode...; ii) inter-individual type: new distribution of tasks between individuals.

2- Modelling approach

Constructing a conceptual model

The purpose of modelling is to qualify forms of work organisation. From data of a livestock farm case, how do you take account of the way tasks and workers are linked all over a year? It is in fact a question of knowledge enabling such a representation to be constructed. Knowledge Engineering (KE) for action (Teulier and Girard, 2001) proposes «to construct a set of concepts, theories and tools to analyse and model human activity in a set of organisational arrangements». By mobilising KE, we propose a conceptual model that, from case studies, makes it possible to understand the diversity of forms of organisation, and make them intelligible by going further than just a simple description of the cases. The knowledge used is structured in i) a model of the domain or ontology which defines the concepts of the domain (here work organisation in livestock farming) and their relations ; ii) a model of reasoning which consists of defining the actions to be implemented to arrive at qualifying forms of work organisation from case study data.

Survey data

The principle of the survey was to collect data on work practices at the scale of a farming year. We proceeded in two phases. The first visit consisted of collecting information on i) the structure and present functioning of the farm, the other economic activities of the household, ii) the usual work practices: in general, who does what, where and when. Processing the data served to cut up the year into work periods. The objective of the second visit was to discuss with the farmer this cutting up and organisation by period, then to deal with variations in relation to these forms of organisation (which occur regularly enough to be integrated into the functioning). We took into account the activities associated with organisations internal to the farm system and to the family, or external organisations important enough to have an impact on the organisation of farming work at the scale of the period. The

¹ From now on, the terms activity and work activity, if not otherwise indicated, are meant in the ergonomist's sense.

observation units are, on the one hand, the farm system and on the other, the basic group and its combination of economic activities. The basic group corresponds to the members (the farmer, the couple, associates...) who organise the work on the farm. It is indispensable to know the combination of their economic activities to understand the work organisation of the farm, and their margin for manoeuvre, in order to define possible ways of development.

The survey is based on 15 cases of livestock farms (principally dairy cattle, but also sheep and goats) situated in Maurienne (French Northern Alps). They were chosen according to a hypothesis of diversity of cases in relation to combinations of economic activities and work groups (number of permanent workers, seasonal workforce...) (table 1). Our sample is considerably marked by pluriactivity, the use by the animals of summer mountain pasture, and by family participation that is still significant in the form of helping out.

Table 1: diversity of farms surveyed

	Number of persons in the basic group		
Combined activities	1	2	3 and over
One or more livestock activities (cattle, sheep, goats; milk, meat)	2	1	
Livestock activity (activities) and diversification or service activity (activities)	1	2	
Livestock and non farming activity (activities)	5	2	1
Livestock diversification and non farming activity (activities)		1	

II- Results: modelling work organisation at the scale of a period

1-Model of reasoning to qualify forms of work organisation of a period

The general approach for modelling work organisation at the scale of a period is based on 5 stages (figure 1). We focus here on elements that enable the way between stages 2 and 3 (identification of the forms of daily work organisation, delimitation of the periods) and stage 4 (qualification of the form of organisation of a period). That is to say we will present the concepts used to extract and analyse the different levels of organisation: from the activities to the forms of work organisation. The stage 4 will be presented through an illustration: three different types of work organisation met in farms during late spring. The stage 4' (the identification of factors playing on the work organisation) will just be introduced.

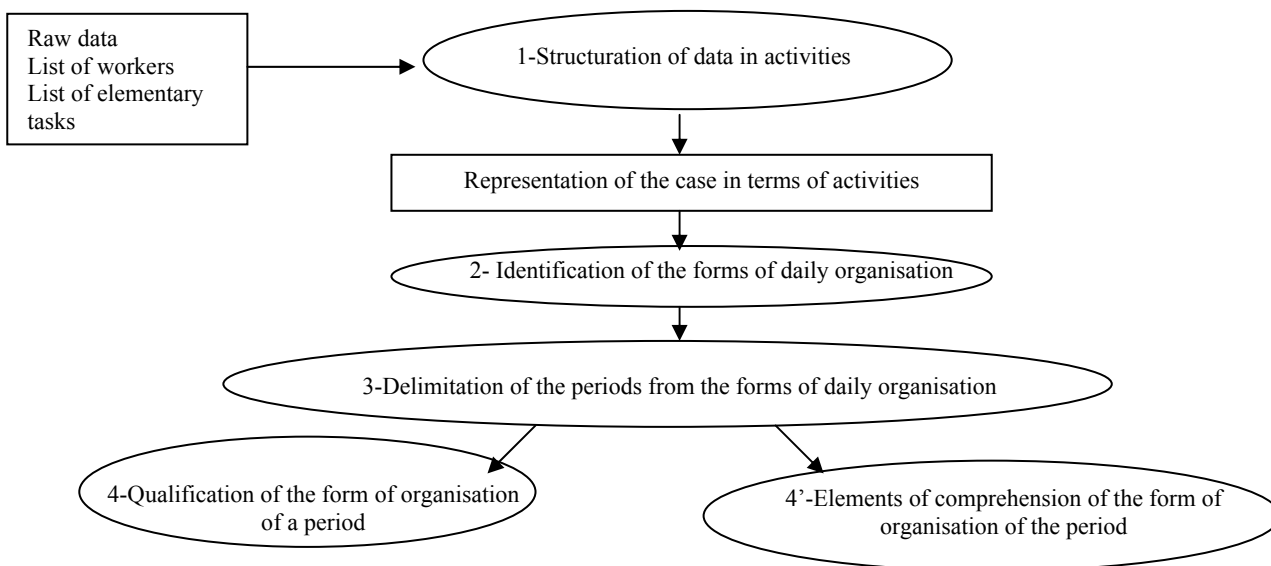


Figure 1: model of reasoning to qualify the form of work organisation of a period

2- Ontology relative to work organisation in livestock farms

2.1- The elementary concept: activity and relation between activities

The activities: characterisation by a task, a team of workers and a temporal characteristic

We define an activity as an association between a task, the team which has the responsibility for carrying it out and a temporal characteristic. The content of each task is specified from a list of elementary tasks. This list was constructed on the basis of the smallest common level of breaking the work down into tasks in the cases studied. As far as the work team is concerned, we specify the characteristics of the workers according to i) their type of involvement on the farm, as in Dedieu et al. (2000): the basic group, help (family or other), mutual help between farmers, employees, service providers; ii) their rhythm of involvement : i) permanent (the worker is present every day, except for days off, over the unit of time considered) ; ii) regular (he is present with a certain frequency (defined or not), but not daily). We note in particular weekly rhythms, such as the presence of children at weekends (WE); iii) occasional (this concerns people with no regular rhythm : asked for help or lending a hand). The type and rhythm of workforce involvement enable us to specify the profile of the work group and the type of help to which the basic group has recourse in the management of its system of activities.

To understand the systems of activities, we were led to specify the activities by the temporal characteristics of their tasks (table 2). The characteristics are the combination of different temporal criteria :

- the rhythm, daily or not. A daily rhythm refers to the repetitive nature of the task from one day to another, that cannot easily be concentrated. Here we find characteristics of the TA: care of animals, activity on a ski resort monopolising members of the work group every day;
- the character of being deferred. It can be expressed in the day (daily task whose completion time can be adjusted, such as monitoring batches of easily managed animals, for example), or in the period, over an interval limited by deadline dates (DD). The capacity for being deferred in the period expresses the possibility of putting off to another time a task even though all the conditions for carrying it out are right. For example, for certain farmers, haymaking, a non daily task (because dependent on the climate) cannot be put back: as soon as conditions are right, they do it. For others, it can be deferred : even if the conditions are right, they sometimes put it off to another day, because other tasks take priority, such as sorting and selling mountain pasture lambs, or they never work on Sundays and consequently will not mow on a Friday.
- the capacity for postponement to another period;
- the predictability of its positioning (in the day or in the period);
- the temporal extension: task of limited duration (the tasks correspond to occasional interventions which last one day or less) or task of an «interval» type (the tasks are spread over several days in a possible interval of work).

Table 2: types of activities according to the temporal characteristics of their task

daily task → daily activity (DA)	the position of the task is fixed, and cannot be deferred in the day → fixed daily obligatory activity (e.g.: milking)	
	the position of the task is not « fixed » in the day	the position is free, can be deferred in the day → free daily obligatory activity (e.g.: taking water to animals in the paddock)
		the occurrence of the task is not predictable and the task can't be deferred when the conditions are gathered → activity of a «fireman» type (e.g.: direct sale that varies with the presence and number of customers)
non daily task → non daily activity (NDA)	task of limited duration	repeated limited duration task → non daily obligatory activity (e.g.: work in the resort 5 days/week)
		repeated limited duration task that can be deferred in the period → activity of a «repeated manipulation» type (e.g.: visit to animals in mountain pastures once/week)
	single limited duration task → activity of a «manipulation» type (e.g.: prophylaxis)	
	task of an interval type	defined start and finishing deadline dates (DD), and during this interval: accomplishment of the task to its completion. Task that cannot be postponed → activity of a «worksites» type (e.g.: spreading work)
		defined start DD from which accomplishment of the task to its end. Task that cannot be postponed → activity of a «harvest» type (e.g.: hay-making, harvest)
		accomplishment of the task to its completion before a defined finishing DD. Task that cannot be postponed → activity of a «preparation» type (e.g.: preparation of paddocks, equipment...)
start and finishing DD and during this interval, the farmer accomplishes what he can of the task. Task that can be postponed to another period → activity of a «maintenance» type (e.g.: harrowing fields, clearing scrub)		

The examples are indications only. They do not imply that the spreading task, for example, is always of a "worksites" type, it can also be of a "maintenance" type in some farms...

The relations between activities

To understand how a combination of economic activities is implemented, the structuring of the activities must be explicitly taken into account. Among the relations between activities, we distinguish, according to Javaux (1996), orders of priority between activities; relations of a temporal order. To understand the structuring of activities with different rhythms, we specify these relations at a daily scale and at the scale of the whole period. They can also be unspecified (boxed text 1).

Boxed text 1: relations between activities (x, y, z)

Daily relations

Subordination: y takes place at the time left available by x;

Interstice: if there is some time left on some days, once x has been done, then y is done;

Parallel working: x takes place at the same time as y;

relations at the scale of the period

succession: y follows x as the period progresses ;

conditional connection (CC) : in defined conditions x is implemented, otherwise y. The CC enable alternative ways of carrying out the tasks to be specified. They are often associated with the climate;

priority: x takes priority over y in the period;

interruption: x becomes a priority over y and z when the conditions are right for its being carried out. Its implementation interrupts y and z for the day, or defers y and z in the day.

Unspecified relations: no order of priority or temporal order is specified

These relations enable priorities between activities to be specified. For example, if a farmer works in a resort in the winter and is subject to set hours, then the farming activities in which he is involved take place in the time slot left available by the skiing activity. In other words, the farmer will take care of the animals before and after the skiing: the farming activity is subordinate to the skiing activity. Other

farmers are free in the organisation of the resort activity at a daily scale (e.g.: packing down the slopes when it has snowed), in this case it is the non farming activity that is subordinate to the farming activities.

The characterisation of the system of activities is not based just on the technical viewpoint

The activities and the relations between them depend on the way the farmers see them. Our goal, starting from the farmer's expression on who does what, is to identify the specific features of his system of activities. The allocation by a farmer of temporal characteristics to his activities and relations between them translates the way he positions an activity (manages time and constraints) in his system of activities. This represents the importance of each task in his eyes (which tasks are daily, which tasks he accepts to delegate, postpone, order of priorities...), in association with the workforce available and its characteristics. So an activity is not defined a priori, it is determined in each case from what the farmer says.

2.2- The concepts at the different levels of organisation: from the activities to the forms of work organisation of a period

The forms of daily work organisation

To express the temporal management of activities, especially the articulation between daily (DA) and non daily activities (NDA), we consider the daily scale as an elementary scale of work organisation. Each day leads to a particular combination of activities according to the meteo, the present workers and the tasks to be done. We call *form of daily organisation* (FDO), a synthesis of several possible daily combinations of activities in which the DA and the relations between DA and NDA are the same whereas the NDA can vary (figure 2).

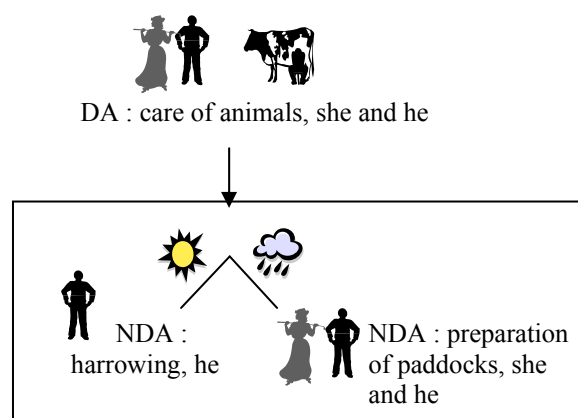


Figure 2: two daily combination of activities for a same FDO

In this example, there are two possible daily combinations of activities: when it's sunny and when it's rainy.

In each case, the form of the DA is the same, and the NDA are subordinate to the DA. Thus, we represent these two combinations in a single FDO.

Thus, there are as many FDO as different forms of DA (described by their task, team and temporal characteristics) and relations between DA and NDA.

Alternation of FDO

Within a same interval of time of the year, several FDO can alternate. Two basic rhythms of alternation between FDO have been identified:

- *a day-by-day rhythm.* This case is linked with the implementation of particular activities which result in modifying the form of daily activities and their arrangement. For example, if it's sunny a worker carries out in priority non daily tasks in the fields whereas he participates in DA (care of animals) when it's rainy and can't go in the fields.
- *a weekly rhythm.* Daily activities can take different forms depending on the days of a week in relation to: i) the intervention of regular workers on daily activities (children at WE for example). Their presence brings about a redistribution of tasks and therefore a redefinition of daily activities; ii) the occurrence of non daily obligatory routine activities (work in a ski resort in winter 5 days/week for example), modifying the daily activities.

The different forms of organisation are our expression of *regulations*. Indeed, the livestock farmers adapt their organisation to face the different work situations of the period (tasks to be done, present workers, meteo...). It exists other regulations that are more occasional, of an «exceptional» nature (punctual absence of workers, fluctuations in the conditions for carrying out tasks...), but they are not taken into account in the qualification of the work organisation at this stage of the study.

The periods: characterisation by a combination of FDO

Over an interval of time, the FDO can be superimposed if they alternate with a day-by-day or weekly rhythm, or they can follow each other (one FDO when the animals are inside then another FDO when they are outside). A *work period* is an interval of time, characterized by a single FDO or several FDO alternating on a day-by-day or weekly basis (figure 3).

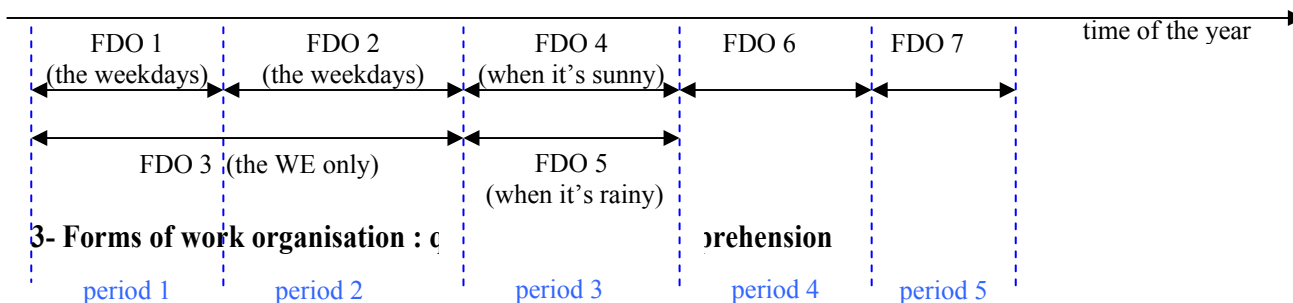


Figure 3: delimitation of the periods

3.1- Qualification of forms of work organisation in three farms at the scale of a period

The alternation of FDO is one of the terms for the qualification of work organisation at the scale of a period. The way the work is divided and coordinated into subsets of activities is another one, which won't be detailed here. According to the number of FDO and their rhythm of alternation (in the case there are several FDO in a period), different types of work organisation can be defined: i) *a stable form of organisation over the period* when the period corresponds to a single FDO ; ii) *a variable form of organisation in the period* when the period corresponds to several FDO alternating (on a day-by-day or weekly basis).

We illustrate below three different work organisations set up by farmers at a same period (late spring).

A stable form of organisation over the period

The daily organisation is founded on the same principle over the whole period (one single FDO). The organisation changes with the change of period (boxed text 2).

Boxed text 2: a FDO stable in the period – case of JCG

For this farmer, producing milk all year round with 20 dairy cows (VL) in the Beaufort area, the tasks to be done from mid May to mid June consists of caring of the animals outside, keeping on with work on the land areas, while preparing the summer mountain pasture and hay making, and also collecting milk every day for the cooperative on his sector (1 to 2h every morning). This farmer benefits from the help of his mother, permanent in this period, to milk the VL in the animal housing. For daily travels of animals and other tasks he is alone. For significant animal travels, he tries to wait for the WE to have help from his nephew or his sisters. The daily organisation of activities is stable over the whole period (one single FDO): he milks with his mother, then takes the VL to the paddock and goes to collect the milk. Before the evening milking (when his mother is present again) and depending on the weather, he carries out work, mechanised (end of spreading, harrow around the alpine chalet...) or not (preparation of fields, of the alpine chalet, of the hay-making equipment...). Occasional regulations can occur concerning situations when he is behind with his work, solved by postponing tasks between periods.

In the case of JCG, *the occurrence of non daily activities is always subordinate in this period to the unfolding of the daily activities*. If there are regulations, they are of the occasional type (but they are not integrated in the qualification).

A variable form of organisation in the period on a day-by-day basis

Several FDO alternate in the period, linked with the setting up of particular activities which cause the form of daily activities to be modified. The daily organisation is subject to conditions, in other words it is defined from one day to another (boxed text 3).

Boxed text 3: two FDO alternate according to weather conditions – case of LV

For this farmer, the only member of the basic group, who produces milk all year round with 30 VL, we find the same tasks to be done, from late May to late June, than in the previous case (minus the milk collection round): care of the animals outdoors, while carrying out work on the land areas, and preparing hay and summer mountain pasture. At this period, the farmer benefits from the permanent presence of his brother, and with whom he is interchangeable. LV reserves 2 tasks for himself: preparing the high pastures, because he will be there in the summer, and the transport of manure he gives to the owners of fields he uses. One FDO is when LV is busy with the daily tasks around the herd with his brother. In the time left available, non daily tasks take place, which they carry out together or separately according to the nature of the task. Another FDO is defined when the brother carries out work on the fields: slurry spreading, harrowing... In these cases, LV deals with the daily work alone and with his brother's herd (slaughter cattle and goats). In other words, according to the conditions of the day (suitable or not for spreading...) the organisation of daily activities varies.

In the case of LV, there are two FDO: one form corresponds to a division of work between the daily tasks (including at the brother's) carried out by LV and the work on the fields carried out by his brother. The other form (when the work outside is not possible) is that they work together for the daily tasks and share out the rest. The alternation between these two forms is linked to weather conditions. *The definition of daily activities is dependent on the occurrence of non daily activities*.

A variable form of organisation in the period according to a weekly rhythm

Several FDO alternate in the week, in association with the presence of regular help on a weekly rhythm (boxed text 4) or with the occurrence of non daily obligatory activities.

Boxed text 4: two FDO alternate in the week because of the presence of children at WE – case of the JD and VD couple

With this couple of farmers, producing milk all year round with 50 VL, goat's milk cheeses with 30 goats and high pasture lambs with 100 ewes, the tasks to be done from mid May to mid June are similar to the previous case : care of the animals outdoors (except that there are three herds), with in addition the making and sale of goat's cheeses, while carrying out work on the fields, and preparing for the period of summer mountain pastures and hay making. The tasks are distributed differently according to the farming units. They carry out together the care of the VL and goats, but he (JD) looks after the ewes and she (VD) makes the cheeses and sells them. JD can do everything on the farm, whereas his wife cannot milk the VL alone and she does not drive the tractors, so it is he who sees the tasks on the land areas. They also benefit from the help of their children at the WE. The children are not able to do everything. The son can carry out work on the fields and look after the VL, the daughter works more with the goats. As soon as they arrive on the Friday evening, the work organisation is changed. She sees to the goats and cheese with her daughter. He looks after the VL with his son, and they divide out the rest. JD will see to everything concerning the herds and his son the fields. All the same, JD reserves for himself the work with slopes and the spreading of fertiliser for the commune. Thus, the daily organisation of activities varies according to the time of week. Certain tasks requiring manpower are carried out preferably at WE when the children are there. If they cannot wait for the WE, like sometimes the change of paddocks for the VL, then the task is carried out during the week, which requires another organisation solution, which correspond to an occasional regulation: JD and VD call on neighbours for help.

In the FDO of the week JD and VD carry out a group of activities together and each one has activities reserved. In the FDO of the WE a division of the work operates between men and women. *The definition of daily activities is dependent on the weekly rhythm of presence of regular workers.*

3.2-Elements of comprehension of the form of organisation

The system of activities of a period is our way of representing the organisation produced by a set of decisions taken by livestock farmers. They also express : i) the way in which the farmer has « negotiated » the constraints on the long term for carrying out the activities ; ii) the possibilities for the farmer to mobilise a network of help and to delegate tasks to others. It is interesting to identify these factors, and establish their relations with the forms of work organisation observed. The factors can be linked with the social environment (workforce, family, group farming organisations...); to biological cycles, to weather conditions; to the buildings and equipments; to contractual commitments. What is more, the farmer can fix constraints for himself (dates, preferred times for carrying out certain tasks).

For example, in the case of JD and VD, there is a constraint on the time of milking the cows due to the milk collection system. Thus they deal with the cows before the goats since they do the cheese themselves and are free with it. Other constraints associated with the social environment concerning carrying out a task for others, whether the owners for LV or the commune for JD, are translated by the fact that the corresponding task is reserved for the farmer himself, while the same task, when it is for the farm, can be carried out respectively by the brother or the son.

Discussion - conclusion

The pursuit of this modelling approach is in progress and concerns two aspects:

- to qualify work organisation at the scale of the period, not only in relation to the alternation of FDO, but also in relation to the division and co-ordination of activities;
- to qualify work organisation at the scale of the agricultural year, on the basis of the periods and their linking up.

The prospect for this work is that it may serve as a basis for considerations about technical or organisational changes, and their consequences on work organisation. For this we have chosen to situate ourselves where [the farm and the farming work group] meet [the households and their combinations of

economic activities]. Then we were led to propose an ontology of work organisation in livestock farming and a model of reasoning. This makes it possible to take account of farming activities and the other activities in the same way, and allows us to treat the capacities for evolution of livestock farms involved in complex systems of activities.

In the case of modification of the combination of economic activities or of the work group, as for the adaptation of livestock management to the issue of sustainability, the approach of transformations in the work organisation could be identical. It would be a question of determining i) in what way the delimitation and expression of each period is modified ; ii) in what way the forms of daily organisation risk being disturbed in their content (the activities and the relations between activities) and in their occurrence.

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