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Micro-Level Sustainability Transition Pathways of Institutional Food Services in France

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Very few studies have dealt with sustainability transitions in the agrifood sector, especially in institutional food services (IFS), and notably at a micro level. Based on 29 interviews with head cooks in France, we characterized the micro-level sustainability transition pathways that institutional catering units have been following, taking essentially four sustainable practices into consideration: organic food use, ultra-processed food use, vegetarian meals and waste management. We identified four transition pathways according to the speed, size, dimensionality and time-period of changes in those practices. We showed how these pathways are linked to the diversity of transition contexts; internal (e.g., skills) and external (e.g., local suppliers) resources and constraints. This original empirical study revealed the diversity and feasibility of sustainability transition pathways in IFS. It also showed that they do not require unreasonable increases in resources. Positive narratives on transitions need developing, together with diagnosis tools to guide them.

Keywords: behavioral studies, catering, food service, sustainability transition, micro-level transition, practice change

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INTRODUCTION

Society is facing a number of severe environmental issues on a global scale including climate change, resource depletion and loss of biodiversity (Rockström et al., 2009). Another related and major concern is food security, i.e., a failure to provide healthy and environmentally sustainable diets on a global scale (Godfray et al., 2010). Addressing these issues is one of the major challenges to face these coming decades, calling for a sustainability transition in the agrifood sector. Transitions of agrifood systems are an emergent theme in transition research (El Bilali, 2019), especially institutional food services (IFS), a growing part of the agrifood sector in Europe. IFS gather "entities that provide meals at institutions including schools, colleges and universities, and hospitals, as well as correctional facilities, public and private cafeterias, nursing homes, and day-care and senior centers" (Conner, 2014). France, has the most developed IFS sector in Europe, representing about 3 billion meals served per year, i.e., 36% of out-of-home meals (GIRA Foodservice, 2020). Thus, transition of the IFS sector is a considerable lever for fostering sustainability in agrifood systems.

Transitions are mainly considered as sectoral transformations (Elzen et al., 2004). Accordingly, some studies provide insights on the brakes and levers related to a sustainability transition of IFS at sector level (Lopez et al., 2019). However, as pointed out by Markard and Truffer (2008) for sustainability transitions at large, understanding of transitions also requires "[considering] more explicitly innovation processes as perceived at the micro level of organizations." Very few studies

have addressed the micro-level dynamics of change in institutional catering units (ICU) and nearly all these studies focus either on specific functions (e.g., food procurement) or on specific impacts (e.g., dietary changes). A Finnish study (Kaljonen et al., 2020) conducted at a workplace restaurant monitored changes in consumer choices of food items linked to the application of informational and nudging techniques (e.g., climate-friendly labeling informing customers). Also in Finland, Lehtinen (2012) critically analyzed sustainability of the delivery of potatoes from a local farmer to an ICU preparing school meals. A multi-site study across Europe (Tregear et al., 2022) went further and quantitatively assessed the environmental, economic and nutritional impacts of different food procurement models in ICUs. A study (Morley, 2021) based on English school ICUs involved in the Soil Association's Food For Life program explored the impact of public food procurement on farmers' strategies and the potential for further steering on-farm changes toward sustainability. Another study (Stahlbrand, 2016) examined the establishment of this program at two universities and concluded that sustainability transitions in ICUs are complex, difficult, labor-intensive and require a further study of who are known as "practitioner-champions" to generate insights in view to larger-scale transitions.

Our objective was to capture the main types of sustainability transition pathways followed by ICUs at a micro level, where strategic and operational changes regarding multiple functions within IFS take place (e.g., food procurement, cooking). Hence, we characterized the changes that ICUs had implemented during their sustainability transitions. To do so, we adapted the conceptual framework "trajectories of changes in practices" by Chantre et al. (2014) to analyze the sustainability transition pathways of 29 ICUs in France. Following Wahlen et al. (2012) who highlighted the active role of catering professionals in such changes, we interviewed the head cooks of these ICUs in a view to rebuilding their transition pathways over time and built a typology of transition pathways. In addition to opening insights into supporting transition in the IFS sector on a larger-scale, our article provides an analytical framework suited to the analysis of micro-level transition pathways.

ANALYTICAL FRAMEWORK

Micro-Level Transition Pathways

In agricultural sciences, micro-level sustainability transition pathways have been analyzed at the level of farms particularly in recent years (Lamine, 2011; Bouttes et al., 2020; Perrin et al., 2020). Several such studies conceptualize a sustainability transition pathway as a succession of phases starting from an initial and unsatisfactory situation, followed by a series of transitory phases which lead to a given end point. The transition process is open-ended and adaptive as it co-evolves with the environment. Changes in environmental conditions such as societal demand and policy incentives may lead to regular re-evaluation and re-adjustment of the transition goals and of action principles guiding the implementation of sustainable practices.

A transition pathway at the micro level of an organization like a farm or an ICU can thus be regarded as a chain of successive "coherence phases", i.e., phases of relative stability characterized by expected consistency in general technical, economic and social goals and action principles (Chantre et al., 2014). Such phases are analytical constructs characterized by interdependencies among general goals, sets of action principles and related practices to achieve expected functions (**Figure 1**). As new goals emerge due to opportunities and constraints linked to environmental and organizational features, especially available resources (human, material, etc.), or current performance patterns differ from expectations, thus requiring changes in action principle and implemented practices, they trigger new phases (Perrin and Martin, 2021). The development of new knowledge necessary to support the transition will inevitably accompany each successive phase strengthening the synergy toward sustainability among action principles and implemented practices (Chantre et al., 2014). The transition and its phases can be qualified according to the speed, size, and time-period of change (Rotmans et al., 2001) as well as its dimensionality, i.e., whether changes across multiple dimensions occur simultaneously or not.

Conceptual Model of ICU Sustainability Transition Pathways

Based on previous literature on IFS (Stahlbrand, 2016; Lopez et al., 2019; Magrini et al., 2021) combined with the conceptual model of coherence phases, we instantiated a conceptual model of ICU sustainability transition pathways. In ICUs, the head cook discusses a catering project (e.g., establishing the share of organic products to be used) with elected representatives who usually decide upon the budget assigned to the unit. This unit has intrinsic features (e.g., size, facilities) defining opportunities and constraints, in addition to any relating to the environment (e.g., presence of local organic farmers). These facts make it possible to set general goals and define action principles and related practices accordingly. The main functions found in ICUs are activity planning and monitoring, food procurement, meal preparation, serving, cleaning, and waste management (**Figure 2**). These functions are not all equal in terms of impact on ICU sustainability. Some (e.g., food procurement) are directly linked to more sustainable practices (e.g., organic food procurement, Section Sustainability Challenges for ICUs) whereas others have a more limited or indirect impact (e.g., serving).

Several of these functions are interdependent. Menus are prepared in advance, possibly in collaboration with a dietitian. Based on these menus and expected number of meals to be prepared thanks to activity monitoring, the head cook orders corresponding types (e.g., local, organic, including ultra-processed or not) and amounts of food from farmers, food industries or supply intermediaries, according to territorial context. Whenever needed, he/she can expect support in this procurement process from food and agriculture organizations. Once the food is delivered, the head cook and his/her team of cooks prepare the meals based on their accumulated knowledge and skills. This preparation leads to later stages involving cleaning, using cleaning agents, and waste and leftover management. Meals are served in the dining room, and presented to guests by dining-room staff previously briefed by the head

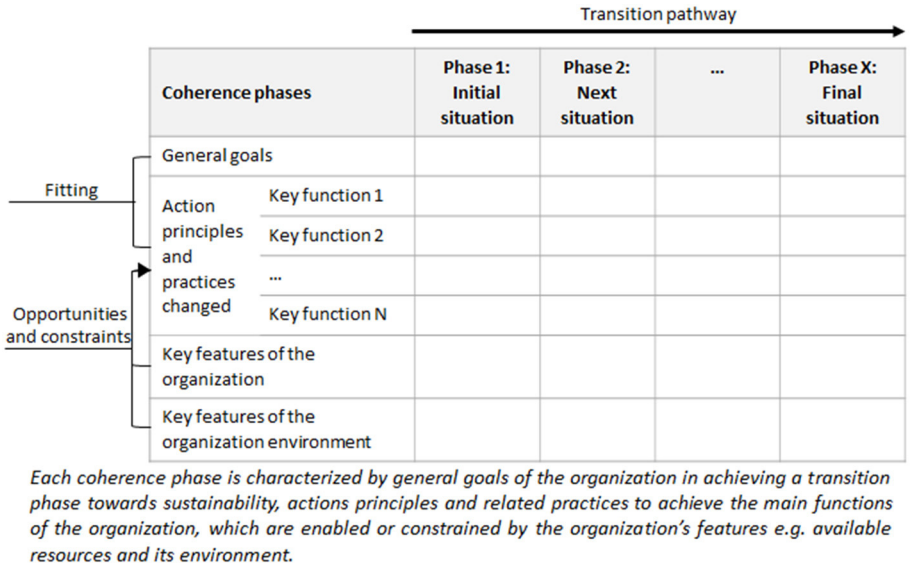


FIGURE 1 | Conceptual model at the micro level of an organization (e.g., farm or ICU) of a transition pathway as a succession of coherence phases (authors).

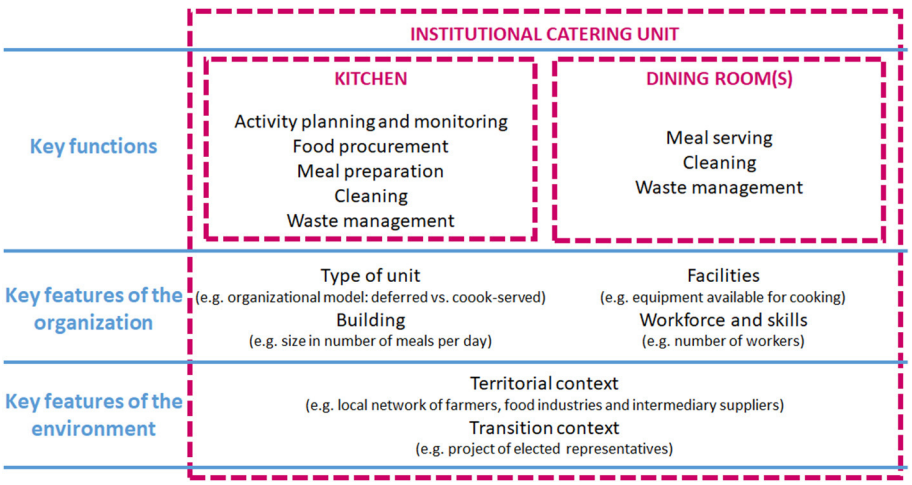


FIGURE 2 | Overview of the key functions of institutional catering units, features, and surrounding context (authors).

cook. The dining room is then cleaned using cleaning agents and leftovers are treated. Throughout the whole process, training agencies can help develop any necessary skills that are missing and labeling bodies can assist in both practice change and recognition of such changes.

Sustainability Challenges for ICUs

Previous literature highlights different practices engaging ICUs in sustainability transition pathways. An important practice toward sustainability in ICUs is the procurement of organic food. According to a review (Reganold et al., 2016), organic farming systems supply more nutritious foods, reduce exposure to pesticides, their environmental impact is low and are likely to have higher ecosystem services. They are also more profitable and likely to generate more social benefits. Another complementary option is reducing the share of meat protein in people's diets. Demitarian diets are well-suited to reducing the elevated land and environmental footprint of livestock (Billen et al., 2018), especially if they accompany circular systems involving more local and organic food procurement, and the limitation and recycling of waste (Caputo et al., 2017; Billen et al., 2018; Tregear et al., 2022). Also, due to the known effects of ultra-processed food on a number of health parameters, notably lipid profiles in children, their use in institutional catering units should be limited or even inexistent (Rauber et al., 2015). Finally, it has been shown that humans' exposure to most cleaning agents provoke certain clinical problems such as asthma and lung function decline (Svanes et al., 2018; Lemire et al., 2020). Workers in particular are

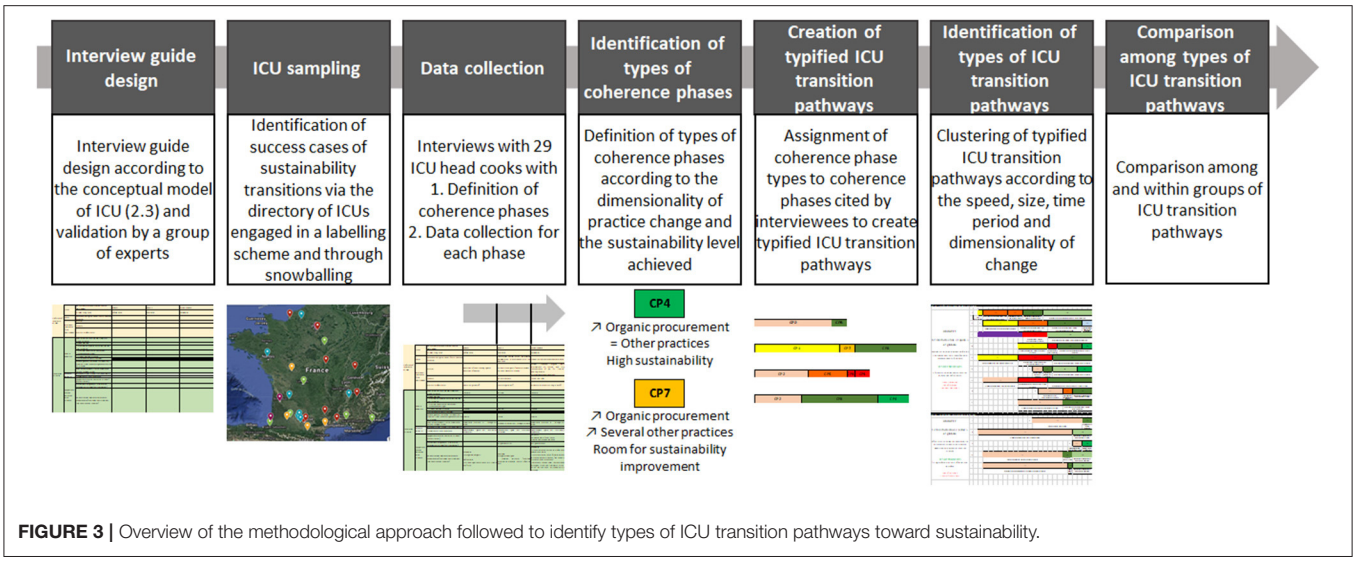


FIGURE 3 | Overview of the methodological approach followed to identify types of ICU transition pathways toward sustainability.

the most affected, and ICUs should favor eco-friendly cleaning agents. There are therefore a range of practices that can be assessed when characterizing the sustainability commitment of ICUs. These practices and underlying action principles can be combined in different ways over time to achieve sustainability.

MATERIALS AND METHODS

To capture and cluster micro-level transition pathways of ICUs, we created a methodology based on seven successive steps (**Figure 3**): design of an open-ended interview guide (3.1), ICU sampling and data collection (3.2), categorization of coherence phases (3.3), creation of typified ICU transition pathways based on the types of coherence phases previously identified, clustering ICUs according to a succession of coherence phase types, and comparison among and within groups of ICU transitions pathways (3.4).

Designing the Interview Guide

We built an open-ended interview guide (overview on **Table 1**) to collect data for re-building ICU transition pathways through: (i) a succession of coherence phases (defined in Section Conceptual Model of ICU Sustainability Transition Pathways) over time, defined by the interviewees themselves according to the way they experienced the transition; (ii) the evolution of head cooks' goals over these phases; (iii) ICU main features and how they have enabled or on the contrary constrained change; (iv) the main environmental features, and (iv) action principles and practices maintained at a stable level or changed across phases for each of the main functions identified (Section Sustainability Challenges for ICUs). Interviews combined closed questions aimed at gathering quantitative, binary or categorical data, and open questions to gather more qualitative content, such as additional comments, self-criticism, and anecdotes. The interview guide was validated during a collective meeting that involved six head cooks and two experts on IFS, including one of the authors (LP) and a member of an association (UnPlusBio) supporting sustainability transitions in IFS.

ICU Sampling and Data Collection

Because this research aimed at documenting success cases of sustainability transitions in the French IFS sector, and since there are currently few such cases in France, we did not try to establish a representative sample of ICUs. Instead, we sought for ICUs that had successfully undergone a transition process following the approach pursued when tacking on-farm innovations (Salembier et al., 2021). Since 2015, the labeling scheme "En Cuisine" (Pujos, 2021) aims at recognizing sustainability transition efforts from ICUs. Its specifications cover the various dimensions of sustainability presented in Section Micro-Level Transition Pathways. The label is awarded to ICUs following an annual audit by Ecocert-France, France's leading organic certification firm. Sampling ICUs engaged in this labeling scheme therefore guaranteed success cases of sustainability transitions, and whenever possible, it was an opportunity to compare interview data with those stored in the "En Cuisine" client database. We explored the directory of ICUs engaged in this labeling scheme and tried to cover a diversity of models (deferred vs cook-served, i.e., with central units sending out meals to satellite restaurants, or meals cooked and served on site at the unit respectively), sizes (sampling some tens of meals per day to several hundreds), territories (urban, peri-urban, and rural), and sustainability levels achieved through the transition (equivalent to levels 1, 2, 3, and 3 excellence levels of the "En Cuisine" labeling scheme). Twenty-five ICUs of interest were identified and four additional ones outside this labeling scheme were suggested by interviewees as outstanding cases and were added to the sample (**Table 2**). Two to three hour interviews were held with each head cook or director of the 29 sampled ICUs between May and July 2021.

TABLE 1 | Overview of themes and types of practices for which data were collected for each coherence phase through the interview.

Model component		Sub-theme or type of practice concerned	Type of answer
General goals	Objectives and motivations	Technical	Qualitative
		Economic	Qualitative
		Social	Qualitative
ICU main features	Type of unit	Organizational model (deferred vs. cook-served, etc.)	Categorical
		Type of guests (kindergartens, schools, etc.)	Categorical
	Building	Age	Quantitative
		Size (number of meals)	Quantitative
	Facilities	Vegetable processing area	Binary
		Changes in equipment	Qualitative
		Difficulties faced regarding the equipment and actions undertaken	Qualitative
	Workforce and skills	Number of workers	Quantitative
		Missing skills	Qualitative
		Training undertaken	Qualitative
		Difficulties faced regarding human resources and actions undertaken	Qualitative
ICU environment	Territorial context	Type of territory	Categorical
		Financing	Categorical
	Transition context	Adherence to labeling schemes	Qualitative
		Favorable and unfavorable elements	Qualitative
ICU functions	Planning and monitoring of the unit activity	Meal planning	Binary
		Difficulties faced regarding meal planning and actions undertaken	Qualitative
		Data registration	Binary
		Number of meals prepared	Quantitative
		Meal food cost	Quantitative
		Cost control strategy	Qualitative
		Difficulties faced regarding the activity and actions undertaken	Qualitative
	Food procurement	Type of procurement (public contract, forward agreement, etc.)	Categorical
		Features of the procurement strategy	Qualitative
		Sourcing practices	Qualitative
		External support received (e.g., agriculture organizations)	Qualitative
		Level of procurement of organic, local and DPO products	Categ. and Quanti.
		Type of organic products procured	Categorical
		Difficulties regarding food procurement and actions undertaken	Qualitative
	Preparation of meals	Frequency of vegetarian meals	Categorical
		Use of ultra-processed food	Categorical
		Major changes in meal preparation	Qualitative
		Difficulties regarding meal preparation and actions undertaken	Qualitative
	Waste management	Planning of guests	Binary
		Reduction of portions	Binary
		Weighting of leftovers	Binary
		Other actions	Qualitative
		Difficulties faced regarding waste management and actions undertaken	Qualitative
	Cleaning	Limitation of doses of cleaning agents	Binary
		Reduction in the number of toxic cleaning agents	Binary
		Difficulties regarding cleaning and actions undertaken	Qualitative

Preliminary Analysis to Define Types of Coherence Phases

From previous literature (section Sustainability Challenges for ICUs), we identified six types of practices supporting an ICU sustainability transition: (i) use of organic products; (ii) use of local and organic products; (iii) preparation of vegetarian meals; (iv) avoidance of ultra-processed foods; (v) avoidance of toxic cleaning agents and (vi) waste reduction practices. Interviewees defined 96 coherence phases out of which 29 were initial phases characterizing situations before the transitions had officially

TABLE 2 | Key features of the ICUs selected.

Feature	Categories	Number of ICUs
Type of ICU	Deferred	16
	Cook-served	13
Size as the number of meals per day	<1,000	17
	1,000–2,999	5
	3,000–9,999	5
	≥10,000	2
Type of territory	Urban	12
	Peri-urban	4
	Rural	13
Sustainability level achieved according to Ecocert "En Cuisine" labeling scheme	1	4
	2	8
	3	6
	3 Excellence	7
	Out of the scheme	4

begun. For each of these phases, we analyzed practice changes supporting ICU sustainability transitions. When analyzing these changes, we observed that:

- because eco-friendly cleaning agents only started appearing in IFS in the 2010's, head cooks were not always clear about the toxicity of previously used products. There were too many missing values on the avoidance of toxic cleaning agents especially in the early phases, to include this data in the analysis;
- 62 out of the 67 phases (including two missing values) following the initial phases showed an increase in the use of organic products. Even though the final levels of organic product uses were very different among ICUs (12–100%), this was still the most significant marker of the transitions;
- the use of local and organic products decreased in only two out of these 62 cases, meaning the use of general organic products and local organic products were strongly correlated, so the latter were excluded from the first quantitative stage of analysis;
- this increase in the use of organic products occurred either alone or in conjunction with one to several other changes such as the frequency of vegetarian meals, avoidance of ultra-processed foods, or waste management practices, but again with very different final levels among ICUs.

In a second step, to assess the level of sustainability achieved at each coherence phase, we transformed the quantitative and categorical data into scores. The use of organic products was converted according to the final level attained. An increase was worth 1 for a final level of organic products below 20%, 2 for a final level between 20 and 50% and 3 for a final level above 50%. Frequency of vegetarian meals (never, monthly, weekly, and daily) was converted into scores from 0 to 3. Use frequency of ultra-processed foods (never, occasionally, predominantly, and always) was informed for 10 different categories of products (vegetarian ready-made meals, pre-cooked vegetables, pre-cooked meat, ready-made sauces, etc.). Converting these levels into scores from 0 to 3, we calculated an average score of use frequency across categories. For waste reduction practices, we counted how many practices out of three, i.e., planning of guests, reduction of amounts at the preparation stage and weighting of leftovers, had been implemented at each phase, giving a score from 0 to 3. This corresponded with a continuum from no waste management to an advanced waste management strategy. All four scores were added up with equal weights into an ICU sustainability score per phase.

Based on these observations and calculations, we defined eight types of coherence phases (CP; **Figure 4**). For the initial phases, we distinguished between the more "conventional" ones, i.e., those that had not yet implemented any practices oriented toward sustainability (CP1; score ≤ 1) compared to those showing initial signs toward a sustainability transition (CP2; score > 1). For the following phases, two types of coherence phase focused on just one practice change: increasing the use of organic products. For the first type (CP3), there was still room for improvement in ICU sustainability (score ≤ 2) whereas for the second (CP4), the corresponding phases had already reached a high level (score > 2). Two other types of coherence phases saw increasing use of organic products in combination with just one other change in frequency of vegetarian meals, avoidance of ultra-processed foods, or waste reduction practices. Again, we distinguished between the first type (CP5) that had room for improvement in ICU sustainability and less so for the second type (CP6). Finally, the last two types of coherence phases combined increases in the use of organic products with several other changes, either with room for improvement in ICU sustainability (CP7) or not (CP8).

Typology of ICU Sustainability Transition Pathways

In a manner similar to Chantre et al. (2014), we grouped ICUs according to their transition pathways described as a succession of coherence phases types. To do so, we assigned the type of coherence phase to each phase defined by the interviewees. Based on how these coherence phase types linked up over time for each ICU, we grouped similar ICU transition pathways according to speed, size, time-period, and dimensionality of change (gradual vs. systemic). Once we had identified these types of pathways (i.e., successions of coherence phases), we conducted a comparison within and among groups. Taking in account all the components of the conceptual model (**Figure 2**), we were able to describe these transition pathway types in greater detail from the evolution of head cooks' goals, of ICU main features and how they enabled or constrained change, the main environmental features, and changes in action principles and practices across all types of identified functions. This comparison relied partly on descriptive statistics applying to quantitative and categorical data, and partly, on content analysis of qualitative data. This was done by inductive coding of interviewees' answers into categories

FIGURE 4 | Overview of the main types of coherence phases (CP) identified.

regarding the themes and practices addressed in the interview guide as recommended by Elo and Kyngäs (2008). We also took note of the most significant interviewees' quotes, translated by the authors.

RESULTS

Considering the successive types of coherence phases followed by ICUs (**Figure 5**), we grouped them into four main types of ICU sustainability transition pathways which are essentially differentiated according to speed, size, time-period, and dimensionality of change (**Table 3** and **Supplementary Material 1** for more detailed representations of pathways) and that we describe hereafter.

Group 1: The Pioneers

This group gathers small to intermediate sized ICUs who were pioneers regarding multiple practice changes managed simultaneously and who have reached a very high sustainability level.

Transition Context

This group corresponds to pioneering ICUs engaging in a transition: "*we were the only ones to advance, we were pioneers.*" It is mainly composed of cook-served ICUs and of two deferred ICUs of small to intermediate size (1,050 meals/day at most). All serve a single type of guest in various types of territories. All the head cooks considered they were initially faced with an unfavorable context to implement a transition due to the lack of locally available information on how to proceed and a shortage of organic farmers. Key support organizations (e.g., UnPlusBio) were created during these transitions, sometimes at the initiative of these pioneers in order to share knowledge, skills and experience. In all cases but one, there was strong political resolve to meet head cooks' objectives and motivation to engage ICUs in a transition against the mainstream: "*at a time when everyone else was [. . .] doing assembly cooking, we cooked raw products served on-site.*" In six out of eight cases, head cooks said that their main aim was to address health issues by offering guests better quality meals.

Transition Features

Transition pathways observed in this group lasted from 9 to 22 years; the earliest starting in the 2000's. Only 3 ICUs displayed early signs of transition (CP2), yet all three began with a solid starting point (e.g., 17% of organic food product use in ICU22). Also, seven out of the eight ICUs never or just occasionally used ultra-processed food, so less efforts were needed in this respect. All the ICUs started out with increasing organic food product use (CP3 and CP4) and went on to change all the other sustainability practices considered (**Figure 5**), managing these transitions with a systemic approach. As a result, these transitions have led to actual transformations of ICUs, now displaying a high level of organic food product use (71 $\pm$ 21%), one vegetarian meal a week, no use of ultra-processed foods in all but one case (occasional) and multiple waste reduction practices (**Figure 5**).

Resources for the Transition

The number of staff required to run ICUs stayed the same for all cases but one where it decreased in proportion to the increase in number of meals prepared daily per worker. New skills (e.g., vegetarian cooking) were deemed necessary by most head cooks, either through recruiting new profiles, external training or learning-by-doing and experimentation. Specific equipment had to be purchased in four out of eight ICUs to facilitate cooking from raw food (e.g., peeler machines) and avoiding waste (e.g., cooling cells). Despite the increase in organic food use, food costs for ICUs remained stable in four cases and slightly increased before reaching a plateau in the other four cases. Head cooks listed a number of practices in place that contributed to controlling costs such as fighting waste, developing vegetarian meals, and using more and more raw and seasonal foods. Subsequently, the average food cost for ICUs came to 2.30 €/meal, which was considered reasonable: "*Quality has a cost.*"

Changes in ICU Functions

All head cooks reported on the complexity of menu-planning when turning to more sustainable practices. They all worked alongside dietitians, especially for the practice of introducing vegetarian meals that guaranteed guests the expected protein intake. Nevertheless, menu-planning still had to be vague enough to leave room for conciliating working with seasonal and local

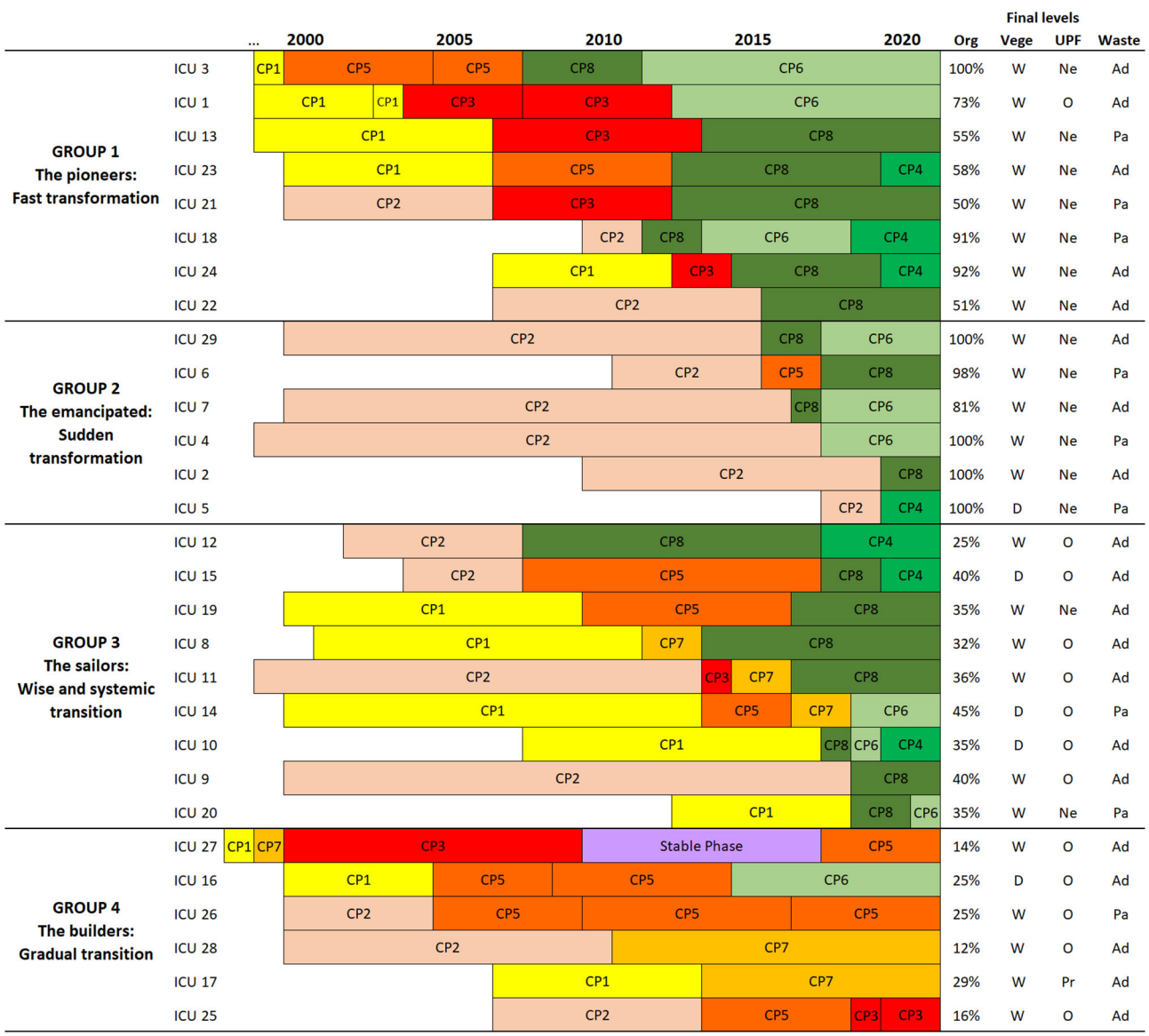
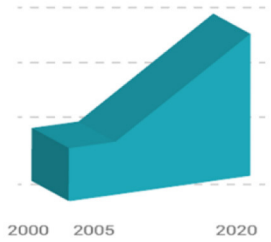
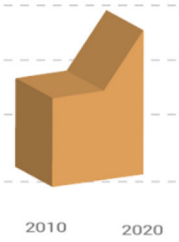
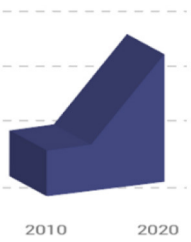
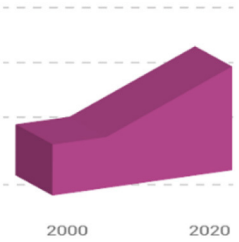


FIGURE 5 | Overview of the four groups of ICU transition pathways with successions of types of coherence phases over time and the final sustainability levels achieved for the four main practices considered (Org, use of organic products in % of total purchase; Vege, frequency of vegetarian meals as D-daily, W-weekly, M-Monthly, Ne-Never; UPF, use of ultra-processed foods as Ne-Never; O-Occasionally, Pr-Predominantly, Al-Always; Waste, waste management practices as No-None, L-Limited; Pa-Partial, Ad-Advanced).

fruits and vegetables: "*if they call me and say 'I have kohlrabi, I will order it from them'*." Food procurement had to be completely revisited by designing new procurement strategies (e.g., dividing orders into smaller batches of products) either *via* public procurement contracts or forward agreement contracts, strictly monitoring compliance to these contracts. In one case, due to a lack of satisfactory agricultural production on the territory, a public farm was created; it now supplies 96% of the ICU's needs. In other cases, meetings were organized with farmers to appreciate and address each other's constraints. Beyond cooking either raw or lightly processed products (e.g., tomato sauce), a major change in meal preparation entailed integrating vegetarian meals and making them appealing and tasty. All ICUs improved their waste management. All but one was used to planning and monitoring the number of guests before the transition. Reducing served portions and weighing leftovers were progressively implemented for further improvements. Almost all head cooks (except for kindergartens) emphasized the importance of the presence of facilitators and taste education in the dining room in the fight against waste.

TABLE 3 | Main features of the four main types of ICU sustainability transition pathways identified (number of cases in parentheses).

Group	1: The pioneers (8)	2: The emancipated (6)	3: The sailors (9)	4: The builders (6)
					
Key features of ICUs				
Type of unit	6 cook-served, 2 deferred	4 cook-served, 2 deferred	3 cook-served, 6 deferred	6 deferred
Size	22–1,050 meals/day	40–1,000 meals/day	250–23,500 meals/day	1,100–9,000 meals/day
Type of guests	Single	Single	7 single, 2 multiple	1 single, 5 multiple
Key features of the environment				
Territorial context	3 urban, 1 peri-urban, 4 rural	1 urban, 1 peri-urban, 4 rural	5 urban, 4 rural	3 urban, 1 peri-urban, 2 rural
Transition context	Initially unfavorable but strong political resolve	Strong political resolve Collaboration with hd. cooks	Strong political resolve and support from other stakeholders	Strong political resolve
Type of transition pathway				
Speed	Rapid	Sudden	Cautious	Cautious
Size	Transformation	Transformation	Unfinished transition	Unfinished transition
Time-period	7–14 years	1–4 years	3–14 years	8 to >20 years
Dimensionality	Systemic	Systemic	Systemic	Gradual
Resources for the transition				
Staff	Decrease (1), Stability (7)	Stability (6)	Stability (9)	Stability (4), Increase (2)
Mean food cost per meal	2.30 ± 0.46 €	2.47 ± 0.42€	2.11 ± 0.27€	1.77 ± 0.37€
Cost trend	Stability (4) Increase then stability (4)	Stability (1) Increase then stability (5)	Decrease (1) Stability (2) Increase then stability (5)	Decrease (1), Increase then stability (5)
Adherence to a labeling scheme in 2021	"En Cuisine" levels 2 (1), 3 (6) and 3 Excellence (1)	"En Cuisine" level 3 Excellence	"En Cuisine" levels 1 (2) and 2 (7)	"En Cuisine" levels 1 (2) and out of any scheme (4)

Group 2: The Emancipated

This group gathers small sized ICUs who recently implemented very fast transitions marked by multiple practice changes simultaneously and a very high final sustainability level.

Transition Context

These ICUs started engaging in a transition later than in group 1 aiming on implementing a sudden change. These small sized ICUs (1,000 meals/day at most), four cook-served and two deferred, all serve a single type of guest, and are located in various types of territories with different constraints (presence vs. lack of local organic farmers). To initiate the transition, elected representatives worked together with head cooks who all had project manager profiles and were guided by strong personal convictions. These ICUs were all supported by various organizations, including some in which the pioneers (group 1) were engaged, to pave the way for this sudden transition and strengthen their commitment: "*Since I arrived, I have completely switched to this. In fact, you have to say to yourself, 'these products do not exist anymore, we are doing it this way'*."

Transition Features

The transition pathways observed in this group lasted from 1 to 4 years and were all relatively recent. All ICUs showed early signs of transition (CP2), especially regarding the use of organic products and waste management. Other signs were present in specific ICUs, e.g., daily vegetarian meals (ICU5) or advanced waste management (ICU4). All these ICUs rapidly conducted multiple practice changes simultaneously with a systemic approach. Transitions completely transformed these ICUs; they ended up with a high level of organic food product use (97 ± 8%), proposed at least one vegetarian meal per week or per day, excluded all ultra-processed foods and implemented multiple waste management practices (**Figure 5**).

Resources for the Transition

Like group 1, the transition did not require additional workers, but all head cooks except one were recruited purposely to implement the transition according to their project manager profiles combining technical and management skills. Every ICU but one had to purchase specific equipment to facilitate cooking from raw food (e.g., peelers, blenders) and avoid waste (e.g.,

cooling cells), as observed in group 1. Due to the sudden increase in organic food use, food costs went up in 5 ICUs, reaching an average of 2.47 €/meal. Although cost control practices were implemented, similar to those in group 1, they did not appear to be a priority in these transitions: "*I don't care about controlling costs! [. . .] To put 50c more in the children's plate, you turn off public lighting for 2 h per night. Can we afford to turn off the light for 2 h per night?*"

Changes in ICU Functions

Like group 1, all head cooks reported on the complexity of sustainable menu-planning and got support from elected representatives, dietitians and various software to assemble the required set of skills. Because seasonal and local fruit and vegetable production can be unpredictable, they kept their menus vague: "*I used to itemize all my menus. But sometimes the carrots had not yet reached maturity and as they were on the menu, I was forced to use frozen carrots.*" This group's ambition was to turn to 100% (or close to) organic food procurement as quickly as possible. Due to the modest size of most ICUs, 5 of them used forward contracts and only one worked under public procurement. Consequently, the former made conscious efforts in sourcing directly to farmers, food industry entities or *via* farmer platforms. However, it can prove difficult finding suppliers happy to deliver the amounts needed for small-scale ICUs, and delivery costs can be excessive. Therefore, certain orders were pooled in order to lower costs and priority was always given to local supplying. The smallest ICU was located in a very rural area and instead decided to create a municipal farm. All ICUs turned to cooking raw products and stopped using ultra-processed food. This tended to increase the workload: "*cleaning, disinfecting, draining, slicing, dressing and storing that had not been done before.*" All ICUs but one was already used to planning and monitoring the number of guests before the transition and the remaining one started to do so during the transition. All ICUs but one also reduced served portions and all started to weigh leftovers. Several other actions were mentioned for reducing leftovers in the dining room (e.g., eco-delegating children, getting them to watch out for leftovers) and beyond (e.g., organizing children's visit of the municipal farm supplying the ICU, creating awareness as to the work and time required in producing vegetables).

Group 3: The Sailors

This group gathers ICUs of different sizes who implemented transitions in a more cautious although systemic way and who keep room for improvement in sustainability.

Transition Context

This group represents the ICUs that took more time for their transitions than groups 1 and 2. It is composed of 6 deferred and 3 cook-served ICUs of very different sizes (250–23,500 meals/day) serving either a single type (7/9) or multiple types (2/9) of guests. The majority of head cooks (7/9) considered their transition context to be favorable as to local agricultural production and they all received support from their environment (e.g., elected representatives, budget managers) whatever their stimulus for this transition, should it be a change in political context (5 ICUs) or personal willingness on behalf of the head cook (4 ICUs). Most ICUs contributed to professional networks of the IFS sector and benefited from various support organizations, including farmers' organizations.

Transition Features

The transition pathways observed in this group lasted from 3 to 14 years and began in 2008 for the earliest. Four ICUs showed early signs of transition (CP2), especially regarding the use of organic products and waste reduction practices. All these ICUs worked simultaneously on multiple practice changes (CP7 and CP8): "*I do this whole global, holistic strategy where diversifying proteins, home cooking food products, doing things yourself, [. . .] reducing waste, etc. all go together.*" Although these were cautious transitions that led to high sustainability levels (CP4, CP6, or CP8), there was nevertheless room for improvement; we observed an intermediate level of organic food product use (36 $\pm$ 6%) and an occasional use of ultra-processed foods in 7 ICUs. The frequency of vegetarian meals (one meal per week in 6 ICUs) and waste reduction with an advanced strategy in most cases (7/9) appeared to leave less room for improvement.

Resources for the Transition

The transition required no additional workers. Six head cooks experienced no problems with their personnel when it came to implementing the transition; on the contrary, they felt they were rediscovering the profession. Still, most ICUs organized training on specific techniques, mostly for cooking appealing and tasty vegetarian meals. They conducted regular trials to keep improving the organoleptic quality of the meals they served, especially in the case of deferred ICUs which had their own specific constraints (e.g., re-heating meals). As for the two previous groups, specific equipment had to be purchased in 6 ICUs to facilitate cooking from raw food with minimum waste. As the use of organic products was more modest than in groups 1 and 2, the average food cost was lower, at 2.11 €/meal even after the slight increase reported in 5 ICUs. As opposed to group 2, cost control was cited as an objective for all but one ICU and relied on various practices such as waste reduction and revising their procurement strategies.

Changes in ICU Functions

Like the previous groups, head cooks reported on the complexity of menu-planning, especially for the largest ICUs where head cooks felt they had to comply with multiple constraints on production, quality, budget, supply, etc. Also, as in the two previous groups, guests' menus were not fully itemized, meaning they were adaptable. Food procurement for this group was more moderately revised compared to groups 1 and 2. Their efforts mainly lay in establishing new specifications for public procurement contracts (used predominantly to exclusively in 8 ICUs), especially by dividing their demand into smaller batches allowing farmers to bid, and in sourcing farmers and other local suppliers. Meetings were organized with farmers to build their trust: "*At the beginning I did a lot of sourcing. We were in a territory full of farmers, but nobody wanted to work with us.*

Why, for the good and simple reason that the word 'deferred kitchen' scared them, scared them in terms of volumes but also in terms of prices paid. […] I spent 3 years doing meetings on the kitchen site, showing them the kitchen, I went to their place." For meal preparation, these ICUs increased the use of raw products, especially for vegetables and meat, but they carried on using ultra-processed foods such as sauce bases due to constraints regarding the quantities they needed and the work that entailed. All but one ICU had already been planning and monitoring the number of their guests before the transition and the remaining one began during the transition. All ICUs also reduced quantities when preparing and serving meals and all but one continued or began weighing leftovers in addition to other actions such as recycling by cooking waste.

Group 4: The Builders

This group gathers large deferred ICUs who implemented the slowest transitions with the largest room for improvement in sustainability due to their dependence on the development of value chains capable of supplying.

Transition Context

This group represents the ICUs that implemented the slowest transitions. It is composed of 6 deferred ICUs of 1,100–9,000 meals/day serving multiple types of guests in all but one case. Given the size of these units, all head cooks considered local agricultural production was unsuited for initiating a transition while all of them initially aimed at developing a local supply: "*I am in love with short food supply chains, local fair trade and quality.*" To that end, they all received support from elected representatives either to start and/or develop the transition. All head cooks contributed to professional networks of the IFS sector and 5 of them belonged to a union of head cooks managing deferred ICUs promoting overall quality in IFS.

Transition Features

The transition pathways observed in this group lasted from 8 to over 20 years, the earliest starting in the 1990's. Three ICUs showed early signs of transition (CP2), especially regarding the use of organic products. These transitions were the slowest; most ICUs implemented practice changes gradually, focusing on increasing the use of organic products (CP3) and just one additional change at the most (CP5): "*We want to go further in a progressive way.*" There was even a phase of stability during one of these transitions (ICU27). Among the four groups, this one left the most room for improvement in sustainability as its organic food product use was the lowest of all (20 ± 7%) and it had the most frequent use of ultra-processed food [occasional (5/6) or predominant (1/6)]. Only the frequency of vegetarian meals and waste management appeared to leave little room for improvement.

Resources for the Transition

The transition did require additional workers in proportion to the number of meals prepared daily in two out of the 6 ICUs, as opposed to other cases. Because transitions were slow and gradual, any problems with staff in implementing the transition were not reported. Training, again on cooking appealing and tasty vegetarian meals, and recruiting experienced staff, were the methods used to counter a lack of knowledge and skills: "*We have always tried to find competent personnel to meet our ambitions.*" Unlike the previous groups, no extra equipment was purchased to facilitate the transition in all but one case. Out of all the groups, this one used the least amount of organic products, and consequently their food costs were the lowest, at an average of 1.77 €/meal even though there was a slight increase in 4 ICUs. However, cost control was mentioned as a priority in only 2 ICUS whereas others acknowledged it was necessary to increase food costs when sourcing more sustainable food products. Across all ICUs, waste reduction was perceived as the main lever for freeing resources and budget the implementation of sustainable practices.

Changes in ICU Functions

Unlike the previous groups, head cooks did not report on an increase in complexity of menu-planning; this was already high, due to the diversity of their guests (from babies to seniors). ICUs turned to public procurement contracts if it was not already implemented (4/6). Still, all head cooks designed these contracts so that local farmers or farmers' unions could bid by dividing their demand into small batches, and tried to convince these suppliers to initiate a collaboration: "*We help farmers to start farming, we tell them—Go ahead, do not try to sell your products, we will buy them from you at a price that allows you to live. You won't be driving a Ferrari, but at least you will live off your product*" (ICU16). Outlet security and stability is also ensured *via* planning: "*Now when I want salads, I order them from a group of market gardeners 45 days in advance, because that is how long they take to grow.*" Sometimes, head cooks even co-designed value chains with farmers to procure food products (organic ground beef, organic pasta) that were not available locally. In return, five head cooks said they were very demanding on the quality of the deliveries. Like group 3, although these ICUs increased the use of raw products, they carried on using ultra-processed foods too, mainly sauce bases, again due to quantities needed. This group's head cooks also mentioned they were always experimenting to find ways to keep vegetarian meals appealing and tasty using a deferred system that involves re-heating meals prior to serving. In all but one case, these ICUs were very advanced when it came to waste management. They planned and monitored the number of guests, reduced portions served and weighed leftovers.

DISCUSSION

This empirical study reports on transition pathways in IFS with a large and diversified sample whereas previous studies have been based on very few cases (Lehtinen, 2012; Stahlbrand, 2016; Morley, 2021) outside France. We demonstrated the feasibility of sustainability transitions in IFS for all types of model (deferred vs. cooked-served). The ICUs we studied have succeeded in increasing organic product use and frequency of vegetarian meals, and reducing ultra-processed food use and waste over short timeframes from a few years to a little more than a decade

in the vast majority of cases. The next question is: how can sustainability transitions be scaled-up in the IFS sector?

Acknowledging the Diversity of Transition Contexts and Pathways

The four types of transition pathways we identified show that there is no single way for transitioning to sustainable IFS. These four pathways were consistent with observed levels for each group's ICUs in Ecocert's "En Cuisine" labeling scheme (**Table 3**). Some of the studied ICUs, particularly the smaller ones (Group 2), were fully transformed over very short time-periods demonstrating high agility, whereas others took more time and/or operated changes more gradually. These different pathways related to the diversity of transitions contexts, in particular internal and external resources and constraints. This was already observed for farms converting to organic farming (Bouttes et al., 2019).

Transitions were made possible by head cooks who had very different educational background and experience with cooking in ICUs. However, they all had project manager, or even company manager profiles, all guided by firm convictions about the need for change in the IFS sector. They were already or became increasingly aware about sustainable practices, even regarding the most controversial challenges e.g., use of ultra-processed food. Thus, human resources appeared as a fundamental element in managing the transition as a work transformation, as observed in the agricultural sector (Coquil et al., 2018). Across all ICUs, new skills were developed through targeted recruitment (head cooks whenever necessary), training in sustainable practices (e.g., cooking tasty vegetarian meals) and/or networking throughout the transition.

The availability of local suppliers such as organic farmers was a major external determinant of the pathways undertaken. While small ICUs relied only on just a few suppliers making it easy to revise their procurement, the largest of these had to create suitable local conditions by developing local value chains within incumbent value chains. Meynard et al. (2018) showed the complexity of innovating in agrifood socio-technical systems that are characterized by strongly interconnected impediments including farmers' knowledge shortcomings and logistical constraints. In several cases, it was the head cooks themselves, often supported by agricultural organizations, who acted as innovation brokers to address these lock-ins. Interestingly, in the era of Industry 4.0, advanced technologies (e.g., Internet of things platforms, smart sensors, and human-machine interfaces) did not appear to play a key role in the transition process, contrary to coordination among actors in the "old way."

Head cooks insisted that support from elected representatives was essential in terms of resources, trust and providing room for maneuver, even though this type of support was not always that great from at the beginning of the transition and tended to develop thereafter. Another critical factor that frequently came up was the development of trust among head cooks and suppliers as this ensured reliability and stability of food procurement, particularly when developing direct supplying with farmers and agricultural organizations. Trust is a recognized key ingredient of sustainable governance in agrifood systems (Gaitán-Cremaschi et al., 2020).

Before elaborating any advice to a head cook or elected representative wanting to engage an ICU in a sustainability transition, we suggest making a preliminary diagnosis, particularly regarding any internal and external resources that could be used or rapidly adapted for achieving the transition goals. From this diagnosis, a projected pathway of successive coherence phases could be built to implement the transition progressively.

Developing Positive and Realistic Narratives on Transition Processes

Our study showed that transitions do not lead to unreasonable increases in necessary resources. In the vast majority of cases, interviewees reported no significant increase in staff and facilities required to implement the transition. When new staff was recruited, their cost was compensated by a proportional or higher increase of ICU activity, indicating scale economies throughout the transition. Only the food cost per meal tended to increase along with the increase in organic food procurement, but this extra cost applied to a secondary expense (about 25%) of the full cost (after personal costs—about 50%; DRAAF, 2016), remaining limited and considered acceptable by both head cooks and elected representatives. This confirms recent findings of two studies (Bardon and Feignier, 2021; UnPlusBio, 2021; the latter over 6,000 ICUs) in French ICUs showing that the development of vegetarian meals and organic procurement respectively does generate an increase food costs in most cases and in some cases can even improve the quality of the meat purchased. This is consistent with interviewed head cooks' practices who articulated several changes in synergy to reach an almost cost-neutral transition: use of more raw and seasonal products, vegetarian meals, waste reduction, etc. These synergies act as enabling factors and reveal the need to consider the overall consistency of transition projects, as reported by Puech et al. (2021) in agriculture. According to head cooks, cost control was also the result of an accurate monitoring of costs and of suppliers' compliance to their contracts, using accounting software. Such assessment tools are essential in managing transitions (Turnheim et al., 2020).

As already shown by Stahlbrand (2016), undertaking these sustainable practices tended to increase the workload as new tasks were required in the kitchen (e.g., cleaning and disinfecting incoming vegetables) with an equivalent workforce. The work was also more complex as it required additional efforts in establishing trust and different collaborations with suppliers. Still, most head cooks said they had reorganized their working methods by e.g., synchronizing logistics in order to address the multiple deliveries generated by an increase in suppliers or implementing new ways of preparing meals (e.g., slow-cooking meat at low-temperatures, sometimes starting the day before). Overall, this transition was an opportunity for head cooks to align their values and practices, as already observed for farmers transitioning to organic farming (Bouttes et al., 2018). They all reported on their professional satisfaction and some even said they were rediscovering their profession. In addition to the satisfaction of elected representatives and guests, most head cooks received recognition for their efforts invested in the transition by the "En Cuisine" labeling. This engagement allowed

an objectification (e.g., of costs) of the changes actually made, as already observed in the wine industry (Delmas and Gergaud, 2021).

According to head cooks, ICU transitioning directly benefited the local economy. When sourcing more organic products, they also sourced local suppliers, thus confirming the findings of UnPlusBio that covered a large sample of ICUs: 72% prioritize local suppliers when sourcing organic products (UnPlusBio, 2021). Whenever needed, head cooks contributed to developing value chains or creating new ones. In this way transitions stimulated the spread of organic farming, a more sustainable form of agriculture over the territories (Reganold et al., 2016), as it is highly dependent on the presence of local market access (Allaire et al., 2015). Head cooks consequently also contributed to creating a leverage effect in developing a more circular economy in the agrifood sector (Jurgilevich et al., 2016), also *via* a supply that directly serves consumers in the same territory.

These findings could support the development of positive narratives on sustainability transitions in IFS. These narratives are essential tools for inducing actors to revise their values and encourage them to share common values for sustainability transition (Hubeau et al., 2019).

Conceptual and Methodological Insights and Limits

We developed an ad hoc analytical framework inspired from agricultural sciences (Chantre et al., 2014; Perrin and Martin, 2021) to capture and analyze micro-level sustainability transition pathways in IFS. This original framework is easily re-usable by researchers willing to study cases of sustainability transitions at the micro-level in the food sector. This framework integrated the complexity of such transitions with interrelated and dynamic changes in goals, action principles and practices by underlying actors, over a larger number of case studies nested in various contexts. Our framework highlighted how resources and contextual features are determinant to individual actors managing a transition process (in this case, head cooks in ICUs). Considering coherence phases also revealed the diversity of micro-level sustainability pathways followed. Nevertheless, the data for diachronic studies such as these were collected a posteriori, sometimes even decades before, which may have induced possible recall biases discussed in detail by Perrin and Martin (2021). Head cooks were very familiar with the firm Ecocert and its "En cuisine" labeling scheme and were informed about the purpose of the interview in advance, so this may have weighed on their objectivity: they may have implicitly tried to meet the interviewers' expectations. These biases could be better controlled with longitudinal studies monitoring transitions in the making, as conducted in agriculture (Bouttes et al., 2019).

CONCLUSION

Based on 29 interviews with head cooks in France, we identified four transition pathways that institutional catering units have been following to implement four sustainable practices: organic food use, ultra-processed food use, vegetarian meals and waste management.

We showed the feasibility and diversity of micro-level sustainability transitions in IFS. Diversity of pathways is related to the different contexts of transition, especially internal and external resources and constraints. Nevertheless, transitions occurred without unreasonable increases in necessary resources. These findings are expected to convince policy-makers about the potential for scaling up these transitions to address environmental and food security challenges that the agrifood sector is facing. Identified pathways will also guide candidates of these transitions according to internal and external resources at their disposal and constraints they might face. In each case, a preliminary diagnosis regarding such resources and constraints also clarifying the transition goals will allow identifying which pathway of successive coherence phases could be built to successfully implement the transition.

We developed a structured analytical framework to analyze micro-level sustainability transitions in IFS. Understanding specific behaviors is essential in defining relevant policies to implement large-scale socio-technical transition. Beyond the case study on IFS, our analytical framework can explain behavioral changes during sustainability transitions. It thereby contributes to understanding transition processes in the food sector at the micro level.

In addition to supporting the development of positive narratives on sustainability transitions in IFS, this work opens perspectives regarding *in itinere* analysis of sustainability transitions in the making in IFS, as well as more detailed focus on lock-ins and how they were addressed by practitioner-champions such as head cooks.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Our study procedure followed the guidelines provided by INRAE's Charter of deontology, scientific integrity and ethics. Interviewees participated in the research voluntarily and provided informed written consent. All data were analysed anonymously.

AUTHOR CONTRIBUTIONS

GM and LP: conceptualization. GM: methodology and writing of the original draft. GM and LP: data analysis. M-BM and LP: editing of the draft. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2022.943020/full#supplementary-material

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The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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