

AUTOMATING BUSINESS PROCESSES USING THE N8N PLATFORM: OPPORTUNITIES AND CHALLENGES

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Abstract

In the context of accelerated digitization and the proliferation of software platforms used in the organizational environment, integrated process automation is becoming a decisive strategic factor for increasing efficiency and competitiveness. This study rigorously examines the open-source, low-code n8n automation platform, analyzing its potential to optimize business processes by integrating CRM (Customer Relationship Management) systems and orchestrating data flows. The research focuses on n8n's technical architecture, its operational advantages in enterprise scenarios, and the economic implications of adopting it, emphasizing cost models and return on investment (ROI) assessment. Through a case study dedicated to CRM process automation, the article highlights how n8n contributes to improving data quality, accelerating the lead management cycle, and strengthening customer relationships through intelligent and scalable flows. The results suggest that implementing n8n can significantly increase operational efficiency and inform performance-based investment decisions, thereby demonstrating the strategic value of automation in complex digital ecosystems.

Keywords: leads, marketing, form, n8n, AI.

JEL Classification: O30.

1. Introduction

This article presents a comprehensive and rigorous analysis of the n8n platform, examining its applicability in the fields of business, e-commerce, and digital marketing. The paper explores in depth the technical architecture of the platform, the differences between the operational models – the managed cloud version and the self-hosted variant—as well as their implications for scalability, security, and operating costs.

The study also integrates economic assessments by analyzing cost models, return on investment (ROI), and the impact of automation on organizational efficiency. It includes case studies and scenarios applied in e-commerce (such as order flow automation, customer segmentation, and inventory synchronization)

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and marketing strategies (including lead scoring, campaign personalization, and CRM platform integration).

The article highlights best practices for implementing n8n in organizational contexts, analyzes the associated risks—technical, operational, and ethical—and proposes a methodological framework for assessing the impact of n8n on the productivity and efficiency of business processes. By integrating real and up-to-date bibliographic sources, the paper offers a well-founded and relevant perspective for researchers, professionals, and organizations interested in optimizing processes through low-code automation.

2. Using n8n in business

The n8n platform is emerging as one of the most flexible contemporary solutions for business process automation, thanks to its modular architecture and availability in two distinct operating models. The first model, self-hosted and based on the open-source and fair-code paradigm, allows organizations to implement n8n on their own infrastructure, whether on-premise or in a private cloud. This implementation offers a high level of control over the technical environment, predictable scalability, and extensive customization capabilities. However, it requires a significant degree of technological maturity, as well as complete responsibility for security, maintenance, and backup management. In contrast, the managed cloud model (n8n Cloud) operates as a SaaS service, facilitating rapid adoption and substantially reducing the need for operational resources. Its limitations are mainly manifested in variable costs, which depend on the number of workflow executions, and in a lower level of flexibility compared to the self-hosted option.

The technical architecture of the platform is built around an intuitive visual editor, a distributed execution engine, and databases dedicated to the management of process status and history. These components are complemented by an extensive ecosystem of integration nodes that enable connection to hundreds of third-party applications and services. Support for various authentication methods (API keys, OAuth, and proprietary mechanisms) and the ability to interact with artificial intelligence APIs generate a robust framework for building advanced semantic processing flows, content generation, and analysis assisted by large language models.

In the business environment, n8n is widely used for automating operations, integrating data, and consolidating IT decisions. Automation flows enable dynamic inventory synchronization between e-commerce platforms, ERP systems, and logistics providers, reducing processing times and operational errors. From an analytical perspective, n8n can function as a central link in ETL ecosystems by extracting, transforming, and loading data from heterogeneous sources into analytical warehouses or business intelligence dashboards. This feature is particularly useful in marketing, where up-to-date reports and real-time

visibility of campaign performance are essential for optimizing managerial decisions.

In e-commerce, the platform has proven its effectiveness in scenarios such as real-time inventory updates, fulfillment process automation, automatic post-purchase campaign generation, and proactive competitive price monitoring. Public case studies, such as that of Border, highlight that n8n can facilitate accelerated scaling of operations without requiring proportional staff expansion, suggesting a direct impact on the performance and sustainability of the operational model.

In marketing and growth, n8n functions as an orchestral mechanism that interconnects the processes of lead capture, validation, data enrichment, CRM integration, and nurturing campaign execution. This synergy enables coherent coordination between email marketing, SMS campaigns, and digital advertising, increasing the relevance of the conveyed message and optimizing the customer experience. In addition, the automation of daily reporting on indicators such as customer acquisition cost (CAC), lifetime value (LTV), and conversion rates contributes to data-driven strategic decision-making.

The return on investment (ROI) in implementing n8n is assessed by comparing implementation and operating costs with the time savings generated and the reduction in administrative errors. The calculation model includes manual hours saved, associated salary costs, potential increase in conversions, and infrastructure or licensing costs. Literature and comparative analyses indicate that the self-hosted model is significantly more cost-effective for organizations with high execution volumes.

In terms of competitive advantages, n8n stands out for its high flexibility, advanced customization options, and extensive ecosystem of integrations. However, there are also limitations, such as the need for technical skills for implementation and additional security responsibilities in self-hosted variants. Also, the cloud model can generate significant long-term costs as the volume of automation increases.

Ethical and compliance risks cannot be ignored in the context of decision-making automation. The automatic generation of personalized messages, algorithmic processing of customer data, or orchestration of integrations between sensitive systems must be managed in strict compliance with GDPR regulations and the principles of transparency and auditability. In this regard, the implementation of logging, version control, and permission management mechanisms is mandatory for ensuring proper governance.

Looking ahead, n8n is positioned to become a pivotal platform in intelligent business ecosystems, unifying classic automations, AI pipelines, and enterprise integration processes. Recent developments suggest that the market is moving towards preconfigured templates for specific verticals, such as e-commerce, finance, or retail, which will facilitate rapid adoption and reduce technical

barriers. At the same time, hybrid models are expected to emerge, in which organizations will combine the advantages of on-premise infrastructure with the flexibility of managed cloud services.

3. The methodology used in the application

The objective that we wish to achieve is to devise a methodology that would facilitate the automated aggregation of data concerning prospective customers from a marketing agency. Consequently, through a designated form, consumers have the capacity to input pertinent identification information, specify the desired investment amount, delineate their respective areas of interest, and indicate the preferred timeframe for communication on their behalf. The decision regarding whether or not to initiate email correspondence for the purpose of further discussion is made on the basis of a calculated score.

The methodology for conducting this study is as follows:

Step 1. The initial stage of the process involves the analysis of the problem and the acquisition of the relevant information.

Step 2. The process of engineering the automation functionality in n8n entails a systematic and methodical approach.

Step 3. The previously developed automation is to be executed.

Step 4. This will facilitate the identification of potential improvements to the automation system.

4. The application's design process utilizes the n8n framework.

The implementation of this automation will be executed within the n8n program, encompassing a total of nine nodes, as illustrated in Figure 1. The sequence of primary actions constituting the algorithm can be outlined as follows:

- lead generation form
- calculate lead score
- store all leads
- check leads score
- get available slots in calendar
- format email data
- send email to high score leads.



Figure 1. The application of automation in n8n

Data from potential customers is collected via a designated form, known as a lead generation form. This collected data is subsequently configured for data

flow, which is governed by workflow configuration. Subsequently, the values entered by the customer are assigned, and a score is calculated based on these values (calculated lead score). The data, along with its associated score value, will be stored in a table created in n8n (store all leads). The availability of customers with the highest scores will be checked in the calendar (i.e., the system will identify available timeslots), and subsequently, an email will be sent to each of them (i.e., the system will send an email to high-score leads).

In the present section, a thorough exposition of the primary codifications executed will be delineated. The following data collection fields were utilized for the form: The textbox is to be used for the entry of the following information: name, email address, company name, phone number, and potential customer's area of interest. The combo box is to be used for the selection of the budget level set for a potential negotiation with the company and for expressing willingness to be contacted. At the final stage of the form, a button was incorporated for the purpose of transmitting the data for processing.

Field	Value	Type
highScoreThreshold	70	# Number
calendarId	primary	T String
senderEmail	mihaela.iordache1984@gmail.com	T String
name	value	T String

Figure 2. Workflow Configuration

The threshold value that determines whether potential customers will be contacted, as well as the email address from which the confirmation email will be sent, will be configured within the Workflow Configuration node (see Figure 2). Consequently, in our application, we have selected a minimum level of 70 as a benchmark for initiating communication with prospective customers.

The arithmetic mean between the score assigned to the time option and the score allocated to the budget option is calculated for each potential customer, thus producing a score for each customer. The numerical values assigned to each score are enumerated in Table 1.

Table 1. Scores awarded according to the option chosen

Budget Score		Time Score	
Option	Value	Option	Value
Under \$5k	20	Immediate (within 1 month)	100
\$5k-\$20k	40	Short-term (1-3 months)	70
\$20k-\$50k	70	Medium-term (3-6 months)	40
\$50k+	100	Long-term (6+ months)	20

The sequence of instructions that define the aforementioned processing operations is delineated as follows::

Calculate lead-score:

/ Get form data from previous node

```
const budgetRange = $input.item.json['Budget Range'];
```

```
const timeline = $input.item.json.Timeline;
```

```
// Budget scoring logic
```

```
let budgetScore = 0;
```

```
if (budgetRange === 'Under $5k') {
```

```
  budgetScore = 20;
```

```
} else if (budgetRange === '$5k-$20k') {
```

```
  budgetScore = 40;
```

```
} else if (budgetRange === '$20k-$50k') {
```

```
  budgetScore = 70;
```

```
} else if (budgetRange === '$50k+') {
```

```
  budgetScore = 100;
```

```
}
```

```
// Timeline scoring logic
```

```
let timelineScore = 0;
```

```
if (timeline === 'Immediate (within 1 month)') {
```

```
  timelineScore = 100;
```

```
} else if (timeline === 'Short-term (1-3 months)') {
```

```
  timelineScore = 70;
```

```
} else if (timeline === 'Medium-term (3-6 months)') {
```

```
  timelineScore = 40;
```

```
} else if (timeline === 'Long-term (6+ months)') {
```

```
  timelineScore = 20;
```

```
}
```

```

// Calculate average lead score
const leadScore = Math.round((budgetScore + timelineScore) / 2);

// Generate qualification notes
const qualificationNotes = `Lead scored ${leadScore}/100. Budget range:
${budgetRange} (${budgetScore} points), Timeline: ${timeline}
(${timelineScore} points). ${leadScore >= 70 ? 'High-priority lead with strong
budget and timeline.' : leadScore >= 50 ? 'Medium-priority lead with moderate
potential.' : 'Lower-priority lead requiring nurturing.'}`;

// Determine suggested action based on score
const suggestedAction = leadScore >= 70 ? 'Schedule call' : 'Follow up via
email';

// Return the enriched data
return {
  ...($input.item.json),
  leadScore,
  qualificationNotes,
  suggestedAction
};

```

Additionally, by invoking the functions in JSon, the information will be stored in a table designated as "Leads." The functions in JSon for each field of the database are illustrated in Figure 3.

The image shows three side-by-side screenshots of the n8n 'Prepare Data for Table' configuration interface. Each panel has tabs for 'Parameters', 'Settings', and 'Docs'. The 'Parameters' tab is active in all three.

- Left Panel:** Shows 'Mode' set to 'Manual Mapping'. Under 'Fields to Set', it lists:
 - fullName: mapped to `{{ $json['Full Name'] }}`
 - email: mapped to `{{ $json.Email }}`
 - companyName: mapped to `{{ $json['Company Name'] }}`
 - phoneNumber: mapped to `{{ $json['Phone Number'] }}`
- Middle Panel:** Shows:
 - inquiry: mapped to `{{ $json['What are you looking for?'] }}`
 - budgetRange: mapped to `{{ $json['Budget Range'] }}`
 - timeline: mapped to `{{ $json.Timeline }}`
 - leadScore: mapped to `{{ $json.leadScore }}`
 - qualificationNotes: mapped to `{{ $json.qualificationNotes }}`
 - suggestedAction: mapped to `{{ $json.suggestedAction }}`
- Right Panel:** Shows:
 - suggestedAction: mapped to `{{ $json.suggestedAction }}`
 - submittedAt: mapped to `{{ $json.submittedAt }}`
 - A section for 'Include Other Input Fields' with a toggle switch.
 - An 'Options' section with 'No properties' selected and an 'Add option' button.

Figure 3. Importing data from the form into the table via Json

The Check Lead Score node is responsible for verifying whether the score obtained through the established algorithm is higher than the initial score that was set at the onset of the automation process.

fx	{{ \$json.leadScore }}	# is greater than or
fx	{{ \$('Workflow Configuration').first().json.highScoreThreshold }}	

If the score exceeds the threshold established in the Workflow Configuration node, the process progresses to the verification of availability in the calendar and the subsequent transmission of a confirmation email (see Figure 4). If the score falls below the specified threshold, no subsequent action is taken. Specifically, the system does not initiate an inquiry into the potential customer, nor is an email transmitted.

The screenshot displays the 'Format Email Data' configuration window. On the left, under 'Parameters', the 'Mode' is set to 'Manual Mapping'. Under 'Fields to Set', three fields are configured: 'availableSlots' (String) with value '{{ \$json.summary ? "Busy" : "Available" }}', 'emailSubject' (String) with value 'Great News! Let's Schedule Your 15-Minute Call', and 'emailBody' (String) with a complex template including a greeting and a reference to form data. On the right, the 'emailBody' field is expanded, showing the rendered HTML template: 'Thank you for reaching out! Based on your inquiry, I'd love to schedule a quick 15-minute call to discuss how we can help with {{ \$('Lead Generation Form').first().json[\"What are you looking for?\"] }}.' Below this, there are sections for 'Include Other Input Fields' (toggled on) and 'Input Fields to Include' (set to 'All').

Figure 4 Defining a template for a personalized email with the data entered in the form

In the next section, we will present a detailed demonstration of the previously created automation, utilizing concrete data for illustrative purposes.

5. The mode of operation of automation and how it can be improved

The automation algorithm comprises the following sequence of actions: first, accessing the form and entering the data into it; then, clicking the submit button; and finally, depending on the parameters entered, receiving an email to schedule a future meeting.

Get in Touch - Let's Discuss Your Needs

Fill out this form and we'll get back to you shortly

Full Name *

Email *

Company Name *

Phone Number

What are you looking for? *

Budget Range *

Select an option ...

Timeline *

Select an option ...

Submit

Form Submitted

Thank you! We've received your information and will be in touch soon.

Figure 5. Data entry form

The user is prompted to enter identification information, the amount they wish to invest, and their availability for preliminary contact regarding the transaction. Subsequently, they are instructed to click the Submit button (see Figure 5). A confirmation message will be sent to the recipients to verify the successful transmission of the data.

#	leadScore	T qualificationNotes	T suggestedAction	T submittedAt	createdAt	updatedAt
45		Lead scored 45/100. Budget range: Unc	Follow up via email	2025-12-01T19:02:39.388+02:00	2025-12-01T19:02:41.105+02:00	2025-12-01T19:02:41.105+02:00
100		Lead scored 100/100. Budget range: \$5	Schedule call	2025-12-01T19:04:16.992+02:00	2025-12-01T19:04:18.597+02:00	2025-12-01T19:04:18.597+02:00
100		Lead scored 100/100. Budget range: \$5	Schedule call	2025-12-01T19:06:49.432+02:00	2025-12-01T19:06:51.139+02:00	2025-12-01T19:06:51.139+02:00
100		Lead scored 100/100. Budget range: \$5	Schedule call	2025-12-01T19:08:09.204+02:00	2025-12-01T19:08:10.933+02:00	2025-12-01T19:08:10.933+02:00
100		Lead scored 100/100. Budget range: \$5	Schedule call	2025-12-01T19:13:00.425+02:00	2025-12-01T19:13:02.076+02:00	2025-12-01T19:13:02.076+02:00
100		Lead scored 100/100. Budget range: \$5	Schedule call	2025-12-01T19:13:52.434+02:00	2025-12-01T19:13:54.104+02:00	2025-12-01T19:13:54.104+02:00
100		Lead scored 100/100. Budget range: \$5	Schedule call	2025-12-01T19:15:07.423+02:00	2025-12-01T19:15:09.037+02:00	2025-12-01T19:15:09.037+02:00
Null		Null	Null	2025-12-03T20:32:11.405+02:00	2025-12-03T20:32:13.164+02:00	2025-12-03T20:32:13.164+02:00
Null		Null	Null	2025-12-03T20:32:58.261+02:00	2025-12-03T20:32:59.916+02:00	2025-12-03T20:32:59.916+02:00
Null		Null	Null	2025-12-03T20:33:37.182+02:00	2025-12-03T20:33:38.853+02:00	2025-12-03T20:33:38.853+02:00
100		Lead scored 100/100. Budget range: \$5	Schedule call	2025-12-04T10:47:59.551+02:00	2025-12-04T10:48:01.388+02:00	2025-12-04T10:48:01.388+02:00

Figure 6. The table that stores potential customer data

The data collected via the form is subsequently stored in a table (Leads) and can be accessed through n8n. The management of records within this table is facilitated through the execution of filtering, deleting, or adding operations. This table also stores information about each customer's score, whether they qualify to be contacted, and when the email was sent (Figure 6).

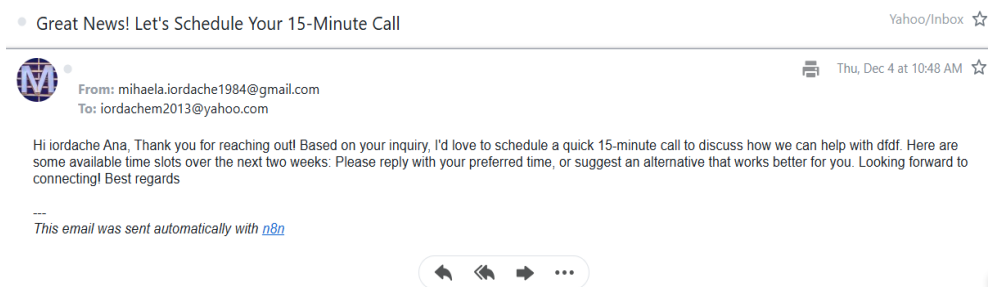


Figure 7. The email received by the customer who meets the conditions to be contacted

If the customer attains a score that exceeds the initial value established by the algorithm, they will receive an email notification prompting them to schedule an appointment (see Figure 7).

The efficacy of automation can be enhanced by replacing the existing data collection form with an intelligent agent. This agent would be tasked with gathering data about potential customers from social media networks. The agent would then be capable of sending messages directly to customers, and the history of these interactions would be stored. There are other methods for improving automation. One such method is the implementation of an intelligent agent to calculate a score. Another method involves the storage of data regarding potential customers in a Google 365 table.

6. Conclusion

In the domain of e-commerce and customer relationship management (CRM), it is imperative to identify the most efficacious methods that offer a favorable cost-benefit ratio. The identification of potential customers, the understanding of their business intentions, and the agility of a company's responses to them are indispensable for the enhancement of sales and, consequently, profitability. By automating repetitive tasks, adopting customer relationship management (CRM) solutions, and utilizing intelligent agents in their work, companies are becoming increasingly competitive.

References

- [1] Desmond, M., Duesterwald, E., Isahagian, V., & Muthusamy, V. (2022). *A No-Code Low-Code Paradigm for Authoring Business Automations Using Natural Language*. arXiv. DOI: 10.48550/arXiv.2207.10648
- [2] El-Gharib, N. M., & Amyot, D. (2023). *Robotic Process Automation Using Process Mining – A Systematic Literature Review*. Data & Knowledge Engineering, 148, 102229. DOI: 10.1016/j.datak.2023.102229
- [3] Pramod, G., & Pappula, K. K. (2023). *Low-Code and No-Code Evolution: Empowering Domain Experts with Declarative AI Interfaces*. International Journal of Artificial Intelligence, Data Science, and Machine Learning. DOI: 10.63282/3050-9262.IJAIDSML-V4I2P112
- [4] Javidroozi, V., Tawil, A.-R., Azad, R. M., Bishop, B., & Elmitwally, N. S. (2025). *AI-Enabled Customized Workflows for Smarter Supply Chain Optimization: A Feasibility Study*. Applied Sciences, 15(17), 9402. DOI: 10.3390/app15179402
- [5] Sobczak, A. (2021). *Robotic Process Automation implementation, deployment approaches and success factors – an empirical study* (Robotic Process Automation Implementation, Deployment Approaches and Success Factors – an Empirical Study). Entrepreneurship and Sustainability Issues.
- [6] Prucha, P., & Madzik, P. (2023). *SiDiTeR: Similarity Discovering Techniques for Robotic Process Automation*.
- [7] Abdellaif, O. H., Nader, A., & Hamdi, A. (2024). *LMRPA: Large Language Model Driven Efficient Robotic Process Automation for OCR*.
- [8] Enhancing Trust in LLM-Based AI Automation Agents: New Considerations and Future Challenges (Schwartz, Yaeli & Shlomov, 2023)
- [9] <https://blog.n8n.io/ai-agentic-workflows/>
- [10] <https://zediot.com/solutions/n8n-ai-automation/>
- [11] <https://n8n.io/>