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IT PROJECT MANAGEMENT FOR THE IMPLEMENTATION OF INTELLIGENT ACCESS SYSTEMS AND VEHICLE IDENTIFICATION TECHNOLOGIES: OPERATIONAL MODEL OF A MOBILE SERVICE ENTERPRISE

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Abstract. This article examines the management of a mobile service that programs automotive smart keys and installs electronic locks as an example of IT project management. Based on the experience of Denys Vakuliuk, owner of an automotive locksmith service, the article proposes a Five-Loop Operational Management Model that integrates five interconnected loops of his work: technological, institutional, dispatch, marketing-economic, and reputational. The technological loop covers access to the manufacturer's secure data, cloning and generating chips, and immobilizer diagnostics. The institutional loop involves legal access to dealer systems. The dispatch loop distributes service calls among technicians based on their location and workload. The marketing-economic loop manages the flow of service requests based on return on advertising investment. The reputational loop covers countering malicious attacks through customer reviews. It is shown that the competitiveness of an independent service depends on legal access to dealer systems and on the manager's ability to quickly identify weak points in the process from the initial inquiry to the completion of the job. The empirical basis is provided by this specialist's documented experience, which reveals the connections between the loops of work that are usually hidden by the division of labor among different people. The novelty of the study lies in integrating these separately-studied areas into a single decision-making framework for a small mobile service.

Keywords: IT project management, mobile service, intelligent access systems, automotive safety, key programming, dispatch management, right to repair, advertising spend.

Introduction

In recent years, working with car keys and electronic locks has become much more technically complex. Previously, a mechanic dealt mainly with mechanical components, but now must program chips, access the manufacturer's secure databases, and diagnose the car's electronic control units. A standard key fob already contains an encrypted chip; without the correct programming, the car won't start. Because of this, each job requires specific equipment, must be completed within a limited time frame, and leaves no room for error – since a failed attempt could leave the owner without a working car.

Entering this business today is both easier and more difficult than before. It's easier because programmers compatible with most cars have become cheaper and are sold almost freely. It is more difficult because the latest models cannot be legally serviced without verified access to the manufacturer's proprietary data, and a single mistake with the immobilizer or control unit will render the car inoperable. It is precisely this gap between inexpensive tools and the high cost of errors that gives rise to the management challenges discussed in this article.

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Literature Review

The topics covered in this article are addressed within four research areas, each of which explores only one aspect of managing mobile services for intelligent access systems.

The first research area covers field service management and the optimization of on-site service. Current work on this topic, particularly studies related to the automotive and manufacturing industries, describes dispatching as a problem of dynamic route planning and task assignment, in which the decision to assign a call to a specific technician is made based on their location, skill set, and current workload. The primary source of benefit is recognized as the transition from static daily planning to real-time reassignment and rerouting of field technicians, which makes it possible to significantly reduce travel time between service calls [1]. This approach provides a theoretical framework for the dispatch process; however, it treats the field technician as an anonymous resource with predefined parameters. It does not take into account that in a small mobile service, the dispatcher, technician, and owner are often the same person, and decisions regarding a specific technician's assignment are made not by an algorithm but by a manager based on a comprehensive analysis of events.

The second area concerns the institutional conditions of independent auto service, which are studied within the context of the "right to repair" debate. In a chapter of a collective monograph published by Springer, it is shown that the automotive aftermarket keeps approximately 1.5 billion vehicles in working order and contributes roughly $1.8 trillion to the global economy; however, this sector faces the threat of restricted access to maintenance and repair data provided by manufacturers. The author traces relevant regulatory initiatives at the EU and UN levels [2]. The legal aspect – namely, the priority of access to service information over the manufacturer's copyright in that information – is examined in the Journal of Intellectual Property Law & Practice published by the University of Oxford in the context of the right to repair under the EU Green Deal, where access to repair information is analyzed in relation to copyright restrictions [3]. The economic basis for this discussion is laid out in an article in The Antitrust Bulletin: N. Hawker argues that even in the face of competition in the primary market for new cars, a manufacturer is able to earn monopoly profits in the secondary service market by restricting independent service providers' access to spare parts, information, and training, and one of the recognized solutions is mandatory access [4]. These studies explain why legal access to dealer systems became possible in the first place, but they do not describe exactly how an individual firm transforms such access into an operational advantage.

A third area concerns the economics of online reputation and review manipulation. In an article in the American Economic Review, D. Mayzlin, Y. Dover, and J. Chevalier empirically demonstrated that the incentive to inflate reviews is highest for independent, single-owner businesses and lowest for chain companies, while neighboring competitors of such businesses receive a higher share of negative reviews on open-posting platforms [5]. A study in Information Systems Research formalizes an individual business's vulnerability to attacks with fake reviews based on its visibility and ranking on the platform [6]. These results directly explain the situation faced by the service in question, which positions itself as the most expensive company in the city, but they overlook the practical countermeasures that the business itself can take.

Thus, the operational, institutional, and reputational aspects have been studied quite thoroughly in the literature, but each in isolation. There is a lack of studies that would examine them together at the level of a single enterprise, where the technologist, dispatcher, and marketer are all the same person. The novelty of this work lies precisely in integrating these separately-studied areas into a single decision-making system for a small mobile service, formalized here as the Five-Loop Operational Management Model. The documented experience of the service's current owner helps fill this gap, which is the purpose of this article.

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Purpose of the Article

The purpose of this article is to formulate, based on a synthesis of the practices of Denys Vakuliuk, owner of a mobile locksmith service, an integrated operational model for managing IT projects related to the implementation and maintenance of intelligent access systems – termed the Five-Loop Operational Management Model – that combines technological, institutional, dispatch, marketing-economic, and reputational dimensions, as well as to identify measurable indicators that a manager can use to diagnose bottlenecks in the business process.

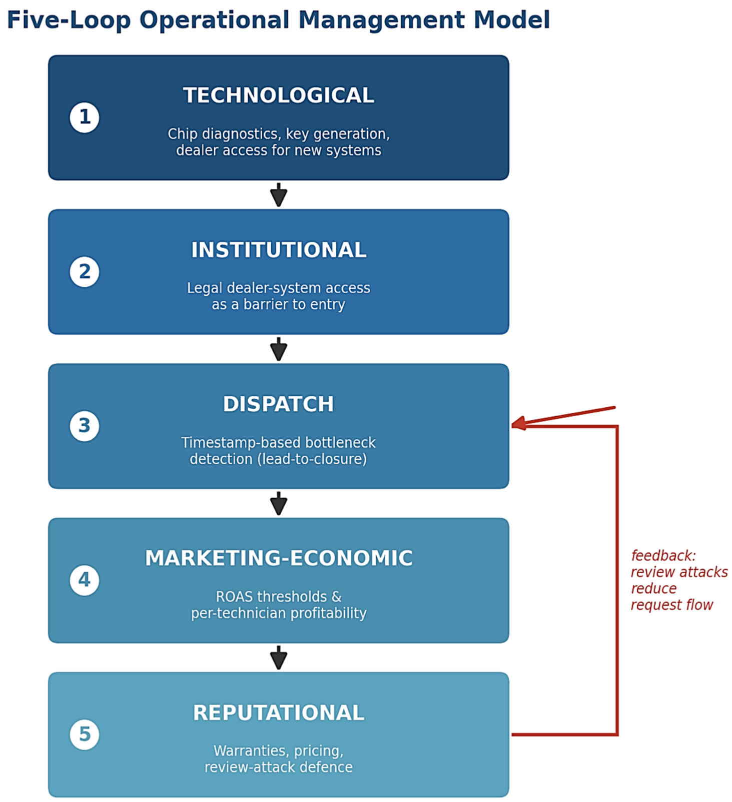

Figure 1. The Five-Loop Operational Management Model

Materials and Methods

The study is structured as a qualitative analysis of a single case study. This method was chosen because the combination of management practices under study is rare and does not lend itself well to mass surveys; instead, it requires a detailed description and interpretation of a specific situation.

This study focuses on the business activity of Denys Vakuliuk, the owner of a mobile locksmith service in Florida, USA. He has certified and legal access to dealer systems through a secure data-disclosure model. His case is useful for analysis because he performs several key functions himself: technical work, dispatching, marketing, and day-to-day management. This allows the study to trace how operational and managerial decisions are made inside one small business. In qualitative research, such cases are often chosen for the depth of insight they provide rather than for the number of examples they include.

The primary data were collected in two complementary formats. The first is a structured written questionnaire covering three thematic areas: performance indicators and business economics, competitive advantage in the form of a case study, and cross-cultural marketing,

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within which the informant provided specific quantitative benchmarks. The second is a detailed oral account in which he described the technology behind working with keys and locks, the organization of dispatch operations, pricing and warranty policies, countering reputational attacks, and changes in the industry over the past five years. The combination of structured responses and free-form discussion made it possible to correlate quantitative indicators with specific work situations and management decisions.

The material was analyzed using thematic analysis. The informant's responses were coded by content and grouped into five management areas, which form the analytical framework of the article. The quantitative data provided by the expert – including the percentage of vehicles covered by universal chip generation, the price range of services, and the threshold values for return on advertising – were used as concrete illustrations of these practices. To compare the observations with existing scientific knowledge, peer-reviewed international sources on field service management, repair rights, and the economics of online reputation were consulted.

The limitations of this approach stem from the nature of a single-case study; therefore, its conclusions describe a specific case and cannot be automatically generalized to the entire population of enterprises without further verification, and the quantitative indicators reflect the informant's estimates and are indicative in nature. These limitations determine the directions for further verification, outlined in the concluding section of the article.

Results

1. Technological Loop: From the Chip to Dealer Access

In the technological loop of the service, the specialist first assesses the condition of the chip. When a key stops working – for example, due to moisture exposure or a short circuit on the circuit board that disables the remote control – the chip is checked first, since in most keys it retains functionality even without battery power. A functional chip allows the key to be repaired, whereas a damaged one requires a new key to be made. The result of this check determines the entire course of further work.

The common misconception that newer cars are always more difficult to service is false. Older cars can sometimes be harder to service than newer models. Their electrical systems and components may not communicate with modern diagnostic computers, which means the technician has to use older equipment designed for those systems. A significant turning point occurred around 2021, when many automakers switched to new types of systems that standard Chinese and American diagnostic tools cannot read. Working on such vehicles requires dealer-level access, which this service center provides through the appropriate certification.

The operation of the technical workflow is illustrated by Denys Vakuliuk's case involving a 2016 Ford Escape with a Push-to-Start system, where it was necessary to disable the MyKey feature, which imposes restrictions on speed and the volume of the car stereo. Usually, this is done simply by adding an admin key; however, this particular system turned out to be atypical, and the standard method did not work. He had to use dealer-level access to restore the proximity function; at one point, he was only able to program the chips, so the car would start only when the key was in a specific location, did not respond to the key in a pocket, and the buttons on the key did not work. According to his assessment, it is unlikely that any of the local service providers would have been able to handle such a situation. The management lesson from this episode is that the ability to maintain the highest level of access in reserve turns a rare exception into a competitive advantage.

Vakuliuk considers the universal chip generation device (superchip) to be crucial for the service's economy. Without it, the company would have to spend tens of thousands of dollars extra on equipment and carry every chip and every key separately. The superchip works almost every time and covers approximately 85% of all cars. For the remaining 10–15% of exceptions,

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the company keeps template blanks for cloning or aftermarket keys for specific models in stock. Thanks to this, a single universal platform covers the vast majority of cases, while the small remainder is handled by specialized solutions.

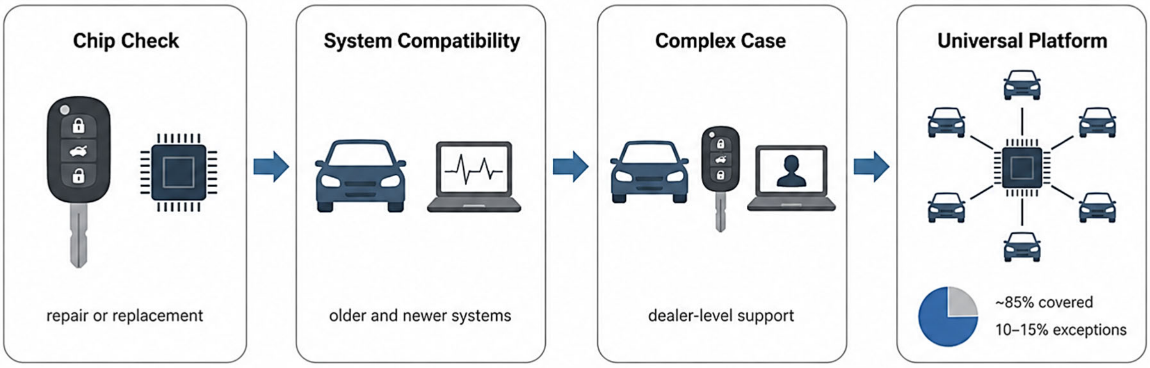

Figure 2. Technical Workflow and Equipment Logic in Automotive Key Service

2. Institutional Loop: Legal Access as a Barrier to Entry

Independent specialists gained the right to work with dealer software thanks to the movement to open access to service information. According to the operator, there was historically a loophole in the legislation related to an initiative by enthusiasts who secured the right for ordinary specialists to have the same access as dealers, since the model under which a car could only be repaired at a dealership contradicted antitrust law. This movement and industry agreements are in line with the global trend toward the "right to repair," as described in academic literature [2; 3; 4].

Any technician from any state can apply for such access, but few pass the screening process. Applicants are screened against police and criminal records databases, required to verify their experience with certifications, and must obtain recommendations from several technicians already admitted to the system. As a result, there are few holders of this access within the country, which makes it an effective barrier to entry and a sustainable competitive advantage. Thanks to this access, a specialist can order keys for new Ford, GM, and other brands directly from the dealer, with delivery to the client's specific vehicle, although a recurring fee is required to maintain this access.

3. Dispatch Loop: Flow Management and Bottleneck Detection

The operational foundation of the dispatch system is the flow of requests. The company receives an average of 15–20 requests per day and 120–150 per week, with pronounced seasonality: demand drops by 20–25% in winter, while during peak months, the workload increases by up to one and a half times. In the service funnel, out of 100% of inquiries, about 75% result in a successful contact, about 40% lead to a service call, and about 35% result in payment; the largest number of customers is lost between the first contact and the scheduling of a service call due to price, poor communication, and delayed responses. The average arrival time is 18–30 minutes and directly affects conversion rates, since without prompt feedback, the customer will continue to call competitors.

Call dispatch requires the most attention in daily operations. The manager acts as an intermediary between the dispatch service, which takes calls, and the technicians who go out to perform the work. Armed with information about each technician's location and workload, the manager strives to group tasks by geographic area to reduce travel time and increase the technician's daily productivity. In field service research, this type of dispatching is viewed as dynamic task assignment that takes into account the technician's geolocation and workload [1].

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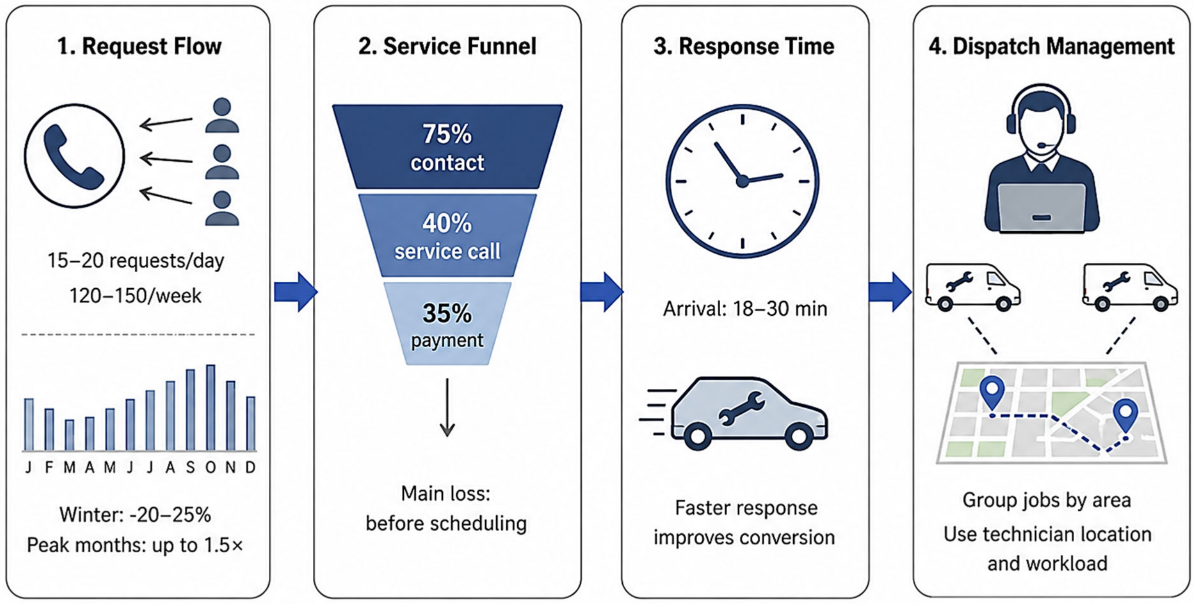

Figure 3. Dispatch System Workflow and Bottleneck Identification

The primary management tool in this process is identifying bottlenecks through end-to-end event tracking. Each job is assigned a unique tracking number, and if a technician has been assigned several jobs in a row but has not completed any of them, the manager analyzes the timestamps – specifically, the time the lead was received, when it entered the chat, when it was assigned to the technician, and when the technician called the client. These timestamps make it possible to identify the cause of the failure, which could be a processing delay on the dispatch center's end, improper behavior by a manager that causes the customer to refuse to cooperate, or an issue on the technician's end. In the latter two cases, the job is reassigned to another technician; as for the technician in question, the manager decides whether to send them for training, investigate the circumstances, or terminate their employment. By its nature, this is a simplified version of end-to-end event logging, which forms the basis of modern field service platforms [1].

End-to-end event tracking relies on a specialized tracking system. While the service previously used the Workiz platform, it is now transitioning to Housecall Pro, which allows the source of each request to be linked to a specific call handler, technician, service type, total amount, and individual employee metrics. As a result, marketing expenses are directly correlated with actual revenue, and the manager receives a unified factual basis for decisions regarding advertising, service areas, and hiring.

The owner consciously chooses between quality and scale and describes this choice by comparing a sniper to a machine gun. Working on his own, Vakuliuk closes 80–90% of inquiries. This was confirmed by an experiment he conducted. When the owner himself answered calls instead of dispatchers, the conversion rate increased by approximately 25–30%, because customers trusted a confident conversation more. As the team expands, the conversion rate drops, but with a high volume of traffic – provided that advertising and the overall conversion rate are balanced – the business remains profitable. It is impossible to combine maximum personal conversion with scale in a single model, and prioritizing scale is justified only when the owner monitors the key performance indicators.

4. Marketing-Economic Loop: Return on Advertising and Customer Segmentation

A separate component of management concerns finance and advertising. He focuses primarily on actual return on ad spend (ROAS), that is, the ratio of money spent to money earned. If X is spent in a month and 2X is earned, the result is acceptable; a ratio of 1.5X is worse, and 1.3X indicates an unsatisfactory month. The specialist performs a similar calculation for

ISSN: 2787-9364

each technician. One technician achieved a ratio of about 3X, while another only 1.2X, which shows who should be promoted and who should be removed from the workflow. For decision-making, the manager only needs aggregated metrics, which aligns with industry analysts' recommendation to collect performance and ROI metrics comprehensively after each project [1].

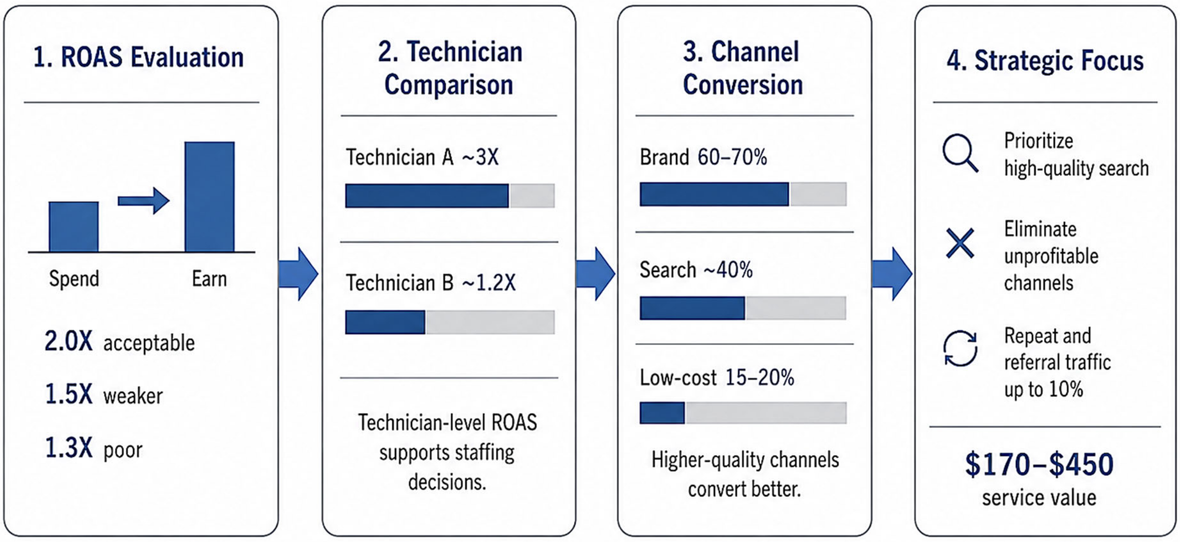

Figure 4. ROAS-Based Advertising and Channel Management in Automotive Key Service

Segmenting channels and customers is crucial. Google's search channels consistently deliver the highest-quality traffic, whereas certain low-cost platforms generate leads with low profitability because customers on those platforms focus solely on the lowest price. Conversion rates by source confirm this. Brand-related leads convert into orders in 60–70% of cases, standard search leads in about 40%, and leads from low-cost platforms in only 15–20%. Search leads are typically time-sensitive, so such customers are less price-sensitive. The actual cost of car key services ranges from approximately $170 to $450, depending on the type of job; moreover, in the search channel, customers are willing to pay more than those coming from social media, provided the value is properly justified. Repeat customers and referrals account for up to 10% of the traffic at virtually zero acquisition cost. This gives the service owner a reason to shut down unprofitable channels and focus on high-quality sources and urgent requests.

The hidden cost of customer savings is illustrated by the example of a Ford F-150, which required a new engine control module and new keys due to a malfunction in the existing module. Denys Vakuliuk recommended a high-quality control module costing about $400, but the customer purchased two cheap alternatives (for $100 and $130), and both failed. As a result, the customer spent over a thousand dollars and still did not end up with a working vehicle, whereas the entire repair could have cost approximately $600 from the start. This case demonstrates that cutting corners on a critical component results in a multiple increase in total costs – a phenomenon described in the aftermarket economy by the concept of total cost of ownership [4].

5. Reputational Loop: Warranty, Pricing Communication, and Defending Against Attacks

Protecting the company's reputation also requires significant effort. The warranty terms are clearly defined. For work performed on a customer's own key, a 30-day warranty is provided on the service itself, while a one-year warranty applies to keys programmed by the

ISSN: 2787-9364

service provider. If a customer provides their own key, its cost (approximately $30–35) is deducted from the total amount; however, the customer forfeits the one-year warranty. For the most part, customers opt out of this option and return to the full service; the service works with a small number of persistent customers, but responsibility for the key's future condition rests with the customer. In this way, the risk is shared between the service and the customer depending on the key's origin.

An important element of pricing communication is explaining the invisible difference in quality. Even keys that look identical on the outside can differ significantly on the inside. In China, a key can be purchased for as little as two dollars or as much as twenty, and these will be fundamentally different products that are resold on the local market for approximately $30 and $100, respectively. A similar pattern holds true in the service sector. A higher price allows for the use of high-quality products and the provision of a warranty, whereas an excessively cheap service means cutting costs at the customer's expense. This is precisely what Denys Vakuliuk explains to customers, justifying the higher price through transparent pricing.

He also has to counteract unscrupulous attacks, primarily the flooding of negative reviews and price dumping, which damage the company's visibility on maps and its rating. Studies confirm that it is precisely independent, single-owner businesses that face the greatest pressure from such manipulation by competitors [5], and a lower ranking on the platform makes a business less visible to customers [6]. Author configured AI-based algorithms that recommend responses to specific reviews or attacks; during the most recent attack, all twenty reviews were successfully removed. The company takes a measured approach to price dumping, as it positions itself as the most expensive service provider in the city and relies on its ability to perform jobs that others cannot. Short-term losses do occur, however. In particular, during one attack, the volume of work over a three-week period was barely enough to keep one and a half of the seven technicians busy. Reputational resilience in the long term is achieved primarily through differentiation based on quality.

6. Model Expansion: Smart Locks and the "Residential–Corporate" Segment

A similar business logic applies to stationary access control systems – that is, locks – which are technologically less advanced than automotive systems. Companies that install locks costing $3,000–$5,000 typically source them from Europe, whereas Denys Vakuliuk found an American solution for $1,500–$2,000. In one instance, a client who had been offered a system starting at $5,000 by other contractors was provided with a solution for $1,500, leaving the client satisfied while the service provider made a profit and successfully completed the task.

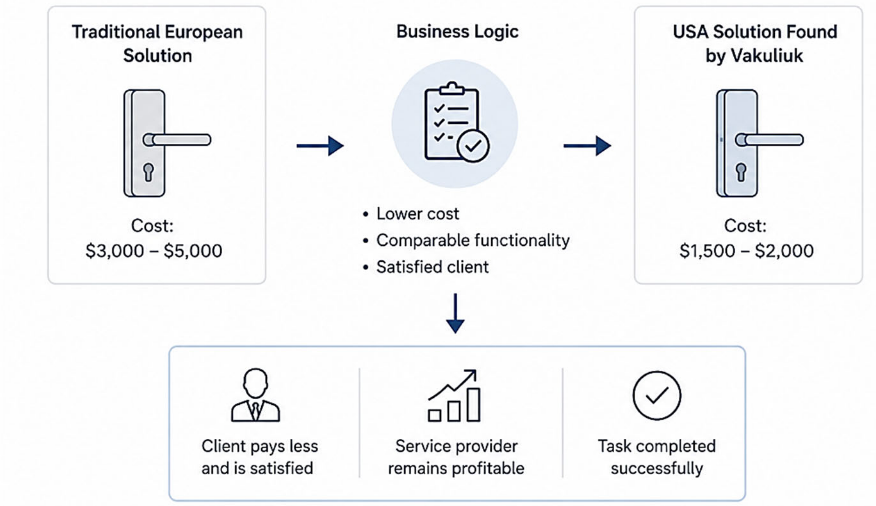

Figure 5. Business Logic in Stationary Access Control Systems: Cost Optimization and Value Delivery

ISSN: 2787-9364

He does not consider this to be dumping, because the client received exactly the product they needed. The main challenge here is to select a lock that can handle the actual workload. A store or office needs a commercial-grade lock designed for hundreds of openings per day (according to the operator's estimate, about five hundred), whereas in an apartment where the door is opened two or three times a day, such a lock forces the owner to overpay for unnecessary durability. Matching the specifications to the actual workload is the correct way to implement an access control system; the same principle applies to IT project management.

7. The Dynamics of the Technological Environment

A five-year retrospective reveals a contradictory shift. Just five years ago, the technological barrier to entry was high in terms of knowledge and skills; however, the development of Chinese technology has significantly changed the situation. Relatively affordable programmers have appeared – costing roughly between one and a half and five thousand dollars – capable of working with almost all vehicles, and their prices continue to fall. What cost about two and a half thousand two years ago is now available for roughly one and a half thousand. Since the equipment has become cheaper, the decisive factors for success have become the specialist's qualifications, the presence of an experienced mentor, and the ability to communicate with clients.

The situation is different in the field of locks. Here, the U.S. tends to lag behind, while Europe and Asia have made greater strides in high-security systems; locks commonly found on the local market can be opened using relatively simple methods, so the skill threshold is lower. In the automotive sector, by contrast, the European auto industry is more advanced in security systems, which requires removing control units and having skills in soldering components and wires. The specialist did not initially possess these skills but mastered them as he worked on relevant tasks. Since tools become cheaper faster than skills improve, the main advantage lies in continuous training and the ability to diagnose problems, while the importance of the equipment itself diminishes.

Author's Contribution

The empirical basis of this article is the practical experience of Denys Vakuliuk, a certified automotive security specialist and owner of a mobile locksmith service in Florida (U.S.) with legal access to dealership systems. The main value of this experience lies in real-world data from an environment that rarely comes to the attention of researchers. Metrics such as the proportion of vehicles covered by universal chip generation, actual labor costs, the limits of acceptable return on advertising, or the scale of a reputation attack are rarely found in scientific publications and cannot be derived from theoretical calculations.

Specifically, the author proposes the following:

1. A **Five-Loop Operational Management Model** integrating the technological, institutional, dispatch, marketing-economic, and reputational dimensions of a mobile access-systems service into a single decision-making system;
2. A **bottleneck-detection method** based on end-to-end timestamp analysis across the lead–dispatch–technician–closure chain;
3. An **advertising-channel efficiency approach** built on return-on-ad-spend (ROAS) thresholds and per-technician profitability rather than per-lead attribution;
4. A **model integrating technical and managerial decision-making** within a single operator, revealing cross-loop dependencies normally hidden by the division of labour.

Vakuliuk's case is important because it shows the links between areas that are often analyzed separately. As the same person performs technical, operational, financial, and customer-facing functions, the study can trace how these decisions influence one another inside a small mobile service business.

ISSN: 2787-9364

The case also demonstrates that conventional management models have limits in this context. Automated route planning, for example, does not replace the owner's judgment but is combined with manual assessment of distance, urgency, traffic, and job complexity. Detailed analytics are also adapted to the scale of the business and often reduced to practical indicators that can guide daily decisions. These observations form the empirical basis for further research into the management of mobile services.

The Five-Loop Model shown in Figure 1 carries direct implications for practice beyond this individual case. Managers of comparable field-service businesses can use the five loops as a diagnostic checklist, isolating which loop is failing before a client complaint or a missed job forces a reactive response. Because the loops interact, the model also gives owners of small operations a language for decisions that are normally made intuitively, such as whether a marketing gain in one loop creates hidden costs elsewhere in the business.

This diagnostic function separates the Five-Loop Model from a descriptive summary of his routines. He operated the five loops as an integrated whole in practice, but he did not treat them as a formal management structure. Identifying the boundaries between the loops and connecting them into a single decision-making system is the contribution of this article; the resulting model is an original managerial framework, applicable beyond the case that produced it, rather than a retrospective label attached to an existing routine.

Prospects for Further Research

The generalized findings open up several avenues for further work. The first involves formalizing the proposed five-loop model through a system of measurable key performance indicators (KPIs), followed by validation using a sample of companies; in particular, the drop in conversion rates from 80–90% to 20–30% described by Denys Vakuliuk during the transition from a solo to a team model requires verification using a sufficiently large set of calls. The second area concerns legal access to dealer systems as a barrier to entry, where it is advisable to compare companies with and without such access in terms of profitability and the share of complex work.

The economics of countering reputational attacks deserve separate study, since the use of artificial intelligence-based algorithms aligns with findings regarding the increased vulnerability of independent companies [5; 6] and raises questions about the ratio of countermeasure costs to preserved revenue. Extending the model to related fields of field service – such as plumbing, electrical work, or emergency maintenance – remains a promising avenue. In these fields, the dispatch loop (timestamp-based bottleneck detection) and the marketing-economic loop (ROAS-threshold channel management) transfer directly, since call flow and lead economics are structurally identical. The technological and institutional loops require domain-specific adaptation: for plumbing or electrical work, the equivalent of dealer access is trade licensing and code certification rather than manufacturer data. This selective transferability requires separate empirical verification.

Conclusions

The analysis conducted shows that the operations of a mobile service should be viewed as IT project management, within which the manager simultaneously operates the five loops of the proposed Five-Loop Operational Management Model. In the technological loop, they diagnose the chip, perform about 85% of the work using universal diagnostics, and maintain backup solutions for the remaining cases; for the latest models, they use dealer access. In the institutional loop, this access provides an advantage due to the difficulty of obtaining it. In the dispatch loop, the manager tracks events and timestamps to identify weak points in the workflow from the initial request to the completion of the job. In the marketing-economic loop, they manage return on advertising and allocate customer acquisition channels. In the

ISSN: 2787-9364

reputational loop, they apply differentiated warranty terms, justify pricing, and counter negative reviews.

The main managerial conclusion is that, amid the rapid decline in the cost of the tool, competitive advantage is primarily ensured by the integration of all five loops and the manager's ability to quickly identify the stage at which the process fails, at which point the quality of the equipment becomes secondary. The proposed model can serve as the basis for further, formalized research into the effectiveness of mobile service enterprises in related fields of field service.

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