

CONTENTS

1. INITIATION STAGE DOCUMENT	2
1.1 Business-Analysis Initiation Stage for Retail Chain	2
1.2 Background	2
1.3 Project Rationale	3
1.4 Problem Statement	3
1.5 Business Goals	4
1.6 Scope	4
1.7 Initial stakeholders	6
1.8 High-Level Requirements	6
2. DISCOVERY STAGE DOCUMENT	8
2.1 As-is Analysis of Price Tag Management Subprocess within “Prepare” stage of sales business-process. Discovery Stage Document for Electronics Retail Chain	8
2.2 Objective	8
2.3 Scope of Analysis	8
2.4 Current Process Analysis. (Based on author’s work experience and informal stakeholder discussions) Key Process participants:	9
2.5 Current Process Description (As-Is)	10
2.6 As-Is BPMN diagrams:	12
2.7 Time Analysis and Process Variability	13
2.8 Key Finding and Pain Points	14
2.9 Current System Limitations	16
2.10 Economic Impact Analysis and Quantified Cost Breakdown	18
2.11 Short Summary and Next Steps	21
3. SOLUTION DESIGN DOCUMENT	22
3.1 To-Be Design of Price Tag Management Subprocess within “Prepare” stage of sales business-process	22
3.2 Objective	22
3.3 To-Be Process Description	22
3.4 To-Be BPMN Diagrams	24
3.5 User Stories	25
3.6 Acceptance Criteria	26
3.7 Initial ESL Device Setup and Connection Process (AC 4.1 & AC 4.2)	29
3.8 Process Transformation Summary	31
3.9 Benefits Realization	32
3.10 Implementation Considerations	32
3.11 Next Phase Recommendations	33
GLOSSARY	34
EXECUTIVE SUMMARY	36
PROJECT LIMITATIONS AND FUTURE DEVELOPMENT	38

1. INITIATION STAGE DOCUMENT

1.1 Business-Analysis Initiation Stage for Retail Chain.

Project: integration of Electronic Shelf Labels (ESL) for Electronics retailer.

External Analyst: Samoilov Anton Trainee/Junior BA in “Company name”.

Version: 9

Date (yyyy-mm-dd): 2025-06-08.

1.2 Background.

The author of this business analysis project has two years of professional experience working as a salesperson at one of the Ukraine’s leading consumer electronics and appliances retail chain. As someone who was interested in more than just their direct responsibilities and was well versed in about other positions’ operations, they gained comprehensive insights and personal point of view on various management processes, including manual price tag replacement.

Through that hands-on experience, several unproductive actions were identified that have a significant impact on both operational costs and customer experience. The current system requires substantial manual labor for price updates across the entire chain, not just individual stores. The process involves multiple steps in each location: checking price updates or revaluations in ERP, copying revaluation numbers and pasting them into a specialized admin panel, or manually type (or copy+paste) products IDs with required counts of the product. Store associates must then choose between two printing options: “by remains”, “by availability”. Additionally, incorrect paper color (white or yellow) different format of price tags, could be inside one revaluation, therefore associates making enough duplicates for correct formats and part of the paper just throwing into bin, just because of duplicates. After this lengthy process, which remains human error risks, store staff must print the tags, cut them in size (which means due to bad cutting staff must reprint the price tag), walk around to find out where does the product is on the tag. Often, products have been

sold or moved, that requires additional time to take item(s) from storage, unpack them, and properly display them with updated pricing, or just throw the paper into bin.

This project focuses on analyzing the integration of ESL as a strategic solution to optimize one of the very first sales business process – “Prepare” which involves time-consuming price tag management operations. This initiative aims to solve the identified problems and help the company stay competitive in Ukraine’s retail market. Additionally, ESL implementation will improve customer experience by ensuring price accuracy and reducing pricing errors and additional checkout.

The analysis draws upon practical knowledge of existing workflows, stakeholder requirements, and operational limitations observed during the author’s employment period, implementation realistic and implementable recommendations.

1.3 Project Rationale

Implementation of ESL integrated with the Product Data Server that feeds into the “revaluation” page in current ERP will eliminate manual price tag management bottlenecks, reduce costs by minimizing paper consumption, printing supplies, associated logistics expenses while enabling rapid price updates during promotional periods. Ultimately, it will significantly improve operational efficiency and enhance customer experience through automated and accurate pricing.

1.4 Problem Statement.

- Highly unpredictable workload of price tag management depending on the different activities like promotions, volume of revaluations, etc.
- Both other duties and high-volume revaluations could mutually create bottlenecks
- Repeated price changes during day/week/etc. require repeating of the process

- Significant store staff productivity and motivation could be worse because of high volume revaluations, their repeating, and a big dealing part with manual labor.
- Correct price verification needed with laptop and scanner due to potential discrepancies between retail and internet prices, especially after major repricing
- Risk of human error in price tag placement and accuracy

1.5 Business Goals.

1. Achieve price accuracy of > 99% between price tag and POS system.
2. Reduce supply costs by at least 50% during the first 2 months through the significant minimization of expenses related to price tag management such as paper, printing materials and their associated logistics expenses.
3. Eliminate over 90% of manual labor related to price tag management by implementing ESL specially for price change sensitive products.
4. Enhance overall retail-chain operational efficiency and store associate's productivity through comprehensive ESL system integration.
5. Accelerate automated price deployments to within 1 minute.
6. Increase customer experience by reducing price discrepancies, especially at the checkouts

1.6 Scope

In scope:

- ESL deployment for all open display products with dedicated fixed shelf positions including electronics, gadgets, home appliances, audio equipment except hanging ones;
- Required product information display like on paper tag depending on the format: price, name of product, ID, characteristics, last time update. Except product barcode due to unnecessary manual price validation with laptop and scanner;

- ESL integration with current PDS;
- Development or adaptation of software for managing ESL system;
- Development of monitoring and supporting the ESL system;
- Selection of ESL;
- Pilot implementation in 2 selected stores in Kyiv;

Out of scope:

- ESL deployment for hanging products;
- Chain-wide implementation rollout;
- ESL integration with other systems than PDS;
- Developing new ERP or POS system;
- Store associate's study;
- Installation and configuration of ESL required equipment;
- Purchase of ESL;

1.7 Initial stakeholders

Stakeholder	Role/Interest
Retailer Senior Management	Project approval, budget allocation, strategic decision making, reduce operational costs by minimizing paper and printing supplies, establish competitive advantage by this innovation, positioning the company as industry leader in retail automation.
Store Associates	Primary system users, responsible for daily operations and pricing accuracy, are interested in reducing risks of manual labor.
IT Development Team	Development/Adaptation software for ESL managing and monitoring, creating databases for new system, sync with PDS.
Retailer IT Team	System technical support, integration with other systems than PDS (if need), install and configure ESL equipment. Later chain-wide rollout of ESL system.
Merchandizing department	Using ESL for promotions and advertising campaigns. Creating new ideas for designing.
Customers	Accurate pricing information, good customer experience, store associates focus on us.
ESL Supplier	Saling and supplying ESL components.

1.8 High-Level Requirements

Core Requirements:

- Fully automated price synchronization: PDS price change > ESL update without store associate's intervention
- Real-time sync: price changes appear on shelf within 1 minute of PDS update
- Complete information display on ESLs – same as current paper tags, but without barcode.

Product Management Requirements:

- Web-based admin panel with mobile adaptation for price tag management
- In addition to standard black and white, yellow color support is mandatory, and red color support is desired for ESL displays
- Product reassignment options:
 - On-site Reassignment via smartphone by scanning unique QR-code displayed on ESL (accessed via a physical button press) which opens web-based admin panel, enabling scanning of the product barcode, or manually entering product ID
 - Remote Reassignment via in-store computer by selecting or manually entering ESL ID, then scanning product barcode, or manually entering product ID
- ESL update within 1 minute after assignment confirmation

System Requirements:

- Integration with existing PDS
- ESL Base Stations for Zigbee protocol communication
- Mesh network architecture supporting 100-200 ESL devices per Base Station
- Developing error reporting and sync failure alerts
- Admin access from store computers and mobile devices

ESL Requirements:

- Battery life: at least 5 years
- Programmable physical button
- Ability to save last update timestamp, own ID, shown product ID
- Reliable wireless connectivity via dedicated ESL Base Stations
- Zigbee protocol compliance for low-power mesh networking

2. DISCOVERY STAGE DOCUMENT

2.1 As-is Analysis of Price Tag Management Subprocess within “Prepare” stage of sales business-process.

Discovery Stage Document for Electronics Retail Chain.

Project: integration of Electronic Shelf Labels (ESL) for Electronics retailer.

External Analyst: Samoilov Anton Trainee/Junior BA in “Company name”.

Version: 8

Date(yyyy-mm-dd): 2025-06-10.

2.2 Objective.

To analyze and document the current manual price tag replacement subprocess within the “Prepare” stage of the sales business-process, identify operational bottlenecks, quantify time and resource variability, and establish baseline metrics for automated ESL implementation evaluation.

2.3 Scope of Analysis.

In Scope:

- Price tag management subprocess within “Prepare” stage of sales process
- All involved roles: Salesperson (primary), Store Admin, Store Director, Cashier.
- Current tools: ERP system, browser in PC admin panel, printers, ink, paper, scissors and other supplies with risks related to them
- Time measurements and process variability analysis

Out of Scope:

- Other “Prepare” stage activities (cleaning, self-preparation, etc.)
- Remaining sales business-process stages
- Checkout and payment processes

- Inventory management and restocking operations
- Technical development of the ESL system or PDS integration (covered later)

2.4 Current Process Analysis. (Based on author's work experience and informal stakeholder discussions)

Key Process participants:

Role	Involvement in Price Tag Process	Own "Prepare" Duties
Salesperson	Reviews ERP, print/cut/place tags, verify price accuracy	Visual product merchandising, product alignment, cleaning
Cashier	Helps print and cut tags when not engaged with primary duties	Prepare and open the register, verify financial reports
Store Admin	Performs full tag cycle and coordinates store associates, covers salesperson, and cashier if needed	Check all KPI reports and share them, and other store updates with management. Tracks updates in Company and informs the Team about them.
Store Director	Occasionally joins cutting/placement, verifies pricing	Repeated from Store Admin's but with other reports.

Clarifications:

While formal responsibility for price tag replacement is often assigned to the salesperson, during major revaluations such as the start of the month, promo launches or ends, brand-specific updates, the task becomes shared operational subprocess within the "Prepare" stage.

In those scenarios, all staff may take direct action: printing, cutting, replacing tags, verifying prices accurately. This collaboration happens when physical workload and timing outweigh formal job descriptions.

- The official model looks like: Salesperson does > Cashier assists > Director/Admin checks and validate.
- The real model: “One for all and all for one”, with the note that only salespersons and admins usually walk the floor to place tags.

Process Role Flexibility:

- All preparation tasks (ERP access, printing, cutting) can be performed by any available staff member
- Floor placements are primarily done by Salesperson, occasionally Admin or even Director. Cashier excluded due to duties
- Actual task assignment depends on current workload and staff availability rather than formal job descriptions

2.5 Current Process Description (As-Is).

Manual Price Tag Replacement Subprocess:

This subprocess starts before the store opens (for clients) focuses on the printing and replacing price tags for revaluated products. Although initiated by the salesperson (direct duty), it is common for all available staff to assist during peak loads.

Step-by-Step Flow:

1. ERP Access and Revaluation Selection – Store associate logs into the ERP system, navigates to “Revaluation” section, and identifies which have “For retail” mark. Associate opens each revaluation batch and review what formats of price tags are needed;
2. Admin Panel Interaction – The revaluation number is copied from ERP and pasted into the browser-based admin panel. Based on filters, the system returns only actual products present in store stock;
3. Label printing – Tags are printed on paper;
4. Manual Cutting – Printed labels are manually cut using scissors. Also, promo price tags may require yellow paper or/and ad wobblers;

5. Product Walkthrough – Store associate physically moves through the store to locate target items and their old tags;
6. Inventory Adjustment – If a product is misplaced, or missing – it's fetched from the store storage, unpacked and shelved on the correct place;
7. Tag Replacement – Old price tags are removed and replaced with the new printed. Attention is paid to correct placement, paper color, format and wobbler if needed;
8. Confirmation – Completion is often confirmed verbally. Store management may casually verify that the process is finished (based on trust and mutual responsibility). Sometimes this informal approach may occasionally lead to mistakes.

Additional Notes:

- Each revaluation batch may contain a lot of products, but filters reduce that to the actual items.
- Promo campaigns, brand-specific offers, etc., may lead to multiple revaluations per week, repeating the process for the same products (sometimes for each).
- Errors such as using white instead of yellow paper/incorrect format, may require reprinting and redoing certain price tags.

2.6 As-Is BPMN diagrams:

Author: Trainee/Junior BA Samoilov Anton
Version: 1.2

Note: This BPMN diagram is a preliminary representation. I am committed to continuous improvement in BPMN 2.0 modeling

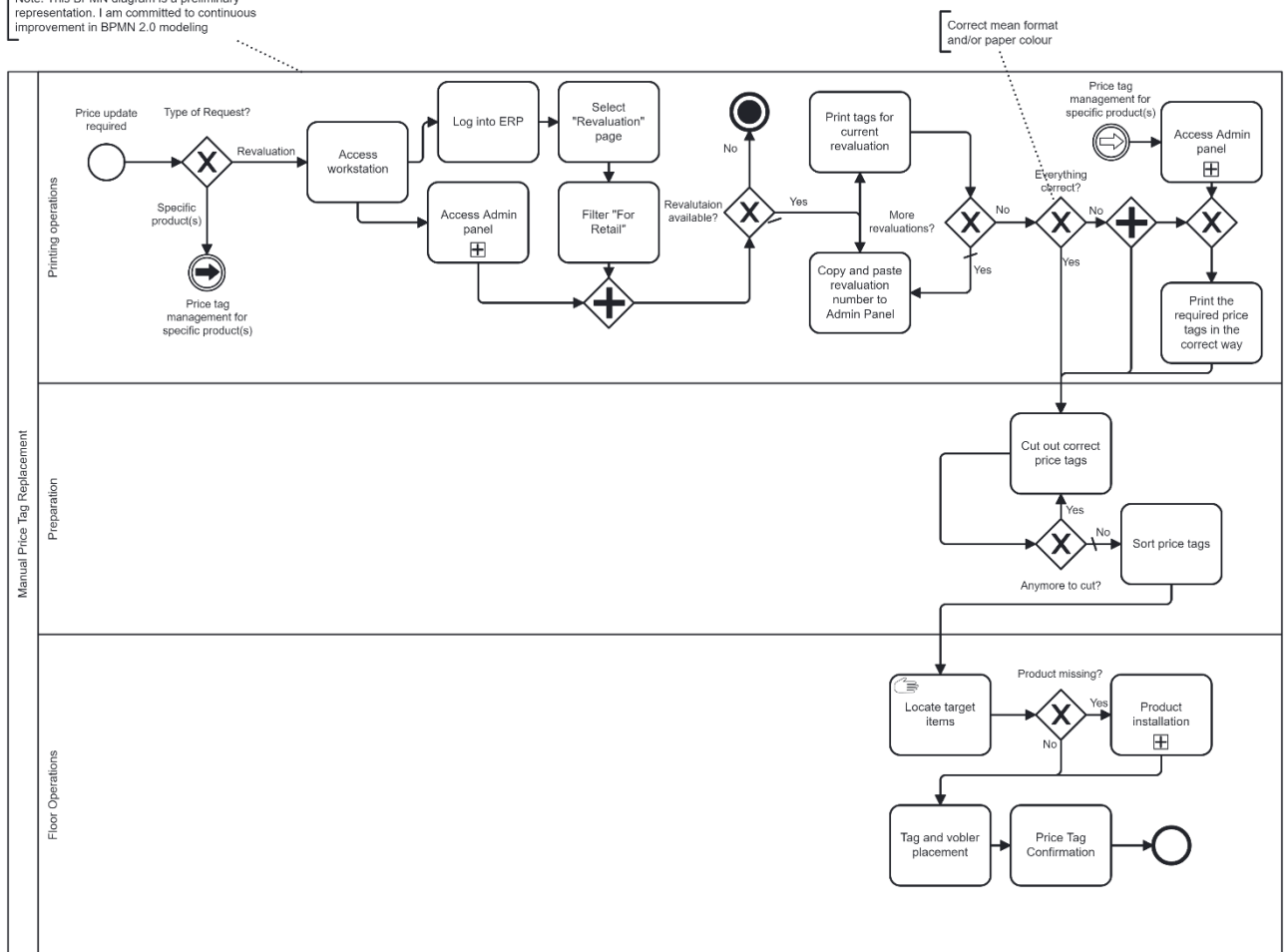


Image 1 – Manual Price Tag Replacement As-Is BPMN Diagram

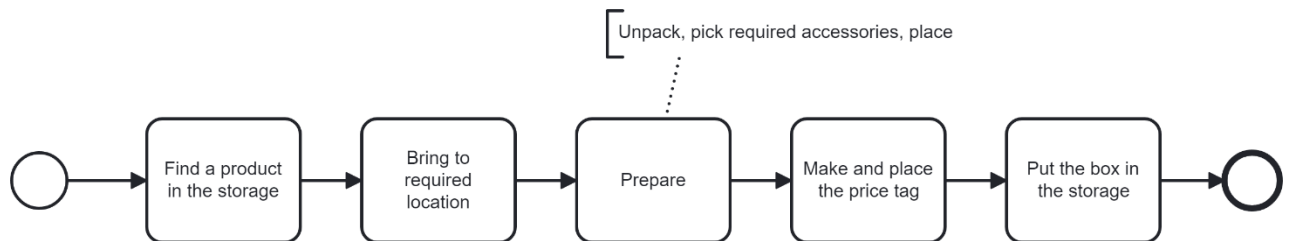


Image 2 – Product installation subprocess

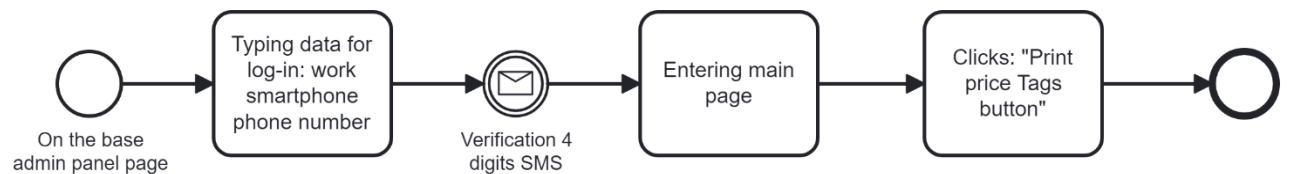


Image 3 –Access Admin Panel Subprocess Diagram

2.7 Time Analysis and Process Variability.

Based on operational observations, the manual price tag replacement subprocess demonstrates significant time variability depending on revaluation volume, promo activities and operational context.

Scenario-Based Time Analysis:

Scenario	Time Range	Key Factors	Frequency
Minimal Updates	5-15 minutes	≤10 tags, quick print and place	Occasional
Standard Daily	≤35 minutes	Regular price adjustments, ≤20 tags	Most days
Major revaluation	1.5+ hours	Month-start, promo/brand specific revaluations: ≥30 tags	Monthly/Seasonal
Interrupted Process	Unpredictable	Customer priority, delivery assistance, urgent tasks	Frequent

Process Step Time Distribution:

Process Step	Time Range	Main Variability Drivers
ERP review and revaluation selection	2-10 minutes	System performance, number of active revaluations
Admin panel data entry	5-20 minutes	Copy-paste, quick selection, validation for future printing workflow
Label printing and cutting	5-35 minutes	Printer queues, paper changes, manual cutting fatigue
Store walkthrough and placement	5-40 minutes	Walking distance, product location accuracy, interruptions
Inventory adjustment (when needed)	5-20 minutes	Storage accessibility, product unpacking requirements

Peak Load Impact Scenarios:

- Major revaluations: requiring $1.5 \geq$ hours of dedicated attention, across different categories with special formatting requirements and wobblers installation.
- Seasonal Transitions: Holiday pricing adjustments affecting multiple product lines
- High Customer Traffic Days: Process competes with customer service priorities, creating delays

Factors of Variability:

- Staff availability and role flexibility during peak periods
- Equipment reliability (printers, scissors, paper supply)
- Product displacement requiring storage retrieval
- Incorrect price tags necessitating reprinting cycles
- Multiple revaluations for the same products during the period

Operational Impact:

The high variability creates unpredictable workload distribution, with some days requiring minimal price management (5-15 minutes) while others demand several hours ($1.5 \geq$), significantly impacting other "Prepare" stage activities and customer service availability.

2.8 Key Finding and Pain Points.

Based on the observed subprocess, staff feedback, and time variability analysis, the following critical issues and pain point have been identified:

Operational Pain Points:

1. High Manual Labor Load - Manual price tag operations - from ERP navigation to printing, cutting, and placement - consume up to hours during peak periods, significantly impacting daily operations.

2. Staff Role Disruption - All available employees may be pulled into tag management, disrupting their primary duties (cashier operations, KPI reporting, product merchandising, cleaning, customer service).

3. Repetition & Redundancy - Some products undergo multiple rounds of revaluation in a single week due to promotions, rollbacks, or formatting corrections requiring the entire process to be repeated for identical items.

4. Format/Paper Mistakes - Incorrect use of paper color or tag format leads to wasted materials and repeat printing/cutting cycles, increasing operational costs and reducing staff efficiency.

5. Physical Fatigue & Resource Inefficiency - Prolonged walking, cutting, and manual handling leads to employee fatigue, inconsistent price tag quality, and inefficient allocation of staff resources.

6. Informal Verification Process - Process completion is typically verified informally through trust-based verbal confirmation, increasing the likelihood of missing price tags or incorrect placements.

7. Price Mismatches at Checkout - When customers encounter incorrect pricing (old tags not replaced), Ukrainian consumer law requires honoring the displayed price, leading to direct revenue loss or customer conflicts at checkout.

8. Customer Service Delays - While price tags are being updated, customer-facing staff become partly unavailable, resulting in reduced customer engagement and slower assistance response times.

9. Compromised Store Readiness at Opening - During periods of significant revaluation, store staff may be unable to complete all price tag updates before opening hours. This necessitates tagging work to continue while customers are present, leading to suboptimal store presentation, missing or incorrect price tags, and negative initial customer experience.

Impact Summary

Category	Impact
Staff Time	Up to 1.5≥ hours/day lost on manual subprocess operations
Material Costs	Wasted paper, ink cartridges, scissors
Error Risk	Manual input/output errors, price tag mismatches
Customer Experience	Price confusion, checkout conflicts, delayed assistance
Business Risk	Revenue loss from honoring outdated displayed prices

Strategic Implications:

The identified pain points demonstrate that the current manual price tag management subprocess creates substantial operational inefficiencies, increases business risk exposure, and negatively impacts customer experience. These findings provide strong justification for automated ESL implementation to eliminate manual bottlenecks and ensure pricing accuracy.

2.9 Current System Limitations.

Despite staff coordination and adaptive teamwork, the existing paper price tag management system presents multiple limitations across technology, process, and resource domains.

1. No Real-Time Price Synchronization: ERP system is not directly connected to physical price displays - every price change requires manual intervention and multi-step processing.
2. No Error Validation: The system does not detect format errors, incorrect paper selection, or missed products. Mistakes are discovered only after printing or during checkout.
3. No Mobile Support for retail price: Tag reassignment or verification requires laptop with scanner and access into ERP system, limiting floor-level operations and real-time adjustments.

4. Fragmented Workflow Tools: ERP and Admin Panel operate as separate systems requiring copy-paste operations between platforms, increasing risk of human error and data entry mistakes.
5. Linear, Sequential Workflow: Tasks such as printing, cutting, and placing tags cannot be parallelized from the beginning, making the process inherently slow and inflexible during peak periods.
6. Equipment Dependency (occasionally): Printer, cutting tools, and finite paper supply create single points of failure that can halt the entire process.
7. Supply Chain Risks: White and yellow paper, and ink supplies may be unavailable during critical periods, particularly during promotional campaigns when demand peaks.
8. Competing Priority Management: Staff must balance price tag replacement with primary responsibilities, resulting in divided attention and increased error probability during multitasking scenarios.
9. Limitation Impact Summary: The current price tag management system is non-scalable, error-prone, labor-intensive, and operationally fragile. It relies heavily on human reliability, creates workflow bottlenecks, and introduces unnecessary business risks in critical retail operations.
10. No Digital Infrastructure: Current paper-based system lacks any digital connectivity, requiring future implementation of Zigbee mesh network infrastructure via ESL Base Stations for automated price management.

System Readiness Assessment:

These limitations demonstrate that the current manual system has reached its operational capacity and cannot effectively support business growth, promotional complexity, or operational efficiency requirements. The identified constraints provide clear justification for automated ESL implementation.

2.10 Economic Impact Analysis and Quantified Cost Breakdown.

Author's Slogan - "From manual chaos to Automated Clarity".

The current paper-based process is time consuming, error-prone, and unscalable. Implementing an ESL system will eliminate manual labor, reduce human error, and free up staff for higher-value activities such as customer service, and generally improve the efficiency of the store, and therefore the company.

Baseline Staff cost Structure

Role	Days/Month	Hours/Day	Hours/Month	~Salary/Month (UAH)	~Hourly Rate (UAH)
Salesperson	22	12	264	45 000 ₺	170,5 ₺
Cashier	22	12	264	26 000 ₺	98,5 ₺
Admin	22	8	176	30 000 ₺	170,5 ₺
Director	22	8	176	40 000 ₺	227,3 ₺

Daily Operations

Role	~Involvement (%)	~Time/Day (min)	~Time/Month (hours)	~Cost/Month(UAH)
Salesperson	70%	24,5	9,4	2 041,7 ₺
Cashier	10%	3,5	1,5	126,4 ₺
Admin	10%	3,5	1,3	255,2 ₺
Director	10%	3,5	1,3	328,1 ₺
Staff	100%	35	13,5	2 751,4 ₺

Major Revaluation

Role	~Involvement (%)	~Time/ Day (min)	~Time/ Month (hours)	~Cost/Month(UAH)
Salesperson	50%	50	19,2	4 166,7 ₴
Cashier	20%	20	8,7	722,2 ₴
Admin	20%	20	7,3	1 458,3 ₴
Director	10%	10	3,7	937,5 ₴
Staff	100%	100	38,8	7 284,7 ₴

Additional Operational Costs

Cost Category	~ Monthly Cost (UAH)	Description
Materials	25 000 ₴	White/yellow paper, cartridges
Equipment (wear & tear)	5 000 ₴	Printers repairing, Scissors, logistics expanses
Pricing error loses	3 000 ₴	Dismount for price mismatches
TOTAL	33 000 ₴	-

Total Price Tag Management Costs

Operation Type	Time/ Month	Costs/ Month	Total staff time %
Daily	13,5	2 751,4 ₴	1,4%
Major	38,8	7 284,7 ₴	4,1%
Total	52,3	10 036,1 ₴	5,6%

Salesperson example of Time Distribution Analysis

Activity	~Time %	Hours/Month	Optimization Potential
Price tag Management & Merchandising	25%	69	Will eliminate 95% of this time
Breaks	8%	22,08	x Regulatory
Direct Sales	15%	41,4	Can be Increased
Customer consultations	40%	110,4	Can be Increased
Other tasks	12%	33,12	x Administrative

ESL Implementation Economic Impact

Saving Source	Monthly Savings (UAH)	Annual Savings (UAH)
Price tag labor costs	10 036,1 ₺	120 433 ₺
Materials & supplies	33 000 ₺	396 000 ₺
Pricing error losses	3 000 ₺	36 000 ₺
TOTAL	46 036,1 ₺	552 433 ₺

Comparison: As-Is vs To-be (ESL Future State):

Dimension	Current Process (As-Is)	Future State (To-Be)
Price updates	Manual: ERP>copy>Admin Panel> Print>Cut>Manual Place	Automatic: PDS> ESL
Price tag formats and paper	Manual format selection, paper color, frequent reprints	Digital – always accurate
Staff involvement	Often All staff engaged for hours	Minimal: occasional reassignment only
Time Spent	35-90+ minutes per day	~5 minutes, smartphone QR-scan reassignment
Customer Experience	Errors, old price tags and conflicts within it	Always synced, accurate pricing
Risk Exposure	High, revenue loss from price mismatches	Near-zero, with proper sync

2.11 Short Summary and Next Steps.

The comprehensive As-Is analysis provides compelling evidence that the current manual price tag management system has reached its operational limits and poses significant business risks. The quantified costs, identified inefficiencies, and strategic implications clearly justify investment in ESL automation. The transition from manual to automated price management represents not just an operational improvement, but a strategic transformation that will enhance customer experience, optimize staff productivity, and position the retail chain for sustainable growth in an increasingly competitive market.

Project Recommendation: proceed with ESL implementation planning and vendor evaluation, targeting pilot deployment within x days of project approval.

3. SOLUTION DESIGN DOCUMENT

3.1 To-Be Design of Price Tag Management Subprocess within “Prepare” stage of sales business-process.

To-Be Process Design Document for “Company” Retail Chain.

Project: integration of Electronic Shelf Labels (ESL) for Electronics retailer.

External Analyst: Samoilov Anton Trainee/Junior BA in “Company name”.

Version: 3

Date(yyyy-mm-dd): 2025-06-12.

3.2 Objective.

To design and document the optimized price tag replacement subprocess within the “Prepare” stage of the sales business process using ESL. The proposed ESL hardware is assumed to include a physical interaction button (tap or hold) for basic operations such as switch off/on and reassignment process. The objective is to eliminate manual paper tag handling by providing automated price synchronization between the PDS and all ESLs across the retail chain, while ensuring full data accuracy, fast deployment, and operational scalability.

3.3 To-Be Process Description.

The optimized price tag management subprocess operates through automated ESL synchronization, eliminating manual printing, cutting and (re)placement activities. Store Staffs involvement is limited only to product reassignment tasks and exceptions (e.g. mismatch) handling.

Step-by-Step Flow:

1) Product Data Change Event: A data update (e.g., price, description) for any product ID (currently 6 digits, expanding to 7 digits in the future) is entered into the PDS and published.

2) ESL Device Status Reporting & Server Identification: Each ESL device transmits its current assignment (ESL ID, assigned product ID, and the last update timestamp) to the ESL Server via Zigbee protocol through ESL Base Station

3) Data Formatting and Push to ESL Devices: Based on the identified ESL devices' characteristics (e.g., dimensions, display templates) and the updated product information retrieved from the PDS, the ESL Server processes and formats the display data (including product name, details, new price, and the current 'last updated' timestamp). This formatted data is then pushed through ESL Base Station via Zigbee protocol to each respective ESL device.

4) ESL Display Update & Confirmation: Each ESL device refreshes its display within 1 minutes to show the updated product name, details, new price (this information received from PDS), its own ESL ID, and the 'last updated' timestamp.

5) Error Handling & Notification: If an ESL fails to respond or confirm the update within 2minutes, an alert is generated on ESL-server and sends into the store's admin console (and optionally via a notification bot).

6) Product Reassignment (Regular Task) – When staff need to change which product is displayed on a specific ESL, they perform the reassignment through the following methods:

- Via QR Scanner: Store staff presses (e.g. 2 times/for 5 seconds) on the physical interaction button which is on the ESL frame and: scans the QR code appearing on screen with their phone > sees current product in the Web-Interface > taps “Reassign” button > scans or enters a new product barcode/ID > click confirms > ESL Server reassign.

- Via Admin Panel: Store staff opens the ESL management page > enters the target ESL ID > accesses the same reassignment page > scan with a scanner or enters a new product barcode/ID > confirms > ESL Server reassign.

3.4 To-Be BPMN Diagrams.

Author: Trainee/Junior BA Samoilov Anton
Version: 2.1

Note: This BPMN diagram is a preliminary representation. I am committed to continuous improvement in BPMN 2.0 modeling

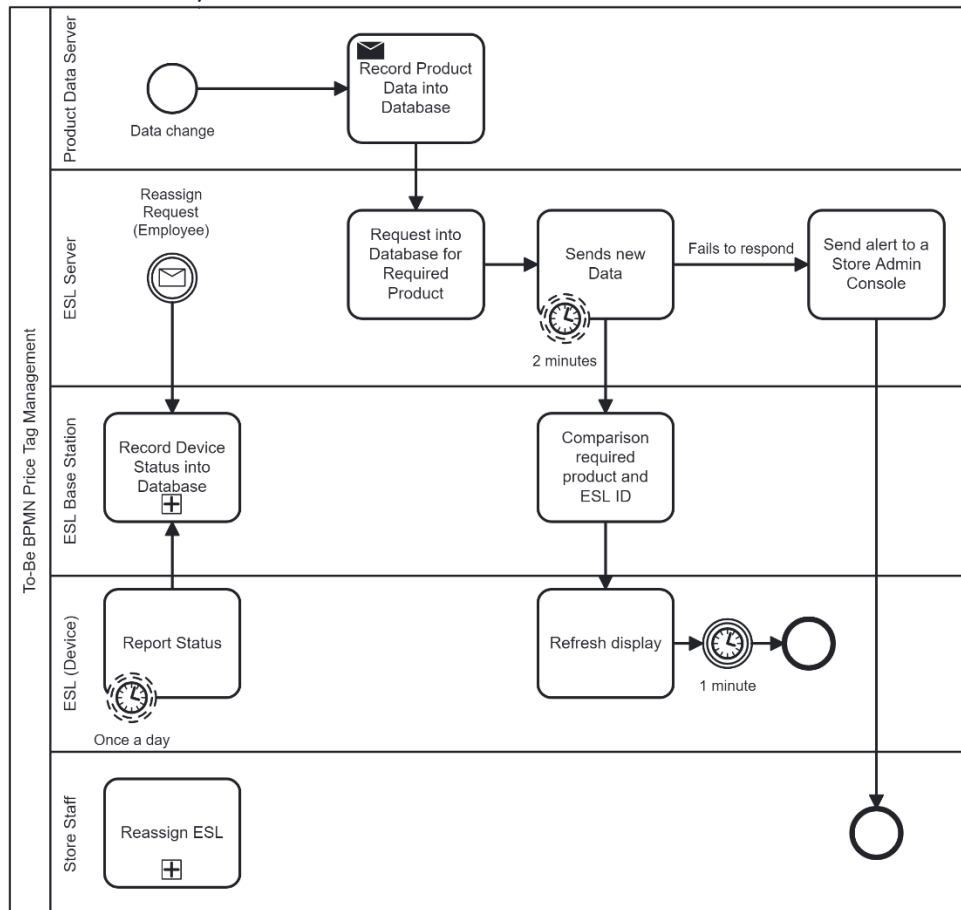


Image 4 – To-Be BPMN Price Tag Management Diagram

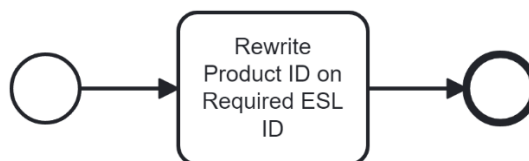


Image 5 – Record ESL Device Status on ESL Server

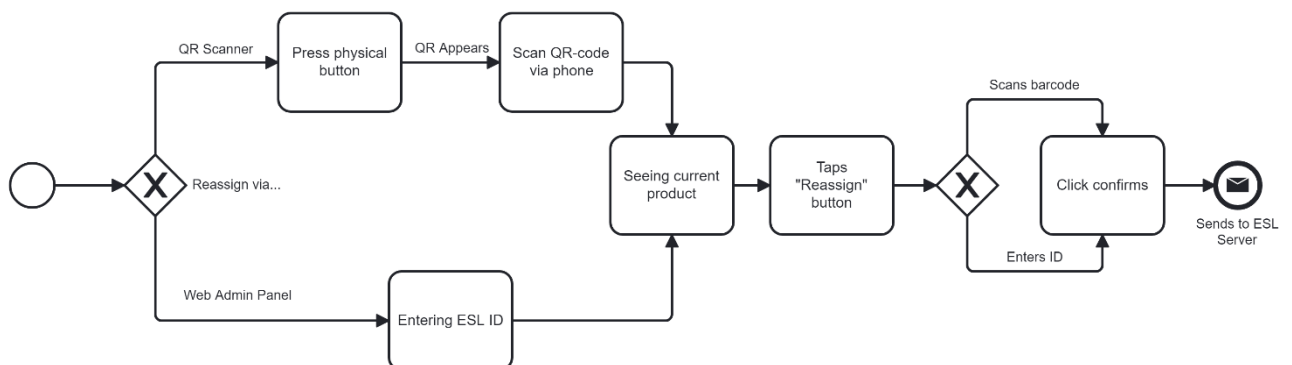


Image 6 – Reassign ESL(To-Be)

3.5 User Stories.

User story 1:

As a store associate, I want ESL price tags to update automatically when product data changes so that I don't need to spend hours printing, cutting and placing price tags manually.

User story 2.1:

As a store associate, I want to press a physical button on the ESL device to display a QR-code, so that I can easily access the reassignment page for that specific ESL device.

User story 2.2:

As a store associate, I want to reassign ESL devices to different products by scanning ESL device QR code ID via smartphone, so that I can quickly update shown product.

User story 2.3:

As a store associate, I want to reassign ESL devices to different products by ESL ID via the admin panel, so that I can quickly update shown product.

User story 3:

As a retail chain, I want all ESL prices to show the product changed data in real time, so that price consistency is maintained across stores.

User story 4:

As a store associate, I want to quickly connect new ESL devices to the network, so that I can get them up and running with accurate pricing without delay.

3.6 Acceptance Criteria.

AC 1.1: Given an ESL device fails to receive a price update or confirm a successful update within the defined timeframe (e.g., 2 minutes, as per AC1.2), when the system detects this failure, Then the system automatically generates an alert for that specific ESL device.

AC 1.2: Given an alert is generated for an ESL device sync failure (as per AC1.1), when the system alerts, Then store management receives a notification (e.g., in admin panel special page) containing the ESL ID, and type of failure.

AC 1.3: Given store management accesses a designated "ESL Errors" section in the admin panel, when they open this section, Then a list of all ESL devices with reported problems is displayed, including relevant details (e.g., last known status, time of failure).

AC 1.4: Given a sync failure for an ESL device has been resolved, when the ESL device successfully, Then the corresponding alert is automatically marked as resolved in the system and removed from the active alerts list.

AC 2.1.1: Given an ESL device displaying product information, When a store associate presses a designed physical button on the ESL device (e.g. twice press, or hold for 5 seconds), Then ESL device displays a unique QR code on its screen.

AC 2.1.2: Given a QR code displayed on the ESL device (as per AC 2.1.1), When a store associated scans this QR code with mobile device's camera, Then the scanned QR code opens the Web-Interface ESL reassignment page with the specific ESL device's ID automatically pre-selected.

AC 2.1.3: Given a store associate attempts to open the Web-Interface via scanned QR code and is not logged in, Then the Web-Interface redirects the associated to a login page.

AC 2.2.1: Given a logged-on and authorized store associate scans an ESL device's QR code using a mobile device's camera (opens the Web-Interface in a browser), When the Web-Interface processes the scan, Then the Web-Interface displays current product assigned to that ESL on a dedicated "Reassign" page.

AC 2.2.2: Given the “Reassign page” is displayed (on the mobile device) the current product (as per AC 2.2.2), When the store associate selects an action to reassign the product, Then the Web-Interface provides options to either scan the barcode or manually enter its ID.

AC 2.2.3: Given the Web-Interface is ready to accept a new product ID via scan (as per AC 2.2.2), When the store associate scans the barcode of the new product, Then the Web-Interface successfully reassigns the new product to the ESL device, and the ESL immediately (within 5 seconds) displays the new product's information.

AC 2.2.4: Given the Web-Interface is ready to accept a new product ID via manual input (as per AC 2.2.3), When the store associate manually enters a valid 6 or 7-digit product ID, Then the Web-Interface successfully reassigns the new product to the ESL device, and the ESL immediately (within 5 seconds) displays the new product's information.

AC 2.2.5: Given the Web-Interface is ready to accept a new product ID, when the store associate scans or enters an invalid (e.g., non-existent, incorrect format) product ID, Then the Web-Interface displays a clear error message (e.g., "Invalid Product ID") and allows the associate to retry.

AC 2.2.6: Given a product has been successfully reassigned to an ESL device, when the reassignment process is complete, Then the Web-Interface displays a confirmation message (e.g., "Reassignment Successful") and the ESL device displays the new product's data.

AC 2.3.1: Given an ESL device is operational and displaying product information, When a store associate observes the ESL screen, Then the ESL device's unique ID is clearly displayed on the screen (e.g., in a dedicated corner) alongside the product information.

AC 2.3.2: Given a store associate attempts to access the ESL management section of the admin panel, when the associate is not currently logged in or authorized, Then the admin panel redirects the associate to a login page.

AC 2.3.3: Given a logged-in and authorized store associate accesses the ESL management section of the admin panel, when the associate searches for or selects a

specific ESL device ID, Then the admin panel displays the current product assigned to that ESL on a dedicated “Reassign page”.

AC 2.3.4: Given the “Reassign page” is displayed showing the current product (as per AC 2.3.3), when the store associate selects an action to change the product (e.g., clicks a “Reassign” button), Then the admin panel provides an input field to manually enter the new product ID.

AC 2.3.5: Given the admin panel is ready to accept a new product ID via manual input (as per AC 2.3.4), When the store associate manually enters a valid 6 or 7-digit product ID, Then the reassignment successfully completes as per AC 2.2.4.

AC 2.3.6: Given the admin panel is ready to accept a new product ID, when the store associate enters an invalid (e.g., non-existent, incorrect format) product ID, Then the error handling proceeds as per AC 2.2.5.

AC 2.3.7: Given a product has been successfully reassigned to an ESL device via the admin panel, when the reassignment process is complete, Then the confirmation proceeds as per AC 2.2.6.

AC 3.1: Given a product data change is published in the PDS, when the ESL Server processes this update, Then the corresponding ESL device displays the updated product information within 1 minute of the data publication.

AC 3.2: Given an auto product data update event, When the ESL Server sends the update data to the required ESL devices, Then the server receives a confirmation of successful update for each respective ESL device.

AC 3.3: Given a product is displayed on multiple ESLs across different stores, when its product data is updated in the PDS, Then all ESLs displaying this product across all relevant stores must show the same, updated product information.

AC 4.1: Given a new ESL device is powered on for the first time, when the store associate scans the barcode located on the back of the ESL device using a mobile Web-Interface, then the device connects to the nearest ESL Base Station via Zigbee protocol.

AC 4.2: Given an ESL device is connected to the "Retail Chain" network, when the store associate initiates the pairing process, then the device is successfully registered in the ESL management system and ready to be assigned to a product.

3.7 Initial ESL Device Setup and Connection Process (AC 4.1 & AC 4.2)

This section outlines the detailed procedure for connecting a new Electronic Shelf Label (ESL) device to the "Retail Chain" Wi-Fi network and subsequently registering it within the central ESL management system via ESL Base Station.

Prerequisites:

- The new ESL device is powered on for the first time via a single press of its integrated physical button.
- The ESL device is currently in a discoverable and unconnected state, awaiting setup.
- The Store Associate possesses access to the designated mobile Web-Interface equipped with barcode scanning functionalities.
- The "Retail Chain" Wi-Fi network is actively operational and correctly configured within the store environment, ensuring robust connectivity.

Step-by-Step Flow:

- 1) **ESL Device Power-On:** The Store Associate initiates the ESL device by performing a single press of its integrated physical button. Upon activation, the ESL device's display typically shows a default status indicating it is unconnected or awaiting setup.
- 2) **Associate Accesses Connection Interface:** The Store Associate accesses dedicated connection functionality within the mobile Web-Interface on their smartphone (or navigates to the corresponding section of the admin panel).
- 3) **Barcode Scanning:** The Store Associate locates the unique barcode positioned on the back of the ESL device. This barcode, containing the device's unique ESL ID (with serial number), is then scanned using the mobile Web-Interface integrated scanner.
- 4) **Web-Interface Transmits ESL ID:** The mobile Web-Interface securely transmits the successfully scanned unique ESL ID (serial number) to the central ESL Server, via ESL Base Station connected to Wi-Fi network.

5) ESL Server Initiates Zigbee Connection: Upon receiving the ESL ID, the ESL Server commands the nearest ESL Base Station to initiate pairing with the specific ESL device via Zigbee protocol. The Base Station broadcasts pairing signals within its Zigbee network coverage area

6) AC 4.1 Fulfilled: The ESL device successfully establishes a Zigbee connection to the nearest ESL Base Station, which serves as the communication gateway to the ESL server.

- 7) Network Architecture Overview:
- ESL devices communicate via Zigbee protocol (low power, mesh network)
 - ESL Base Station/Gateways serve as bridges between Zigbee network and store's local network
 - ESL Server receives data from Base Station via Ethernet/Wi-Fi store infrastructure
 - Typical coverage: 1 Base Station per 100-200 ESL devices depending on store layout

8) ESL Device Registers with Server: Following a successful Wi-Fi connection, the ESL device automatically transmits its unique ID and current operational status to the ESL Server via ESL Base Station. This action initiates the device's formal registration within the ESL management system.

9) ESL Server Records Device Status: The ESL Server records the device's newly acquired status as "connected" and "unassigned" within the central ESL management system's database. This step partially fulfills AC 4.2, as the device is now successfully registered in the system.

10) Associate Initiates Product Assignment: From within the same mobile Web-Interface, the Store Associate can now proceed to assign the newly registered ESL device to a specific

3.8 Process Transformation Summary

Key Process Price Tag Management Changes:

Aspect	As-Is (manual)	To-Be (automated)
Price Updates	ERP>copy>print>cut>manual placement	Data server>ESL Server>ESL Base Station>ESL
Time Required	~25-240+ min	~1-2 minutes for reassignment
Staff Involvement	All available staff until done	Minimal: Exception handling
Error Risk	High due to manual process	Near-zero
Scalability	Limited by manual Capacity	Unlimited (network-based)

Eliminated Activities:

- ERP navigation and revaluation copying
- Admin panel uses for Formatting and Printing
- Paper printing and manual cutting
- Store walkthrough for manual tag placement
- Error corrections
- Repeated labor as a making revaluation for same product during week

New Activities:

- ESL product reassignment
- Exception monitoring
- System performance oversight

3.9 Benefits Realization.

Quantified Improvements:

- Time Savings: 95% reduction in daily price management time
- Error Reduction: Near-elimination of pricing discrepancies
- Staff Optimization: daily free for customer service
- Cost Elimination: 80% less paper, ink, or cutting supply expenses
- Process Reliability: Automated sync ensures consistency

Strategic Advantages:

- Real-time promotional campaign deployment
- Easy-scalable pricing operations across multiple locations
- Enhanced customer experience through accurate pricing
- Competitive positioning as technology-forward retailer

3.10 Implementation Considerations.

Technical Requirements:

- Reliable store network infrastructure for ESL Base Station connectivity
- Strategic placement of ESL Base Station for optimal Zigbee coverage throughout store PDS and ESL integration development
- ESL Base Station installation and configuration for Zigbee mesh network
- New ESL-server for sync between PDS and ESL
- New database for ESL-server
- Agreement and adding/replacing new formats (size) for Price Tags into ESL-server
- New threads architecture for the whole process
- Staff training on reassignment procedures

Change Management:

- Transition from manual to automated mindset
- New formal and non-formal role definitions for price management tasks
- Exception handling procedure establishment
- Performance monitoring system setup

Success Metrics:

- Price update completion time (<1 minute)
- System uptime and reliability (>99%)
- Error notification response time (<2 minutes)
- Staff time allocation optimization
- Pilot stores management feedback about team focus and free time

3.11 Next Phase Recommendations

- Technical Specification Development - Define detailed ESL-PDS integration requirements
- Vendor Selection - Evaluate ESL system providers based on their solution capabilities, including support for barcode-initiated device connection, programming physical button and management software integration.
- Pilot Implementation Planning - Prepare 2-store pilot deployment strategy
- Staff Training Program - Develop reassignment and exception handling procedures
- Performance Monitoring Setup - Establish KPIs and tracking mechanisms

GLOSSARY

- **ERP** (Enterprise Resource Planning) – A central system used by businesses to manage key operations such as inventory, pricing, sales, purchasing, and finance. In the retail context, it stores product pricing and stock levels and is typically the source for revaluation data.
- **POS** – (Point of Sale) – The system used by cashiers to scan items and process transactions during checkout. The POS must be synchronized with ERP.
- **ESL** (Electronic Shelf Labels) - Digital price tags that display product information and can be updated wirelessly through a central management system.
- **PDS** (Product Data Server) - Abstract data server containing product information (prices, descriptions, specifications) that serves as the single source of truth for ESL updates. Designed to be system-agnostic and separate from ERP/POS integration complexities.
- **ESL Base Station** - Hardware device that serves as a communication gateway between the store's network infrastructure and ESL devices via Zigbee protocol. Typically covers 100-200 ESL devices depending on the store layout.
- **Zigbee Protocol** - Low-power wireless mesh networking standard used for ESL communication, enabling long battery life and reliable device-to-device connectivity.
- **Revaluation** - Price change event or batch of price changes processed through the current ERP system, requiring manual price tag updates in the existing workflow.
- **Filters** in admin panel:
 - **“By remains”** – N products on stock = N count of price tags, for example it is especially relevant to hanging products, because most of them in retail hall, not in stock
 - **“By availability”** – N products on stock = ONE count of price tag for each unique product, but if it needs to, staff can enter count of duplicates into special admin panels' area;
- **Price Tags Format** - size of the price tag (e.g. 45x26 mm)

- **Wobbler** - Small advertising sign attached to shelf displays designed to attract customer attention to promotions or special offers.

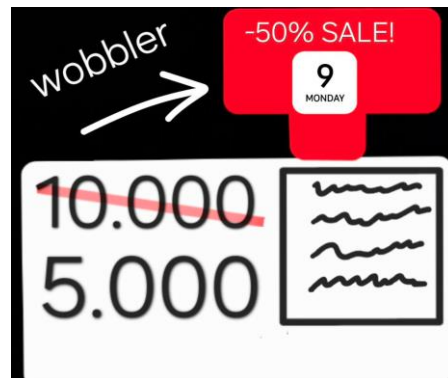


Image 3 – Price tag with Wobbler

- **Hanging products** - cables, chargers, phone cases, backpacks, screen protectors, gaming peripherals and other products currently using sticker price tags
- **QR Code Reassignment** - Process where store associates scan a QR code displayed on an ESL device (activated by physical button press) to access the web interface for product reassignment.
- **Web-Interface** - Mobile-optimized web application allowing store associates to manage ESL assignments, accessible via smartphone or computer.
- **Admin Panel** - Current browser-based system used for filtering and printing price tags, to be integrated with ESL management functionality.
- **Prepare Stage** - Initial phase of the daily sales business process involving store preparation activities, including price tag management, before opening to customers.
- **Physical Interaction Button** - Programmable button integrated into ESL hardware allowing basic operations like displaying QR codes for reassignment processes.
- **Mesh Network Architecture** - Self-healing network topology where ESL devices can communicate through multiple pathways, ensuring reliability even if individual devices fail.

EXECUTIVE SUMMARY

Project Overview

This business analysis proposes the implementation of Electronic Shelf Labels (ESL) for a Ukrainian electronics retail chain to eliminate manual price tag management processes. The project addresses critical operational inefficiencies identified through direct retail experience, where manual price updates consumes 35-90 minutes daily and involve all available staff during major revaluations.

Business Problem

The current manual price tag process creates significant operational bottlenecks: staff spend up to 1.5 hours daily on ERP navigation, printing, cutting, and placing paper tags. This labor-intensive workflow disrupts primary duties, increases error risk, and negatively impacts customer service availability. Price mismatches at checkout can trigger direct revenue loss due to Ukrainian consumer protection laws requiring retailers to honor displayed prices.

Proposed Solution

Implementation of ESL system with automated price synchronization from Product Data Server (PDS) to digital shelf labels within 1 minute. The solution includes a web-interface accessible via smartphone QR scanning and computer admin panel, allowing seamless product reassignment from both smartphone (on-site) and PC (remote). product reassignment capabilities.

Key Benefits

- Operational Efficiency: 95% reduction in daily price management time, saving over 52.3 hours monthly per store
- Cost Savings: 552,433€ annual savings through reduced labor costs (~120,433€), materials (~396,000€), and pricing error losses (~36,000€)
- Staff Productivity: Price tag management drops from ~5.6% of total staff time to minimal exception handling only

- Customer Experience: Eliminate pricing discrepancies and checkout conflicts through real-time price accuracy
- Competitive Advantage: Position as technology-forward retailer with automated pricing infrastructure

Implementation Approach

Pilot deployment in 2 Kyiv stores focusing on fixed-shelf products (electronics, appliances, audio equipment). System designed for integration with existing Product Data Server while remaining independent of legacy ERP/POS environments. ESL hardware features 5+ year battery life, Zigbee mesh networking, and programmable physical buttons for intuitive operation.

Investment Considerations

The analysis demonstrates the strongest ROI when ESL implementation coincides with new store openings or planned renovations, an incremental ~2,000\$ investment for 200 ESL units represents minimal incremental cost compared to overall store setup expenses. This approach avoids operational disruption and maximizes cost-effectiveness.

Strategic Impact

Beyond immediate operational improvements, ESL implementation enables rapid promotional campaign deployment, consistent pricing across locations, and enhanced staff allocation toward high-value customer engagement activities. The system provides foundation for future retail automation initiatives while addressing current critical pain points in daily operations.

PROJECT LIMITATIONS AND FUTURE DEVELOPMENT

1. Current Project Limitations

Technical Analysis Constraints

Network Architecture and Infrastructure: The current analysis provides high-level ESL system architecture but lacks detailed network infrastructure specifications including bandwidth requirements, network segmentation, redundancy planning, and failover mechanisms. Detailed technical architecture would require collaboration with network specialists.

Cybersecurity and Data Protection: Security aspects including data encryption, access control, device authentication, and compliance with Ukrainian data protection regulations are not comprehensively addressed. Professional cybersecurity assessment would be required for production implementation.

System Integration Complexity: The decision to use an abstract Product Data Server (PDS) rather than direct ERP/POS integration simplified the analysis but may require additional integration work in real-world deployment, such as syncing reassignment status back to ERP or ensuring pricing consistency across POS interfaces.

Financial Analysis Gaps

Comprehensive ROI and Investment Analysis: While cost savings are calculated, the analysis lacks detailed Return on Investment (ROI) calculations, Net Present Value (NPV) analysis, payback period assessment, and risk-adjusted financial projections. Complete financial modeling would require collaboration with financial analysts.

Hardware and Infrastructure Costs: Detailed hardware procurement costs, installation expenses, ongoing maintenance contracts, and system upgrade costs are not fully quantified in the current analysis.

Business Process Analysis

Complete Sales Process Impact: The analysis focuses specifically on price tag management within the "Prepare" stage but does not comprehensively analyze

potential effects on other sales stages, such as “Engage” or “Suggest”. These could be indirectly influenced through improved pricing speed and accuracy.

Change Management Strategy: While staff training is mentioned, a detailed change management plan including communication strategy, training curriculum, and organizational readiness assessment has not yet been developed.

Documentation and Methodology

BPMN Standards Compliance: The process diagrams were created during a trainee learning phase and may not fully comply with BPMN 2.0 standards.

Professional process modeling review would enhance documentation quality.

Stakeholder Analysis Depth: The stakeholder analysis could be expanded to include detailed impact assessments, communication preferences, and resistance management strategies. For example, potential cashier reliance on ESL data or store manager trust in auto-synced prices were not deeply explored.

2. Future Development Opportunities

System Enhancement and Expansion

- **Advanced Analytics Implementation:** ESL usage data could be analyzed to understand customer behavior, optimize pricing strategies, and improve inventory decisions through interaction tracking.
- **Enhanced Display Capabilities:** Future ESL hardware may support color screens, larger formats, or multimedia content for better promotional visibility.
- **IoT Ecosystem Integration:** Potential integration with smart shelving, automated inventory tracking, and customer journey mapping to form a comprehensive retail IoT environment.

Strategic Business Development

Competitive Intelligence: Real-time price updates enable faster response to competitors’ moves and localized pricing strategies.

Sustainability Initiatives: Quantification and reporting of eliminated paper, ink, and plastic usage can support ESG (Environmental, Social, Governance) disclosures and corporate sustainability goals.

Long-Term Positioning and Green Marketing Potential: While the ESL system may not drive direct profitability in the first 1–2 years, it offers long-term strategic advantages:

- Store Staff’s efficiency improvements through time savings
- Better customer experience via accurate pricing
- Strengthened brand positioning as a tech-driven, eco-conscious retailer
- Opportunity for sustainability-based marketing campaigns (e.g. “Green Retail”)
- Potential recycling or resale of legacy plastic price holders to offset costs and reinforce environmental messaging

Deployment Scope Constraints:

The ESL implementation is currently recommended only for newly opened stores or locations undergoing renovation or layout reformatting. This staged approach minimizes disruption to existing operations and allows infrastructure planning (e.g., network coverage, shelf layout, ESL density) to be embedded from the start. Full-scale retrofitting of operational stores is excluded from initial scope due to cost, logistical complexity, and staff adaptation challenges.

3. Learning and Development Acknowledgments

This project represents a trainee-level business analysis with deliberately scoped limitations to ensure quality within available expertise. The analysis prioritizes practical implement ability over theoretical completeness and focuses on real-world improvements rooted in direct retail experience.

Future professional development areas include advanced financial modeling, technical architecture design, and formal change management planning to strengthen both the analytical depth and alignment with industry standards.

This project demonstrates problem-solving ability, structured thinking, and realistic delivery — along with clear awareness of current limitations and growth areas.