

WORKFORCE-LED DIGITAL INNOVATION IN UZBEKISTAN'S AGRI-FOOD SMEs: A CHANGE MANAGEMENT AND ADOPTION ROADMAP

O'ZBEKISTON AGROOZIQ-OVQAT KICHIK VA O'RTA KORXONALARIDA XODIMLARGA TAYANGAN RAQAMLI INNOVATSIYA: O'ZGARISHLARNI BOSHQARISH VA JORIY ETISH YO'L XARITASI

ЦИФРОВЫЕ ИННОВАЦИИ В АГРОПРОДОВОЛЬСТВЕННЫХ МСП УЗБЕКИСТАНА С ОПОРОЙ НА ПЕРСОНАЛ: УПРАВЛЕНИЕ ИЗМЕНЕНИЯМИ И ПЛАН ВНЕДРЕНИЯ

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Abstract. *Digital tools can improve recordkeeping, production coordination and post-harvest decision-making in agrifood businesses, yet implementation often fails when technology selection precedes managerial preparation. This conceptual paper examines how small and medium-sized enterprises (SMEs) in Uzbekistan's agrifood sector could organise workforce-led digital innovation. It synthesises evidence on digital adoption in Uzbekistan, SME transformation, sociotechnical change and food-loss management to develop a five-step implementation roadmap: diagnose, co-design, train, pilot and embed. The proposed model places employees and process owners at the centre of data quality, incentive alignment and technology evaluation. Examples involving stock records, lot tracking, temperature logs and order planning illustrate possible applications; they are not reported field cases. The paper proposes a balanced scorecard covering operational reliability, workforce use, financial viability and data governance, while distinguishing digitalisation from demonstrated performance improvement. Its contribution is a management-oriented adoption process that can be tested in Uzbek food processing, storage and distribution SMEs through future empirical studies.*

Keywords: *digital transformation; change management; agrifood SMEs; innovation adoption; workforce skills; Uzbekistan; managerial capability*

1. Introduction

Digital technologies are increasingly available to small businesses, but acquisition does not ensure organisational improvement. A food processor may purchase inventory software without establishing reliable units of measure; a cold-storage operator may install sensors without specifying who reacts to an abnormal reading. These cases illustrate a common management issue: devices and platforms can create data, but people and routines determine whether

information changes decisions. The issue is particularly relevant to Uzbekistan's agrifood SMEs, where seasonal inputs, quality variation, small supplier networks and time-sensitive products can make operational coordination difficult.

The OECD reports that Uzbekistan has made progress in digital connectivity while private-sector use of digital tools remains constrained by awareness and skills [1]. International SME evidence similarly identifies uneven adoption and size-related barriers [2]. In agriculture, scholarship highlights the social and institutional dimensions of digital technologies rather than treating their diffusion as a purely technical process [5]. These findings motivate a study of the organisational conditions necessary for meaningful adoption. They do not demonstrate that any specific Uzbek agrifood enterprise suffers from a given deficiency; enterprise-level evidence is needed for that claim.

This paper asks: what sequence of management actions can help Uzbekistan's agrifood SMEs adopt digital tools while building employee capability and managing operational risk? It proposes an implementation roadmap and measurement system that link technology choice to work processes, accountability and learning. Unlike broad research on circularity and SME competitiveness, the focus is specifically on change management within agrifood operations. Circular resource outcomes may be a desirable result, but they are not presumed to follow automatically from digital adoption.

2. Literature and conceptual foundations

Digital transformation research distinguishes digitising information, digitalising processes and deeper changes to an organisation's value creation model [3]. The distinction matters for SMEs: replacing paper order books with a spreadsheet is an information-management intervention; reorganising purchasing and production around shared demand forecasts is a managerial transformation. Vial [4] further stresses that digital change involves strategic responses, structural adaptations and potential positive and negative outcomes. Thus, the analysis should focus not just on whether software is installed but on how it reshapes decisions, responsibilities and performance.

Rogers' diffusion-of-innovations theory [7] helps explain why perceived advantage, compatibility, complexity, trialability and observability influence uptake. In an agrifood workplace, managers may see the advantage of digital batch records, but frontline users may experience them as extra administrative work if data are entered twice. The technology becomes more compatible when it fits existing handovers and produces immediate feedback useful to operators. Trialability also matters: a small-scale pilot allows the business to reveal workflow difficulties before committing to a full rollout.

The agrifood context makes the consequences of poor adoption visible. FAO [6] emphasises identifying loss points along food value chains rather than assuming that interventions have the same effect everywhere. Digital records can support this diagnosis by documenting dates, temperatures, inventory movements and rejection reasons. Yet sensors may be inaccurate, records incomplete, or measurement categories inconsistent. Klerkx and colleagues [5] show that the social dimensions of digital agriculture warrant explicit attention, including stakeholder

relationships and responsible innovation. Workforce training, error handling and realistic incentives therefore form part of the technology, understood as a working organisational system.

A managerial model also needs to distinguish workers' ability to operate a tool from their authority to act on it. A clerk may accurately enter order data but be prohibited from altering procurement schedules; a production supervisor may receive alerts without sufficient time to investigate them. If the intended operational decision is outside the user's authority, additional training alone cannot solve the problem. Job descriptions, reporting lines and escalation rights are therefore part of digital capability. This insight supports a central proposition of the paper: employee capability and managerial decision rights jointly shape the likelihood that useful data become timely action.

The literature also indicates that diffusion is affected by the characteristics of an innovation as experienced by adopters [7]. This suggests that perceived workload should be tracked as a formal outcome, not treated as resistance that can simply be overcome through persuasion. A well-designed digital process should reduce uncertainty or unnecessary work at a point that matters to the user. For example, recording a supplier lot identifier can be valuable when it helps resolve a rejected batch quickly, but a code that no one can retrieve or interpret creates limited operational value. Usability must be evaluated in the language and time constraints of the intended workforce.

3. Materials and methods

This article employs an integrative, desk-based conceptual method. The evidence base consists of two OECD publications on Uzbekistan and SME digitalisation [1-2], peer-reviewed reviews of digital transformation and agriculture [3-5], FAO guidance on food-loss analysis [6], and innovation-diffusion theory [7]. The sources were selected because they illuminate adoption barriers, organisational change, sector-specific information needs and evaluation. The review is purposive, not systematic, and the paper does not report proprietary data, field observations, interviews or experimental trials.

The synthesis proceeded in three stages. First, relevant management problems were grouped into process design, employee capability, governance and performance measurement. Second, adoption activities were organised into a sequence that starts with an operational problem and ends with embedded routines. Third, each phase was connected to a feasible indicator or decision threshold. The result is a proposal for practical testing, not a validated predictive model. Examples that follow are explicitly hypothetical illustrations of management choices.

For analytical clarity, a digital intervention is defined here as a change in information capture, exchange, interpretation or use supported by a digital tool. Outcomes are assessed at the process level rather than inferred from the purchase of hardware or software. This definition makes it possible to compare very different solutions—such as a shared spreadsheet and an integrated warehouse system—without assuming that the more expensive option is better. The method deliberately separates explanatory mechanisms (skills, workflow fit, decision rights)

from target outcomes (errors, response time, cost). This separation is necessary if later fieldwork is to test why an intervention succeeded or failed.

4. Results and discussion

4.1. Select the operational problem before choosing software. Digital innovation should begin with a process-level diagnosis. Managers can ask where delays, discrepancies or losses arise; what decisions depend on missing information; and whether staff can reliably collect the required data. Potential entry points include stock reconciliation, delivery planning, lot-level quality records and cold-chain monitoring. These use cases are illustrative rather than confirmed priorities across Uzbek firms. In any enterprise, a baseline should precede investment: error frequency, staff time, discarded product, late deliveries or unreconciled stock, as appropriate.

The benefits of better data depend on who can act on it. A daily digital temperature log contributes little if readings are reviewed after a batch has spoiled. Likewise, a stock dashboard has limited value if purchasing decisions remain disconnected from the inventory record. Managers should map the full decision cycle: observation, recording, verification, escalation, action and feedback. Where communication is informal, it is especially important to specify the person who resolves conflicting records and the permitted level of automated action.

4.2. Proposed workforce-led adoption roadmap. The roadmap comprises five activities. Diagnose establishes the business problem and baseline. Co-design involves the employees who perform the task in simplifying the data-entry workflow. Train equips staff with operational and digital skills, including correction of errors and escalation procedures. Pilot tests the workflow with a bounded product line or team. Embed revises roles, supervision and routine indicators only after adoption and usefulness have been demonstrated. Table 1 provides representative management evidence for each activity.

Table 1. Proposed managerial implementation framework (author's conceptual synthesis).

Step	Core manager decision	Pilot evidence / exit criterion
1. Diagnose	Which process failure warrants attention?	Defined baseline; responsible process owner; feasible measurement.
2. Co-design	How will the tool fit the actual workflow?	User-tested form/process; roles and exception handling agreed.
3. Train	Can workers execute and correct the task?	Practical demonstration; error-correction procedure; training time.
4. Pilot	Does the change work without unacceptable burden?	Use rate; data accuracy; workload; cost; safety observations.
5. Embed	Should this become a regular way of working?	Named owner; review cycle; backups; documented improvement.

A strength of the roadmap is that it does not require expensive systems at the outset. For a small enterprise, a controlled spreadsheet or an appropriately secured mobile form may be

sufficient for a baseline if it meets operational and legal needs. More advanced applications, such as integrated enterprise software or automated forecasting, should be justified by data quality, process stability and expected incremental benefit. Digital investment without data stewardship may magnify unreliable information. The sequence therefore treats low-cost learning as a strategic asset, not as evidence that the firm is technologically backward.

4.3. Employee involvement and change risk. Staff may resist an innovation for reasons unrelated to willingness to learn. A new system may increase work, expose errors without providing corrective support, use unfamiliar terminology or duplicate existing records. Management can reduce these risks by identifying a worker champion, explaining the practical purpose of each data field, protecting time for training and involving users in periodic reviews. Supervisors should monitor whether a new process genuinely replaces an old task rather than silently adding a second layer of reporting. New roles should be documented in language staff can understand.

Data governance is equally important. Operational records may include customer details, supplier prices and commercially sensitive production volumes. Managers should restrict access by role, provide backup and recovery procedures, define retention rules and review vendor contracts before entering information into external services. Where digital tools employ automated recommendations or AI, employees need clear instructions about verification and escalation; the business remains responsible for quality and safety decisions. A prediction should never silently override a recorded inspection or a legally required control.

4.4. Balanced performance evaluation. The paper proposes four linked measurement dimensions. Operational reliability may use inventory discrepancy rate, batch traceability completeness or time to resolve exceptions. Workforce adoption may use proportion of eligible transactions recorded correctly, training completion and the frequency of workarounds. Financial viability should consider recurring subscription, device replacement, staff time and savings actually realised. Data governance should monitor unauthorised access incidents, backup restoration tests and unresolved quality exceptions. None of these indicators alone demonstrates digital transformation; together, they support a better management decision.

Evaluation should establish what changed and what did not. For instance, improved completeness of temperature records is evidence of better documentation, not proof of lower spoilage unless spoilage is measured comparably. A reduction in reported loss may reflect altered classification rather than actual efficiency. Pilot assessment should therefore use a pre-defined observation window, stable units of measure and a description of seasonal or demand changes. This cautions against interpreting a single successful digital pilot as a causal demonstration of competitiveness gains.

4.5. Implications for support organisations. Training providers and SME support agencies could help by combining digital literacy with operational problem solving, rather than teaching software features in isolation. The OECD [1] explicitly emphasises supportive institutions, awareness and skills in Uzbekistan's private-sector digital uptake. In agrifood SMEs, practical training could use fictional exercises in purchase-order reconciliation, lot coding, quality alerts

and cost-benefit estimation. Shared terminology and affordable technical assistance may also help small firms engage technology vendors on more equal terms, while respecting firm-specific constraints.

4.6. Illustrative agrifood use case: batch records. Consider a hypothetical fruit-drying SME with paper intake notes, warehouse cards and handwritten dispatch information. The proposed intervention is not initially an AI system: it is a single, consistent batch identifier linked to incoming material, process date, finished quantity and dispatch. Before implementation, managers identify who assigns an identifier, who checks duplicate entries and which record is authoritative. During a short pilot, they record missing fields, time spent on corrections and staff feedback. A positive result would be increased record completeness without disproportionate labour costs, not an unproven claim that the new system has improved product quality or profitability.

4.7. Illustrative agrifood use case: storage decisions. In a hypothetical refrigerated store, temperature alerts could help identify equipment faults or door-management problems. Yet this benefit depends on calibrating sensors, documenting acceptable ranges for specific products and assigning someone to respond. The project should specify what triggers an escalation, how to handle false alerts and when manual inspection overrides the device. Pilot indicators might include valid readings, response times and documented corrective actions. Financial and spoilage outcomes should be monitored separately to determine whether the technology delivers substantive operational value. A manager should not label alerts 'AI-driven' unless an actual AI component exists and its performance has been evaluated.

4.8. Adoption failure modes and safeguards. Three failure modes merit special attention. First, duplicate data entry causes fatigue and increases the likelihood of inconsistent records; the safeguard is to remove redundant steps during co-design. Second, vendor dependence can make a firm unable to access historical records or change providers; the safeguard is an exportable format, a contract review and tested backup recovery. Third, output metrics may improve artificially when workers stop reporting defects or when the definition of a 'completed' record changes. The safeguard is an audit procedure and a stable indicator definition. These risks reinforce the view of technology implementation as managerial governance rather than a one-time purchase.

The roadmap supports several testable propositions. Proposition 1: workflow co-design with frontline workers is positively associated with correct system use, controlling for software complexity. Proposition 2: adoption quality mediates the relationship between technology expenditure and process improvement. Proposition 3: a named decision owner and documented exception process moderate the impact of digital monitoring on operational response times. These propositions do not imply that every digitised firm outperforms non-adopters; they direct attention toward conditions under which digital investments may create value. A longitudinal study could test them using comparable firms or repeated process measurements.

5. Limitations and empirical research agenda

The model has not been validated through a survey or field intervention in Uzbekistan and should not be interpreted as an estimate of adoption rates, losses or financial returns. The selected sources cover diverse sectors and geographies; transferability to any particular Uzbek processing, logistics or storage enterprise remains uncertain. Requirements related to food safety, privacy and contracts also vary across processes and must be confirmed with competent local authorities and practitioners.

Further research could recruit agrifood SMEs at different stages of digital maturity and compare implementation experiences. Interviews with owners, workers and technology providers would test whether the proposed stages represent actual decision points. A follow-up pilot could collect baseline and post-adoption data on record accuracy, response time, training burden and net process cost, with an appropriate comparison group where feasible. Negative outcomes and discontinued technologies should be included to avoid selection bias.

A feasible evaluation design could follow a small set of participating firms for one agricultural season. Researchers would record the intervention's initial workflow, staff training hours, technology cost and indicators chosen before deployment. Follow-up observations would verify actual usage and distinguish the effects of implementation from changes in production volume, weather-related input quality or customer mix. Interviews with employees and supervisors could explain why measured adoption differed from planned adoption. Such research would provide stronger evidence than testimonials or vendor demonstrations and could inform locally relevant management education.

6. Conclusion

Digital innovation in Uzbekistan's agrifood SMEs should be managed as an organisational learning process rather than a software purchase. The proposed roadmap places diagnosis, worker involvement, targeted skills, piloting and accountable routines ahead of full rollout. Its measurement approach separates technology use from process improvement and financial value. The practical implication is to start with one decision that better information could improve, equip the employees responsible for it and scale only after the firm can demonstrate reliable data, usable workflows and acceptable costs. This conceptual model offers a foundation for future empirical testing, not a claim of verified performance improvement.

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