

# **Transparency-Oriented Digital Rental Ecosystem (T-ODRE Model) for Economical Equity and Sustainability**

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## **Abstract**

For an economically cohesive and vibrant sustainable urban development, equitable transparency and socioeconomic responsibility bear as much importance as ecological and environmental responsibility. In Bangladesh, where about 90 percent of the population in the capital are renters, there exists information asymmetry, lack of documentation, trust, and accountability on both ends, the renters and the tenant. These elements bring forth financial discrepancies, inefficient property utilization, and ultimately, instability between tenant-landlord relations. Furthermore, inefficient usage of data of these entities affects other institutions like banks/creditors and market overseers in the long term. Hence, this paper introduces a model named Transparency-Oriented Digital Rental Ecosystem (T-ODRE Model). It is a digital platform infused to formalize and optimize the rental-tenant process through traceability and transparency. The model integrates verified digital identities for both landlords and tenants, automated rent payment and receipt systems, and historical record tracking to ensure accountability and long-term trust. Upon gathering that information, it addresses stakeholders like the renter and tenant, the overseer Ministry, and the financial system, bank/creditors, by creating a financial portfolio of individuals and their periodical payment habits. With the minimization of information asymmetry in the market for all stakeholders, and enabling data-driven decision-making, T-ODRE contributes to the Sustainable Development Goals (SDGs) related to sustainable cities (SDG 11), reduced inequalities (SDG 10), and decent work and economic growth (SDG).

## **Keywords**

Sustainable Digital Systems, Transparency, Rental Ecosystem, Information Asymmetry, Creditors, Bangladesh.

## **1. Introduction**

Bangladesh's highly concentrated population has given inception to a huge rental housing market, illustrating both opportunities and challenges of dwelling in urban sites in such a crowded nation. such (International Finance Corporation, 2022). However, the rental housing market is mostly unvalidated, informal, and ambiguous. This has been creating a persistent information asymmetry between the parties, tenants, and the landlord. The rental agreements that are produced are mostly unverified, unstandardized documentation, and are coupled with unreliable to no record-keeping systems. Consequently, major information such as dispute history on both ends, payment discipline, property status quo, and contract compliance remains untraceable, unstructured, and unverifiable. An unarrayed assortment of information, as such, directly stands as a barrier to sustainable cities and communities (SDG 11). Furthermore, the absence of such structured rental information affects not just the immediate parties but the broader institutions and their ecosystem. Creditors and banks are unable to assess the tenants' payment discipline as part of risk assessment and providing credit. Similarly, regulatory bodies lack real-time monitoring of the market, allowing policy compliance issues and leaving them blind to emerging socioeconomic trends (Unnayan Shamannay/IFC, 2020). Discrepancies such as this contribute to being major hurdles in achieving reduced inequalities (SDG 10) and economic prosperity (SDG 8). Hence, to tackle these issues, an ecosystem is needed rather than one-on-one tackling of solutions. Thus comes the T-ODRE system, which acts as the ecosystem to address all of the issues altogether to formalize the rental process, assure verifiable documentation, ensure proper accountability on all ends, and enable data-driven decision-making tools for the financial and regulatory bodies, as the need for an integrated, transparency-oriented digital ecosystem is unmatched (Harvard JCHS, 2023).

### **1.1 Objectives**

- Reducing Information Asymmetry in the Bangladesh Rental Market.
- Creating traceable, immutable rental interactions in a digital ecosystem to reduce disputes and disagreements.
- Building a Credit/financial portfolio of tenants digitally based on user history.
- Formulation of aggregated and anonymized insights and statistics for regulatory bodies to access.
- To improve sustainable urban housing management through data-driven decisions.
- Designing a future-proof digital platform supporting modules for a thriving ecosystem.

## **2. Literature Review**

Since the inception of the Bangladesh rental market, it has self-regulated informally, without documentation and any governmental oversight. According to UN-Habitat (2016), informal rental systems in South Asian cities contribute significantly to urban vulnerability due to absent record-keeping and unclear tenant–landlord obligations. Similar patterns are reflected in Dhaka's rental environment, where the prevalence of unregistered agreements, ambiguous payment terms, and minimal legal protection for tenants exists. These conditions create systemic information asymmetry and reduce trust between stakeholders.

Globally, property management through digital platforms and digitalisation has demonstrated the potential embedded with automated contract systems coupled with digital identity verification and centralized rental databases. By reviewing global trends and happenings systematically in terms of property management, it is noticed that it's moving towards technologies such as IoT, AI, and digital platforms, which have drastically streamlined the formalization of the rental process, data-driven oversight, and transparency (Prasetya and Ramadhan, 2022). In South Asia, steps and decisions taken influenced by urban data analytics are responsive in supporting housing governance efficiently and enabling sustainable policy conclusions contributing to smart city planning. Thus proving the emphasis of governance networks managing residential and housing data and urban growth effectively (Westerman et al., 2014).

Sustainability fosters social and economic resilience, and to achieve sustainability, maintaining transparency and good governance in the housing and rental market is incumbent. Affordable rental housing is also widely recognized as significant to sustainable urban development in the context of the SDG framework. Equity and inclusion in the residential supply and access can only be ensured if housing market regulations are in place and urban planning is implemented effectively (Unnayan Shamannay, 2020).

In recent years, behavioral payment data has been used to measure creditworthiness by many financial institutions. Studies exhibit that rental payment history, coupled with other data such as utility bills or transaction behavior, is being termed as a reliable metric for improving credit access for individuals who lack conventional credit history. More precisely, when verified rent payment data is included in credit score modeling, it has been shown to raise credit

visibility for many and also make the credit-invisible renters' scores better. Therefore, transaction behavior data is now very necessary in forming alternative credit scoring models, ultimately, impacting lending decisions made by financial institutions (Theodos, Teles and Lieberman 2025).

Regulatory bodies have even brought policies in place to tackle the SDG hindering issues, but implementation is scarce. The Rent Control Act, 1991, policy directly addresses the equity and sustainability issues within the rental market of Bangladesh (Bangladesh Laws, 1991). But the tools and infrastructure required to implement this policy are completely absent in the status quo.

However, these developments have little to no influence on the Bangladesh paradigm as most of the platforms here remain focused primarily on property listings and renting rather than creating an integrated, transparent, and traceable ecosystem linking multiple stakeholders altogether. This void signifies a need for a system like the Transparency-Oriented Digital Rental Ecosystem (T-ODRE), which aspires to integrate documentation, identity verification, payment records, and institutional access within a single sustainability and transparency-driven framework.

### **3. Theoretical Framework**

#### **3.1 Key Concepts**

The system is built on a few core principles that it will be aiming to achieve with each functionality implemented.

- **Transparency:** The System defines transparency as events factualized for each actor and curbing disruption, disputes, or dissolution of data in the long run. Each event is recorded and kept accessible based on the necessity of the role.
- **Digital Identity:** All the data begotten is given a digital identity and kept against that identity for future reference.
- **Traceability:** The Digital identity given creates a unique signature for each identity. Events, activity, and data stored against each identity are accessible and well-structured figuring it to be easily traceable.
- **Data-driven Decision:** Analytics are derived from the above concepts after they are implemented. Insights generated are used to influence decisions.

### **4. Methodology**

#### **4.1 Research Approach**

The approach to develop the Transparency-Oriented Digital Rental ecosystem (T-ODRE) consists of mixed-process, role-based, design-driven research and integration of conceptual infrastructures with iterative software solution prototyping. The inception of the research started with the notice of operational holes present within the existing rental market and was steered by research on sustainable housing governance, actor-based transparency, and digital identity management. These researches rendered into identifying prominent stakeholders- tenants, landlords, financial institutions, and regulatory bodies. Existing platforms in other countries, such as RentPayment (USA), which primarily focuses on the documentation of the landlord-tenant interaction, and Rentbetter(Australia), which is a government-recognized platform managing the tenant-landlord relationship only, are operations that are to be mentioned in tackling the aforesaid problems; however, none of these platforms has attempted to include or create an integrated ecosystem with the vast data begotten (RentBetter, 2023; RealPage, 2023).

The system translates transparency based on the roles of the user, hence translating its practicality within the context of Bangladesh. Each role was then diffused into working modules in order to achieve traceability, nominal information redundancy, real-time analytics generation, and an efficient workflow. Role Infused models were accredited with iterative prototyping; hence, the framework used was lightweight in nature to keep the system modular for future iteration.

#### **4.2 T-ODRE Division-Based Architecture**

The T-ODRE ecosystem is built ultimately with four divisions in order to achieve role-based transparency and documentation throughout the entire stage of the rental cycle. The four subdivisions are composed of:

- **Interface division**  
Interactive elements such as the dashboard for all the actors-tenants, landlords, creditors, regulators- are contained here. The primary objective of this division is to make the accessibility of features/functionality such as contract management, payments, property listing and renting, monitoring compliance, and viewing financial portfolio more intuitive.

- **Logic division**

This division houses the formal processes and turns it into layered steps. KYC verification and Identity management, Contract Management history and workflow, payment and receipt generation, ubiquitous documentation and preservation, pattern recognition and analytics for insights and compliance are all contained in this division.

- **Data Management Division**

Information and data related to the users and their created data points are stored in this division. Information regarding user, property, payments, reviews, market rates, transactions, and transaction history, etc., is stored here in order to maintain data integrity and secure access control.

- **Integration Division**

This division connects with other institutions' data assets for validation, verification, and authentication of the received requests and data points. With the aim of interoperability, this division consists of Creditor/banking APIs for assessment of credit, Government services for identity verification, payment gateways, and regulatory stats.

### **4.3 Data Flow Model**

In Figure 1, The Data flow diagram has been explained with a flowchart. The process initiates with the registration and verification of the user's identity. For landlords, the next step is property enlisting, and for tenants, it is a rental property search and application. With the agreement of both parties, the system generates rental contracts for signing and documentation. The next stage is payment, and with the advent of this stage, multiple triggers happen. An automatic receipt is generated, simultaneously, the tenant's rental payment history and the landlord's income log is updated. Then, the data is documented for analytics and compliance monitoring (Figure 1).

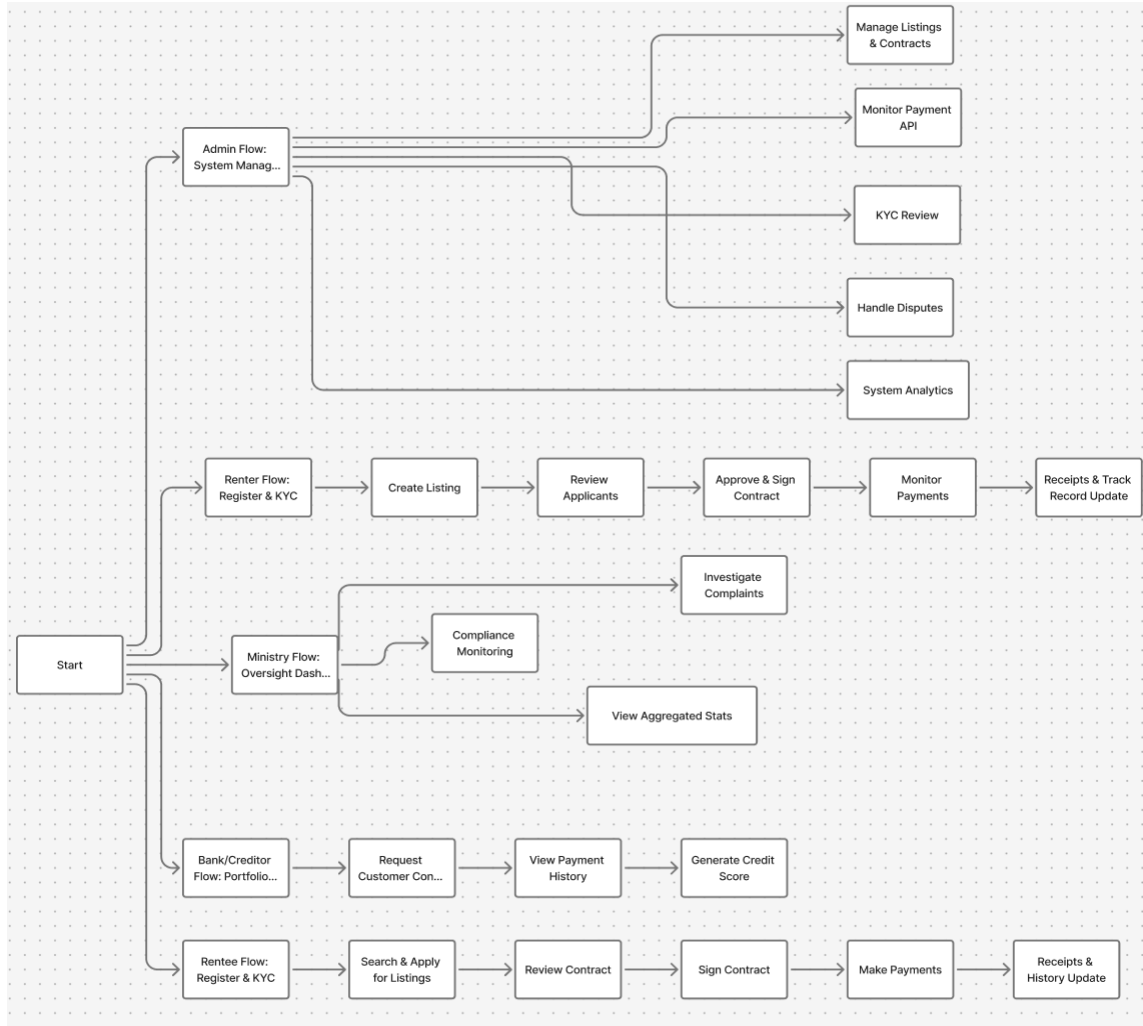


Figure 1. System Data Flow

To have transparency does mean to violate privacy; hence, anonymized analytics are derived from the data points received from the above process. And at the same time, a credit score is derived from the tenant-landlord data and created into individual portfolios for financial institutions to access only upon the user's consent.

#### 4.4 Technology Stack

In order to maintain transparency and scalability, Modern web Architecture has been utilized to develop the Transparency-Oriented Digital Rental Ecosystem T-ODRE. The frontend is developed by Next.js 14, a modern React framework with server-side rendering, which is crucial for speed and Search engine optimization (SEO). Additionally, TypeScript is used for type-safe development, which reduces bugs and enhances maintainability. Tailwind CSS provides a utility-first CSS framework that offers a consistent design across diverse users' devices. Furthermore, the backend was developed by integrating Node.js, a runtime environment for scalable and event-driven applications, with Express.js, which provides efficient routing, middleware, and API creation. On the other hand, MongoDB, a NoSQL database with a flexible schema for rental records, tenant/landlord profiles, and historical payment tracking through CRUD operations. For Secure identity verification for all users, OTP-based authentication APIs were implemented. Lastly, the System was deployed in Vercel as Vercel's infrastructure guarantees uptime and seamless scaling.

## 5. Model Implementation and Analysis

### 5.1 Implemented Modules

The implemented prototype includes the following functional modules:

**User and Identity Module:** This module consists of registration and login in accordance with the assigned role. KYC data capture is used to recognize each identity, signifying a verified participant's interaction within the ecosystem.

**Property Management and Renting Module:** Property listing functionality, coupled with editing and updating the details of the property by the landlord, is added with this functionality. Information regarding the property is cross-checked with the regulatory bodies for the correct assignment of properties to the right owner. Tenants seeking property also interact with the properties listed within this module.

**Contract Management Module:** This module formalizes the events of the contracts as facts and makes them immutable for the parties under the jurisdiction of the country's law. The contract is preapproved by the regulatory to be of standard and implemented as binding for both parties. The workflow of the contract starts with approval and then the digital representation of the rental terms. And finally, parties can activate and deactivate their contracts through negotiation, or according to the dictated terms in the contract.

**Payment and Receipt Module:** Payment through the system generates automated receipts for both parties to keep. The transactions are kept recorded and remain immutable.

#### Rental History and Portfolio Module:

Events, data points, and portfolios derived from the data are managed here. This module primarily deals with analytic and insight inception. For instance, logs of monthly payments and payment behaviour, portrayal of tenant and landlord behaviour with payment, property management, and tax, and etc., are generated in this module.

**Admin Panel:** Holistic overview and system operation logs are recorded and monitored in this panel. Security of the system and smooth operation 24/7 with integrity and governance are the functionalities of this module.

## 6. Prototype GitHub and Screenshot

Samples of role-based user interface have been shown below in Figure 2, Figure 3, Figure 4, and Figure 5. The features for each role are mentioned on the sidebar of the role's interface.

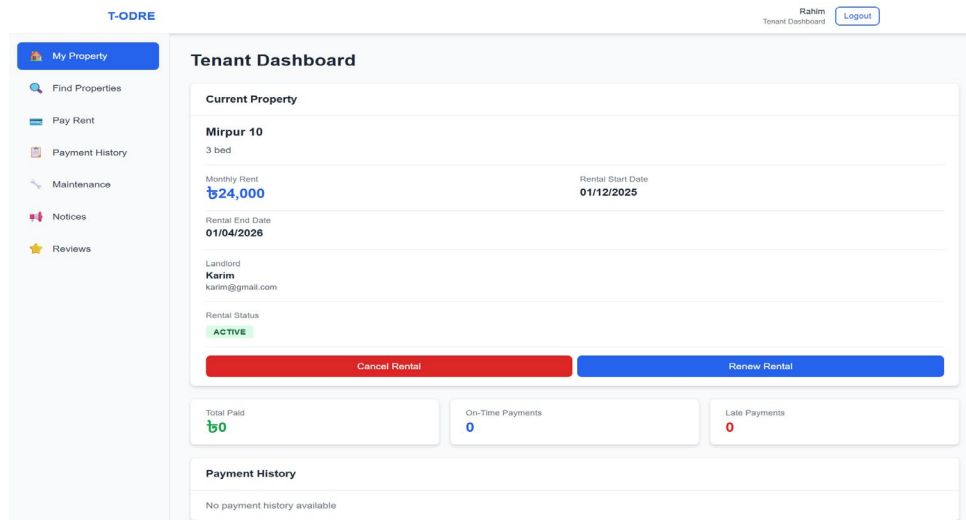


Figure 2. Tenant User Interface

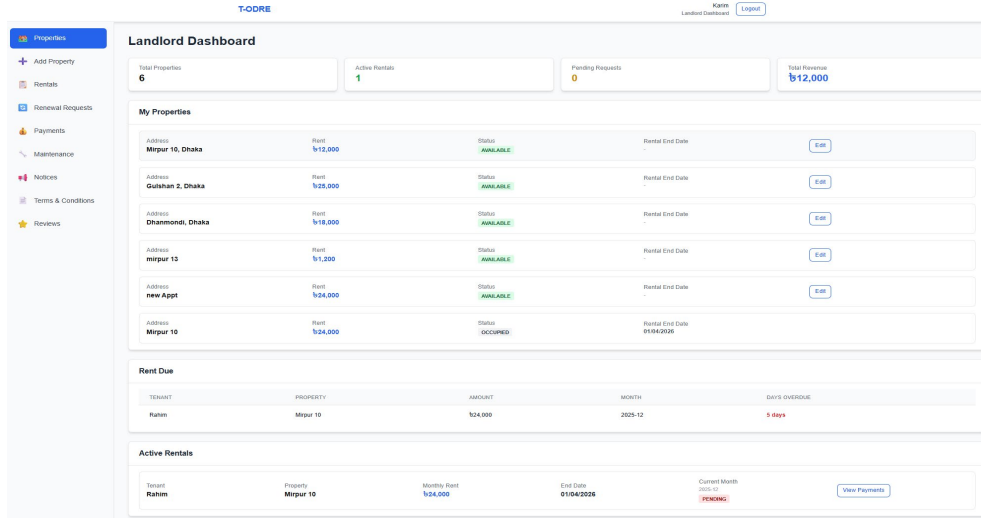


Figure 3. Landlord User Interface

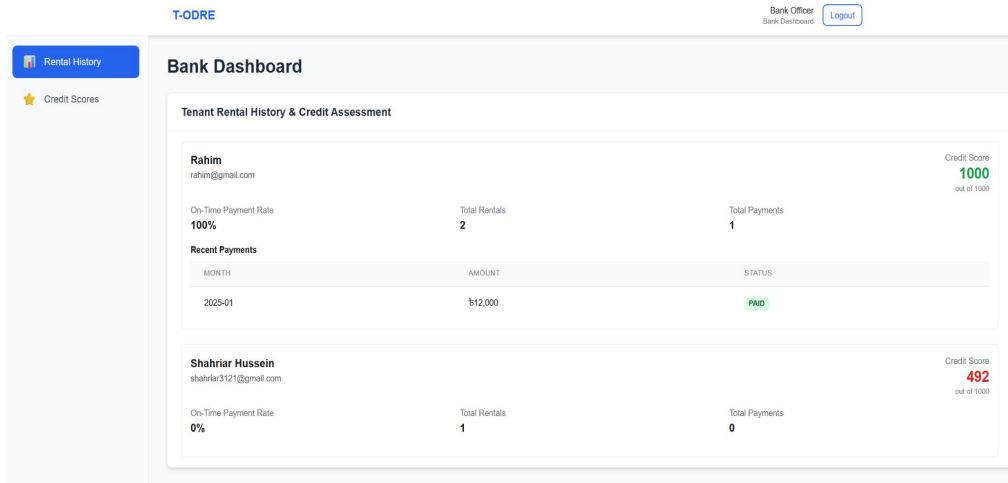


Figure 4. Creditor/bank user interface

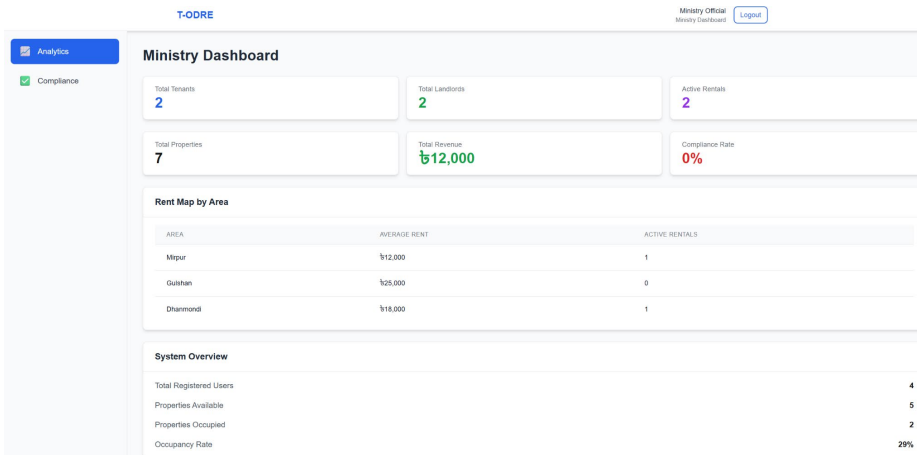


Figure 5. Regulatory bodies user interface

### Github:

The prototype has been uploaded to GitHub, and the link is given below.

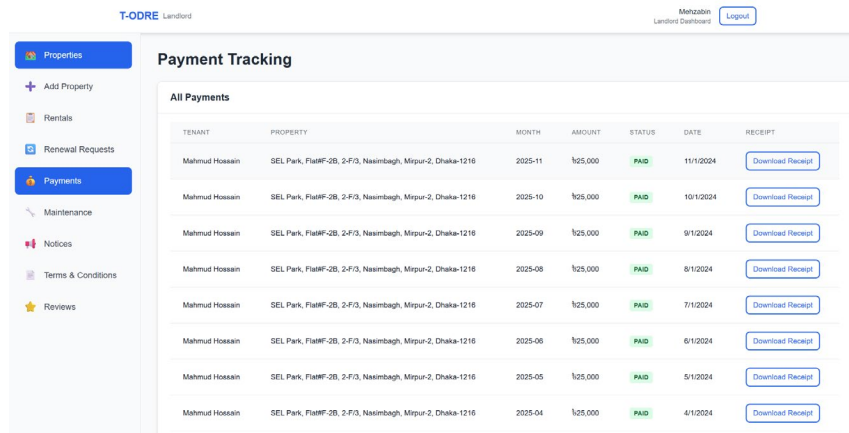
<https://github.com/KaziAbdurRahim/Landlord>

## 7. Results and Discussion

### 7.1 Expected Outcomes of T-ODRE

For different stakeholders, the functionalities curbed to the actors' needs, hence, the outcome/impact for each actor is diverse. Below is a concise explanation of the impact.

**Landlord:** The property owners receive a much-improved tenant screening interface with identities verified, coupled with previous rental history. Furthermore, a formalized portal to settle disputes and each dispute is tokenized and kept for future reference. Finally, holistic payment tracking is possible as a result, rental properties can be kept on tabs with the least amount of administrative work (Figure 6).

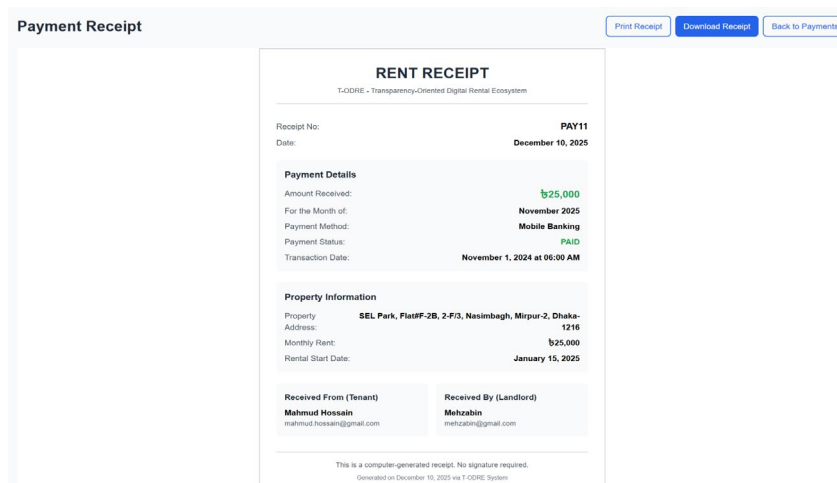


The screenshot shows the 'Payment Tracking' section of the T-ODRE Landlord Dashboard. It features a table titled 'All Payments' with columns for Tenant, Property, Month, Amount, Status, Date, and Receipt. The table lists ten payment records for tenant Mahmud Hossain at property SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216. All payments are marked as 'PAID' and include a 'Download Receipt' button.

TENANT	PROPERTY	MONTH	AMOUNT	STATUS	DATE	RECEIPT
Mahmud Hossain	SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216	2025-11	৳25,000	PAID	11/1/2024	<a href="#">Download Receipt</a>
Mahmud Hossain	SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216	2025-10	৳25,000	PAID	10/1/2024	<a href="#">Download Receipt</a>
Mahmud Hossain	SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216	2025-09	৳25,000	PAID	9/1/2024	<a href="#">Download Receipt</a>
Mahmud Hossain	SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216	2025-08	৳25,000	PAID	8/1/2024	<a href="#">Download Receipt</a>
Mahmud Hossain	SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216	2025-07	৳25,000	PAID	7/1/2024	<a href="#">Download Receipt</a>
Mahmud Hossain	SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216	2025-06	৳25,000	PAID	6/1/2024	<a href="#">Download Receipt</a>
Mahmud Hossain	SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216	2025-05	৳25,000	PAID	5/1/2024	<a href="#">Download Receipt</a>
Mahmud Hossain	SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216	2025-04	৳25,000	PAID	4/1/2024	<a href="#">Download Receipt</a>

Figure 6. Payment tracking system (Landlord end)

**Tenant:** On the renters' end, it is possible to access standardized digital contracts to reduce major disputes and factualizing contracts. Traceable payment history on the renters' end, improving tenant protection (Figure 7).



The screenshot shows a 'Payment Receipt' form titled 'RENT RECEIPT' from T-ODRE - Transparency-Oriented Digital Rental Ecosystem. It includes fields for Receipt No. (PAY11), Date (December 10, 2025), and Payment Details (Amount Received: ৳25,000, For the Month of: November 2025, Payment Method: Mobile Banking, Payment Status: PAID, Transaction Date: November 1, 2024 at 06:00 AM). It also lists Property Information (SEL Park, Flat#F-2B, 2-F/3, Nasimbagh, Mirpur-2, Dhaka-1216, Monthly Rent: ৳25,000, Rental Start Date: January 15, 2025) and the names of the Tenant (Mahmud Hossain) and Landlord (Mehezabin). The receipt is computer-generated and includes a footer with the date and version.

Figure 7. Automated Rent Receipt generation

**Financial Institution:** Banks, Creditors, and other credit-providing financial institutions get access to reliable rental payment history for a better credit evaluation (Figure 8). Thus, lending risk is reduced due to keener insight into the borrower. Furthermore, the system allows the inclusion of new borrowers into the financial system who do not have mentionable assets to show.

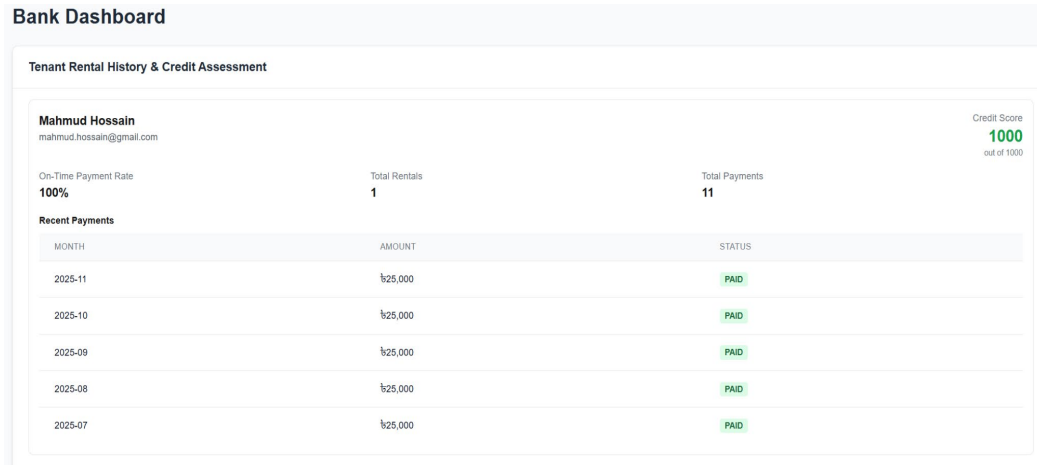


Figure 8. Credit score details of a tenant on the creditor's end

**Regulatory Body:** Governmental agencies get access to real-time market analysis (Figure 9) derived from aggregated rental data. Hence, implementation and monitoring of policy (Figure 10) is up to par; as a result, stronger enforcement of compliance can be ensured. On a further note, with the insights managed, an improved urban planning can be created.

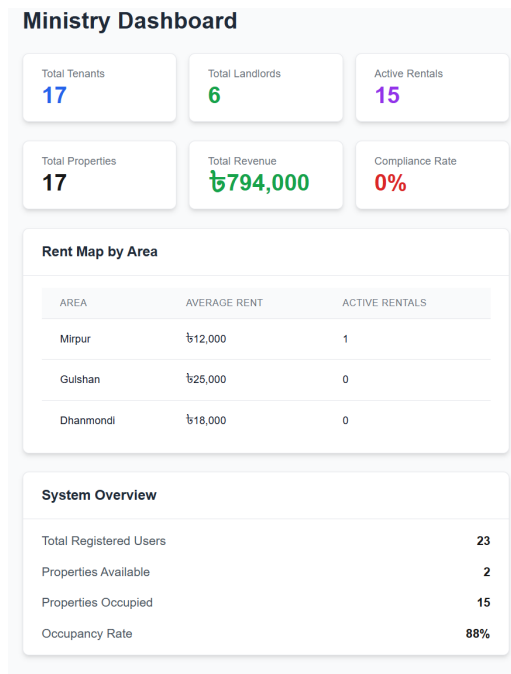


Figure 9. Real-time Total Rental Market Analysis

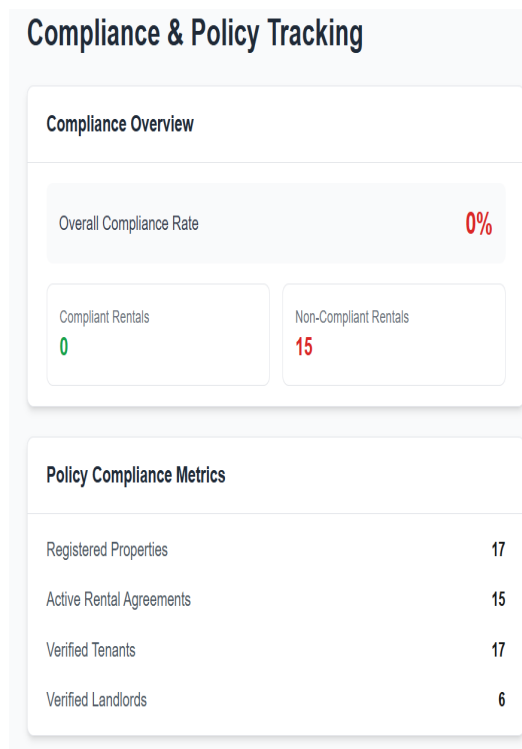


Figure 10. Compliance & Policy Monitoring Portal

## 7.2 Impact on Sustainable Development Goals

With embedded traceability, accessibility, inclusivity, and accountability, T-ODRE coordinates strongly with multiple Sustainable Development Goals (SDGs). It aligns with:

### SDG 11: Sustainable Cities and Communities

T-ODRE facilitates immutable documentation, inclusivity, safety, and resilient urban living by structuring landlord-tenant relationships with features like verified e-contracts, traceable payments and contracts, and centralized record keeping. As a result, the process eases the settlement of disputes, access to user history and reputation, streamlining of legal enforcement, and implementation of policies. Due to the real-time data accessibility, policies implemented and insight generation are modular and consistent towards urban management.

### SDG 10: Reduced Inequalities

The ecosystem ensures that people from low and middle-income renters have access to the prime functionalities like documentation, formal agreements, and a credit portfolio. With the advent of new metrics for providing credit, such as the behavior-based transaction histories, tenants excluded from the capital lending system in the past can be integrated into the system formally. This helps to close the accessibility gap and curbs systemic constraints in both housing and finance sectors.

### SDG 8: Decent Work and Economic Growth

With the implementation of the ecosystem, a fair share of increment can be expected from different industries like real estate, scalable fintech, and PropTech Services. Furthermore, with economic inclusion and accountability set, stable market growth is expected, fostering growth in urban economies.

## 7.3 Comparison to Other Models

In the current context, multiple platforms work in this domain, such as Bproperty and To-Let.com.bd. The Comparison is given in Table 1 below:

Table 1. Comparing T-ODRE with the System existing in the Status Quo

Feature	Bproperty	To-Let.com.bd	T-ODRE (Proposed)
Primary Function	Property listing & brokerage	Property listing & advertisements	Full rental ecosystem (end-to-end)
Documentation Capability	Limited (manual)	None	Digital contracts, standardized docs, digital traceability
Identity Verification	No digital ID verification	No evidence	KYC-based verified identities
Payment Traceability	Not supported	Not supported	Automated, time-stamped payment logs
Receipt Generation	No evidence	No evidence	Auto-generated digital receipts
Rental History Tracking	No evidence	No evidence	Full rental payment & behavior history
Regulator Integration	None	None	Ministry dashboard, compliance tracking
Bank/Creditor Integration	No evidence	No evidence	Rental portfolio for credit evaluation
Transparency Level	Low	Very low	High (traceability, verifiable records)
Ecosystem Coverage	Partial (listing only)	Very limited	End-to-end, multi-stakeholder

## 8. Conclusion

### 8.1 Summary of Key Findings

This paper promoted and described the Transparency-Oriented Digital Rental Ecosystem(T-ODRE), an integrated model designed to address long-prevailing issues in the informal rental market of Bangladesh. The Study explains the consequences and the demerits due to the absence of documentation, traceability, digital identity verification, and credit score modeling with financial records heavily lead to disputes, information asymmetry, and organized inefficiencies. Hence, the major stakeholders- landlords, tenants, financial institutions, and regulatory bodies - will be able to access functionalities like standard rental contracts, automated payments, centralized rental history, and verified digital history. The ultimate objective of this model is to align itself with the digital-governance priorities and the SDGs. Overall, the finding denotes T-ODRE to be a scalable, viable way to structure the rental ecosystem of Bangladesh.

### 8.2 Future Research

In the near future, the model is expected to expand in multiple dimensions. First and foremost, scaling the platform to take in millions of users altogether is the primary goal. Secondly, penetration into the secondary cities and semi-urban regions in order to get the most accurate insight of the market all over the country. Thirdly, integrating national identity, digitized land data, and municipal tax database to create the ultimate interoperational seamless ecosystem. Finally, blockchain-based smart contract integration coupled with a geospatial heatmap for visual analysis of rental trends will be integrated once the model reaches an ample number of users.

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## **Biographies**

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