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“Improving Cost Efficiency and Operational Performance through
Time-Driven Activity-Based Costing and Leveled TDABC: A Case
Study of a Pizza Restaurant in Greece”

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Patras, Greece, “May” “2026

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“I would like to express my sincere gratitude to my supervisor, Professor Antonios Rezitis and the academic staff of the MBA programme of the Hellenic Open University. Of course, special thanks to the selected restaurant and its people for their contribution.

This dissertation is dedicated to the hungry minds.”

Abstract

This dissertation examines how Time-Driven Activity-Based Costing (TDABC) and Leveled TDABC can support cost visibility, workload understanding and operational decision-making in a small foodservice business in Greece. The study is based on a case study of a pizza restaurant located in Chrysoupoli, Greece, operating through dine-in, takeaway and delivery channels.

The research applies a mixed-method case study approach. Qualitative information from direct observation and managerial input was used to map the restaurant’s main operational processes, identify resource groups and develop time equations. Quantitative business data for January–April 2026 were then used to estimate product mix, service-channel activity, active labour workload and labour cost by product category and resource group.

The empirical analysis shows that the restaurant recorded 8,282 orders and total revenue of €122,833.76 during the main analysis period. Whole pizza and sweet pizza products generated the highest revenue, with €53,500.95. Nevertheless, they only accounted for 15.0% of estimated active labour minutes. By contrast, the kitchen station absorbed the largest share of active labour workload, accounting for 58.6% of total estimated active labour minutes. This finding demonstrates that revenue concentration and workload concentration are not the same. The estimated active labour cost for the analysed product mix was €3,814.20. This figure refers only to active labour time directly connected with product preparation, handling and service-support activities, and does not represent total payroll cost. Historical demand evidence also supported the Leveled TDABC logic, as Friday, Saturday and Sunday showed higher demand and greater capacity pressure.

Overall, the dissertation shows that TDABC can help small foodservice businesses move beyond sales-based analysis by making labour workload and capacity consumption more visible. The study also highlights that operational efficiency should be understood not only through cost control, but also through workload distribution, staffing needs and the human factor behind daily operations.

Keywords

Time-Driven Activity-Based Costing, Leveled TDABC, Foodservice SMEs, Cost Efficiency, Workload Analysis, Operational Performance

Περίληψη

Η παρούσα διπλωματική εργασία εξετάζει πώς η μέθοδος Time-Driven Activity-Based Costing (TDABC) και η προσέγγιση Leveled TDABC μπορούν να υποστηρίξουν την ορατότητα του κόστους, την κατανόηση του λειτουργικού φόρτου και τη λήψη διοικητικών αποφάσεων σε μία μικρή επιχείρηση εστίασης στην Ελλάδα. Η μελέτη βασίζεται σε μελέτη περίπτωσης ενός εστιατορίου πίτσας στη Χρυσούπολη, το οποίο λειτουργεί μέσω τριών καναλιών εξυπηρέτησης: dine-in, takeaway και delivery.

Η έρευνα ακολουθεί προσέγγιση μελέτης περίπτωσης με ποιοτικά και ποσοτικά στοιχεία. Η άμεση παρατήρηση και η διοικητική πληροφόρηση χρησιμοποιήθηκαν για τη χαρτογράφηση των βασικών λειτουργικών διαδικασιών, την αναγνώριση των ομάδων πόρων και την ανάπτυξη εξισώσεων χρόνου. Στη συνέχεια, τα επιχειρησιακά δεδομένα της περιόδου Ιανουαρίου–Απριλίου 2026 χρησιμοποιήθηκαν για την εκτίμηση του μείγματος προϊόντων, της δραστηριότητας ανά κανάλι εξυπηρέτησης, του ενεργού εργατικού φόρτου και του εκτιμώμενου εργατικού κόστους ανά κατηγορία προϊόντος και ομάδα πόρων.

Η εμπειρική ανάλυση έδειξε ότι κατά την κύρια περίοδο ανάλυσης η επιχείρηση κατέγραψε 8.282 παραγγελίες και συνολικό τζίρο €122.833,76. Τα προϊόντα ολόκληρης πίτσας και γλυκιάς πίτσας δημιούργησαν τον υψηλότερο τζίρο, ύψους €53.500,95. Ωστόσο, αντιστοιχούσαν μόνο στο 15,0% των εκτιμώμενων ενεργών λεπτών εργασίας. Αντίθετα, το πόστο της κουζίνας απορρόφησε το μεγαλύτερο μέρος του ενεργού εργατικού φόρτου, με ποσοστό 58,6% επί των συνολικών εκτιμώμενων ενεργών λεπτών εργασίας. Το εύρημα αυτό δείχνει ότι η συγκέντρωση του τζίρου και η συγκέντρωση του λειτουργικού φόρτου δεν ταυτίζονται.

Το εκτιμώμενο ενεργό εργατικό κόστος για το αναλυθέν μείγμα προϊόντων ανήλθε σε €3.814,20. Το ποσό αυτό αφορά αποκλειστικά τον ενεργό χρόνο εργασίας που συνδέεται με την προετοιμασία, τον χειρισμό και την υποστήριξη των προϊόντων και δεν αντιπροσωπεύει το συνολικό μισθολογικό κόστος.

Συνολικά, η εργασία δείχνει ότι το TDABC μπορεί να βοηθήσει μικρές επιχειρήσεις εστίασης να κατανοήσουν καλύτερα πώς καταναλώνεται η εργασιακή δυναμικότητα και πώς η λειτουργική αποδοτικότητα συνδέεται με τον ανθρώπινο παράγοντα.

Λέξεις – Κλειδιά

Time-Driven Activity-Based Costing, Leveled TDABC, Μικρομεσαίες επιχειρήσεις εστίασης, Αποδοτικότητα κόστους, Ανάλυση φόρτου εργασίας, Λειτουργική απόδοση.

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List of Abbreviations & Acronyms

Abbreviation	Meaning
ABC	Activity-Based Costing
TDABC	Time-Driven Activity-Based Costing
KPI	Key Performance Indicator
SMEs	Small and Medium-sized Enterprises
POS	Point of Sale
AOV	Average Order Value
CCR	Capacity Cost Rate
RQ	Research Question
HOU	Hellenic Open University

1. Introduction

1.1 Background of the study

In recent years, small and medium-sized enterprises operating in the foodservice sector have faced increasing pressure to improve cost efficiency, maintain service quality and respond effectively to fluctuations in customer demand. Restaurants, cafés and takeaway businesses operate in a highly competitive environment where profit margins are often narrow, operating costs are continuously increasing and customer expectations regarding speed, quality and consistency remain high. In this context, accurate cost information becomes essential for managerial decision-making, pricing, resource allocation and operational improvement.

Traditional costing systems often allocate indirect costs using broad averages or volume-based allocation measures, such as total sales, labour hours or number of orders. Although these approaches may be simple to apply, they can provide distorted cost information when business activities differ significantly in terms of time, complexity and resource consumption. This is particularly important in foodservice businesses, where activities such as order taking, food preparation, baking, packaging, delivery coordination, cleaning and customer service may consume different amounts of time depending on order type, demand intensity and operational conditions.

Time-Driven Activity-Based Costing (TDABC) was developed as a simplified and more practical extension of Activity-Based Costing. Instead of requiring detailed activity surveys and complex cost-driver structures, TDABC estimates the cost of supplying resource capacity and the time required to perform business activities. By using time equations, it allows businesses to understand how much time and cost are consumed by different operational processes, products, services or customer orders. Therefore, TDABC can provide useful insights into unused capacity, inefficient activities and opportunities for process improvement.

The present dissertation focuses on the application of TDABC and Leveled TDABC in a pizza restaurant located in Chrysoupoli, Greece. The selected business represents a typical

foodservice SME where operational performance depends heavily on labour productivity, process coordination, demand fluctuations and accurate cost control. Through the case study, the dissertation aims to examine how TDABC can support cost visibility and how Leveled TDABC can be used to adjust cost analysis for seasonal and operational variations.

1.2 Problem Statement

Foodservice SMEs often make managerial decisions based on experience, intuition or simplified financial indicators rather than detailed operational cost information. While such approaches may be sufficient in stable conditions, they may become inadequate when the business faces rising costs, changes in customer demand, delivery pressures and the need to maintain service speed. A pizza restaurant, for example, may know its total monthly costs and total sales, but may not know the actual cost per order, the cost of specific operational activities or the extent to which staff time is efficiently used.

This lack of detailed cost information can lead to several managerial problems. First of all, the business may underestimate the cost of complex or time-consuming orders. Secondly, it may fail to identify bottlenecks in the production and service process. Thirdly, it may not be able to distinguish between productive labour time and unused capacity. Finally, it may struggle to evaluate whether operational changes actually improve performance.

The problem addressed by this dissertation is therefore the limited visibility of activity-level costs and operational efficiency in a small foodservice business. By applying TDABC and Leveled TDABC, the study seeks to provide a structured method for measuring the relationship between time, cost and performance in the daily operations of the restaurant.

1.3 Research Aim and Objectives

The main aim of this dissertation is to investigate how Time-Driven Activity-Based Costing and Leveled TDABC can improve cost visibility, workload understanding and operational decision-making in a pizza restaurant in Greece.

In order to achieve this aim, the dissertation pursues the following objectives:

1. To map the main operational processes and activities of the selected pizza restaurant.
2. To identify the key resources, activities and time drivers involved in order fulfilment.
3. To develop time equations for the main activities and product categories of the restaurant.
4. To calculate activity-level labour costs through the application of a TDABC model.
5. To apply a Leveled TDABC approach in order to account for demand intensity, seasonality and resource utilisation differences.
6. To evaluate selected operational indicators, including active labour workload, cost per labour minute, workload by product category and workload by resource group.
7. To examine how TDABC-based information can support managerial decision-making, capacity planning and workload visibility in a small foodservice business.

1.4 Research Questions

Based on the above aim and objectives, the dissertation is guided by the following research questions:

RQ1: How can TDABC be applied to map and measure the main operational activities of a pizza restaurant in Greece?

RQ2: What are the main product categories and resource groups that consume active labour capacity in the restaurant's order fulfilment process?

RQ3: What do the TDABC results reveal about the relationship between revenue generation and workload distribution?

RQ4: How can TDABC and Leveled TDABC support managerial decision-making, capacity planning and workload visibility in foodservice SMEs?

These research questions are designed to connect the theoretical contribution of TDABC with the practical needs of a real business case.

1.5 Significance of the Study

The study creates academic value and practical value. The dissertation provides academic value by contributing to management accounting literature through its research on cost management and TDABC implementation in a small foodservice establishment. Although TDABC has been researched in multiple industries which include healthcare and logistics

and services and manufacturing its use in small restaurant operations remains limited. The case study demonstrates how foodservice small and medium enterprises can utilize TDABC in their daily operations.

The study achieves its purpose through its implementation of the Leveled TDABC method. Foodservice businesses experience demand changes which include peak hours and weekends and holidays and seasonal periods. The standard TDABC model provides accurate cost and time measurements for activities but it fails to capture the full range of operational variations between high-demand times and low-demand times. Leveled TDABC provides a more accurate assessment of resource usage because it adjusts the cost model according to various operational levels.

The dissertation provides practical value through its managerial insights which will benefit the restaurant. The business identifies key activities because it needs to track their duration and expenses which helps them understand how resources are used and what processes generate waste and how they can optimize their workforce. The results will help guide decisions about staffing needs and pricing strategies and order handling and process improvements and monitoring of results. The study offers small foodservice businesses a practical framework which they can use to enhance their abilities in controlling costs and achieving operational success.

1.6 Overview of the Methodology

The dissertation adopts a case study research design, focusing on a pizza restaurant located in Chrysoupoli, Greece. A case study approach is suitable because the research investigates a real business setting and aims to understand cost and operational performance in depth. The study combines qualitative and quantitative elements. The business process is understood through qualitative data which also helps identify main activities for creating an operational map. The study uses quantitative data to determine resource costs and activity time estimates which are needed for creating TDABC calculations and assessing performance metrics.

The data collection process includes direct observation of restaurant operations, informal staff interviews and internal business data. The research team uses direct observation to measure the duration of essential processes which include receiving an order, preparing ingredients, assembling the pizza, baking, cutting, packaging, delivery preparation and cleaning. Staff interviews are used to validate the process map and identify variations in activity times. Internal data are used to estimate resource costs, labour capacity, order volumes and other operational indicators.

The TDABC model is developed through two main parameters: the capacity cost rate and the time required for each activity. The capacity cost rate is calculated by dividing the total cost of supplied resources by the practical capacity of those resources. The process of time estimation for various activities and order types requires the application of time equations. The Leveled TDABC method implements demand estimation by recognizing distinct operational intensity levels which include normal and peak times. This allows the analysis to reflect demand fluctuations more accurately.

The empirical analysis is based on descriptive statistics, TDABC workload estimation and resource-group interpretation. Product quantities are converted into estimated active labour minutes and then into estimated labour cost through the relevant capacity cost rates. The analysis also uses historical demand information to interpret peak and normal demand conditions and to support the Leveled TDABC logic. The purpose is not to prove causality, but to provide a structured and evidence-based understanding of how product mix, labour time and resource capacity interact in the selected restaurant.

1.7 Scope and Limitations of the Study

The scope of this dissertation is limited to one pizza restaurant in Chrysoupoli, Greece. The study focuses on the restaurant’s operational processes related mainly to order fulfilment, food preparation, service and delivery coordination. It does not attempt to analyse the entire Greek foodservice sector or compare multiple restaurants. Instead, it provides an in-depth case study of one business in order to demonstrate the practical application of TDABC and Leveled TDABC.

The research has multiple limitations. The analysis depends on two factors which are both available and precise internal business data. Small businesses may not always maintain detailed cost records, and some data may need to be estimated based observation and managerial input.

Second, activity times may vary depending on staff experience, order complexity, customer demand and unexpected operational disruptions. Third, the results of a single case study cannot be generalised statistically to all foodservice businesses. However, the findings may offer useful analytical insights and a practical framework for similar SMEs.

Another limitation concerns causal interpretation. The dissertation does not claim that TDABC implementation alone produces measurable performance improvement within the analysis period. Instead, the model is used to improve cost visibility, workload understanding and managerial interpretation of operational performance. The findings should therefore be interpreted as case-study evidence and managerial insight rather than as statistically generalisable causal proof.

1.8 Structure of the Dissertation

The dissertation is organised into five chapters.

Chapter 1 introduces the background of the study, the research problem, the aim and objectives, the research questions, the significance of the study, the methodology and the main limitations.

Chapter 2 presents the literature review. It discusses cost accounting systems, traditional costing, Activity-Based Costing, Time-Driven Activity-Based Costing and Leveled TDABC. It also examines operational performance in foodservice businesses and identifies the research gap addressed by the dissertation.

Chapter 3 describes the research methodology. It explains the case study design, the data collection process, process mapping, development of time equations, TDABC cost allocation, Leveled TDABC application, KPI measurement and comparative exploratory performance assessment.

Chapter 4 presents the analysis and results. It includes the empirical analysis period, service-channel overview, monthly demand development, product mix analysis, TDABC workload estimation, workload distribution by resource group and historical demand context supporting the Leveled TDABC interpretation.

Chapter 5 discusses the findings in relation to the literature, presents managerial implications, highlights the human factor in operational efficiency, acknowledges the limitations of the study and proposes recommendations for future research.

2. Literature Review

2.1 Introduction

This chapter reviews the theoretical and empirical literature related to cost accounting, Activity-Based Costing (ABC), Time-Driven Activity-Based Costing (TDABC), Leveled TDABC and operational performance measurement in foodservice businesses. The purpose of the chapter is to establish the academic foundation of the dissertation and to justify the use of TDABC and Leveled TDABC as suitable tools for analysing cost efficiency and operational performance in a pizza restaurant in Greece.

Cost management is essential for service businesses, where labour, customer demand, operational variability and hidden support costs strongly affect profitability. The foodservice industry requires businesses to maintain operational efficiency while managing their food expenses and staffing expenses and time spent on food preparation and delivery of meals to customers. The resource usage costing system establishes a direct link between organizational resource use and actual work processes which enables organizations to make better strategic choices.

The chapter begins by discussing traditional cost accounting and its limitations. The chapter analyzes ABC as a better method than traditional costing systems and proceeds to examine TDABC which offers organizations greater operational flexibility. The discussion then turns to Leveled TDABC, which is particularly relevant for restaurant operations because labour resources may differ in cost, skill level and productivity. Finally, the chapter reviews TDABC applications in hospitality and foodservice settings, identifies the research gap and presents the theoretical framework of the dissertation.

2.2 Cost Accounting and Cost Management in Service Businesses

Cost accounting provides managers with information about the cost of products, services, activities and processes. In manufacturing environments cost calculation becomes easier because direct materials and direct labor expenses can usually be linked to particular

products. In service businesses, however, cost measurement is more complex because a large part of total cost may relate to labour, overheads, shared resources and time-based activities. Restaurants represent a typical example of this complexity because each customer order requires a combination of ingredients, labour, kitchen capacity, equipment use, packaging, delivery coordination and customer service.

Traditional cost accounting systems usually allocate indirect costs through broad allocation bases, such as sales revenue, number of units sold, labour hours or direct material cost. Although these systems are relatively simple, they may distort the real cost of products or services when activities differ in complexity and resource consumption. For example, two pizza orders can produce equivalent revenue results yet require different amounts of time needed for their cooking, their processing of materials, their delivery needs and their methods of packing. If both orders are assigned the same average overhead cost, the business may misunderstand the true profitability of each order type.

The foodservice industry in small and medium-sized establishments uses cost information for essential financial control which operates at basic level rather than supporting complex operational decision-making. Managers may have knowledge about total sales made during the month together with total purchases, total payroll expenses and total profit but they may not know about how much each operational task costs which includes order taking, dough preparation, pizza assembly, baking, cutting, boxing and delivery preparation. This lack of activity-level visibility limits the ability to detect performance gaps and discover ways to enhance their business operations.

For this reason, modern cost management systems aim not only to calculate costs but also to explain why costs occur. The system now assesses how resources interact with activities to produce outcomes instead of using basic cost allocation methods. Foodservice SMEs need this transition because even minor labour productivity progress and process flow enhancements and capacity utilization progress will raise their profit margins.

2.3 Activity-Based Costing

Activity-Based Costing emerged as a solution which addressed the shortcomings of traditional costing systems. Cooper and Kaplan demonstrated that general cost distribution methods would result in incorrect product cost determination which would mislead

executives into making wrong decisions about pricing and product selection and operational enhancement. The system of ABC establishes cost distribution by first identifying costs which are allocated to various activities before assigning these costs to products and services and customer groups according to their usage of activities.

The central idea of ABC is that activities consume resources and products or services consume activities. Therefore, instead of allocating overheads using one general cost driver, ABC identifies multiple activities and cost drivers. For example, in a restaurant, relevant activities may include receiving customer orders, preparing ingredients, cooking, packaging, serving, cleaning and handling delivery. Each of these activities may have a different cost driver, such as number of orders, preparation minutes, number of deliveries or number of menu items.

The advanced approach of ABC brings better cost estimation results because it understands that various products and services use resources in different ways from each other. The ABC system allows restaurant managers to identify which menu items generate higher profits and which activities require maximum labor and which processes result in excessive costs. The research on restaurant costing shows that ABC provides benefits to foodservice operations through its application in menu pricing and profitability evaluation and cost tracking.

However, traditional ABC also has limitations. Kaplan and Anderson noted that conventional ABC systems can be expensive and time-consuming to build and maintain because they often require interviews, surveys and repeated estimates of how employees allocate their time across activities. They also argued that ABC systems can become difficult to update when processes, products or customer behaviours change.

These limitations are particularly relevant for small businesses. A pizza restaurant may not have the administrative capacity, accounting systems or managerial time required for these multiple activities and cost drivers. Therefore, while ABC provides an important conceptual foundation, a more practical costing approach is needed for real-time and operationally useful analysis in a small foodservice business.

2.4 Time-Driven Activity-Based Costing

Time-driven activity-based costing, initiated by Kaplan and Anderson, is a relatively small and flexible form of ABC. TDABC requires two main estimates: the cost of supplying resource capacity and the time required to perform a transaction or activity. This makes the model easier to implement and update compared with traditional ABC.

The first key element of TDABC is the **capacity cost rate**. This is calculated by dividing the total cost of supplying a resource by the practical capacity of that resource. For example, if the monthly cost of kitchen labour is divided by the number of practical working minutes available during the month, the result is a cost per labour minute. This cost rate can then be used to calculate the labour cost of specific activities.

The second key element of TDABC is the **time equation**. Time equations estimate how much time is required to perform an activity depending on the characteristics of the transaction. Kaplan and Anderson emphasised that time equations allow the model to capture variation in orders, customers and operational conditions without creating a large number of separate activities.

In a pizza restaurant, a simple time equation may take the following form:

Pizza preparation time = basic preparation time + extra time for additional toppings + extra time for special packaging + extra time for delivery coordination

This type of equation is useful because not all orders are identical. A single takeaway pizza requires less preparation time than a complete delivery order which includes multiple pizzas and additional toppings and custom delivery requests. TDABC can therefore provide a more realistic estimate of order-level cost.

TDABC also allows managers to identify unused capacity. If the practical labour capacity of the restaurant is higher than the time actually used for productive activities, the difference represents idle or unused capacity. This information is important because unused capacity is not always visible in traditional accounting reports. A business may appear to have normal payroll costs, but TDABC can show whether part of the paid labour time is not being used productively.

Another advantage of TDABC is that it can support operational improvement. By connecting time consumption with cost, managers can identify activities that are expensive, slow or inefficient. According to this particular example, where packaging and delivery coordination causes a high labor time cost during peak hours, the company could think about changing the workflow, reassigning workers, or sequencing orders better.

Everaert and Bruggeman explained the basic principles of TDABC because they demonstrated how to build the model through resource groups and cost rates and practical capacity and time equations. Their work supports the view that TDABC can be used not only as a costing method but also as a managerial tool for understanding operational processes.

2.5 Leveled TDABC

Leveled TDABC is a more recent extension of the TDABC approach. Its purpose is to improve the accuracy of cost calculations when resources differ in terms of skill level, cost rate or productivity. In standard TDABC, a single capacity cost rate may be used for a resource group. However, in real operational settings, employees may not all have the same wage rate, experience, speed or role. This is especially relevant in restaurants, where chefs, assistants, delivery staff, waiters and managers may contribute differently to the same process.

Enes and Koşan applied TDABC in a fine dining restaurant and proposed a Leveled TDABC approach that considers workers with different skill levels and associated labour costs. Their study shows that Leveled TDABC can provide a more detailed understanding of labour productivity, idle capacity and cost behaviour in restaurant operations.

The concept of Leveled TDABC is relevant for this dissertation because the selected pizza restaurant may involve different categories of labour. For example, the owner-manager, kitchen staff, delivery staff and support workers may have different cost rates and different roles in the order fulfilment process. If the model uses only one average labour cost rate, it may oversimplify the real cost structure. A leveled approach allows the analysis to distinguish between different labour levels and to assign costs more accurately.

In addition, this dissertation uses the logic of Leveled TDABC to account for different operational levels, such as normal demand periods and peak demand periods. Restaurant operations are not stable throughout the day, week or year. Demand may increase during evenings, weekends, holidays or tourist periods. During peak periods, staff may work faster, waiting times may increase and resource utilisation may become more intensive. During low-demand periods, the same staff may have more idle time. Therefore, a leveled approach can help the analysis reflect operational fluctuations more realistically.

For this study, Leveled TDABC is treated as an extension of TDABC that improves the model in two ways. First, it recognises differences between labour categories and cost rates. Second, it allows the model to distinguish between different demand or operational levels. This is important because the dissertation is not only to calculate the average cost per order but to understand how cost efficiency changes under different operating conditions.

2.6 TDABC in Hospitality and Foodservice Businesses

TDABC has been implemented across various service industries which include healthcare, logistics, hospitality and restaurant operations. Dalci, Tanis and Koşan used TDABC to evaluate customer profitability in a hotel by conducting interviews, observing the operations and studying internal documents. The study showed that service businesses can use TDABC to measure their customer segment profitability while discovering their unused resources in departments which include front office, housekeeping and food preparation.

The value of TDABC for hospitality exists because hotels and restaurants operate through a combination of workforce management and operational synchronization and customer service functions. The traditional costing systems which businesses use cannot accurately measure service delivery because customer demand patterns change throughout the day and multiple service delivery steps are necessary for these businesses to operate. Therefore, TDABC can provide more detailed cost information for pricing, profitability and operational decisions.

Everaert, Cleuren and Hoozée applied TDABC in a university restaurant and showed that the method can be used to identify operational improvements. This is highly relevant to the present dissertation because it demonstrates the applicability of TDABC in a foodservice environment, where time, labour and process design directly influence cost performance.

Elshaer examined the use of TDABC in restaurant operations and combined TDABC with value stream mapping to distinguish value-added and non-value-added activities. The study found that TDABC can be a feasible method for analysing restaurant operations and for identifying the real cost of operational activities.

More recently, Enes and Koşan applied TDABC and Leveled TDABC in a fine dining restaurant. Their study is particularly important for this dissertation because it focuses directly on restaurant labour cost and introduces a leveled approach to TDABC. The study supports the argument that restaurant costing should account for labour time, skill differences and productivity variations rather than relying only on material cost or broad overhead allocation.

Overall, the literature suggests that TDABC is suitable for foodservice businesses because it links cost measurement with operational processes. However, existing studies remain limited, especially in relation to small independent restaurants and pizza restaurants. Many applications focus on hotels, fine dining restaurants or larger service organisations. This creates an opportunity for further research into the use of TDABC in small foodservice SMEs.

2.7 Operational Performance and Key Performance Indicators

Operational performance refers to the ability of a business to use its resources efficiently while delivering products or services effectively. In a restaurant, operational performance is closely related to cost control, labour productivity, preparation time, service speed, order accuracy, customer waiting time and capacity utilisation. Because restaurant operations are time-sensitive, even small inefficiencies can affect profitability and customer satisfaction.

For this dissertation, the most relevant performance indicators are those that connect cost, time and output.

The first KPI is **cost per order**, which measures the average cost required to fulfil one customer order. This indicator is useful because it allows the business to understand whether different order types consume different levels of resources.

The second KPI is **cost per labour minute**, which measures how much labour cost is associated with one minute of practical capacity. This indicator is central to the TDABC model because it forms the basis for assigning labour cost to activities.

The third KPI is **service time per customer**, which starts when an order begins and ends when the order completes. The KPI measures operational speed because service time directly affects how customers experience the restaurant.

The fourth KPI is an **operational efficiency ratio**. This can be calculated by comparing productive activity time with available labour capacity or by comparing output with resource input. The purpose of this ratio is to evaluate whether the restaurant uses its labour and process capacity efficiently.

These KPIs are appropriate for the dissertation because they are directly connected to TDABC because it does not only calculate costs, but also it explains how time and activities create costs. Therefore, the selected KPIs allow the analysis to evaluate both financial and operational performance.

2.8 Research Gap

The literature shows that organizations use ABC and TDABC as tools that help them improve cost accuracy and make better management decisions. ABC provides a more detailed understanding of activities and cost drivers than traditional costing while TDABC simplifies the model through its dedication to resource capacity and time equations. The leveled TDABC system enhances its functionality by identifying different labor levels which require distinct skills and cost structures.

However, several gaps remain. First, TDABC applications in small independent foodservice businesses are still limited. Much of the existing literature focuses on manufacturing, healthcare, hotels or larger restaurant settings. Second, there is limited evidence on the use of TDABC in Greek foodservice SMEs. Third, the use of Leveled TDABC in restaurants is still a recent and underdeveloped area of research. Fourth, many studies focus mainly on cost calculation, while fewer studies connect TDABC results with operational performance indicators and before–after comparison.

This dissertation addresses these gaps by applying TDABC and Leveled TDABC to a pizza restaurant in Chrysoupoli, Greece. The study contributes to the literature by showing how a relatively simple costing model can be used in a small business context to improve cost visibility, measure activity-level performance and support managerial decision-making.

2.9 Theoretical Framework

The theoretical framework of this dissertation is based on the relationship between resource consumption, activity time, cost allocation and operational performance. The starting point is that restaurant operations consume resources, mainly labour, ingredients, equipment and overheads. These resources are used to perform activities such as order taking, preparation, baking, packaging, delivery coordination and cleaning.

TDABC provides the mechanism for connecting resources to activities through capacity cost rates and time equations. Leveled TDABC refines this mechanism by recognising that labour resources may differ in cost and productivity and that operational conditions may vary between normal and peak periods. The output of the model is activity-level cost information, which can then be used to calculate KPIs such as cost per order, cost per labour minute, service time per customer and operational efficiency.

The expected managerial outcome is improved cost visibility and better decision-making. The restaurant can locate its inefficient operations by studying which activities require the most time and expenses. The framework of the dissertation can therefore be summarised as follows:

Resource Costs and Practical Capacity → TDABC Time Equations → Leveled TDABC Adjustments → Activity-Level Cost Information → KPIs → Cost Efficiency and Operational Performance Improvement

This framework supports the empirical analysis in Chapter 4 and provides the theoretical basis for interpreting the findings in Chapter 5.

3. Research Methodology

3.1 Research Design

This dissertation adopts a single case study research design, focusing on a selected foodservice business placed in Chrysoupoli, Greece. The case study approach is suitable because the research is trying to examine a real business environment in depth and to apply a costing model onto the actual day to day operational processes of the business. Instead of analysing the foodservice sector in general, the dissertation investigate how Time-Driven Activity-Based Costing (TDABC) along with Leveled TDABC can be used in a specific restaurant context, so as to enhance cost transparency and operational performance.

The study follows a mixed methods logic, blending qualitative and quantitative elements. Qualitative information is used to understand the structure of the business, identify the main operational processes and map the flow of activities from order receipt to order completion. Quantitative data are used to estimate activity times, resource costs, practical capacity, cost per activity and selected performance indicators. This combination is suitable for TDABC because the method requires both process understanding and numerical estimation of time and cost parameters.

The research can also be classified as a business data analysis and quantitative application study. The dissertation uses internal business information, direct observation and staff input in order to construct a TDABC model and evaluate selected Key Performance Indicators (KPIs). The objective is not only to calculate costs, but also to examine how

activity-level cost information can support managerial decision-making in a small foodservice enterprise.

3.2 Case Study Context

The selected restaurant is a small foodservice business operating in Chrysoupoli, Greece. For confidentiality and academic presentation purposes, the business is referred to throughout the dissertation as “the selected restaurant”. The restaurant provides three main service channels: delivery, takeaway and dine-in. These channels are operationally different because each one requires a different combination of activities, labour time and resource consumption. Delivery orders require preparation, packaging, coordination and distribution. Takeaway orders require preparation, packaging and handover to the customer. Dine-in orders require preparation, service at the table and cleaning or resetting of the dining area.

The restaurant’s product range includes several food categories, such as pizza, pasta, salads, burgers, appetizers, desserts and beverages. Therefore, the operational analysis does not focus exclusively on pizza production, but on the broader order fulfilment process of the business. However, pizza-related activities remain central to the analysis because pizza represents one of the core product categories and involves several distinct operational stages, including preparation, assembly, baking, cutting and packaging.

The restaurant operates under two different seasonal schedules. From June to September, it operates seven days per week. During this period, the opening hours are normally from 18:00 to 00:30, while on Friday and Saturday the restaurant operates from 18:00 to 01:00. During the remaining months of the year, the restaurant normally operates six days per week and remains closed on Tuesdays, except for certain public holidays or commercially important dates. In this period, the restaurant operates from 17:30 to 00:00 on Monday to Thursday and Sunday, and from 17:30 to 00:30 on Friday and Saturday.

This seasonal operating pattern is important for the methodology because it affects practical capacity, labour allocation, demand intensity and idle capacity. The distinction

between the summer period and the rest of the year provides the basis for the Leveled TDABC approach. In this dissertation, Leveled TDABC is used to reflect differences between operating periods, demand levels and labour resource utilisation.

The restaurant’s staffing structure includes a main pizza maker and a pizza assistant in the pizza station, a cook and a kitchen assistant in the kitchen station, a store manager responsible for front desk and operational coordination, service staff for the dining area and one delivery driver. In addition, the two owners and the store manager can provide flexible support across different roles when required. This flexibility is typical of small foodservice businesses and is important for understanding how labour capacity is actually supplied and used in practice.

During the summer period, the restaurant also reinforces its production capacity during the strongest demand days. More specifically, one additional assistant is added to the pizza station and one additional assistant is added to the kitchen station on Friday, Saturday and Sunday. This staffing change provides for the increased workload expected during peak summer demand, and supports the Leveled TDABC distinction between normal and high demand operating conditions.

The strongest demand periods during the week are Friday, Saturday and Sunday. These days are treated as peak demand periods in the analysis, while the remaining operating days are treated as normal or lower-demand periods. This distinction is useful for the development of the TDABC and Leveled TDABC model because activity times, staff utilisation and order flow may differ significantly between normal and peak periods

3.3 Data Collection Methods

The dissertation uses three main sources of data: direct observation, informal staff interviews and internal business data. These sources are combined in order to improve the reliability of the TDABC model and to ensure that the analysis reflects the actual operating conditions of the selected restaurant.

Direct observation is used to record and understand the main operational activities of the restaurant. The observed activities include receiving orders, registering orders, preparing food, assembling pizza, baking, cutting, packaging, preparing delivery orders, serving dine-in customers and cleaning or resetting the work area. Observation is necessary because TDABC depends on realistic estimates of the time required to complete each activity.

Informal staff interviews are used to validate the process map and the estimated activity times. Input from the store manager, kitchen staff, pizza station staff, service staff and delivery staff helps identify variations between normal and peak periods, as well as operational difficulties that may not be visible from numerical data alone. These discussions are also useful for understanding how employees support multiple roles during busy periods.

Internal business data are used to estimate resource costs, practical capacity and performance indicators. These data may include order volumes, sales information, labour hours, staffing schedules, wage or labour cost estimates, operating expenses and delivery-related information. Where exact data are not available, the dissertation uses managerially validated estimates. Such estimates are clearly stated in the analysis in order to maintain transparency.

The data collection process is designed to support the development of time equations, the calculation of capacity cost rates and the measurement of KPIs. The main KPIs include cost per order, cost per labour minute, service time per order and operational efficiency. The collected data are also used to distinguish between seasonal operating periods and peak versus non-peak demand conditions.

3.4 Process Mapping

The process mapping stage was used to identify the main operational steps required to complete a customer order. Since the selected restaurant operates through delivery, takeaway and dine-in channels, the order fulfilment process includes both production and

service-related activities. The delivery process was analysed first because it includes the largest number of operational stages, from order receipt to final distribution to the customer.

A typical delivery order begins either through a telephone call or through an online ordering platform. Platform orders are transferred to the restaurant in less than fifteen seconds, while telephone orders require more time depending on whether the customer is already registered in the restaurant’s customer database. If the customer is already stored in the system, the order can usually be recorded in less than one minute. If the customer is new, the process normally requires one to two minutes because the customer’s address and contact information must also be recorded.

After the order has been received, it is transferred to the relevant production station through the restaurant’s central printing system. This transfer usually requires less than ten seconds, as the order is automatically printed at the pizza station or kitchen station, depending on the products included. When an order includes products from more than one station, an additional coordination activity is required. This coordination normally requires approximately thirty seconds and ensures that the pizza station, kitchen station and delivery function are aligned so that the order can be completed correctly.

The production stage differs according to product category. For pizza products, the process includes opening the dough, assembling the pizza, baking, cutting and packaging. Dough opening takes roughly twenty seconds, while pizza assembly is around thirty seconds each pizza. Then baking takes about four to seven minutes, which depends on the product and the way it’s being handled.

Cutting and packaging require approximately ten seconds each. Therefore, the total elapsed production time for a pizza is mainly driven by baking time, while the active labour time is mainly related to dough opening, assembly, cutting and packaging. For kitchen products, the production time varies depending on the category. Pasta dishes usually take about ten minutes to boil and then another two or three for sauce preparation, and packaging. Portions also require roughly ten minutes including cooking and the

packaging. Salads need around four to seven minutes ,it depends on what kind of salad it is. Bao buns take approximately fourteen minutes, while burgers are more like fifteen to twenty minutes. Sandwiches generally sit at ten to twelve minutes. Hot dogs and calzone products are handled in a similar way to pizza products, in regard to the production time.

Once the production process has been all the way finished, the order moves to the front desk or dispatch area, immediately. At this point, the order is consolidated packaged and separated—using order labels when they’re needed. That step takes around thirty seconds. The store manager or the front desk employee, then coordinates with the delivery driver. they go through the order details again, and also check if payment needs to be collected in cash or if it’s already been done via card or online payment.

This coordination requires approximately thirty seconds. The final stage is the physical delivery of the order to the customer.

The delivery stage varies according to the delivery area. The town of Chrysoupoli is divided into five delivery areas. Deliveries to the town centre usually require less than five minutes, while deliveries to the other four areas usually require between five and ten minutes. The restaurant may also deliver to nearby villages, where the driver’s round-trip time may range from fifteen to thirty minutes. For TDABC purposes, the delivery time is important because it represents the time during which the driver’s capacity is committed to a specific order.

The takeaway process follows the same logic as the delivery process until the order completion stage. The main difference is that takeaway orders do not require physical distribution by the delivery driver. Instead, the final activities include payment and handover to the customer. Payment may take place either during order receipt or when the customer collects the order from the restaurant. The payment process usually requires approximately fifteen to thirty seconds, regardless of whether payment is made by cash or card.

The dine-in process includes additional service-related activities. These include customer reception, order taking, service to the table, table monitoring, payment and cleaning or resetting of the table. As a result, dine-in orders require the involvement of service staff or the store manager, in addition to the pizza and kitchen stations. This makes dine-in operationally different from delivery and takeaway, even when the same products are prepared.

An important distinction in the process map concerns normal and peak demand periods. The strongest demand periods are Friday, Saturday and Sunday. During peak periods, the preparation time of each product remains relatively stable, but the total service time may increase because of order queues and higher workload across the stations. Therefore, the Leveled TDABC model distinguishes between normal and peak conditions in order to capture differences in capacity utilisation and service time.

The process map provides the basis for the development of the TDABC model. Each activity identified in the process map is connected with a specific resource group, such as the pizza station, kitchen station, front desk, service staff or delivery driver. The estimated time required for each activity is then used to construct time equations and calculate activity-level costs.

3.5 Activity Identification and Resource Groups

After mapping the main order fulfilment processes, the next stage of the methodology was the identification of the activities and resource groups involved in the restaurant's operations. This step is essential for the development of the TDABC model, because each activity must be connected with the resources that supply the capacity required to perform it.

The activities of the selected restaurant were grouped according to the main operational stations. The first resource group is the pizza station, which includes the main pizza maker and the pizza assistant. This resource group is responsible for dough opening, pizza assembly, baking supervision, cutting and packaging of pizza-related products. Calzone

and hot dog products are also treated as part of this resource group, because their preparation time is similar to the pizza production process.

Table 3.1: Main Activities and Resource Groups

Activity	Main Resource Group	Main Role Involved
Order receipt and registration	Front desk / coordination	Store manager
Order transfer to stations	POS / printing system	System-supported activity
Order coordination	Front desk / coordination	Store manager
Pizza preparation	Pizza station	Pizza maker, pizza assistant
Kitchen preparation	Kitchen station	Cook, kitchen assistant
Cutting and packaging	Pizza / kitchen station	Pizza or kitchen staff
Dispatch preparation	Front desk / coordination	Store manager
Payment handling	Front desk / service	Store manager / waitress
Delivery	Delivery function	Delivery driver
Dine-in service	Dining area / service	Waitress / assistant waiter
Table cleaning and reset	Dining area / service	Waitress / support staff
Pre-opening preparation	All stations	Relevant staff
Closing and cleaning	All stations	Relevant staff
Flexible support	Cross-functional support	Owners / store manager

Source: Author’s own elaboration based on direct observation and managerial input.

The second resource group is the kitchen station, which includes the cook and the kitchen assistant. This group is responsible for pasta dishes, portions, salads, burgers, sandwiches and bao buns. The preparation time of kitchen products differs significantly by product category. For this reason, the TDABC model does not treat all kitchen products as identical, but distinguishes between the main product groups according to their estimated preparation time.

The third resource group is the front desk and coordination function, which is mainly performed by the store manager. This function includes receiving and registering orders, coordinating the flow of orders between the pizza and kitchen stations, managing the dispatch area, confirming payment information and coordinating with the delivery driver. In practice, the store manager may also provide support to other stations when required. This is a common characteristic of small foodservice businesses, where employees often perform more than one role during busy periods.

The fourth resource group is the dining area and service function. This group includes the waitress and, during the summer period, an additional assistant waiter during the strongest demand days. The dining area resource group is responsible for customer reception, order taking, table service, table monitoring, payment and cleaning or resetting tables. Dine-in activities are therefore treated separately from delivery and takeaway activities, because they require additional service-related labour beyond food preparation.

The fifth resource group is the delivery function, which is performed by one delivery driver. The driver's capacity is consumed by the physical distribution of delivery orders. Delivery time differs depending on the delivery area. Deliveries to the town centre require less than five minutes, deliveries to the other areas of Chrysoupoli usually require between five and ten minutes, while deliveries to nearby villages may require approximately fifteen to thirty minutes for a round trip. This distinction is important because delivery distance affects the amount of driver capacity consumed by each order.

In addition to these fixed resource groups, the restaurant also has flexible support capacity. This support is provided by the two owners and the store manager, who can assist different stations when necessary. During the summer period, the production stations are further reinforced on Friday, Saturday and Sunday. One additional assistant supports the pizza station and one additional assistant supports the kitchen station during these peak days. These roles are not treated as permanent full-week resources, but as additional peak-period capacity. This distinction is important because it allows the TDABC model to separate regular weekly capacity from demand-driven capacity reinforcement.

This support is especially important during peak demand periods, when the restaurant may experience order queues, higher workload and increased coordination requirements. In the basic TDABC model, this flexible support is not treated as a separate fixed resource group attached to one activity. However, it is recognised as an important operational characteristic of the business.

The restaurant’s resource structure differs between the summer and non-summer periods. During the summer period, from June to September, the restaurant operates seven days per week. During the non-summer period, it normally operates six days per week and remains closed on Tuesdays, except for specific public holidays or commercially important dates. This seasonal difference affects staffing requirements, supplied labour capacity and resource utilisation. For this reason, the Leveled TDABC model distinguishes between seasonal operating levels.

Table 3.2: Seasonal Resource Availability

Resource Group	Role	Non-Summer Period	Summer Period
Pizza station	Main pizza maker	All operating days and hours	All operating days and hours
Pizza station	Pizza assistant	All operating days and hours	All operating days and hours
Pizza station	Additional pizza assistant	Not normally used	Friday, Saturday and Sunday
Kitchen station	Cook	All operating days and hours	All operating days and hours
Kitchen station	Kitchen assistant	Friday, Saturday, Sunday and public holidays	All operating days and hours
Kitchen station	Additional kitchen assistant	Not normally used	Friday, Saturday and Sunday
Front desk / coordination	Store manager	All operating days and hours	All operating days and hours
Dining area / service	Waitress	Thursday evening, Friday, Saturday and Sunday	All operating days and hours
Dining area / support	Assistant waiter	Not normally used	Friday, Saturday and Sunday, half shift

Source: Author’s own elaboration based on direct observation and managerial input.

During the non-summer period, the main pizza maker, pizza assistant, cook, store manager and delivery driver are present during all operating days and hours. The kitchen assistant works during the strongest demand days, namely Friday, Saturday, Sunday and public holidays. The waitress works on Thursday evening and during all operating hours on

Friday, Saturday and Sunday. During the summer period, the kitchen assistant and waitress are present during all operating days and hours, while an additional assistant waiter supports the dining area on Friday, Saturday and Sunday for approximately half of the shift.

It is also important to distinguish between customer-service operating hours and total staff presence hours. The customer-service operating hours refer to the period during which the restaurant receives and serves customer orders. However, employees are normally present approximately thirty minutes before opening in order to complete pre-opening preparation activities. These activities include station preparation, ingredient organisation, equipment checks, mise en place and preparation of the work areas.

In addition, closing activities usually require approximately thirty to sixty minutes after the end of customer service. These activities include cleaning, equipment shutdown, stock organisation, waste handling, cash closing, kitchen reset and preparation for the next operating day. Therefore, the total supplied labour capacity of the restaurant is higher than the customer-service operating hours. In the TDABC model, pre-opening and closing activities are treated as necessary support activities rather than direct order-level activities.

The theoretical capacity of each resource group is calculated based on total staff presence hours. Practical capacity is then estimated by adjusting theoretical capacity to reflect breaks, short interruptions, internal communication, preparation time, waiting time and other non-productive time. The general calculation is:

$\text{Theoretical Capacity} = \text{Total Staff Presence Hours} \times 60$

$\text{Practical Capacity} = \text{Theoretical Capacity} \times \text{Practical Capacity Rate}$

The capacity cost rate is then calculated by dividing the estimated cost of each resource group by its practical capacity:

Capacity Cost Rate = Estimated Resource Cost / Practical Capacity

For confidentiality reasons, the dissertation does not use actual payroll figures. Instead, labour costs are anonymised, rounded and expressed as estimated labour cost per role. This approach protects the confidentiality of the business while still allowing the calculation of capacity cost rates and activity-level costs. The use of estimated labour costs is considered appropriate for the purpose of the dissertation, because the objective is to demonstrate the application of TDABC and Leveled TDABC rather than disclose sensitive payroll information.

The activity and resource group structure developed in this section provides the basis for the construction of time equations in the next stage of the methodology. Each order type is connected with the relevant activities, resource groups and estimated activity times, allowing the TDABC model to calculate the cost of different products, service channels and demand conditions.

3.6 Time Equations

Time equations are a central element of the TDABC methodology, because they allow the model to estimate the time required to complete different types of customer orders. Instead of assuming that all orders consume the same amount of time and resources, time equations make it possible to adjust the estimated time according to the service channel, the product category, the complexity of the order and the delivery area.

In the selected restaurant, the order fulfilment process differs across three service channels: delivery, takeaway and dine-in. It also differs according to product category, since pizza, pasta, burgers, salads, portions, sandwiches and bao buns require different preparation processes and different amounts of time. Therefore, the time equations developed in this dissertation combine common order-handling activities with product-specific and channel-specific activities.

A distinction is made between active labour time and elapsed process time. Active labour time refers to the time during which employees are directly involved in performing an activity, such as receiving an order, preparing a pizza, packaging an order or coordinating delivery. Elapsed process time refers to the total time that passes until an activity is completed, including waiting, baking, boiling or delivery time. This distinction matters, because labour cost is mostly pushed by the time people are actively working, while the customer service time gets influenced by the elapsed process time, not only the direct effort itself.

The general time equation for an order can be expressed as follows:

Total Order Time = Order Handling Time + Order Transfer Time + Coordination Time + Product Preparation Time + Packaging / Dispatch Time + Payment Time + Service Channel Time

The specific form of this equation depends on whether the order is delivery, takeaway or dine-in.

3.6.1 Delivery Order Time Equation

For delivery orders, the process begins with order receipt and ends with physical delivery to the customer. Delivery orders may be received either by telephone or through an online ordering platform. Platform orders require less time to register, while telephone orders require more time, especially when the customer is not already registered in the restaurant's system.

The delivery order equation is expressed as follows:

Delivery Order Time = ORT + OTT + COOR + PPT + PDT + DCT + DT

where ORT represents order receipt and registration time, OTT represents order transfer time to the production station, COOR represents coordination time between stations, PPT represents product preparation time, PDT represents packaging and dispatch preparation time, DCT represents delivery coordination time and DT represents delivery time.

Table 3.3 summarises the main variables used in the delivery, takeaway and dine-in time equations.

Table 3.3: Time Equation Variables

Symbol	Description
ORT	Order receipt and registration time
OTT	Order transfer time to production station
COOR	Coordination time between stations
PPT	Product preparation time
PDT	Packaging and dispatch preparation time
DCT	Delivery coordination time
DT	Delivery time
PT	Payment time
HT	Customer handover time
CRT	Customer reception time
OT	Order-taking time
TST	Table service time
TMT	Table monitoring time
TCT	Table cleaning and reset time

Source: Author’s own elaboration based on direct observation and managerial input.

For delivery orders, order receipt time depends on the order channel. Platform orders are transferred to the restaurant in less than fifteen seconds. Telephone orders require more time. If the customer is already registered in the restaurant’s system, the order can usually be recorded in less than one minute. If the customer is new, the process normally requires one to two minutes because the customer’s address and contact information must also be recorded.

Order transfer through the central printing system requires less than ten seconds, as the order is automatically printed at the relevant production station. Coordination time is approximately thirty seconds when an order involves more than one station or requires alignment between the pizza station, kitchen station and delivery function. Packaging and dispatch preparation require approximately thirty seconds, while delivery coordination requires approximately another thirty seconds.

Delivery time depends on the delivery area. The town of Chrysoupoli is divided into five delivery areas. Deliveries to the town centre usually require less than five minutes.

Deliveries to the other four areas of Chrysoupoli require approximately five to ten minutes. The restaurant may also deliver to nearby villages, where the driver's round-trip time may range from fifteen to thirty minutes. For TDABC purposes, the driver's round-trip time is important because it represents the time during which delivery capacity is committed to a specific order.

3.6.2 Takeaway Order Time Equation

Takeaway orders go through a process similar to delivery orders, up until production and packaging are finished and done. The big difference is that takeaway orders don't need physical delivery done by the delivery driver. Instead, the last steps are payment and then the handover to the customer.

The takeaway order equation is expressed as follows:

$$\text{Takeaway Order Time} = \text{ORT} + \text{OTT} + \text{COOR} + \text{PPT} + \text{PDT} + \text{PT} + \text{HT}$$

where ORT represents order receipt and registration time, OTT represents order transfer time, COOR represents coordination time if required, PPT represents product preparation time, PDT represents packaging and dispatch preparation time, PT represents payment time and HT represents handover time to the customer.

Payment may take place either when the order is placed or when the customer collects the order from the restaurant. The payment process normally requires approximately fifteen to

thirty seconds, regardless of whether the payment is made by cash or card. The handover time is also short, but it is included in the model because it consumes front desk or service capacity.

3.6.3 Dine-in Order Time Equation

Dine-in orders include additional service-related activities because customers are served inside the restaurant. These activities include customer reception, order taking, service to the table, table monitoring, payment and cleaning or resetting the table after the customer leaves.

The dine-in order equation is expressed as follows:

$$\text{Dine-in Order Time} = \text{CRT} + \text{OT} + \text{OTT} + \text{COOR} + \text{PPT} + \text{TST} + \text{TMT} + \text{PT} + \text{TCT}$$

where CRT represents customer reception time, OT represents order-taking time, OTT represents order transfer time to the production station, COOR represents coordination time when required, PPT represents product preparation time, TST represents table service time, TMT represents table monitoring time, PT represents payment time and TCT represents table cleaning and reset time.

Dine-in orders are therefore more service-intensive than delivery and takeaway orders. Even when the same product is prepared, dine-in orders require additional labour from the dining area resource group. For this reason, dine-in activities are treated separately in the TDABC model.

3.6.4 Product-Specific Preparation Time Equations

The preparation time of an order depends strongly on the type of product being prepared. For this reason, the TDABC model does not apply a single average preparation time to all menu items. Instead, the restaurant's products are grouped into the main operational categories that reflect the way work is actually performed in the pizza station and the kitchen station.

A useful distinction for the purposes of this study is the difference between total preparation time and active labour time. Total preparation time refers to the full time required until the product is ready for packaging or service. This may include baking, boiling, cooking or heating time. Active labour time on the other hand, is only the time when an employee is actually directly involved in preparing, assembling, verifying, cutting or packaging the product. This distinction is important because a product may take several minutes to be ready, but the employee may not be continuously occupied during the whole process.

For pizza products, the main stages are dough opening, assembly, baking, cutting and packaging. The preparation equation can be expressed as follows:

$$\text{Pizza Preparation Time} = \text{DOT} + \text{PAT} + \text{BT} + \text{CUT} + \text{PKT}$$

where DOT refers to dough opening time, PAT to pizza assembly time, BT to baking time, CUT to cutting time and PKT to packaging time.

Based on observation and managerial input, dough opening requires approximately twenty seconds and pizza assembly approximately thirty seconds for a standard pizza. Baking usually requires four to seven minutes, while cutting and packaging require approximately ten seconds each. Therefore, although the total elapsed preparation time of a pizza is mainly affected by baking time, the active labour time is much lower.

The active labour time for a standard pizza is estimated as follows:

$$\text{Active Pizza Labour Time} = 20 \text{ sec} + 30 \text{ sec} + 10 \text{ sec} + 10 \text{ sec} = 70 \text{ seconds}$$

or approximately: Active Pizza Labour Time = 1.17 minutes

This calculation is important because it prevents the model from treating the entire baking time as direct labour time. While the pizza is in the oven, the pizza maker may monitor the process, but may also work on another order. Therefore, baking time affects the customer's waiting time, but it does not fully represent labour capacity consumed by one order.

Calzone and hot dog products are included in the same broad operational category as pizza, because their preparation follows a similar production logic and uses the same station. However, their active labour time may be slightly higher depending on the assembly and packaging requirements.

Kitchen products follow a different logic. Pasta dishes require approximately ten minutes for boiling and an additional two to three minutes for sauce preparation and packaging. However, the boiling stage is not treated as fully active labour time. The active part mainly includes starting the process, preparing the sauce, checking the dish, finishing it and packaging it.

Portions require approximately ten minutes in total, including cooking and packaging. As with pasta, part of this time may involve cooking time during which the employee can perform other tasks. Salads are different because they usually involve continuous preparation, ingredient handling and packaging. For this reason, most of the salad preparation time is treated as active labour time.

Bao buns, burgers and sandwiches are also treated as separate product categories because they require different levels of preparation and assembly. Bao buns require approximately fourteen minutes in total, while burgers require approximately fifteen to twenty minutes and are among the longest product categories in terms of total preparation time. Sandwiches require approximately ten to twelve minutes.

Table 3.4 summarises the estimated preparation time and active labour time for the main product categories used in the TDABC model.

Table 3.4: Product Category Preparation and Active Labour Time Estimates

Product category	Estimated total preparation time	Estimated active labour time	Main resource group
Pizza	5.2–8.2 minutes	Approximately 1.17 minutes	Pizza station
Calzone	Similar to pizza	Approximately 1.5–2.0 minutes	Pizza station
Hot dog	Similar to pizza	Approximately 1.5–2.0 minutes	Pizza station

Pasta	12–13 minutes	Approximately 3–4 minutes	Kitchen station
Portions	Approximately 10 minutes	Approximately 3–5 minutes	Kitchen station
Salads	4–7 minutes	Approximately 4–7 minutes	Kitchen station
Bao buns	Approximately 14 minutes	Approximately 5–7 minutes	Kitchen station
Burgers	15–20 minutes	Approximately 6–8 minutes	Mixed stations
Sandwiches	10–12 minutes	Approximately 4–5 minutes	Mixed stations

Source: Author’s own elaboration based on direct observation and managerial input.

The estimates presented in Table 3.4 are not intended to represent exact times for every individual menu item. Rather, they provide practical time assumptions for the main product groups of the restaurant. This approach is suitable for a small foodservice business, because it keeps the TDABC model detailed enough to capture operational differences, but simple enough to be applied in practice.

In the analysis, active labour time is used mainly for labour-cost calculations, while total preparation time is used for service-time and operational-performance indicators. In this way, the model can estimate both the cost of labour capacity consumed by each product category and the time experienced by the customer during the order fulfilment process.

3.7 Treatment of Errors, Rework and Operational Variability

In real foodservice operations, customer orders are not always completed without deviations from the standard process. Although the time equations presented in the previous section describe the normal order fulfilment process, the methodology also recognises that errors, rework and operational variability may occur during daily operations. These incidents can increase labour time, material consumption, customer waiting time and pressure on the restaurant’s available capacity.

In the selected restaurant, possible errors may occur at different stages of the workflow. At the order-taking stage, an error may involve incorrect registration of the order, wrong customer details, wrong delivery address or incorrect payment information. At the pizza station, there will be faults, like accidentally making the incorrect pizza, or using the wrong ingredients, or sometimes it gets overly baked or gets damaged while it is in the oven.

At the kitchen station, errors may involve preparing the wrong item, overcooking a product, using the wrong sauce or packaging the wrong product. Errors may also occur during dispatch, for example when products are assigned to the wrong order or when order labels are not correctly matched.

These incidents are not treated as part of the standard activity time. Instead, they are treated as rework activities. Rework refers to the additional work required to correct an error and complete the order properly. Depending on the type of error, rework may require only a short correction, such as checking or repackaging an order, or it may require the full preparation of a product from the beginning. In the latter case, rework affects not only labour time but also food cost and packaging cost.

For TDABC purposes, the expected impact of rework can be expressed as follows:

Expected Rework Time = Probability of Error $\times$ Rework Time

The expected rework cost can then be calculated as:

Expected Rework Cost = Expected Rework Time $\times$ Capacity Cost Rate

When the error also results in wasted ingredients or packaging materials, the material waste cost is added to the labour-related rework cost:

Expected Error Cost = Expected Rework Labour Cost + Expected Material Waste Cost

This approach allows the model to capture the expected cost of operational errors without assuming that every order includes rework. It also allows the dissertation to distinguish between the standard cost of a normal order and the adjusted cost of an order when operational failures are considered.

The probability of errors is not expected to be stable across all demand conditions. During normal or low-demand periods, employees usually have more time to check orders, coordinate between stations and correct minor issues before they affect the customer. During peak periods, particularly on Friday, Saturday and Sunday, the workload is higher and several activities take place at the same time. The pizza station, kitchen station, front desk and delivery function may all operate under pressure. As a result, the probability of mistakes is expected to be higher during peak periods.

For this reason, operational variability is incorporated into the Leveled TDABC logic of the study. The model distinguishes between normal-period and peak-period conditions. In normal periods, the probability of rework is expected to be lower. In peak periods, the probability of rework is expected to increase because of higher order volume, time pressure and greater coordination requirements.

The adjusted order time can therefore be expressed as follows:

Adjusted Order Time = Standard Order Time + Queue Time + Expected Rework Time

For peak periods, the equation becomes:

Peak Adjusted Order Time = Standard Order Time + Peak Queue Time + Expected Peak Rework Time

This adjustment is important because it reflects the actual operating environment of the restaurant. The technical preparation time of a product may remain stable, but the total

time and cost of serving customers may increase when queues, errors and rework are considered. In this way, the methodology avoids presenting the restaurant’s operations as a perfectly linear process and instead recognises the variability that exists in real business conditions.

Table 3.5 summarises the main types of errors and their expected operational impact.

Table 3.5: Possible Errors, Rework Activities and Operational Impact

Area	Possible error	Rework activity	Expected impact
Order receipt	Wrong order, wrong address, wrong payment information	Correction of order details or customer communication	Additional front desk time, possible delay
Pizza station	Wrong pizza, wrong ingredients, burned or damaged pizza	Partial correction or full product remake	Additional pizza station time, material waste, delay
Kitchen station	Wrong item, overcooked product, wrong sauce, wrong packaging	Product correction or remake	Additional kitchen time, material waste, delay
Packaging / dispatch	Wrong product assigned to order, wrong label, missing item	Rechecking, repackaging or correcting the order	Additional coordination time, possible delivery delay
Delivery	Wrong route, wrong delivery point, delayed handover	Additional driver time or customer communication	Higher delivery time and lower service performance

Source: Author’s own elaboration based on direct observation and managerial input.

The treatment of errors and rework strengthens the practical relevance of the TDABC model. It shows that cost efficiency is not affected only by standard preparation times and labour cost rates, but also by the quality and stability of the operating process. This is particularly relevant in foodservice businesses, where small mistakes can create additional labour effort, waste materials and reduce customer satisfaction.

3.8 Capacity Cost Rate Calculation

The next stage of the TDABC methodology is the calculation of the capacity cost rate for each role and resource group. The capacity cost rate expresses the cost of supplying one minute of practical capacity. This is a central parameter of the TDABC model, because it allows activity times to be converted into activity costs.

In this dissertation, capacity cost rates are calculated for the main roles involved in the restaurant's operations. These include the delivery driver, service staff, main pizza maker, pizza assistant, cook, kitchen assistant and front desk / coordination role. Since these roles perform different activities and have different estimated labour costs, the use of separate capacity cost rates improves the accuracy of the cost model.

The general formula used for the capacity cost rate is:

$$\text{Capacity Cost Rate} = \text{Estimated Resource Cost} / \text{Practical Capacity}$$

Practical capacity is calculated by first estimating the total time supplied by each role and then adjusting this time to reflect the fact that not all available time can be used productively. The theoretical capacity is calculated as follows:

$$\text{Theoretical Capacity} = \text{Total Staff Presence Hours} \times 60$$

The practical capacity is then calculated as:

$$\text{Practical Capacity} = \text{Theoretical Capacity} \times \text{Practical Capacity Rate}$$

In TDABC, practical capacity is usually lower than theoretical capacity. Kaplan and Anderson (2004) explain that practical capacity is often estimated as approximately 80% or 85% of theoretical capacity. This adjustment reflects the fact that employees or machines cannot be expected to operate at full theoretical capacity during every available minute. In the case of labour resources, the difference between theoretical and practical

capacity may include breaks, arrival and departure time, communication, short interruptions and other non-productive time.

For the purposes of this dissertation, practical capacity is estimated at 85% of theoretical capacity. This percentage is considered appropriate for the selected restaurant because the business operates in a small foodservice environment where employees perform both direct order-related activities and support activities during the same shift. The remaining 15% reflects normal non-productive time, such as internal communication, coordination between stations, waiting time, small interruptions, cleaning, preparation, task switching and other operational pauses that naturally occur in restaurant operations.

It is also important to distinguish between customer-service operating hours and total staff presence hours. Customer-service operating hours refer to the period during which the restaurant receives and serves customer orders. However, employees are normally present approximately thirty minutes before opening in order to complete preparation activities. In addition, closing activities require approximately thirty to sixty minutes after the end of customer service. These activities include station preparation, ingredient organisation, equipment checks, cleaning, stock organisation, waste handling, cash closing and preparation for the next operating day.

Therefore, the TDABC model uses total staff presence hours, rather than only customer-service operating hours, to estimate supplied labour capacity. Pre-opening and closing activities are treated as necessary support activities. They are not directly linked to a single order, but they are part of the total capacity required for the restaurant to operate.

The restaurant operates under two different seasonal schedules. During the non-summer period, it normally operates six days per week. During the summer period, from June to September, it operates seven days per week. This difference affects the total capacity supplied by each role and resource group. For this reason, the capacity calculation distinguishes between the non-summer and summer periods.

During the non-summer period, the restaurant’s customer-service operating hours are approximately forty hours per week. When pre-opening preparation and closing activities are included, the total staff presence time for full-shift roles increases to approximately forty-six to forty-nine hours per week. During the summer period, customer-service operating hours are approximately forty-six and a half hours per week. When preparation and closing activities are included, the total staff presence time for full-shift roles increases to approximately fifty-three and a half to fifty-seven hours per week.

For confidentiality reasons, the dissertation does not use actual payroll figures. Instead, labour costs are anonymised, rounded and expressed as estimated hourly labour costs per role. This approach protects the financial confidentiality of the selected restaurant while still allowing the TDABC model to calculate capacity cost rates and activity-level costs. The aim of this analysis is not to reveal actual payroll details, but to show how TDABC and Leveled TDABC can be used, to estimate cost efficiency and operational performance in a more structured way.

Where labour cost is expressed as an estimated hourly cost, the capacity cost rate per practical minute is calculated as follows:

Capacity Cost Rate per Practical Minute = Estimated Hourly Labour Cost / (60 × Practical Capacity Rate)

Since the practical capacity rate is estimated at 85%, the denominator becomes:

$$60 \times 0.85 = 51 \text{ practical minutes}$$

Therefore, the formula used in this dissertation is:

Capacity Cost Rate per Practical Minute = Estimated Hourly Labour Cost / 51

For example, if the estimated labour cost of a role is €6.00 per hour, the capacity cost rate is calculated as follows:

$$\text{Capacity Cost Rate} = 6 / 51 = \text{€}0.118 \text{ per practical minute}$$

This means that each practical minute consumed by this role costs approximately €0.118. The same logic is applied to all relevant roles.

Table 3.6 presents the main inputs used for the calculation of capacity cost rates.

Table 3.6: Capacity Cost Rate Calculation Inputs

Input	Description
Estimated labour cost per role	Rounded and anonymised cost estimate for each role
Customer-service operating hours	Hours during which the restaurant serves customers
Pre-opening preparation time	Approximately 30 minutes before opening
Closing activity time	Approximately 30–60 minutes after customer service ends
Total staff presence hours	Customer-service hours plus preparation and closing time
Theoretical capacity	Total staff presence hours multiplied by 60
Practical capacity rate	Percentage of theoretical capacity available for practical work
Practical capacity	Theoretical capacity multiplied by the practical capacity rate
Capacity cost rate	Estimated resource cost divided by practical capacity

Source: Author’s own elaboration based on case-study data and managerial input.

From the anonymised and rounded labour cost estimates the business gave, the expected hourly labour spend is somewhere between €4.00 and €6.00 per hour, depending on the role, and how much responsibility that position actually carries. These values are not actual payroll figures, but rounded estimates used for methodological and confidentiality purposes.

Table 3.7 presents the estimated capacity cost rates by role. The calculation is based on an 85% practical capacity rate. Therefore, one practical labour minute is calculated by dividing the estimated hourly labour cost by 51 practical minutes per hour.

Table 3.7: Estimated Capacity Cost Rates by Role

Role / Resource	Estimated hourly labour cost	Practical capacity rate	Capacity cost rate per practical minute
Delivery driver	€5.00	85%	€0.098
Service / Waitress	€5.00	85%	€0.098
Assistant waiter	€5.00	85%	€0.098
Main pizza maker	€6.00	85%	€0.118
Pizza assistant	€5.00	85%	€0.098
Cook	€6.00	85%	€0.118
Kitchen assistant	€4.00	85%	€0.078
Front desk / Coordination	€6.00	85%	€0.118
Additional kitchen assistant	€4.00	85%	€0.078
Additional pizza assistant	€5.00	85%	€0.098

Source: Author’s own elaboration based on anonymised and rounded managerial estimates.

Those role level capacity cost rates get used in the TDABC model to work out the expense of activities, depending on the resource group involved. For example , pizza preparation activities are costed using the capacity cost rates of the main pizza maker and the pizza assistant, while kitchen work is costed using the rates of the cook and the kitchen assistant. Delivery activities are costed using the delivery driver’s capacity cost rate, and front desk or coordination activities are costed using the capacity cost rate of the front desk / coordination role.

In cases where more than one role contributes to the same activity, the model uses the capacity cost rate of the role that is mainly responsible for the activity or, where appropriate, a combined estimate based on the roles involved. This is especially relevant for mixed-

station products, like burgers and sandwiches, where the kitchen station and the pizza station both may do their part in the preparation process, not just one side.

The capacity cost rates that are computed in this section feed into the following stage of the TDABC model. Once the time required for each activity has been estimated through the time equations, the cost of each activity can be calculated by multiplying the activity time by the relevant capacity cost rate:

$$\text{Activity Cost} = \text{Activity Time} \times \text{Capacity Cost Rate}$$

This allows the dissertation to estimate the cost of different activities, product categories and service channels. For example, a delivery order consumes capacity from the front desk, the pizza or kitchen station and the delivery driver. A dine-in order consumes capacity from the production station and the dining area. By applying different capacity cost rates to different roles, the TDABC model provides a more realistic view of how labour capacity is consumed across the restaurant's operations.

3.9 TDABC Model Development

The TDABC model developed in this dissertation combines the process map, activity structure, time equations and capacity cost rates described in the previous sections. The purpose of the model is to estimate the cost of restaurant activities by identifying the time required for each activity and multiplying this time by the capacity cost rate of the relevant resource group.

The logic of the model follows the standard TDABC approach. Process mapping is used to identify the main activities of the selected restaurant. Second, each activity is assigned to the resource group that performs it. Third, the time required for each activity is estimated through observation and managerial input. Fourth, the capacity cost rate of the relevant role or resource group is applied. Finally, the activity costs are combined in order to estimate the cost of different product categories, service channels and order types.

The basic cost calculation used in the model is:

$$\text{Activity Cost} = \text{Activity Time} \times \text{Capacity Cost Rate}$$

The total cost of an order is then calculated as the sum of the activity costs required to complete that order:

$$\text{Total Order Cost} = \Sigma(\text{Activity Time} \times \text{Capacity Cost Rate of the Relevant Resource Group})$$

This structure allows the model to distinguish between orders that may appear similar in sales value but consume different amounts of time and capacity. For example, a simple takeaway pizza requires pizza station time, packaging time and possibly payment or handover time. A delivery pizza order requires the same production activities, but also front desk coordination and delivery driver capacity. A dine-in order requires food preparation as well as service-related activities such as table service, payment and table reset.

For this reason, the TDABC model does not calculate one average cost for all orders. Instead, it estimates order cost according to three dimensions: the service channel, the product category and the resource groups involved. The main service channels are delivery, takeaway and dine-in. The main product categories are pizza, calzone, hot dog, pasta, portions, salads, bao buns, burgers and sandwiches. The main resource groups are the pizza station, kitchen station, front desk and coordination function, dining area and service function, and delivery function.

Table 3.8 presents the general TDABC calculation logic used in the dissertation.

Table 3.8: TDABC Calculation Logic

Step	Description		Output
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1	Identify the order type and service channel	Delivery, takeaway or dine-in
2	Identify the product category	Pizza, pasta, burger, salad, etc.
3	Identify the activities required	Order receipt, preparation, packaging, delivery, service
4	Assign each activity to a resource group	Pizza station, kitchen station, front desk, service, delivery
5	Estimate activity time	Active labour time or elapsed service time
6	Apply the capacity cost rate	Cost per practical minute
7	Calculate activity cost	Activity time × capacity cost rate
8	Sum activity costs	Estimated total order cost

Source: Author’s own elaboration based on the TDABC model developed for the case study.

The model uses active labour time for labour-cost calculations. This means that only the time during which employees are directly involved in performing an activity is used to calculate labour cost. Elapsed process time is used mainly for service-time analysis and operational-performance indicators. This distinction is important in foodservice operations, where some activities, such as baking, boiling or cooking, may take several minutes but do not require continuous labour involvement.

For example, the elapsed production time of a pizza is mainly affected by baking time. However, the active labour time includes dough opening, assembly, cutting and packaging. Therefore, the TDABC model avoids assigning the full baking time as direct labour cost to a single pizza order. This makes the cost estimate more realistic and prevents overstatement of labour consumption.

The general TDABC structure for a delivery order can be expressed as:

Delivery Order Cost = Front Desk Cost + Production Cost + Dispatch Cost + Delivery Cost

For a takeaway order, the structure is:

Takeaway Order Cost = Front Desk Cost + Production Cost + Packaging Cost + Payment / Handover Cost

For a dine-in order, the structure is:

Dine-in Order Cost = Service Cost + Production Cost + Payment Cost + Table Reset Cost

These formulas are not intended to replace the detailed time equations. Rather, they summarise how different service channels consume different combinations of resources. Delivery orders consume delivery driver capacity, takeaway orders consume mainly front desk and production capacity, and dine-in orders consume additional service capacity.

The production cost depends on the product category. Pizza-related products are mainly assigned to the pizza station, while pasta, portions, salads and bao buns are assigned to the kitchen station. Burgers and sandwiches are treated as mixed-station products because they may require cooperation between the kitchen station and the pizza station. In such cases, the cost is calculated by assigning the relevant active labour time to the resource group that performs each part of the process.

Table 3.9 summarises the connection between product categories and resource groups in the TDABC model.

Table 3.9: Product Categories and Resource Group Assignment

Product category	Main resource group	Notes
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Pizza	Pizza station	Includes dough opening, assembly, baking supervision, cutting and packaging
Calzone	Pizza station	Treated similarly to pizza
Hot dog	Pizza station	Treated similarly to pizza
Pasta	Kitchen station	Includes boiling, sauce preparation and packaging
Portions	Kitchen station	Includes cooking, finishing and packaging
Salads	Kitchen station	Mainly active preparation and packaging
Bao buns	Kitchen station	Includes preparation, heating/cooking, assembly and packaging
Burgers	Mixed stations	Kitchen station with pizza station support
Sandwiches	Mixed stations	Kitchen station with pizza station support

Source: Author’s own elaboration based on direct observation and managerial input.

The model also allows the calculation of cost at different levels of analysis. At the activity level, it estimates the cost of activities such as order receipt, preparation, packaging, delivery or table service. At the product level, it estimates the cost of different product categories. At the service-channel level, it compares delivery, takeaway and dine-in orders. At the performance level, it supports the calculation of KPIs such as cost per order, cost per labour minute, service time per order and operational efficiency.

An important feature of the model is that it remains practical for a small foodservice business. The dissertation does not attempt to create a separate costing formula for every individual menu item. Instead, it groups products and activities into categories that reflect the actual way work is organised in the restaurant. This keeps the model detailed enough to show operational differences, but simple enough to be applied and understood by management.

The TDABC model developed in this section provides the basis for the Leveled TDABC application in the next section. While the basic TDABC model calculates activity costs under standard conditions, the Leveled TDABC approach adjusts the analysis for different operating levels, such as summer and non-summer periods, normal and peak demand periods, and differences in resource utilisation.

3.10 Leveled TDABC Application

The Leveled TDABC approach is used in this dissertation to extend the basic TDABC model by recognising that the restaurant does not operate under the same conditions throughout the year, week or day. A standard TDABC model can estimate the cost of activities under normal operating conditions. However, in a foodservice business, demand, staffing, waiting time, resource utilisation and the probability of rework may differ significantly between operating periods. For this reason, the dissertation applies a leveled approach in order to make the cost model more realistic.

In the selected restaurant, four main levels are considered. The first level is the **seasonal operating level**, which distinguishes between the summer period and the non-summer period. The second level is the **demand intensity level**, which distinguishes between normal and peak demand periods. The third level is the **service-channel level**, which distinguishes between delivery, takeaway and dine-in orders. The fourth level is the **resource and activity level**, which connects different activities with the specific roles and stations involved in the order fulfilment process.

The seasonal level is important because the restaurant operates under different schedules during the year. During the non-summer period, the restaurant normally operates six days per week and remains closed on Tuesdays, except for specific public holidays or commercially important dates. During the summer period, from June to September, it operates seven days per week. The summer operating level is not defined only by seven-day operation and higher demand. It also includes targeted staffing reinforcement during the strongest demand days. More specifically, on Friday, Saturday and Sunday, the pizza station is supported by one additional pizza assistant and the kitchen station is supported by one additional kitchen assistant. This means that the summer period involves both higher demand and higher available production capacity.

This distinction is important for the Leveled TDABC model. A standard TDABC model could treat the summer period only as a period of higher order volume. However, the

leveled approach also recognises that the restaurant adjusts its resource structure in response to this higher demand. Therefore, the summer peak level is characterised by increased workload, higher staffing capacity and greater use of the pizza and kitchen stations.

By including this additional peak-period capacity, the model can better interpret queue time, bottlenecks, idle capacity and labour utilisation. For example, if the additional assistants are fully used during peak days, they may reduce pressure on the main pizza maker and cook. If demand is lower than expected, part of this extra capacity may appear as unused capacity. This distinction is important for evaluating operational efficiency during the summer period.

The demand intensity level is also important. The strongest demand days are Friday, Saturday and Sunday. During these days, the technical preparation time of each product usually remains stable, but the total service time may increase because of order queues and higher workload across the pizza station, kitchen station, front desk and delivery function. In addition, the probability of errors and rework may increase during peak periods due to time pressure and the simultaneous execution of many activities.

The service-channel level reflects the fact that delivery, takeaway and dine-in orders do not consume the same resources. Delivery orders require front desk coordination, production, packaging, dispatch and driver capacity. Takeaway orders require production, packaging, payment and handover, but no physical delivery. Dine-in orders require production as well as service-related activities, such as table service, payment and table cleaning. Therefore, the same product may have a different cost depending on the service channel through which it is sold.

The resource and activity level reflects the different roles involved in the restaurant's operations. Activities are assigned to the resource group that performs them, such as the pizza station, kitchen station, front desk, service staff or delivery function. This is particularly important for products such as burgers and sandwiches, where more than one

station may contribute to the preparation process. In such cases, the model allocates time and cost to the relevant resource groups according to their involvement.

Table 3.10 summarises the main operating levels used in the Leveled TDABC model.

Table 3.10: Operating Levels Used in the Leveled TDABC Model

Level	Categories	Methodological role
Seasonal operating level	Non-summer period / summer period / summer peak reinforced capacity	Captures differences in operating days, opening hours, staff presence, additional peak staffing and practical capacity
Demand intensity level	Normal demand / peak demand	Captures differences in queue time, workload, resource utilisation, rework probability and additional summer peak staffing
Service-channel level	Delivery / takeaway / dine-in	Captures differences in order fulfilment activities and resource consumption
Resource and activity level	Pizza station, kitchen station, front desk, service, delivery	Connects activities with the roles and stations that supply capacity

Source: Author’s own elaboration based on the Leveled TDABC structure developed for the case study.

The leveled model adjusts the standard TDABC calculation by adding the effect of demand level and operating conditions. In the basic TDABC model, the cost of an order is calculated as the sum of the activity times multiplied by the relevant capacity cost rates. In the leveled model, the same logic is maintained, but activity time and resource utilisation are interpreted according to the relevant operating level.

The general leveled order-time equation is expressed as follows:

Leveled Order Time = Standard Order Time + Level-Specific Queue Time + Expected Rework Time

Expected rework time is calculated as:

$$\text{Expected Rework Time} = \text{Probability of Error} \times \text{Rework Time}$$

The corresponding leveled cost equation is expressed as:

$$\text{Leveled Order Cost} = \text{Standard TDABC Order Cost} + \text{Expected Rework Cost}$$

where:

$$\text{Expected Rework Cost} = \text{Expected Rework Time} \times \text{Capacity Cost Rate}$$

If an error also creates material waste, the expected material waste cost is added to the expected rework cost. This allows the model to include the operational effect of mistakes without assuming that every order includes an error.

Table 3.11 presents the main adjustments included in the Leveled TDABC model.

Table 3.11: Leveled TDABC Adjustments

Adjustment	Normal / non-peak condition	Peak / high-demand condition
Product preparation time	Stable technical preparation time	Stable technical preparation time
Queue time	Lower	Higher due to order accumulation
Resource utilisation	Moderate	Higher use of available capacity
Coordination needs	Lower	Higher due to simultaneous orders
Error probability	Lower	Higher due to workload and time pressure
Rework impact	Lower expected effect	Higher expected effect
Delivery pressure	Lower	Higher, especially when many orders are pending

Source: Author’s own elaboration based on direct observation and managerial input.

An important assumption of the model is that peak periods do not necessarily change the technical preparation time of each product. For example, a pizza still requires approximately the same preparation and baking time. However, peak demand affects the total time experienced by the customer because orders wait in a queue before being

prepared, packaged or delivered. Therefore, peak periods mainly affect queue time, capacity utilisation and rework probability rather than the basic technical time of each activity.

The Leveled TDABC model is also useful for interpreting idle capacity. During lower-demand periods, staff may be present but not fully utilised by direct order-related activities. During peak periods, the same staff capacity may be used more intensively, and queues may appear when demand exceeds the available capacity of one or more stations. This distinction is important because cost efficiency is not only a matter of reducing labour cost, but also of understanding how effectively supplied capacity is used under different operating conditions.

In this dissertation, the leveled approach is applied mainly through the comparison of seasonal and demand conditions. The summer period is treated as a higher-capacity operating period because the restaurant operates seven days per week and uses more service and kitchen capacity. The non-summer period is treated as a lower-capacity operating period because the restaurant normally operates six days per week and uses a more limited staffing structure. Similarly, Friday, Saturday and Sunday are treated as peak demand days, while the remaining operating days are treated as normal-demand days.

The purpose of this approach is not to create an overly complex costing system, but to make the TDABC model more realistic for the operational conditions of the selected restaurant. By incorporating seasonal capacity, peak demand, service-channel differences and expected rework, the Leveled TDABC model provides a more accurate picture of how time and cost behave in daily restaurant operations.

The Leveled TDABC application developed in this section supports the later analysis of Key Performance Indicators. It allows the dissertation to compare cost per order, service time, labour utilisation and operational efficiency under different operating conditions. In this way, the model can show not only the average cost of activities, but also how cost efficiency changes when the restaurant operates under normal, peak or seasonal pressure.

3.11 KPIs and Performance Measurement

The TDABC and Leveled TDABC models developed in the previous sections provide the basis for measuring cost efficiency and operational performance in the selected restaurant. In order to evaluate the results of the model, a set of Key Performance Indicators (KPIs) is used. These indicators connect cost, time, labour capacity and service performance, allowing the dissertation to examine how restaurant operations behave under different service channels, product categories and demand conditions.

The selected KPIs were chosen because they are directly related to the objectives of the dissertation. The aim is not only to estimate the cost of activities, but also to understand how efficiently the restaurant uses its available labour capacity and how operating conditions affect service time and order cost. For this reason, the KPIs focus on cost per order, cost per labour minute, service time per order, operational efficiency, idle capacity and rework-related performance.

The first KPI is **cost per order**. This indicator measures the estimated TDABC cost required to complete an order. For an individual order, cost is calculated as the sum of the activity costs required for that order. For a group of orders, the average cost per order is calculated as follows:

$$\text{Average Cost per Order} = \text{Total TDABC Order Cost} / \text{Number of Orders}$$

This KPI is useful because it allows the comparison of different service channels and product categories. For example, a delivery order may have a higher cost than a takeaway order because it consumes driver capacity. Similarly, a dine-in order may require additional service capacity due to table service, payment handling and table reset.

The second KPI is **cost per labour minute**. This indicator is directly connected with the capacity cost rate calculation. It expresses the cost of one practical labour minute for each role or resource group. It is calculated as follows:

Cost per Labour Minute = Estimated Hourly Labour Cost / Practical Minutes per Hour

Since the practical capacity rate is estimated at 85%, each hour is treated as 51 practical minutes. Therefore, the cost per labour minute allows the model to convert activity time into labour cost. This KPI is particularly important for comparing roles with different estimated hourly costs, such as the pizza maker, cook, kitchen assistant, service staff and delivery driver.

The third KPI is **service time per order**. This indicator measures the time required from the beginning of an order until its completion. The exact interpretation depends on the service channel. For delivery orders, service time includes order receipt, preparation, packaging, dispatch and delivery to the customer. For takeaway orders, it includes order receipt, preparation, packaging, payment and handover. For dine-in orders, it includes order taking, preparation, service to the table and related service activities.

The general formula is:

Service Time per Order = Order Completion Time – Order Receipt Time

Service time is helpful for comparing normal and peak demand periods. On peak times, product preparation time can stay steady, but total service time often rises, not just because of workload across stations, and also because order queues build up.

The fourth KPI is the **operational efficiency ratio**. This indicator shows the share of practical capacity that actually gets used for productive things. It is worked out like this:

Operational Efficiency Ratio = Productive Activity Time / Practical Capacity

Or if you want it as a percentage, then:

Operational Efficiency Ratio (%) = (Productive Activity Time / Practical Capacity) × 100

So this KPI helps you judge whether that available labour capacity is being used well or not. If the ratio is low, it can mean unused capacity during quieter, low-demand periods. But if it is extremely high during peak periods, it might suggest pressure on staff, less adaptability, and yeah maybe delays are starting to show.

The fifth KPI is **idle capacity**. Idle capacity means the gap between practical capacity and the time that is actually spent on productive activities. The calculation is:

Idle Capacity = Practical Capacity – Productive Activity Time

Idle capacity can also be turned into a cost:

Idle Capacity Cost = Idle Capacity Minutes × Capacity Cost Rate

This measure matters a lot, because unused capacity can remain invisible in typical accounting reports. In a small restaurant, staff may be present and paid even when order volume is low. TDABC makes this unused capacity visible and allows management to understand how labour capacity changes between normal, peak and seasonal periods.

The sixth KPI is **rework rate**. This indicator measures the share of orders or items that end up needing a fix, because of mistakes, burning issues, wrong preparation, wrong wrapping or other day to day operational blunders. It's a ratio, but more focused on what actually goes off track in routine handling. It is calculated as follows:

Rework Rate = Number of Orders Requiring Rework / Total Number of Orders

Rework is important because it increases both labour time and cost. During peak periods, the probability of rework may increase due to workload, pressure and simultaneous

activity across stations. For this reason, rework is also connected with the Leveled TDABC model.

The seventh KPI is **expected rework cost**, which estimates the cost effect of errors and rework. It is calculated as:

$$\text{Expected Rework Cost} = \text{Expected Rework Time} \times \text{Capacity Cost Rate}$$

where:

$$\text{Expected Rework Time} = \text{Probability of Error} \times \text{Rework Time}$$

If the error also creates material waste, the expected material waste cost is added to the labour-related rework cost. This allows the model to estimate the operational cost of quality failures more realistically.

Table 3.12 summarises the KPIs used in the dissertation.

Table 3.12: Key Performance Indicators Used in the Study

KPI	Formula	Purpose
Average cost per order	Total TDABC order cost / Number of orders	Measures the average cost required to complete an order
Cost per labour minute	Estimated hourly labour cost / Practical minutes per hour	Converts labour time into cost
Service time per order	Order completion time – Order receipt time	Measures the time experienced by the customer
Operational efficiency ratio	Productive activity time / Practical capacity	Measures the use of available labour capacity
Idle capacity	Practical capacity – Productive activity time	Identifies unused labour capacity
Idle capacity cost	Idle capacity minutes × Capacity cost rate	Estimates the cost of unused capacity
Rework rate	Orders requiring rework / Total orders	Measures the frequency of operational errors

Expected rework cost	Expected rework time × Capacity cost rate	Estimates the cost effect of rework
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Source: Author’s own elaboration based on the TDABC and Leveled TDABC model developed for the case study.

The KPIs are calculated at different levels of analysis. At the order level, they show the cost and time required for different types of orders. At the product-category level, they allow comparison between pizza, pasta, burgers, salads, portions, sandwiches and bao buns. At the service-channel level, they allow comparison between delivery, takeaway and dine-in orders. At the demand-level, they allow comparison between normal and peak periods. At the seasonal level, they allow comparison between the non-summer and summer operating periods.

This multi-level KPI structure is important because the selected restaurant does not operate under one stable condition. The same product may consume different total resources depending on the service channel, the time of the week and the level of demand. For example, a pizza sold as takeaway may have a different cost and service-time profile from a pizza sold through delivery. Similarly, a delivery order during a peak period may have the same technical preparation time as a normal-period order, but longer total service time due to queueing and delivery pressure.

The KPIs are therefore used to connect the TDABC calculations with operational performance. Cost per order and cost per labour minute provide cost-efficiency information. Service time per order provides information about customer-facing performance. Operational efficiency and idle capacity shows how well labour capacity gets utilized. The rework rate plus the expected rework cost, reflecting how operational mistakes end up impacting costs and performance.

The KPIs are used to connect TDABC calculations with operational interpretation. Cost per labour minute, estimated active labour cost, workload distribution and resource utilisation provide information about cost efficiency and capacity consumption. These

indicators support the empirical analysis by showing how product categories and resource groups differ in the labour capacity they require.

3.12 Comparative and Exploratory Performance Assessment

The final methodological stage concerns the interpretation of the TDABC and Leveled TDABC results through comparative and exploratory performance assessment. The purpose is to examine how activity-level time and cost information can improve the understanding of cost efficiency, workload distribution and operational performance in the selected restaurant.

The assessment does not aim to establish statistical causality. Instead, it compares the insights obtained from traditional sales-based information with the additional information generated by the TDABC model. Traditional sales analysis shows revenue, number of orders and average order value. TDABC extends this view by estimating active labour minutes, labour cost and workload by product category and resource group.

The main comparison is therefore between a commercial view and an operational-cost view of the restaurant:

Commercial View = Revenue, Orders and Average Order Value

TDABC View = Active Labour Time, Estimated Labour Cost and Capacity Consumption

This comparison is useful because product categories with high revenue do not necessarily create the highest labour workload. Similarly, products with lower revenue may consume more active labour time and create greater pressure on specific stations. The TDABC model therefore provides a more detailed basis for managerial interpretation than sales figures alone.

The dissertation also uses historical demand information to support the Leveled TDABC interpretation. Normal and peak demand periods are compared in order to understand how workload and capacity pressure may change across the week. Friday, Saturday and Sunday are treated as peak demand days, while the remaining operating days are treated as normal demand days. This distinction helps interpret why the same product mix may create different operational pressure depending on demand intensity.

Where complete time-series or order-level data are not available, the analysis remains descriptive and exploratory. Regression analysis and formal before–after testing are therefore not used as final empirical tests in this dissertation. Instead, they are recognised as possible extensions for future research, especially if more detailed order-level service times, rework records and longitudinal performance data become available.

This approach is appropriate for a single case study. The objective is not to produce statistically generalisable causal estimates, but to provide a structured understanding of how TDABC and Leveled TDABC can improve cost visibility, workload interpretation and managerial decision-making in a small foodservice business.

3.13 Reliability, Validity and Ethical Considerations

The reliability of the methodology is supported by the use of a consistent TDABC structure throughout the study. The same logic is applied to all service channels and product categories: activities are identified, assigned to resource groups, measured through estimated time requirements and converted into cost through capacity cost rates. This consistent approach reduces the risk of arbitrary cost allocation and allows the model to be applied in a transparent way.

The validity of the study is in fact strengthened by mixing the combination of direct observation, managerial input and internal business information. The process map and time estimates were developed based on the actual workflow of the selected restaurant and were validated through practical knowledge of daily operations. In addition, the distinction between delivery, takeaway and dine-in orders, as well as the separation between normal

and peak demand periods, improves the relevance of the model to the real operating conditions of the business.

However, the study recognises that some data are based on estimates rather than exact measurements. For this reason, all estimated times and labour costs are presented as managerially validated assumptions. Also, using rounded labour cost estimates helps confidentiality, but it still lets the TDABC model keep working effectively.

Ethical considerations are also taken into account. The business is referred to as “the selected restaurant” in order to protect its identity and sensitive operational information. Real payroll numbers are not shared, and labour costs are anonymised, then rounded too. No personal data of employees or customers are used in the analysis. The purpose of the study is academic and managerial, focusing on cost efficiency and operational improvement rather than on individual employee evaluation.

3.14 Methodological Limitations

The methodology has a couple of limitations, first off the study is anchored in one single case study, which is the one foodservice business in Chrysoupoli, Greece, so it might be harder to generalise. As a result, the findings can't be statistically generalized over all restaurants or foodservice SMEs, more or less across the board. However, the case study approach allows an in-depth analysis of the selected business and provides practical insights that may be useful for similar small restaurants.

Second, some of the data used in the TDABC model are based on observation and managerial estimates. Although these estimates reflect the actual experience of the business, they may vary depending on staff experience, order complexity, customer demand, equipment use and unexpected operational disruptions. Therefore, the calculated costs should be interpreted as practical estimates rather than exact accounting figures.

Third, the analysis is affected by seasonality and demand fluctuations. The restaurant operates differently during the summer and non-summer periods, and demand is higher on

Friday, Saturday and Sunday. Even though the Leveled TDABC model tries to cover these differences, operational conditions can still shift from one day to the next.

Fourth, the regression analysis gets used like an exploratory tool. It can also help spot associations between variables, such as order volume, peak periods, service channel, cost, and service time. However, it cannot confirm causation on its own. There are other influences too, like supplier prices, staff availability, weather conditions, local events, and customer behavior, that may also push service performance around.

Still, despite these boundaries, the methodology offers a structured and workable approach for applying TDABC and Leveled TDABC inside a real foodservice SME. It lets the dissertation link activity times, labour capacity, cost behavior, and operational outcomes in a way that is meaningful both academically, and for managers.

4. Analysis and Results

4.1 Data Scope and Empirical Analysis Period

This chapter presents the empirical application of the TDABC and Leveled TDABC model to the selected restaurant. The analysis examines sales, order volume, product quantities and service-channel performance in order to estimate workload, labour cost and operational efficiency.

The main empirical period is January–April 2026. This period was selected because it provides a complete and consistent basis for analysing dine-in, takeaway and delivery activity within the same time frame. The dataset includes order volume, revenue, product quantities and service-channel information.

Historical data from 2025–2026 are used only as contextual evidence. Their role is to support the interpretation of seasonality, peak-demand patterns and the Leveled TDABC logic. The main TDABC workload and cost calculations are therefore based on the

January–April 2026 period, while the wider historical data are used for descriptive and comparative purposes.

During this period the restaurant had 8,282 orders and €122,833.76 in total revenue across all service channels. These figures provide the basis for the following analysis of service channels, product mix and TDABC workload.

4.2 Data Consolidation and Preparation

The empirical analysis is based on consolidated business records covering orders, revenue, product quantities and service channels. The data were prepared in order to connect commercial sales information with the operational categories required by the TDABC model.

The first step was to group the restaurant’s products into TDABC categories. This was necessary because the costing model is based on how work is performed inside the restaurant, rather than only on how products are commercially listed. Pizza, calzone and hot dog products were assigned to the pizza station. Pasta, portions, salads and bao buns were assigned to the kitchen station. Burgers and sandwiches were treated as mixed-station products, because they require cooperation between the kitchen and pizza station. Beverages, beers, wines, soft drinks and coffee were also included, because they consume service or front-desk handling time.

Table 4.1: TDABC Product Category Mapping

TDABC category	Main resource group	TDABC treatment
Pizza / Calzone / Hot dog	Pizza station	Production activity
Pasta	Kitchen station	Production activity
Portions	Kitchen station	Production activity
Salads	Kitchen station	Production activity

Bao buns	Kitchen station	Production activity
Burgers	Mixed stations	Kitchen and pizza station activity
Sandwiches	Mixed stations	Kitchen and pizza station activity
Coffee	Front desk / service	Preparation and service-support activity
Beverages / beers / wines / drinks	Front desk / service	Handling and service-support activity

Source: Author’s own elaboration based on business records and TDABC assumptions.

After product classification, quantities were converted into estimated active labour minutes. The calculation followed the TDABC logic developed in Chapter 3:

Estimated Active Labour Minutes = Quantity Sold × Active Labour Time per Unit

Estimated labour cost was then calculated as:

Estimated Labour Cost = Estimated Active Labour Minutes × Capacity Cost Rate

This approach allows the analysis to move beyond sales totals. It estimates how much labour capacity is consumed by each product category and service channel.

4.3 Sales and Service Channel Overview

The restaurant operates through three service channels: dine-in, takeaway and delivery. Table 4.2 presents total orders, revenue and average order value for the main analysis period.

Table 4.2: Sales and Orders by Service Channel, January–April 2026

Service channel	Orders	Revenue (€)	Average order value (€)
Dine-in	2,762	40,314.47	14.60
Takeaway	3,368	43,507.59	12.92
Delivery	2,152	39,011.70	18.13
Total	8,282	122,833.76	14.83

Source: Author’s own elaboration based on consolidated business records.

Takeaway generated the highest number of orders, while dine-in generated slightly higher revenue than delivery. Delivery had fewer orders than takeaway but the highest average order value, at €18.13 per order. This indicates that delivery is a commercially important channel, even though it requires additional operational activities such as packaging, dispatch coordination and driver capacity.

The service-channel results confirm that total revenue alone is not sufficient for understanding restaurant performance. Each channel creates a different operational workload. For this reason, the following sections analyse product mix, monthly demand and TDABC workload separately, before interpreting the cost and capacity implications.

4.4 Monthly Demand Development

Table 4.3 presents the monthly development of total orders and revenue during the main empirical period. The figures include dine-in, takeaway and delivery activity.

Table 4.3: Monthly Orders and Revenue, January–April 2026

Month	Total orders	Total revenue (€)	Average order value (€)
January 2026	1,851	25,674.62	13.87
February 2026	1,738	27,736.08	15.96
March 2026	1,992	32,066.76	16.10
April 2026	2,701	37,356.30	13.83

Total	8,282	122,833.76	14.83
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Source: Author’s own elaboration based on consolidated business records.

The results show a gradual increase in business activity during the period. Total revenue increased from €25,674.62 in January to €37,356.30 in April. Similarly, total orders increased from 1,851 in January to 2,701 in April. April was therefore the strongest month of the four-month period, both in terms of order volume and revenue.

The average order value was highest in March, at €16.10, followed by February, at €15.96. Although April recorded the highest number of orders and the highest total revenue, its average order value was lower, at €13.83. This indicates that the increase in April was mainly driven by higher order volume rather than higher value per order.

This monthly development is relevant for the TDABC analysis because higher order volume increases the workload placed on the restaurant’s resource groups. Even within a non-summer period, demand is not stable. Therefore, the monthly results support the need to examine workload, capacity use and labour cost dynamically rather than relying only on total-period averages.

4.5 Product Mix and TDABC Workload Estimation

The next stage of the analysis converts the restaurant’s aggregate product mix into TDABC workload. The purpose is to estimate how much active labour capacity was consumed by the products sold during the main empirical period. All product quantities from dine-in, takeaway and delivery activity are analysed together, because the objective is to measure the total operational workload of the restaurant.

The calculation follows the TDABC logic developed in Chapter 3:

Estimated Active Labour Minutes = Quantity Sold × Active Labour Time per Unit

Estimated labour cost is then calculated as:

Estimated Labour Cost = Estimated Active Labour Minutes × Capacity Cost Rate

This approach allows the analysis to move beyond sales revenue. It shows not only which product categories generated sales, but also which categories consumed more active labour time and placed greater pressure on the restaurant’s resource groups.

Table 4.4: Aggregate TDABC Workload by Product Category, January–April 2026

TDABC category	Total quantity	Revenue (€)	Estimated active labour minutes	Estimated labour cost (€)	Main resource group
Whole pizza / sweet pizza	4,764	53,500.95	5,573.88	641.00	Pizza station
Pizza slice	2,607	8,068.46	508.37	58.46	Pizza station
Calzone / Hot dog	327	2,129.59	572.25	65.81	Pizza station
Pasta	951	6,853.65	3,328.50	326.19	Kitchen station
Portions / other kitchen items	2,099	14,593.28	8,396.00	822.81	Kitchen station
Salads	1,141	7,812.26	6,275.50	615.00	Kitchen station
Bao buns	642	4,315.14	3,852.00	377.50	Kitchen station
Burgers	577	4,799.50	4,039.00	428.13	Mixed stations
Sandwiches / rolls	243	2,077.70	1,093.50	115.91	Mixed stations

Coffee	1,144	3,231.00	1,372.80	134.53	Front desk / service
Beverages / beers / wines / drinks	4,709	11,144.28	1,412.70	138.44	Front desk / service
Sides / extras	240	364.87	120.00	11.76	Relevant station
Bundles / deals	286	3,943.08	715.00	78.65	Composite / mixed
Total	19,730	122,833.76	37,259.50	3,814.20	—

Source: Author’s own elaboration based on consolidated business records and TDABC assumptions.

The results show that whole pizza and sweet pizza products generated the highest revenue, with **€53,500.95**, representing approximately **43.6%** of total revenue. However, they accounted for only about **15.0%** of estimated active labour minutes. This occurs because pizza has a relatively low active labour time per unit, as baking time is not treated as fully active labour time.

By contrast, kitchen-related categories created a higher workload relative to their revenue. Portions and other kitchen items generated **€14,593.28** in revenue but demanded **8,396** active labour minutes, representing the highest workload across all product categories. Salads also brought a rather big workload, about **6,275.50** active labour minutes, even though the revenue was lower than pizza. Burgers and bao buns then followed a similar pattern, because they needed more active preparation time per unit and often involved either kitchen work or mixed-station tasks.

This finding is central to the TDABC analysis. Traditional sales analysis would highlight pizza as the dominant category because of its revenue contribution. TDABC adds a second layer by showing that operational pressure is more widely distributed across the restaurant,

especially toward the kitchen and mixed stations. Therefore, workload management cannot focus only on the pizza station, even though pizza remains the main revenue driver.

The estimated active labour cost for the analysed product mix was **€3,814.20**. This figure refers only to the estimated cost of active labour time directly linked to product preparation, handling and service-support activities. It does not represent the restaurant’s total labour cost, since it excludes idle capacity, support activities, pre-opening preparation, closing activities and general managerial time.

Overall, the workload estimation confirms the usefulness of TDABC for the selected restaurant. It shows that profitability and operational efficiency cannot be understood only through revenue or quantity sold. A product category may generate high revenue while requiring relatively low active labour time, while another category may generate lower revenue but consume more labour capacity. This distinction provides a more accurate basis for analysing cost efficiency and operational performance.

4.6 Workload Distribution by Resource Group

The TDABC workload estimation can also be interpreted at resource-group level. This is important because the restaurant operates through different stations, and each station is affected differently by the product mix. Therefore, the estimated active labour minutes were grouped according to the main resource group involved in each product category.

Table 4.5: Estimated Workload by Resource Group, January–April 2026

Resource group	Product categories included	Revenue (€)	Estimated active labour minutes	Estimated labour cost (€)	Share of active labour minutes
Pizza station	Whole pizza, sweet pizza,	63,699.00	6,654.50	765.27	17.9%

	pizza slice, calzone, hot dog				
Kitchen station	Pasta, portions, salads, bao buns	33,574.33	21,852.00	2,141.50	58.6%
Mixed stations	Burgers, sandwiches, bundles / deals	10,820.28	5,847.50	622.69	15.7%
Front desk / service	Coffee, beverages, beers, wines, drinks	14,375.28	2,785.50	272.97	7.5%
Relevant station / extras	Sides / extras	364.87	120.00	11.76	0.3%
Total	—	122,833.76	37,259.50	3,814.20	100.0%

Source: Author’s own elaboration based on consolidated business records and TDABC assumptions.

The results show a clear difference between revenue concentration and workload concentration. The **pizza station** generated the largest share of revenue, mainly because pizza-related products were the dominant sales category. However, it accounted for only **17.9%** of estimated active labour minutes. This reflects the fact that pizza preparation includes baking time, but the full baking time is not treated as active labour time.

The **kitchen station** created the highest workload, accounting for **58.6%** of total estimated active labour minutes. This is mainly due to portions, salads, pasta and bao buns, which require more active preparation, assembly and packaging time. Therefore, the kitchen station appears as the most labour-intensive operational area during the analysis period.

Mixed-station products, mainly burgers, sandwiches and bundles, represented **15.7%** of estimated active labour minutes. These categories are important because they require

coordination between the kitchen and pizza station. Although their revenue contribution is lower than pizza, their preparation process creates additional complexity.

Front desk and service-related items, such as coffee and beverages, represented a smaller share of active labour minutes. However, they remain relevant because they consume handling and service-support time, especially in dine-in and takeaway activity.

Overall, the resource-group analysis confirms that the restaurant’s operational pressure is not concentrated only in the pizza station. Although pizza is the main revenue driver, the kitchen station absorbs the largest share of active labour workload. This finding supports the use of TDABC, because it reveals capacity consumption that would not be visible through revenue analysis alone.

4.7 Peak, Normal and Historical Demand Context

The previous sections presented the TDABC workload results for the main empirical period. In addition to this four-month analysis, the wider historical data were used to provide context for demand patterns and to support the Leveled TDABC logic developed in Chapter 3.

The historical evidence confirms that demand is not evenly distributed across the week. Friday, Saturday and Sunday are consistently stronger operating days compared with the remaining weekdays. This supports the methodological distinction between normal and peak demand periods.

Table 4.6: Normal and Peak Demand Pattern Based on Historical Records

Demand period	Average orders per day	Average revenue per day (€)	Interpretation
Normal days	88	1,081	Lower workload and lower pressure on capacity

Peak days	107	1,453	Higher workload and increased pressure on stations
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Source: Author’s own elaboration based on historical business records.

The results show that peak days generate both higher order volume and higher revenue. Average daily revenue during peak days is approximately **34.4%** higher than during normal days. This confirms that the restaurant faces a different operating condition during weekends, even before considering seasonal effects.

This distinction is important for the Leveled TDABC model. The technical preparation time of each product does not necessarily change during peak days. However, higher demand increases the pressure on available labour capacity, especially in the kitchen, mixed stations and dispatch-related activities. As a result, queue time, coordination requirements and the probability of rework may increase during peak periods.

The historical data also support the seasonal dimension of the model. The restaurant operates with a different structure during the summer period, including seven-day operation and additional staff support during the strongest demand days. Therefore, the Leveled TDABC model is justified not only theoretically, but also by the observed operating pattern of the business.

For this reason, the main TDABC workload results should be interpreted together with the demand context. The aggregate workload table shows how labour capacity was consumed by product category, while the peak and historical evidence explain why the same workload may create different operational pressure depending on the day and season.

Overall, the historical demand context confirms that the restaurant does not operate under a single stable condition. This supports the use of Leveled TDABC as a more realistic extension of the basic TDABC model.

4.8 Summary of Empirical Findings

The empirical analysis applied the TDABC and Leveled TDABC logic to the restaurant’s consolidated business data for January–April 2026. During this period, the restaurant recorded **8,282 orders** and total revenue of **€122,833.76** across dine-in, takeaway and delivery activity.

The service-channel analysis showed that takeaway generated the highest number of orders, while delivery had the highest average order value. This indicates that each service channel contributes differently to the business. However, the main TDABC analysis was conducted at aggregate product-category level, because the objective was to estimate the total operational workload of the restaurant rather than isolate one channel.

The monthly analysis showed that activity increased during the four-month period. April was the strongest month in both order volume and revenue. This indicates that demand can vary significantly even within the non-summer period, supporting the need for continuous workload and capacity monitoring.

The TDABC workload analysis showed that whole pizza and sweet pizza products were the main revenue contributors. However, they did not create the highest active labour workload. This is because pizza preparation includes baking time, which is not treated as fully active labour time. By contrast, kitchen-related categories such as portions, salads, burgers, pasta and bao buns generated substantial active labour minutes.

At resource-group level, the kitchen station absorbed the largest share of estimated active labour workload, accounting for **58.6%** of total active labour minutes. The pizza station generated the largest revenue contribution but accounted for only **17.9%** of active labour minutes. This is one of the most important findings of the analysis, because it shows that revenue concentration and workload concentration are not the same.

The estimated active labour cost for the analysed product mix was **€3,814.20**. This amount refers only to the active labour time directly linked to product preparation, handling and service-support activities. It does not represent total payroll cost, as it excludes idle capacity, pre-opening preparation, closing activities and general support time.

Finally, the historical demand context confirmed the relevance of the Leveled TDABC approach. Friday, Saturday and Sunday showed higher average orders and revenue compared with normal weekdays. This supports the distinction between normal and peak demand periods, as well as the broader need to consider seasonality and operating-level differences in the restaurant’s cost model.

Overall, the results demonstrate the value of TDABC for the selected restaurant. Traditional sales analysis shows which products and channels generate revenue. TDABC adds a second layer by showing how much labour capacity is consumed by each product category and resource group. This provides a more useful basis for understanding cost efficiency, workload distribution and operational performance.

5. Discussion and Conclusions

5.1 Discussion of Main Findings

This dissertation was meant to look into how Time-Driven Activity-Based Costing , and also Leveled TDABC, might help with cost efficiency and day to day operational performance at a smaller foodservice business in Greece. The case study is centered on one selected restaurant, and then the approach was applied using combined business data for the months of January through April 2026.

In the empirical findings, the restaurant ended up with 8,282 orders and it generated total revenue of €122,833.76 over the whole analysis period. The service-channel analysis

indicated that takeaway generated the highest number of orders, while delivery had the highest average order value. However, the most important contribution of the analysis was not the comparison of sales channels, but the conversion of product sales into estimated labour workload.

The TDABC workload analysis showed that revenue and active labour consumption do not follow the same pattern. Whole pizza and sweet pizza products generated the highest revenue, with €53,500.95, but they accounted for only 15.0% of estimated active labour minutes. This is explained by the fact that baking time is not treated as fully active labour time. Therefore, although pizza is the strongest revenue category, it is not the main source of active labour pressure.

By contrast, the kitchen station absorbed the highest share of workload, accounting for 58.6% of total estimated active labour minutes. Portions, salads, burgers, pasta and bao buns required more active preparation time and therefore consumed more labour capacity. This finding is central to the dissertation because it shows that traditional sales analysis may understate the operational importance of kitchen-related products.

The total estimated active labour cost was €3,814.20. This figure does not represent the restaurant's total payroll cost. It refers only to active labour time directly connected with product preparation, handling and service-support activities. This distinction is important because TDABC separates used capacity from wider supplied capacity, such as idle time, preparation before opening and closing activities.

The historical demand context also supported the use of Leveled TDABC. Friday, Saturday and Sunday were stronger demand days compared with normal weekdays. This indicates that the restaurant does not operate under one stable condition. Demand intensity, seasonality and staffing needs change, over time. so Leveled TDABC gives a more realistic way of costing than just one average model, even if it seems simpler at first.

5.2 Link with the Literature

The findings are consistent with the TDABC logic that Kaplan and Anderson put forward, where the cost is worked out through the blend of capacity cost rates and time equations. The case study confirms that this approach is useful in service environments where time, labour and process variability are key cost drivers.

The results also support the argument that TDABC is more practical than traditional Activity-Based Costing for small businesses. Instead of creating a complex system with many cost drivers, the model uses time estimates and role-based capacity cost rates. This makes it easier to apply in a restaurant setting where managerial time and accounting resources are limited.

The dissertation also contributes to the emerging discussion on Leveled TDABC. The selected restaurant operates with different demand levels, staffing patterns and seasonal conditions. By taking a look at normal versus peak demand, and also sorting out summer and non-summer operating levels, the study shows how TDABC can be reshaped to fit a more shifting foodservice environment.

The findings also support previous applications of TDABC in hospitality and foodservice settings. They show that cost analysis in restaurants should not focus only on sales, ingredients or broad labour cost totals. It should also examine how activities consume time and how different product categories place pressure on specific resource groups.

5.3 Managerial Implications

The analysis provides several practical implications for the selected restaurant.

First, management should not evaluate product categories only through revenue. Pizza is the main revenue driver, but the kitchen station creates the highest active labour workload. Therefore, staffing decisions should consider workload intensity, not only sales volume.

Second, the kitchen station requires particular managerial attention. Since it absorbs the largest share of active labour minutes, small improvements in preparation flow, task allocation or station organisation may have a strong effect on operational efficiency.

Third, mixed-station products such as burgers and sandwiches should be monitored carefully. These products may not dominate revenue, but they create coordination requirements between stations. During peak periods, this can increase waiting time and operational pressure.

Fourth, beverages and coffee should not be ignored. Although their active labour time per unit is low, their high volume means that they still consume service and front-desk capacity. Including them in the TDABC model gives a more complete view of the restaurant’s workload.

Finally, the model can support better peak-period planning. Since Friday, Saturday and Sunday create higher demand, staffing and preparation should be aligned with expected workload. The summer reinforcement of the pizza and kitchen stations is consistent with this logic and can be evaluated more systematically through Leveled TDABC.

5.4 Limitations

The study has some limitations. First of all, it is based on a single case study. Therefore, the findings cannot be statistically generalised to all foodservice businesses. However, the case study provides detailed insight into the operational reality of a small restaurant.

Second, some time estimates are based on observation and managerial input rather than continuous time tracking. This is acceptable for a practical TDABC application, but future work could improve precision through digital time measurement.

Third, actual route-level delivery times were not available. As a result, delivery was included in sales, product mix and workload analysis, but detailed driver-time costing was based on the average delivery-time assumptions defined in the methodology.

Fourth, the estimated active labour cost does not represent total labour cost. It measures only active labour time connected with product-related activities. Idle capacity, support work, opening preparation and closing activities remain important but were not fully allocated at product level.

Finally, the analysis is descriptive and exploratory. It does not claim to prove a causal performance improvement from TDABC implementation. Instead, it demonstrates how TDABC and Leveled TDABC can improve cost visibility, workload interpretation and managerial understanding.

5.5 The Human Factor in Operational Efficiency

Although this dissertation focuses on cost efficiency, time equations and capacity utilisation, the human factor remains central to the interpretation of the results. In a small foodservice business, operational performance depends not only on processes and cost rates, but also on the people who perform the work, coordinate orders and manage pressure during daily operations.

The TDABC analysis showed that workload is not distributed evenly across the restaurant. While pizza-related products generated the highest revenue, the kitchen station absorbed the largest share of active labour workload. This finding is important because operational pressure is not always visible through sales figures alone. High workload does not only create cost; it also creates physical effort, coordination needs and time pressure for employees.

For this reason, TDABC should be understood as a tool of workload visibility rather than employee control. Its value lies in helping management identify where pressure is created and how labour capacity is actually consumed. This can support better staffing, preparation, task allocation and operational support, especially during peak periods.

On high-demand days the human factor is especially important. During Friday , Saturday and Sunday , the heavier workload may nudge up waiting time , create coordination troubles and also raise the likelihood of mistakes or rework. But these things should not be read purely as personal errors , rather they can also be seen as signals of capacity strain. When this pressure is made visible, TDABC can assist management in answering more fairly and effectively.

A sustainable view of efficiency does not mean doing more work with fewer people. Instead, it means aligning demand, staffing and capacity in a way that improves performance without creating excessive pressure on employees. In this sense, the model supports both managerial decision-making and employee well-being.

Overall, the human factor strengthens the practical relevance of TDABC. The model does not replace managerial judgement or staff experience. It provides a structured way to support them. For a small foodservice business, this combination of numerical analysis and human understanding is essential for sustainable operational improvement.

5.6 Future Research

Future research could also extend this study in several ways. First, the TDABC model could be applied over a full annual cycle in order to compare summer and non-summer periods more directly. Second, real-time tracking could be used to measure preparation, waiting and delivery times more accurately. Third, future studies could compare multiple restaurants in order to examine whether similar workload patterns appear in other foodservice SMEs.

Further research could also integrate profitability analysis at product level by combining TDABC labour costs with ingredient costs, packaging costs and platform commissions. This would allow a more complete view of product profitability and pricing decisions.

In addition, future research could build on the present TDABC and Leveled TDABC model by incorporating more formal quantitative analysis. In this dissertation, the empirical assessment remains mainly descriptive and exploratory, focusing on how activity-level time and cost information improves cost visibility, workload interpretation and managerial understanding in a single case study. A natural extension would be to use regression models in order to quantify the relationship between order-level cost or service time and explanatory factors such as service channel, demand level, product mix, station workload and rework occurrence. For example, future studies could estimate models with dependent variables such as cost per order, service time per order or an operational efficiency index, and independent variables capturing delivery versus takeaway versus dine-in orders, normal versus peak periods, seasonal conditions and workload by resource group. Such models would not only confirm the patterns observed in the present analysis, but would also provide statistically supported evidence on how different operational drivers affect cost efficiency and performance in foodservice SMEs.

Finally, future studies could examine the relationship between workload visibility and employee well-being. Since operational pressure affects service quality, error probability and staff experience, the human dimension of TDABC deserves further investigation in small service businesses.

5.7 Final Conclusions

Although this dissertation focuses on cost efficiency, time equations and capacity utilisation, the human factor remains central to the interpretation of the results. In a small foodservice business, operational performance depends not only on processes and cost rates, but also on the people who perform the work, coordinate orders and manage pressure during daily operations.

The TDABC analysis showed that workload is not evenly distributed across the restaurant. While pizza-related products generated the highest revenue, the kitchen station absorbed the largest share of active labour workload. This finding is important because it shows that operational pressure is not always visible through sales figures alone. High workload does

not only create cost; it also creates physical effort, coordination needs and time pressure for employees.

For this reason, TDABC should be understood as a tool of workload visibility rather than employee control. Its value lies in helping management identify where pressure is created and how labour capacity is actually consumed. This can support better staffing, preparation, task allocation and operational support, especially during peak periods.

A sustainable idea of efficiency does not mean pushing out more work with fewer people. Rather, it is about tuning demand, staffing levels and available capacity, so performance improves without piling on excessive stress on employees. In that sense, the model backs both managerial choices and employee well-being.

Overall, the model strengthens the practical relevance of TDABC in small foodservice operations.

The model does not replace managerial judgement or staff experience. It provides a structured way to support them. For a small foodservice business, this combination of numerical analysis and human understanding is essential for the sustainable operational improvement.

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Appendix A: Data Sources and Empirical Analysis Period

This appendix summarises the main data sources used for the empirical analysis. The main empirical period of the dissertation is January–April 2026. The analysis uses consolidated business records covering orders, revenue, service channels and product quantities. Additional historical data from 2025–2026 are used only as contextual evidence for demand patterns, seasonality and Leveled TDABC interpretation.

Data source	Period	Main use in the dissertation
Internal order and turnover records	January–April 2026	Orders, revenue and service-channel analysis
Product sales records	January–April 2026	Product quantities and product mix
Delivery-platform records	January–April 2026	Delivery orders, revenue and delivery product quantities
Historical business records	2025–2026	Contextual evidence for peak demand and seasonality

Appendix B: TDABC Product Mapping and Workload

Assumptions

This appendix presents the supporting product mapping used for the TDABC analysis. Products were grouped into TDABC categories according to their preparation logic and main resource group. The main categories include pizza-related products, pasta, portions, salads, bao buns, burgers, sandwiches, coffee, beverages and extras. Each category was assigned an estimated active labour time per unit, based on observation and managerial input.

TDABC category	Main resource group	Estimated active labour time per unit
Whole pizza / sweet pizza	Pizza station	1.17 min
Pizza slice	Pizza station	0.195 min
Calzone / Hot dog	Pizza station	1.75 min
Pasta	Kitchen station	3.50 min
Portions / other kitchen items	Kitchen station	4.00 min
Salads	Kitchen station	5.50 min
Bao buns	Kitchen station	6.00 min
Burgers	Mixed stations	7.00 min
Sandwiches / rolls	Mixed stations	4.50 min
Coffee	Front desk / service	1.20 min
Beverages / beers / wines / drinks	Front desk / service	0.30 min
Sides / extras	Relevant station	0.50 min
Bundles / deals	Composite / mixed	2.50 min

Appendix C: Supporting TDABC Workload Calculations

This appendix includes the supporting calculations used to estimate active labour minutes and labour cost by product category and resource group. The calculations follow the TDABC logic:

Estimated Active Labour Minutes = Quantity Sold × Active Labour Time per Unit

Estimated Labour Cost = Estimated Active Labour Minutes × Capacity Cost Rate

The detailed calculations are based on the consolidated January–April 2026 dataset and support the empirical results presented in Chapter 4.

Table C.1: Supporting TDABC Workload Calculations, January–April 2026

TDABC category	Total quantity	Revenue (€)	Active labour time / unit	Cost rate / minute (€)	Estimated active labour minutes	Estimated labour cost (€)	Revenue share	Workload share	Main resource group
Whole pizza / sweet pizza	4,764	53,500.95	1.170	0.115	5,573.88	641.00	43.6%	15.0%	Pizza station
Pizza slice	2,607	8,068.46	0.195	0.115	508.37	58.46	6.6%	1.4%	Pizza station
Calzone / Hot dog	327	2,129.59	1.750	0.115	572.25	65.81	1.7%	1.5%	Pizza station
Pasta	951	6,853.65	3.500	0.098	3,328.50	326.19	5.6%	8.9%	Kitchen station
Portions / other kitchen items	2,099	14,593.28	4.000	0.098	8,396.00	822.81	11.9%	22.5%	Kitchen station

Salads	1,141	7,812.26	5.500	0.098	6,275.50	615.00	6.4%	16.8%	Kitchen station
Bao buns	642	4,315.14	6.000	0.098	3,852.00	377.50	3.5%	10.3%	Kitchen station
Burgers	577	4,799.50	7.000	0.106	4,039.00	428.13	3.9%	10.8%	Mixed stations
Sandwiches / rolls	243	2,077.70	4.500	0.106	1,093.50	115.91	1.7%	2.9%	Mixed stations
Coffee	1,144	3,231.00	1.200	0.098	1,372.80	134.53	2.6%	3.7%	Front desk / service
Beverages / beers / wines / drinks	4,709	11,144.28	0.300	0.098	1,412.70	138.44	9.1%	3.8%	Front desk / service
Sides / extras	240	364.87	0.500	0.098	120.00	11.76	0.3%	0.3%	Relevant station
Bundles / deals	286	3,943.08	2.500	0.110	715.00	78.65	3.2%	1.9%	Composite / mixed
Total	19,730	122,833.76	-	-	37,259.50	3,814.20	100.0%	100.0%	-

Source: Author’s own elaboration based on consolidated business records and TDABC assumptions.

Author’s Statement:

I hereby declare that, in accordance with article 8 of Law 1599/1986 and article 2.4.6 par. 3 of Law 1256/1982, this dissertation is solely a product of personal work and does not infringe any intellectual property rights of third parties and is not the product of a partial or total plagiarism, and the sources used are strictly limited to the bibliographic references.